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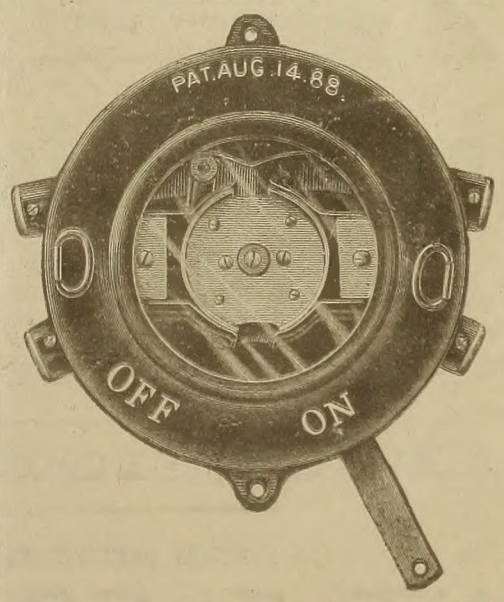
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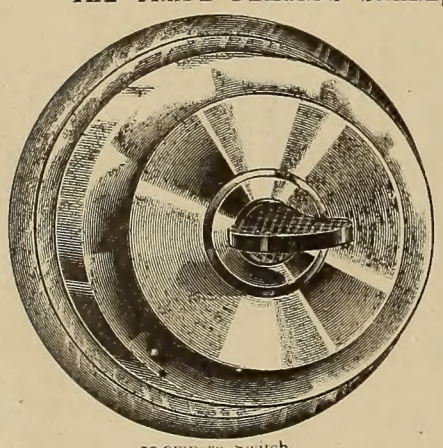
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THE NEW YEAR.

As the New Year begins every business man naturally asks the question "I wonder what the new year has in store for me?" The transition from an old year to a new one begets thoughts of the past and the future, and plans for the future are laid down on the experiences of the past. The year 1891, to all persons engaged in electric work, will be of exceeding interest and importance. The one just closed has been the most active in the history of electrical development, and there is every prospect that the new year will witness greater activity.

There is one fact in connection with the electrical business that is evident to a casual observer, and that is, that all electrical industries are settling down to a firm and solid commercial basis. The "just" and the "unjust" have, in a great measure, been divided, and the "just" are receiving their reward. Responsible and experienced concerns are now untrammeled in the pursuit of their legitimate trade, and the result is a better general appreciation of the service of electricity to man.

As to the business outlook, we have made some inquiries in different electrical trades and learned that a very hopeful feeling exists. The most conservative persons in the trade expressed themselves as having no reason to believe that business would be any less prosperous during the new year than it was in 1890.

Of course the more enthusiastic ones foresaw great activity and predicted that the year 1891 would be one of unexampled prosperity. We earnestly trust that their expectations may be realized, and to these we will say that they may rest assured that the ELECTRIC AGE will do all in its power to bring about such a condition of things.

The prosperity of any business, whether it be electrical or otherwise, depends, to a very great extent, on the publicity given it in public prints. The truth of this is generally aeknowledged. We mention this fact here to remind our friends that if they would have a prosperous business they must enlarge their business, and to enlarge their business they must advertise it.

There can be no question that under natural conditions electrical industries will experience greater activity during the year just begun than ever before. It is in the nature of things that it should. Improvements are constantly being made in one direction or another, and these are usually in the direction of simplicity and cheapness. Simplicity and cheapness mean greater demand and consumption, hence greater activity in production.

After looking over the ground carefully and weighing opinions, we are happy to say that there is every indication that the year 1891 will be one of prosperity in the electrical trades, and we trust that the indications may prove to have been well founded.

OUR NEW SUIT.

The beginning of a new year has been, from time immemorial, considered the most appropriate time of all the year to introduce changes. The old things are then put away and the new taken up. These may be new purposes or they may be things perceptible to our senses. The central idea, however, always is to improve the old, whatever it may be. The ELECTRIC AGE begins the year 1891 with new purposes and aims and a new suit. It has done untold good in the past, and in the future it proposes to be of greater benefit than ever to all interested in electricity. Its aim will be to present to its readers the best obtainable in its line. It will be on the alert more than ever, and nothing will be left undone that may be done in the interest of its readers and patrons.

Journals, like individuals, indulge in new clothes once in a while. The ELECTRIC AGE has discarded its old suit and now appears in a new one, which is more brilliant and attractive than the old.

It also appears with a new heading of more artistic design than the old one. The new heading is emblematic of the scope of the paper. It will be noticed that the telegraph, the telephone, the electric light, and the electric railway, are appropriately represented. These embrace everything of importance, in which electricity is concerned. A little study of the heading will reveal the harmony of the parts with the object in view. It tells its own story. In one corner is represented static or natural electricity emerging from its birthplace, the clouds; at the other end the dynamo is represented, originating the life-giving force on which all of the other apparatus is dependent.

With this introduction the ELECTRIC AGE, in its new suit, makes its bow, and hopes that all of its friends may experience abundant happiness and prosperity during the year 1891.

QUANTITY OF LIGHT.—It is interesting to note what Mr. S. Alfred Varley, the noted English electrician, has to say concerning the comparative merits of illumination by burning coal and the electric light or other methods. In our last issue we published an article by this gentleman, headed "Illumination by Artificial Lights," in which he made some interesting observations concerning the penetrative power of quantity, as distinguished from the quality of light. It is well-known that the electric arc light, the most intense of all artificial lights, has not much more power of penetration in thick weather than ordinary lights of oil or gas. The quality of intensity as compared with quantity in reference to light is exemplified in the electric light as against the old time coal fires burning in iron baskets. Mr. Varley says he would like to see systematic experiments carried out to ascertain the respective penetrating powers of coal fires, gas lights and the electric light through hazy atmospheres, and he would not be surprised if the results obtained from such experiments went to show that, under special conditions, it would be more economical for the purpose of illuminating distant objects, for a given amount of coal to be burned in an open grate fire, than to burn a similar quantity in a steam engine, and from the energy developed, produce an electric light. The determination of this question would be extremely interesting.

LIGHTING NEW YORK.—Forty cents per lamp, per night, is the figure agreed upon for the lighting of New York's streets by electricity during the year 1891. Now if something would be done to improve the appearance of the electric light lines along portions of Broadway and other thoroughfares—if these lines must exist for the present above ground—New Yorkers would feel thankful. The condition of these lines at the present time is enough to make any one ashamed to acknowledge that he is a New Yorker. Certainly in no other place would such unsightly lines be tolerated. They are not only unsightly but they have the appearance of being very dangerous. They look as though they were the property of some bankrupt concern. A New Yorker going to Chicago cannot help but notice the difference in the appearance of the streets of the two cities. In Chicago hardly a pole can be found in the business streets. When shall we be able to say the same of the metropolis which should lead in all things pertaining to the welfare of its citizens?

SUBWAY RENTALS.—The Board of Electrical Control has fixed the amount of rental that must be paid for the use of the subway conduits at $900 a mile. This figure is $100 less than that claimed by the subway company, and is $600 more than the figures the electric light companies declared to be reasonable. The Subway Company has asked the privilege of amending its answer in the pending injunction suits in order to make it agree with the ruling of the Board. This action of the Board of Electrical Control virtually places a valuation on the subways of $9,000 per mile, which is probably considerable more than they cost.

ELECTRIC LIGHT ON LIGHTSHIPS.—The Lighthouse Board is considering the advisability of using electric light on the new lightships now being built for the Atlantic coast service. It is thought that the electric light would give more satisfactory results on board these craft than the usual illuminant, oil. A series of experiments will be conducted at the lighthouse station on Staten Island with a view to ascertaining whether the advantages of electric light over oil light will justify the additional expense of equipment.

PATENTS.—Elsewhere in this paper will be found an article on the subject of withdrawing patents from issue. It will be particularly interesting to electrical inventors. The petitioner requested that his application for three patents be withdrawn from issue for a period of thirty days in order to preserve rights to patents in all foreign countries in favor of the purchasers. The Commissioner of Patents denied the application for the reasons set forth in his decision as printed.

EARLY TELEPHONE TRANSMITTERS.—We recently read of the exhibition in Lowell, Mass., of the first telephone transmitter used in that city. It is a Blake transmitter, and its number is 277. It was first used on January 1st, 1879. It would be interesting to know if transmitter No. 1 is in existence. The original Bell telephone instruments have a great historical value and no doubt are very jealously guarded somewhere.

THE FIRST FIRE ALARM SYSTEM.—The fire alarm system of Boston was put into operation April 28, 1852, and is the first electric fire alarm system established in the world.

ELECTRIC LIGHTING FOR BEGINNERS.*

BY THE EDITOR.

Part XIX.—Incandescent Lamps—Concluded.

355—Is there any actual deterioration of incandescent lamp filaments while in the state of incandescence?

Yes, there is some slight wastage.

356—What is the theory advanced for this action?

It is supposed that infinitesimal particles of carbon are given off, probably in the form of vapor, during the intense molecular action while the filaments are incandescent.

357—What is the cause of rupture of the filament?

The filament may be ruptured from several causes. The natural cause, however, is probably due to reduction of structural tenacity through the alternate heating and cooling, and probably also to a certain species of electrolysis.

358—Give an example of the current necessary to maintain a light of given candle power?

Sixteen-candle power lamps require on an average an E. M. F. of 91.91 volts and a current of .71 of an ampere.

359—What are flashed filaments?

Flashed filaments are those which are rendered incandescent during the process of exhausting the air from the bulb.

360—What is the object of flashing filaments?

Flashing renders the filament of more regular structure and increases its durability.

361—Does flashing the filaments affect the light any?

Yes; on an average flashed filaments give one-third more light than those not so treated.

362—What is meant by the efficiency of an incandescent lamp?

Efficiency means the amount of light it will give for a given electrical power.

363—What is considered a good efficiency?

If a lamp will give a light of one candle power in return for 3.5 watts of energy, it is considered of good efficiency.

364—Is the efficiency of incandescent lamps uniform?

No; the efficiency varies with the candle power of the lamp.

365—What is a "watt?"

The watt is the unit of electrical energy, or power.

366—What constitutes a watt?

A watt is the product of 1 volt and 1 ampere. The electrical energy of a given machine is found by multiplying the electromotive force, or pressure, by the current in amperes: E. M. F. × amperes = watts.

(To be continued.)

NEW TYPE OF BATTERY CELL.

Mr. James H. Mason, the manufacturing electrician, of Brooklyn, has just brought out a new type of cell which promises to find a large field of usefulness in certain classes of work. The cell is cylindrical in shape, seven inches high by two in diameter, and has a capacity of 10 ampere hours. Two cells were recently tested and they ran a 1-candle-power lamp for five hours and 20 minutes before the light began to perceptibly diminish. It takes one-third of a pint of Mason's diluted solution to charge a cell, the cost per charge being one cent. Each cell has an E. M. F. of 2.1 volts, and delivers a current of 6 amperes.

This new cell is of the single fluid type, the cell jar itself constituting the carbon element. These new cells are especially adapted for magic lantern work, and the adaptation of the electric light to lanterns will be greatly appreciated by those who handle such apparatus. The name of the new cell is the "Little Giant." We understand that Mr. Mason is now conducting experiments in this direction, and that there is every promise of success.

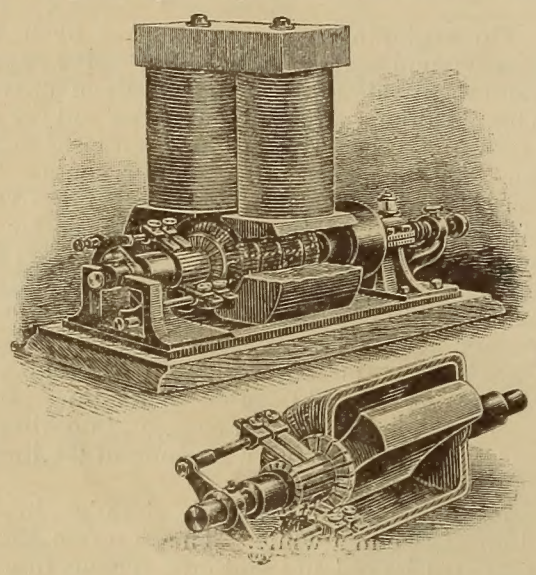
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BRUSH REGULATOR.

Mr. Fremont J. Cleaver and George Fassold, of Pittsburg, Pa., have recently obtained a patent on a regulator for dynamos and motors, the object of which is to maintain the brushes at the point of least sparking. The armature core is designed to shift automatically according to the drag or lead of the armature and always takes position with its poles in the strongest part of the field.

The following facts concerning this improvement, and the accompanying illustration, are taken from the *Scientific American*:

The armature has circular end pieces mounted on tubular shafts, and to these end pieces is secured a hollow cylinder of non-magnetic material, wound with the material in the usual way, as shown in the broken-away portion of the main view in our illustration, the terminals of the coil being connected with the commutator cylinder. Upon the central shaft, and loosely fitting the hollow of a cylinder of iron having concave sides, as shown in the small view. The central shaft is prolonged beyond the tubular armature



BRUSH REGULATOR.

shafts, the ends of the central shaft being supported on pointed screws in yokes attached to the supports of the journal boxes of the tubular shafts. To the central shaft at its commutator end is secured a cross arm of insulating material in which are held rods carrying the commutator brushes. The cross arm also carries metallic contact plates electrically connected with the rods, and which touch curved bars having binding posts for receiving the conducting wires leading from the dynamo. On the end of the central shaft opposite that carrying the cross arm is attached one end of a spiral spring attached by its other end to the yoke, to oppose the pull of the armature on the segmental core, and to return the core and the brushes to their original position when the machine is idle, so that the brushes will always occupy the same position relative to the segmental core.

ANSWERS TO INQUIRIES.

A correspondent asks: "In transmitting time from the observatory at Washington, to a clock in the Western Union office, at Galveston, through five sets of repeaters, how much time would be lost?" A claims the Galveston clock would be 5 seconds slower than Washington, while B claims the variation would not exceed 1 second.

Answer—B is nearer right. The error is variable, depending upon the adjustment of the five repeaters. The minimum error probably would be about five-tenths of a second.

ELECTRIC LIGHT UNDER WATER.—It is a curious fact that if the two carbons of an electric arc light are immersed in water, the light will burn quite as well as it does in open air. Water cannot quench an electric arc light.

REVOLVING DISPLAY FIXTURES.

Every business man knows and appreciates the value of making as effective a display as possible of his goods. There are many ways of accomplishing this object, but the idea always is to make the display as conspicuous and attractive as possible. One of the most effective ways of making displays of goods is by means of what are known as revolving display fixtures. These usually consist of turn-tables of various forms revolved by an electric motor. Such an apparatus is shown in the accompanying illustration, figure 2.

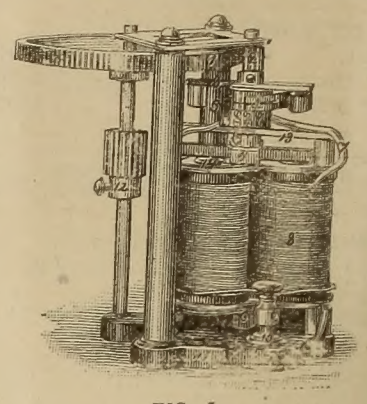


FIG. 1.

For show windows these turn-tables are admirably adapted. They practically show the goods on all sides and in many positions, which, of course, is a great advantage.

Fig. 1 is an illustration of the motor used to revolve the display tables. The motor has two armatures, one above and one below the electro magnets of which there are three. There is no dead centre, consequently the machine is self starting. The motion is transmitted from the motor to the display fixture by means of gearing as shown in the cut.



FIG. 2.

Fig. 2 shows one of the many forms of display fixtures, and gives a general idea of the utility of the apparatus.

The proprietors of this valuable device are the Bush Revolving Store Fixture Company, 24 Park Place, and at their place can be seen in operation seven fixtures of different kinds run by 4 motors, the current being supplied by two of Mason's No. 9 cells. One cell of this size is ample to run as many as four motors and tables for 65 hours, at a cost of six cents. The Bush Company are using Mason's battery exclusively for the operation of their motors, and are well satisfied with the results.

ELECTRIC ENERGY.—All electric action is an exhibition of energy, whether it be in the movement of a pith ball, in the flash of the electric spark, in the brilliancy of the arc light or the softer radiance of the incandescent, in the deposition of metal by electrolysis, the click of the telegraph, the speech-producing movement in the telephone, the propelling of cars on a railway, or in the lightning's flash rending the oak. It produces chemical decomposition, mechanical motion, light and heat. It inflicts pain, destroys life, soothes suffering, heals disease. All these varied phenomena are different manifestations of energy.

STORAGE BATTERY PLATES.—It is now the practice to use a paste of litharge (PbO) and acid for the plate connected to the negative pole of a storage battery, although makers vary the paste considerably. In some cases minium only is employed. In others a mixture of litharge and lead sulphate; and in others, again, all three substances, viz, minium, litharge and lead sulphate enter into the constitution of the paste. In all cases, however, the ultimate result of the initial charging current is the same, viz., the conversion of the paste on the positive plate into peroxide and of the paste on the negative plate into spongy lead.

WITHDRAWING PATENTS FROM ISSUE.

The Commissioners of Patents recently ruled in a case that has much general interest to patentees. "This is a petition," says the Commissioner, "to withdaw from issue for a period of thirty days three applications which have been allowed and await the payment of the final fee. The six months within which the final fee becomes due by statute will expire in each case before the expiration of the thirty days. The effect of the petition if granted is intended to be and will be to permit the final fee to be paid more than six months after the original allowance of the application.

The petitioner states that he is negotiating for the sale of his inventions, and that for that reason he requests that the applications be withdrawn from issue for a period of thirty days in order to preserve rights to patents in all foreign countries in favor of the purchasers.

The section of the statute regulating the payment of final fees is as follows:

SEC. 4885. Every patent shall bear date as of a day not later than six months from the time at which it was passed and allowed, and notice thereof was sent to the applicant or his agent, and if the final fee is not paid within that period the patent shall be withheld.

It will be seen that this statute expressly provides that if the final fee is not paid within the period of six months from the time at which the application was passed and allowed the patent shall be withheld, and in view of the language thus employed I cannot doubt that a patent issued in disregard of the express prohibition of the statute would be void.

It is, however, a part of the experience of the Patent Office that applications are sometimes allowed prematurely, so as to necessitate a withdrawal from issue for further examination to determine whether an application is entitled to a patent under the law. In other cases the filing of an application for the same invention which has already been allowed to another party necessitates a withdrawal of the allowed application from the issue for the purposes of an interference. Again, where the final fee is paid at a time so near the expiration of the six months allowed by law that a new allowance is necessary to enable the patent, which cannot be immediately prepared for signature, to bear date within six months of the allowance, withdrawal from issue becomes necessary; and if other cases exist where withdrawal from issue is permitted by the rules, it is believed that no case is recognized which does not require further action or investigation on the part of the Patent Office.

The applicant relies upon the portion of Rule 165 which provides that after the final fee has been paid and the application has received its date and number the latter will not be withdrawn or suspended for the purpose of enabling the inventor to procure a foreign patent, and he infers that the application may be withdrawn for that purpose before the payment of the final fee. Rule 165 provides that—

after notice of the allowance of an application is given, the case will not be withdrawn from issue except by approval of the Commissioner, and if withdrawn for further action on the part of the Office a new notice of allowance will be given.

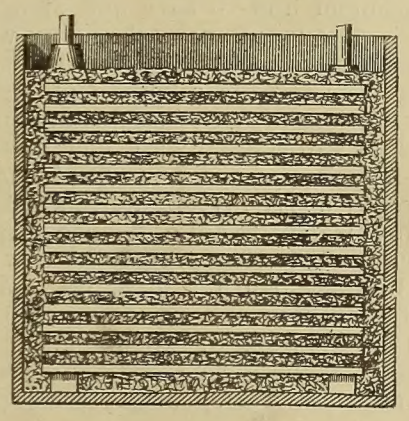
Construing the rule as a whole, it does not alter the situation or in any way authorize the granting of the request of petitioner. If the applications are withdrawn from issue, as prayed, a new allowance and notice thereof will certainly be necessary, because the final fee must be paid within six months after allowance in order to prevent forfeiture. But Rule 165 only provides for a new notice of allowance when applications are "withdrawn for further action on the part of the Office," and therefore no provision exists in the rule for a new notice in case the present petition be granted. I am very clear that the petition should be denied.

I do not intend to decide that no case can arise in which withdrawal from issue may be legal and proper which does not contemplate further action on the part of the Office. The facts in the present case do not call for a decision of such a sweeping character. At present it is enough for me to say that in my judgment the Commissioner of Patents has no authority to directly or indirectly extend the time for paying the final fee to a period later than six months from *that* allowance of the application which results from proceedings according to law in this office. In the present case, as I have already said, the petition if granted would have that effect. If the applications should be reallowed, after being withdrawn for the purpose stated in the petition, a proceeding for which no warrant is to be found in Rule 165, such reallowance would not be because proceedings had been resumed, but would be for the sole purpose, so far as the Patent Office is concerned, of permitting the final fee to be paid more than six months after the only allowance of the applications made after due proceedings had.

The petition is denied."

IMPROVED ACCUMULATOR.

The accompaying illustration shows the method employed by Mr. J. K. Pumpelly, of Chicago, of avoiding the troubles due to the dislodgement of paste or plugs from the plates of accumulators. Mr. Pumpelly places between the plates a layer of cellulose or wood pulp which by pressing



IMPROVED ACCUMULATOR.

against the plates prevents the paste from falling away. The cellulose or pulp is unacted upon by the acids and it offers an insignificant resistance, if any, to the current. It will be readily understood that this feature is a valuable one, particularly if the cells are subject to rough handling, as in street car work, etc.

ELECTRIC RAILWAY IN HUNGARY.

The following particulars of the electric tramway now in operation in Buda Pesth, Hungary, will be of interest:

The channel has a uniform breadth of 11.2 in. The slot giving access to the conductors is placed in the groove of one of the running rails, so that there is no more metal exposed in the roadway than is the case with horse tramway lines. At intervals of 4ft. along the channel, iron chairs 7.2 in. broad serve to support the running rail, and also to carry insulators, to which the conductors are attached. The bottom of the channel, which is formed of concrete, is at a depth of 28 8in. below the surface of the roadway, and the slot between the rails which form its roof is 1.3in. wide. The conductors, of which there are two (positive and negative), consist of angle iron, and are placed at the sides of the channel so as to be out of sight and out of reach. The cars carry a single motor, geared to one of the axles, and four groups of resistance frames for regulating the speed. The current is supplied at a pressure of 300 volts.

Three lines with an aggregate mileage of five and a-half miles are at present in operation on the above system. A fourth line is at present building, but on this an overhead conductor is to be used. At the central station there are at present three 100-horse power compound engines, each driving a dynamo by means of rope belts. A speed of 9⅓ miles per hour is allowed, and at certain parts this may be increased to over 11, while at others it has to be reduced to 6 and to 3¾. The day's work ranges from 75 to 95 miles per day per car.

FOREIGN ELECTRIC RAILWAY NOTES.

A despatch from Vienna, on December 22, says it is announced there that a company is about to be organized in that city with a capital of 38,000,000 florins, for the construction of an electric railway between Vienna and Buda-Pesth, a distance of 250 kilometres. It has hitherto taken four hours and a half to make the journey, but it is expected that travellers by the proposed road will do it in two and a half.

The General Electric Power and Traction Co., Limited, of London, is now offering to tramway companies to supply cars and the electrical equipment, and to *maintain* the motors, switches, gearing, and accumulators at a mileage rate, the tramway company operating the road at their own expense.

FAULTS IN SUB-MARINE CABLES.*

BY J. PARRY LAWS.

Some time ago I had my attention directed first by Mr. Saunders, of the Eastern Telegraph Company, and subsequently by Mr. Herbert Taylor, of Messrs. Clarke, Forde and Taylor, to a particular class of faults occurring in sub-marine cables. The distribution of these faults is decidedly limited, occurring, as they do, only in water having a moderately high mean temperature, and in positions where it is not very deep. When the core is examined, it presents, strictly speaking, an appearance of simple decay, the gutta percha having undergone some chemical change, which renders it extremely brittle, and causes it to shrink in volume. I say chemical change advisedly, as there are no signs whatever of mechanical erosion; indeed, many of these faults are taken, I am informed, from parts of the cable where the outer covering of wire remained intact; the hemp, however, at the particular spot was entirely destroyed. These faults have therefore caused considerable speculation as to their origin, and the explanation I am about to suggest seems to me, on due consideration, to be at least feasible.

Taking into consideration the high temperature of the water, and the very limited position of these faults, I have come to the conclusion that they may probably be produced by the action of putrefying organic material either in actual contact with the cable or in close proximity to it. Guided by this hypothesis, I made some experiments on a laboratory scale to determine whether organisms, such as occur in putrefying fluids, or the products of their life, would have any effect on the core of submarine cables. The few experiments I have made show conclusively that putrefaction does exert a very marked effect upon gutta percha, some classes of putrefaction producing more effect than others. The few experiments I have been able to carry out are certainly confirmatory of the above suggestion, the gutta percha being considerably eroded and pitted after remaining in a putrid fluid for some time.

I hope to make experiments in greater detail, and publish the above as a mere suggestion, in the hope that others may collect facts tending to establish or disprove it.

SUSTAINING THE ARC.—The fact that it is difficult to sustain an arc, or rather that it is easy to select conditions which will prevent arcs forming with the alternating current system, as compared with continuons current system of much less potential is greatly in favor of the former.

*London *Electrical Review*.

RETURN CIRCUIT FOR ELECTRIC RAILWAYS.

The usual methods of supplying means for the return of the current used in operating electric cars are frequently inefficient or expensive, or both, and there are more or less unsatisfactory results in the practical operation of the system.

It is a well-known fact that the earth a very few feet beneath its surface offers no perceptible resistance to the flow of the electric current, and for that reason it forms the best and cheapest known conductor that can be used for the purpose of conducting electric currents.

Mr. Frank W. Sabold, of Albany, N. Y., has on the basis of this fact succeeded in devising a way of successfully overcoming the objections above alluded to.

The principal feature of his invention consists of a series of metallic bars connected electrically with the rails, and inserted into the ground adjacent to and in line with the railway tracks at distances apart that will not exceed the length of an ordinary track rail, so that a car equipped with the usual motor and conducting wires will

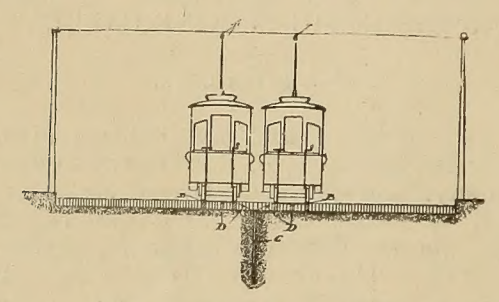


FIG. 1.—EARTH RETURN.

in its transit over said track effect a constant variation in the length of the electric circuit, making the latter longer or shorter, according to the direction in which the car is moving in respect to the generator, the course pursued by the current from the dynamo or generator being through the overhead or trolley wire, downward through the conducting wires of the car to the track rails, thence to the metallic bars through the wires connecting said bars to the track rails, then from said bars through the earth back to the generator, the earth alone being used to complete the circuit from the metallic bar nearest the point on the track where the car is at the time located to the dynamo or generator, regardless of the fact whether at that time the car is in motion or stationary.

Reference to the accompanying illustrations will give a very clear idea of Mr. Sabold's method. Fig. 1 is an end or sectional view of the railway, and fig. 2 is a transverse section of the tracks showing the mode of forming electrical connections between the tracks and the earth through the metallic rods.

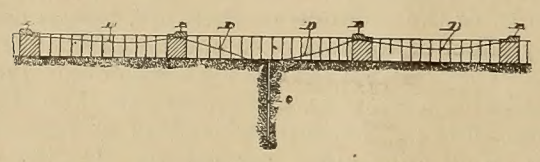


FIG. 2. TRACK CONNECTIONS WITH EARTH.

A indicates the overhead or trolley wires of an electric railway.

C is a series of bars or other forms of metal or other material which possesses suitable electric conductivity, driven into the ground in proximity to and substantially in line with the tracks B. Said bars are connected by means of wires or other electrical conductors D to the track-rails B, and said connections should be in electric contact to insure a proper operation of the circuits. The electric current from the dynamo or generator is conducted to the motor in the car by means of the overhead wire in the usual manner, and from the motor the current passes through the car wheels into the track rails. From the track rails the current is conducted through the nearest conductor D and bar C into the earth, which conducts the current back to the generator, and thereby the circuit is completed.

Experiments in Troy, N. Y., where there was at one time so much litigation over the interference of electric railway currents with the telephone circuits, shows that by Mr. Sabold's method all earth leakage is positively removed, and with the disappearace of that the telephones are practically free from the trouble complained of.

Mr. Sabold's system is in operation in Troy and Albany and a circuit of much lower resistance is the result. The comparative expense, moreover, is much in favor of Mr. Sabold's plan, while the practical results are superior to those obtained by the elaborate system of return wires which is so expensive.

On the electric road running between Troy and Albany Mr. Sabold's rods will be used, it having been demonstrated to the satisfaction of the company that the use of this improvement does away entirely with all interference with the telephone, and is much cheaper and efficient in its results in the operation of the plant.

THE STORAGE OF ELECTRICITY.*

The problem how to save and store up the enormous amount of natural energy which is daily dissipated in producing natural phenomena has long occupied the attention of scientists. During the last fifteen years this attention has been specially directed toward electricity as an agent. This is, perhaps, because the majority of the really active investigators have been occupied in this department of science, or perhaps the popular superstitious credulity that electricity can be made to do anything, has, to a certain extent, taken possession of the scientific mind. At any rate, the result of experiments has been the development of the electrical storage batteries, or accumulators, as they are sometimes called.

The employment of these names for the apparatus is very unfortunate. They are the cause of the popular idea that electricity, which is considered as a subtle, indefinite, and intangible something, is stored up in them; as valuables are stored in a vault. The commercial current electricity can not, in large quantities, be stored and still preserve its character. It has but a flitting existence, and is no sooner produced than it dissipates itself and is converted into some other form of energy. It was because of this momentary existence that science had to wait so long for an accident to reveal to Galvani that such a thing could exist.

The energy which a current may at any instant be said to possess, is immediately transformed into heat in the circuit, which will under certain conditions produce light; into chemical energy; into motion; which may or may not produce sound; or into magnetic and electro-tonic conditions. The last may either be permanent or have the same evanescent existence as the original current.

When electricity is employed to charge a storage battery, only that part which is transformed into chemical energy is used. The rest is dissipated. The battery, then, instead of being a place where electricity is laid away, is a place where chemicals are left by the current, with the expectation that they will in turn produce a current, when called upon. This may seem a fine distinction, but it is only apparently so. For instance, the current might be produced by a dynamo turned by Niagara water-power. The chemical left by it might be zinc deposited from a solution of zinc sulphate. This might be transported, preserved bought and sold, and finally be employed by some physicist to produce another current. Were the electricity itself stored in its original form, then the imaginative reader can best tell what would become of it and how it must be handled.

To understand this transformation more clearly, and to obtain a clear idea of what goes on in a storage battery, one must first become acquainted with that part of electricity which treats of the phenomena resulting when a current of electricity passes through a liquid. This is called electrolysis and the liquid through which a current can be made to pass is called an electrolyte.

If a current of electricity flows into a liquid solution of any metallic salt by means of a wire and if, after traversing it, flows out through another wire, then it will, by its passage separate the salt into two parts and deposit the metal upon the latter wire.

If, for instance, the solution be one of silver cyanide, then silver will be deposited on the second wire. If a brass fork be connected with this wire and dipped into the solution, then it will receive a coating of silver by the process and will be silver plated. Substitute a solution of nickle nitrate and the article will become nickle-plated. By using copper sulphate we are enabled to cover the faces of types and cuts with a coating of copper, which increases their hardness and consequently their endurance.

This electrolytic action can be watched if a solution of tin chloride be used. Tin, instead of being deposited, like most other metals in fine particles, comes out of the solution in quite large crystals. If the current of electricity be made to enter the solution through two wires, placed symmetrically on opposite sides of the wire through which it makes its exit, and the whole is performed in a vessel with glass sides, then, as the current passes, the crystals will appear, as if by magic growing out around the central wire. This is but a modification of the "lead tree" which appears in many text books on physics. The tin crystals, however, are much larger and more beautiful than those of lead.

The simplest storage battery, then, would seem to be one constructed of two copper plates suspended in a solution of some zinc salt. A current of electricity passed into this would deposit zinc upon one of the plates. After disconnecting the charging current, the battery of itself would give off a current until the zinc was re-dissolved. In fact, a modification of this form of storage battery has recently been placed upon the market. The question arises, however, whether it is cheaper to buy zinc sulphate and transform it by expensive horse power into metallic zinc, or to buy metallic zinc directly. In neither case is the zinc lost. It can be recovered by chemical means from the solution. If solutions of zinc were abundant in nature and hence inexpensive, this style of storage battery would, for economical reasons, prevail. Or, still further, if metallic zinc were inexpensive we would have no need of storage batteries at all, but could use primary batteries directly.

A more perfect system of storage batteries is much to be desired. Already electricity is a staple article, and has a market price of so many cents per ampere hour. But its sale is of necessity confined to limited areas. As soon as these can be extended, by means of storage, an improvement in our commercial welfare will become apparent, and the fear arising from the predicted loss of our coal supplies, will not trouble the minds of our immediate posterity.

*Samuel Sheldon, Ph. D., in *Popular Science Monthly*, for December.

THE NEW WESTINGHOUSE MANAGEMENT.—It is reported that Mr. A. M. Byers has been appointed General Manager of the Westinghouse Electric Company, to take the place of Mr. Byllesby, who retired under the new order of things. Assistant Treasurer McCullough will also retire, his successor yet to be named. The banks interested in the reorganization of the company have decided to advance the money needed, and the concern will again be placed on a firm financial footing.

ADVANCE OF ELECTRIC TRACTION.

Mr. Frank Kitton read a paper before the Buffalo Electrical Society on December 15th on the subject of the "Advance of Electric Traction."

From the statistics gathered up to date, said he, there were, it appeared, no fewer than 246 electric roads in this country, operating 2,024 miles of track and employing 3,830 motor cars, the single trolley system, with only a few exceptions, being that in general use. The storage battery he did not yet consider as altogether beyond the experimental stages, though it was not without some promise of ultimate success. Many devices were being constantly brought out with a view to perfecting a conduit system, but no practical demonstration affording a successful solution of the problem had yet been reached. Therefore the advance in electric traction, Mr. Kitton said, must be considered practically from the overhead trolley system. He then described in detail many of the improvements effected in matters of detail of both an electrical and mechanical nature, and pointed out the strong and weak points of the system. The ordinary street car is mounted on a single truck and is about sixteen feet in length, but there was a growing tendency towards adopting longer cars with double trucks; experience having shown that these were attended with less danger and more economy than the use of trail cars.

Referring to the double trolley system, Mr. Kitton explained that this was a method by which the entire system was insulated from the earth. In one or two places cars were being operated on this principle, not because of any particular advantage derived from its use, but more from pressure brought to bear on the railroad companies by other electric corporations who claim a pre-existing right to the "earth," or at least urge the right to its use as an electric return circuit to the exclusion of others whose currents overpower their own more feeble ones. As electric power currents cause serious interference in telephonic lines, the telephone companies are naturally opposed to the introduction of the single trolley system, and have carried their opposition into the courts, which in some cases have sustained the objections.

Mr. Kitton pointed to the recent proceedings of the street railroad convention in this city as evidence of the great strides being made in the advance of electric traction, and concluded by quoting the language of retiring President Lowrey, who was so thoroughly convinced that electricity is the coming power that he believed the Buffalo convention would be the last that would ever seriously consider horses for the operation of street railways.

AWARD OF THE JOHN SCOTT LEGACY MEDAL AND PREMIUM.

In the December number of the *Journal of the Franklin Institute* we notice the announcement that the Committee on Science and the Arts of the Franklin Institute, Philadelphia, has recommended the award of the John Scott Legacy Medal and Premium to Almer Thomas and Luzerne Merket, of North East Pa., for their "Improvements in Casting and Hardening Copper."

Messrs. Thomas and Merket are two of the directors of the Eureka Tempered Copper Co., of North East, Pa., well known in the electrical trade for the excellence of their goods.

The value and importance of pure copper for electrical machinery and electrical transmission is too well understood to need any illustration here. It is, however, of much importance to have the metal pure and of the proper temper to produce the best results. To obtain these qualities is a matter requiring great skill and experience, and the ordinary copper of commerce is not always reliable in these respects. The process of manufacture employed by the Eureka Tempered Copper Company, however, is a scientific achievement over the ordinary methods, and by their process copper of any required temper and absolute purity is produced.

It is well known that the ancients made their edge tools of copper and tempered them with great skill. The ability to do this has, in these later times, been considered a lost art, but the Eureka Tempered Copper Company claims to have discovered the process, and are able to supply the trade with any and all kinds of copper cast solid, tempered to any gauge that the work expected of it demands.

In making commutators, brushes and other parts of electrical machinery, it has been customary to use rolled or drop forge copper or brass, and bronze: the former does not wear well, and the latter is deficient in electric conductivity. Cast copper would be a better substitute, but, as ordinarily manufactured, small blow holes are liable to exist; these, of course, weaken the metal, and renders it unreliable for such purposes.

The copper of the Eureka Tempered Copper Company, however, is free from blow holes and tempered to a high degree. It has, moreover, greater conductivity than rolled or drop forge copper.

The company warrants its goods to have three times the wear of any metal for commutator segments, electric brushes, gear pinions, armature bearings and trollies. Their tempered copper wire has nearly three times the tensile strength of ordinary copper wire and will last three times as long.

Considering these valuable qualities of their products the award of this medal to the Eureka Tempered Copper Company would seem to be a just one, and the company may reasonably feel proud of the distinction conferred upon it.

FOREIGN NOTES OF INTEREST.

A group of French and Belgian capitalists is offering to undertake the construction of a telephone trunk line between Berlin and Warsaw, a distance of about 360 miles.

The regulations hitherto in force that telephone lines in Spain, were not to exceed 10 kilometres in length have been abolished, and concessions for longer lines will now be granted.

The central lighting station on the Ferranti system, which came into operation at Troyes, France, in August last now supplies 2,000 lights, and is paying its way very satisfactorily.

The Austrian Minister of Commerce has resolved to send two engineers to London to study the City and South London Railway, with a view to utilizing the system on the projected Vienna Metropolitan Railway.

Henley's Telegraph Works have recently manufactured a submarine telephone cable which has been laid by the Pilot authorities in Finland between Hanzo, the most southern point of Finland, to a lighthouse 2½ miles from the coast.

An accumulator has been brought out by M. Donato Tommasi, the distinguishing feature of which is the use of hollow cylindrical perforated electrodes. Each cylinder is filled with active material, and closed at the bottom by an insulating plug, into which is screwed a rod running up the centre of the cylinder and terminating in a flat projection. The lids of the cells are slotted, and the cylinders are hung in rows from these metal-edged slots by means of the projections on their central conductors. Each row of cylinders constitutes an electrode.

THERMO-ELECTRICAL RESEARCHES.*

BY MESSRS. CHASSAGNY AND ABRAHAM.

In the course of our study of the thermo-electrical elements, the comparison of several couples formed of different metals has furnished us with a valuable means of checking the accuracy of our measurements. This system of check consists in the fact that the values obtained verify very accurately the law of the intermediate metals.

For the known temperatures of the junctions we get, between the electromotive forces of the couples formed by three metals, A, B, C, the relation $E(AC) = E(AB) + E(BC)$.

The experiments were arranged as described in a former article.† In order to ensure the same temperature at the heated junctions, the wires of the metals under consideration were soldered at one end into the same mass of copper. The other extremities, which were soldered to copper wires, were kept in vessels of ice insulated by wedges of paraffin.

The experiments related to couples formed of the following metals:—iron, platinum alloyed with 10 per cent. of rhodium; copper, pure platinum.

We will now give the results of an experiment in which the junction was placed in the vapor of boiling water:

COUPLES.	Electromotive forces observed. Volts.
Iron platinum alloyed with rhodium.	0.0008945
Platinum alloyed with rhodium-copper	0.0001980
Platinum alloyed with rhodium-platinum	0.0007897

From these quantities we deduce for the electromotive forces of the couples iron-copper, iron- platinum, and copper-platinum, the following values, opposite which we have placed those that were observed directly.

COUPLES.	Electromotive Forces. Calculated. Volts.	Observed. Volts.
Iron-copper	0.0010925	0.0010926
Iron-platinum	0.0016842	0.0016842
Copper-platinum	0.0005917	0.0005917

This system of check, which was necessary for the continuation of our researches, shows, at the same time the degree of exactness of the measurements.‡

Internal Resistance of Accumulators.—The expansion of the plates of an accumulator while discharging is the result of the absorption of sulphuric acid to form the sulphate, and the acid absorbed in this way during the discharge is restored during the charging; from which it is evident that the conductivity of the electrolyte is subject to continual variation; steadily increasing during the charging until the full proportion of acid is restored, declining during the discharge as the acid is absorbed; consequently the internal resistance during the discharge may not become so great as to lessen the practical efficiency of the cell; as a smaller percentage would be liable to entire absorption before the termination of the discharge, leaving only water which has a very high resistance as compared with that of dilute acid.

Cable Extensions.—A fourth cable has now been laid by the Eastern Telegraph Company from Suez to Aden, a distance of 1,400 miles, and by May next a third cable will be laid from Aden to Bombay, a distance of close on 2,000 miles. The Eastern Extension has duplicated its cable from Madras to Penang, which are 1,500 miles apart. There are now three cables between London and Australia. Besides these extensions, negotiations are in progress for the laying of a cable to connect Madagascar and the Mauritius with the Eastern and South African Company's cable at Zanzibar.—On the coast of South America the Western and Brazilian Company are doubling the line from Rio de Janeiro to Buenos Ayres; and nearer home we have just had 600 miles of new cable laid for the Great Northern Company between the North of England and Sweden.—London *Electrician*.

* Comptes Rendus de l'Academie des Sciences.

† Recherches de Thermo-Electricitié (Comptes Rendus, Vol. cxi., p. 447, 1890).

‡ Experiments made at the Physics Laboratory of the Higher Ecole Normale.

ECONOMY IN CONDUCTORS FOR ELECTRICAL DISTRIBUTION.*

In considering what economies it is possible to introduce into a system of conductors laid down for the distribution of electrical energy, one has at the outset to consider the relative merits of the different systems which have been proposed before investigating the best proportions to be given to different parts of the system fixed upon, and the proper current densities to be employed in them.

With regard to this first question, I do not propose to say more than a very few words, or to deal with it in any but the most general way.

It is important to observe, in the first place, that the pressure to be used in houses for lighting by incandescence lamps has been practically limited to a maximum of 100 to 120 volts by the makers of the lamps, and that the pressure in buildings may not in any case exceed the 300 volts fixed by the board of trade. This consideration, while greatly hampering the system of simple parallel distribution, does not affect to any great extent the rival systems employing accumulators or secondary generators.

In his Cantor lectures before the Society of Arts, in 1885, Prof. George Forbes gave a very interesting account of various systems and their sub-divisions; and he showed that, except for a very limited area of compact form requiring a large amount of light per unit of area, this system of simple parallel distribution is impracticable on account of the enormous expense of mains to carry the large currents necessitated by the use of so low a voltage For a very small and compact area such as a block of buildings, it may be worth while to consider the applicability of this system, however, on account of its simplicity and the cheapness of the class of cable that may be employed.

No practical use of the series system for general station work has been made that I am aware of, though, of course, it is largely in use for outdoor lighting and transmission of power. It has the obvious advantage of requiring comparatively small conductors, but against that must be put the expenditure necessary for providing a complete system of automatic cut-outs for every lamp, motor, or other apparatus employed, and the difficulty of regulating with any reasonable degree of economy for the varying numbers of lamps alight on different circuits. The comparatively low efficiency of glow lamps for series lighting is also an important reason against the adoption of such a system.

The next system to which attention may be drawn is the series-parallel system, of which the modifications known as the three-wire, four-wire, and similar systems are the most important. These are in general use both in England and abroad, and give for certain distributions of lamps a very good result indeed.

The degree of economy to be obtained with a three, four, or n wire system over the simple parallel system depends on the certainty or otherwise with which you can rely on a continued balance of load between the different sections. This you would secure as far as possible by putting as many of each class of consumers in each section, and also, if practicable, by insisting upon the wiring of all buildings supplied being upon the same system as that of the mains, and the total load in every case distributed between the sections.

If you are sure that the load in any one section will never exceed that of any of the others by more than m per cent. of the full load of a section, and the system is one of n wires; then if E stands for the per centage reduction in amount of copper used from that necessary in an equivalent simple parallel system.

$$E = 100 \left\{ 1 - \frac{200 + m\,(n - 2)}{200\,(n - 1} \right\}$$

For example, let $m = 25$ and $n = 3$
then $E = 43.8$.

If, as in a case in which all the wiring is done upon the same system as that of the mains, we may take $m = 10$; and supposing $n = 4$, then

$$E = 63.3.$$

If, in the same case we take $n = 5$,

$$E = 71.3.$$

In considering these systems it is necessary, in any practical case, to take into account the increased cost of labor in putting them down, and of the conduits or pipes in which they are enclosed. In connection with this, it is worthy of remark that with underground systems of mains—such as are likely to be in vogue in future — the cost of the actual cables may amount to less than 50 per cent. of the total cost of the cables laid.

With regard to systems employing accumulators or secondary generators, there is at once a great gain in the allowance of very much high pressures in the mains. The cable is, however, very much more expensive, and the cost of the accumulators and their constant inefficiency must be taken into account in the one case, and in the other the cost of the converters and their inefficiency on light loads. In the case of accumulators it is necessary to distribute the energy from sub-stations upon some one of the low tension systems, so that there is only a partial gain in respect to copper; and with converters, and especially those for alternating currents, it is well-known that their cost per kilowatt output diminishes to a considerable extent as their size increases, so that with these also it may be and is advisable sometimes to employ sub-stations, so that the same remark will apply here.

I have now very briefly alluded to some of the conditions affecting the relative economies of the chief systems of distribution of electrical energy; and I have purposely refrained from examination of them in detail for the reason that every particular case will differ to some extent from any other, and in making a choice of the system to be employed to best meet its requirements, a special investigation should be made having regard to all the conditions involved.

Before taking up any problems, such as those referred to in the abstract sent out to members, a word must be said as to the relation of price to size of cable. Bare wires, as you all know, are sold at so much a pound in general; stranded cables being a little more expensive than single wires and wires smaller than No. 20 or 22 a little dearer than those above this size. Speaking generally, however, cables of bare wire of approximately the same cross-sectional area are sold at the same price per pound. Small insulated wires of a definite thickness of insulation, such as one of two layers of cotton or silk, are also often sold at so much a pound, but with these we have nothing at present to do, unless it be to remark that with such wires the insulation resistance necessarily decreases as the wire increases in size.

Insulated cables for use in any of the cases we have to consider are, I believe, invariably sold by length.

For a given class of insulation, and a given insulation resistance per mile, you would expect—seeing that for a given insulation the mass of the insulator is directly proportional to the mass of the copper insulated—that the price should be very nearly proportional to the cross-sectional areas of the copper conductors. In practice this is very nearly so, for the price of a cable may be expressed by the equation

$$P = a + b\,A,$$

where P = cost per mile in pounds.

A = area of conductor in $\frac{1}{1000}$ths of one square inch and where a and b are constants depending upon the class of insulation and the number of strands in the cable, with considerable accuracy with the cables of some of the best known makers.

Taking Silvertown cables for example:

Class L.

7 strands	$P = 10.3 + 3.58\,A$	within	2.6 per cent.
19 "	$P = 15.7 + 3.39\,A$	"	3.5 "
37 "	$P = 22.5 + 3.32\,A$	"	0.7 "

Class D.

7 strands	$P = 4.72 + 1.32\,A$	within	2.9 per cent.
19 "	$P = 7.22 + 1.27\,A$	"	4.6 "
37 "	$P = 12.2 + 1.25\,A$	"	0.4 "

The percentage errors given above are the maxima, and the average are from ⅓ to ½ these.

In a similar way the values of the constants for the other classes manufactured by the Silvertown Company may be tabulated, but I have not thought it necessary to do so here, more especially as I have not their most recent p ic sheet by me.

With Fowler-Waring cables (lead covered) you would not expect this law to hold with the same degree of accuracy, as the thickness of lead is not proportional to the diameter of the cable. We have, however, for seven-stranded cables $P = 25.9 + 2.49\,A$, with a maximum error of 12½ per cent. and an average error of 4.8 per cent.

The cables of Messrs. Siemens are not manufactured upon the plan of having a given insulation resistance per mile for a given class of cable; the insulation resistance of their cables of a given class diminishes as the size of the cable increases. For example, for their classes L, M, and N, the insulation resistance per mile varies from 2,500 megohms for the smallest sizes to 300 megohms for the largest. You would not, then, expect to find the price of a cable proportional to its size, nor, in fact, is it actually nearly so.

With all cables, however, which are very nearly of the same size the price is, of course, very nearly proportional to the cross-sectional area of the copper, and over a narrow range the rule $P = a + b\,A$ still holds, the constants in any case being very easily determined by plotting a few points in the neighborhood of the size you want, and drawing the tangent to the curve (or the chord through points on either side of the size you estimate is about what you require) where the ordinate of the point of intersection of this tangent or chord with the axis of y gives a, and b is the trigonometrical tangent of the angle made by the line as drawn with the axis of x, it being supposed that prices are plotted as ordinates.

Now, in any case of central station work you can estimate from experience what is approximately the cross-sectional area of copper you want, so that we may take it that, for our purposes, the rule $P = a + b\,A$ holds universally. This may be regarded in the light that you pay a sum a for the privilege of being allowed to buy the cable you require from the makers you are dealing with, and for the rest the price of this cable is directly proportional to its size.

The most economical current density to employ for a constant and uniform current circuit working for a given number of hours per annum.

Let a = current in amperes;
n = number of hours of working per annum;
p = resistance of conductor of one square inch sectional area in ohms per mile;
c = value of the Board of Trade unit in pence;
d = sum of the rates of interest, depreciation, and repairs on capital laid out in cable;
x = sectional are of conductor required in $\frac{1}{1000}$ths of one square inch;
D = most economical current density to employ in amperes per square inch;
$P = a + b\,x$ as before;

then
$$x = a\sqrt{\frac{n\,c\,p}{2.4\,b\,d}}$$

and
$$D = 1{,}000\sqrt{\frac{2.4\,b\,d}{n\,c\,p}}$$

* Paper read before the Old Students' Association, London, by Hamilton Kilgour.

For copper conductors $p = 0.0425$, hence

$$x = 0.133\, a \sqrt{\frac{n\,c}{b\,d}}$$

and

$$D = 7.513 \sqrt{\frac{b\,d}{n\,c}}$$

For example, if we take Silvertown class L cable, and

$$c = 5$$
$$d = 13$$

we shall have the most economical current densities for different numbers of hours per annum given by the following table:

n	D 7 strands.	19 strands.	37 strands.
400	1,119	1,089	1,077
600	913	889	880
800	791	770	762
1,000	708	689	681
1,500	578	562	556
2,000	500	487	482
3,000	408	398	393

In this table p has been taken as 0.0446, which is rather higher than it should be.

No account of the increased resistance of the conductor due to heating has been taken account of in the foregoing; but as the current density to employ in a given case is known approximately from previous experience after a little, an allowance can easily be made for the probable heating in the value of p you decide to use.

NOTES ON THE CHEMISTRY OF SECONDARY CELLS.*

(*Continued from page 9, issue of December 27.*)

As already explained, the constant discharge current of 10 amperes was, by the employment of some auxiliary cells, kept flowing through the accumulator under test even when its E. M. F. became very small. Towards the end of the discharge the fall of P. D. at the terminals of the cell under test became extremely rapid, so that, for example, on closing the circuit after the removal of the plugs at D′ (fig. 2), the P. D. fell from 1.9 to 0.6 volts in 33 minutes.

This rapid fall is probably due to lead peroxide being formed on the negative plates more rapidly than it could be removed by local action, since the chemical analysis showed decided evidences of lead peroxide on the plugs removed at D′ from the negative plates. At E′ (fig. 2) the E. M. F. of the accumulator under test became reversed, but rapidly recovered its original direction on stopping the discharge current.

It is a very striking example of the recuperative action of a secondary cell that you can completely discharge it, as you think, and then even charge it in the wrong direction, but it will, on being insulated, rapidly recover an E.M.F. in the original direction. Indeed, we were told of a curious case some time back. After the removal of the laboratory employed for testing ammeters from one part of a well known London factory to another, it was found that the E.P.S. accumulators always ran down very rapidly whenever an attempt was made to use them, in spite of their having been charged in the intervals. As the E.M.F. was always in the right direction, it was supposed that the cells had become partially short-circuited in the removal, and it was not for some time that the true explanation of the refusal of the cells to do their work was discovered. The real fact was that, in fitting up the new laboratory, the leads from the dynamo to the switch had been reversed, so that the unfortunate cells were charged in the wrong direction every time the dynamo was turned on.

The preceding incident also forcibly illustrates the sort of attention that secondary cells may receive in practice, and shows the necessity for the P.D. and specific gravity being occasionally measured even in places where the study of the behavior of cells is not the main business of the factory.

One of the great defects of the earlier specimens of the E.P.S. cells lay in the buckling of the plates. Mr. Capito tells us that it was Mr. Collet who noticed that all the plates generally curved in one direction, and who suspected that this arose from the unequal chemical action on the two sides of the last positive plate of the cell. Mr. Collet therefore proposed putting a negative plate at each end of this cell, and this plan—which has been always followed since—of using one more negative than positive plate, has much to do with removal of the buckling difficulty.

V.

EFFECT OF REST ON CHARGED ACCUMULATORS.

As the result of a number of tests described in our Edinburgh paper we found that if E. P. S. accumulators be charged with 9 amperes and discharged with 10, a number of times without intermission, between the P. D. limits of 1.8 and 2.4 volts per cell, until the cells are brought to a perfectly steady "working state" the quantity efficiency is about 97 per cent., and the energy efficiency 87; further, that if the cells be fully charged until the P. D. per cell is 2 4 volts, and then be left perfectly insulated for 16 days, the next discharge between the fixed P. D. limits only gives out about 65 per cent. of the ampere hours, and about 57 per cent. of the energy put in before the rest. Further, not merely is energy lost during the rest of an insula ed accumulator, but for several subsequent charges and discharges between the same P. D. limits after the rest the storage capacity and the quantity and energy efficiencies are all lower than before the rest.

For the purpose of examining into what took place in an accumulator, which was left charged, a small E. P. S. cell was charged until the P. D. was 2.4 volts, and then the positive plates were withdrawn and put into another vessel containing dilute acid of specific gravity 1.2, the negatives being left in the vessel in which they were charged. Both sets of plates were covered up with gutta percha hoods, the edges of which dipped under the liquid, and to the top of each hood was fitted, gas tight, a vertical graduated glass tube closed at the top. The hoods and the glass tubes were first filled with liquid, and the amount of gas that came off from the two sets of plates was measured from day to day by watching the descent of the liquid in the tubes.

No gas was seen to come off from the positive plates, but in the case of the negatives gas came off very slowly at first, then more rapidly, and finally more slowly again. The following table gives a record of the amount of gas that came off from the negative plates, the gas, on analysis, being found to be hydrogen :—

Hydrogen Gas Collected from Charged Negative Plates after Removal of Positive Plates.

DATE.	Time.	Cubic centimetres of gas collected.	Time of collecting gas in hours.
November 15th....	11 45	0	0
" 17th....	10 0	2	46
" 20th....	12 0	52	120
" 21st....	10 0	72	142
" 22nd....	10 0	87	166

If the lead of the positive plate be turned into lead sulphate by local action, 87 c.c. of hydrogen liberated corresponds with about 0.81 gramme of lead turned into sulphate. It is clear, then, that the lead of the negative plate is steadily being turned into some oxide or salt, and probably the loss of energy which we observed in the charged cell left insulated for many days was due to this local action at the negative plate. And further, as this action takes place apparently only at the negative plate, it is clear that in the subsequent discharge the cell will appear to be discharged before the positive plate is discharged, and charged up again without reducing all the lead sulphate on the negative plate. The local action at the negative plate while a cell is standing charged, has, therefore, for the first few discharges and charges after a long rest, exactly the same effect as if a portion of the negative plate had been bodily removed out of the cell. Hence we see that the peculiarities observed by us in curves 8 to 23 in our Edinburgh paper may be explained by this defective behavior of the negative plates.

VI.

CONSTRUCTION AND FORMATION OF E.P.S. PLATES.

The question arises why the E.P.S. accumulators are so constructed that the plugs in the positive plates contain some 48 per cent more peroxide of lead than is required to be converted into sulphate in the normal discharge. Two explanations suggest themselves. One is that, since the granules of lead peroxide begin, as we find, to be coated with a protecting coating of sulphate early in the discharge, it is impossible, with the present form of plate, for the interior of each granule of lead peroxide to be converted into sulphate, and, therefore, it is necessary to employ nearly twice as much lead peroxide as is actually needed for the chemical action. Another reason is the fear of the positive plate crumbling to pieces if it be completely formed; and this reason Mr. Capito, who was formerly in the employ of the Electrical Power Storage Company, thinks, on the whole, is the more important.

In the construction of the original Faure accumulators, as well as of the early E.P.S. cells, both the positive and the negative plates were pasted with red lead (Pb_3O_4), and formed together for a period of some 50 hours. Later on litharge (Pbo) was used to coat the negative plate, red lead being used only for the positive one, and the plates were formed separately, the negative being much more formed at the works than the positive. Some time ago I was informed by a very competent authority that the following is the modern process of *forming* employed by the Electrical Power Storage Company:

Positive Plates.—8⅞″ by 7⅞″ by ¼″. Two amperes per plate, or 0.028 ampere per square inch, sent for 18 hours.

Negative Plates.—9″ by 9⅝″ by $\frac{3}{16}$″. One and a half to two ampere per plate, *i. e.*, 0.017 to 0.023 amperes per square inch, for 120 hours.

The actual time of forming either set of plates depends greatly on the length of stoppages during the formation. This is especially the case with the negative plates, therefore they endeavor to form the negative for the 120 hours without any stoppage of the current. On the receipt of a cell from the Electrical Construction Corporation, the purchaser is requested to form it for 40 hours more with the ordinary charging current used in working, which is at the rate of 0 026 ampere per square inch.

Mr. Capito tells us that, when he was at Millwall, such periods of formation as 120 hours were not used; and he thinks that this may be due to the fact that formerly the plates were not dried after pasting and before formation, as they are at present. This drying hardens the plates and produces a better cell; but he thinks that, as the paste is itself mixed with sulphuric acid, there is probably some sulphating of the negative plates during drying, and that several hours in the subsequent formation are probably spent in reducing this sulphate.

The reason, we understand, for the manufacturers only forming the positive plates for 18 hours, and leaving the purchaser to form them for the remaining 40 hours, is that if positive plates be *well formed* and then dried for carriage, the plugs become loose, which is not the case if the positive plates be only slightly formed before drying.

We were interested in learning from Mr. Capito whether, while superintending the manufacture of many thousands of accumulator plates, he had ever tried pasting the positive with lead peroxide ($Pb\,O_2$) in order to avoid the necessity of having to form this salt electrically out of the

*Read before the English Institution of Electrical Engineers, November 13th.

red lead with which the positive plates are usually pasted. This idea of applying a paste of lead peroxide directly to the positive plate, he told us, he had tried, but that the method turned out a failure, from the impossibility of getting the lead peroxide paste to stick on to the grid even when some red lead was mixed with the lead peroxide. He also mentioned a very interesting fact—that whereas a paste of red lead mixed with dilute sulphuric acid of density 1.1 gives an adherent deposit on formation, on the contrary, a powdery deposit is produced if the density of the liquid used in making the red lead paste be 1.2. We understand the process that has shown itself the best is to use dilute sulphuric acid of density 1.2 for mixing the red lead paste, and dilute acid of 1.2 for mixing the litharge paste for the negative plates.

THE ELECTRO MAGNET.*

BY PROF. SILVANUS P. THOMPSON.

ACTION OF MAGNETIC FIELD ON SMALL IRON SPHERE.

In dealing with the action of tubular coils upon iron cores, I showed how, when a very short core is placed in a uniform magnetic field, it is not drawn in either direction. The most extreme case is where a small sphere of soft iron is employed. Such a sphere, if placed in even the most powerful magnetic field, does not tend to move in any direction if the field is truly uniform. If the field is not uniform, then the iron sphere always tends to move from the place where the field is weak to a place where the field is stronger. A ball of bismuth or one of copper tends, on the contrary, to move from a place where the field is strong to a place where the field is weaker. This is the explanation of the actions called "dia-magnetic," which were at one time erroneously attributed to a supposed dia-magnetic polarity opposite in kind to the ordinary magnetic polarity. A simple way of stating the facts is to say that a small sphere of iron tends to move up the *slope* of magnetic field, with a force proportional to that slope; whilst (in air) a sphere of bismuth or one of copper tends, with a feeble force, to move down that slope. Any small piece of soft iron—a short cylinder, for example—shows the same kind of behavior as a small sphere. In some of Ayrton and Perry's coiled-ribbon amperemeters and voltmeters, and in some of Sir William Thomson's current-meters, this principle is applied.

SECTIONED COILS, WITH PLUNGER.

An important suggestion was made by Page, about 1850, when he designed a form of coil-and-plunger having a travel of indefinitely long range. The coiled tube, instead of consisting merely of one coil, excited simultaneously throughout its whole length by the current, was constructed in a number of separate sections or short tubes, associated together and to end, and furnished with means for turning on the electric current into any of the sections separately. Suppose an iron core to be just entering into any section, the current is turned on in that section, and as the end of the core passes through it, the current is then turned on in the section next ahead. In this way an attraction may be kept up along a tube of indefinite length. Page constructed an electric-motor on this plan, which was later revived by Du Moncel, and again by Marcel Deprez in his electric "hammer."

WINDING OF TUBULAR COILS AND ELECTRO-MAGNETS.

The mention of this mode of winding in sections leads me to say a few final words about winding in general. All ordinary coils, whether tubular or provided with fixed cores, are wound in layers of alternate right handed and left-handed spirals. In a preceding lecture I mentioned the mistaken notion, now disproved, that there is any gain in making all the spirals right-handed or left-handed. For one particular case there is an advantage in winding a coil in sections; that is to say, in placing partitions or *cloisons* at intervals along the bobbin, and winding the wire so as to fill up each of the successive spaces between the partitions before passing on from one space to the next. The case in which this construction is advantageous is the unusual case of coils that are to be used with currents supplied at very high potentials. For when currents are supplied at very high potentials there is a very great tension* exerted on the insulating material, tending to pierce it with a spark. By winding a coil in *cloisons*, however, there is never so great a difference of potentials between the windings on two adjacent layers as there would be if the layers were wound from end to end of the whole length of coil. Consequently, there is never so great a tension on the insulating material between the layers, and a coil so wound is less likely to be injured by the occurrence of a spark.

Another variety of winding has been suggested, namely, to employ in the coils a wire of graduated thickness. It has been shown by Sir William Thomson to be advantageous in the construction of the coils of galvanometers to use for the inner coils of small diameter a thin wire; then, as the diameter of the windings increase, a thicker wire; the thickest wire being used on the outermost layers, the guage being thus proportioned to the diameter of the windings. But it by no means follows that the plan of using *graded wire*, which is satisfactory for galvanometer coils, is necessarily good for electro-magnets. In designing electro-magnets it is necessary to consider the means of getting rid of heat; and it is obvious that the outer layers are those which are in the most favorable position in getting rid of this heat. Experience shows that the under layers of coils of electro-magnets always attain a higher temperature than those at the surface. If, therefore, the inner layers were to be wound with the finer wire, offering higher resistance, and generating more heat than the outer layers, this tendency to over-heating would be still more accentuated. Indeed, it would seem wise rather to reverse the galvanometer plan, and wind electro-magnets with wires that are stouter on the inner layers, and finer on the outer layers.

Yet another mode of winding is to employ several wires united in parallel, a separate wire being used for each layer, their anterior extremities being all soldered together at one end of the coil, and their posterior extremities being all soldered together at the other. Magnetically, this mode of winding presents not the slightest advantage over winding with a single stout wire of equivalent section. But it has lately been discovered that this mode of winding with *multiple wire* possesses one incidental advantage, namely, that its use diminishes the tendency to sparking which occurs at break of circuit.

EXTENSION OF RANGE BY OBLIQUE APPROACH.

I now pass to the means which have been suggested for extending the range of motion, or of modifying its amount at different parts of the range, so as to equalize the very unequable pull. There are several such devices, some electrical, others purely mechanical, others electro-mechanical. First, there is an electrical method. André proposed that as soon as the armature has begun to move nearer, and comes to the place where it is attracted more strongly, it is automatically to make a contact, which will shunt off part of the current and make the magnetism less powerful. Burnett proposed another means; a number of separate electro-magnets acting on one armature, but as the latter approached these electro-magnets were one after the other cut out of the circuit. I need not say the advantages of that method are very hypothetical. Then there is another method which has been used many times with very great success, the method of allowing the motion of the armature to occur obliquely, it being mechanically constrained so as to move past, instead of towards the pole. When the armature is pulled thus obliquely, the pull will be distributed over a definite wider range. Here is a little motor made on that very plan. A number of pieces of iron set on the periphery of a wheel are successively attracted up sideways. An automatic device breaks the circuit as every piece of iron comes near, just at the moment when it gets over the poles, and the current being cut off, it flies on beyond and another piece comes up, is also attracted in the same way, and then allowed to pass. A large number of top motors have been made from time to time on this plan. I believe Wheatstone was the first to devise the method of oblique approach about the year 1841. He made many little electro-magnetic motors, the armatures of which were in some cases solid rims of iron arranged as a sort of wheel, with two or more zig-zag internal teeth, offering oblique surfaces to the attraction of an electro-magnet. Such little motors are often now used for spinning Geissler's vacuum tubes. In these motors the iron rim is fixed, and the electro-magnet rotates. The pole of the electro-magnet finds itself a certain distance away from the iron ring, it tries to get nearer. The only way it can get nearer is by swinging round, and so it gradually approaches, and as it approaches the place where it is nearest to the internal projection of the rim the current is cut off, and is swings further. This mode may be likened to a cam in a mechanical movement. It is, in fact, nothing else than an *electro magnetic cam.* There are other devices, too, which are more like electro-magnetic *linkages.* If you curve the poles or shape them out you may obtain actions which are like that of a wedge on an inclined plane. There is an electro-magnet in one of Paterson and Cooper's arc lamps wherein the pole-piece, coming out below the magnet, has a very peculiar shape, and the armature is so pivotted with respect to the magnet, that as the armature approaches the core as a whole, its surface recedes from that of the pole-piece, the effect being that the pull is equalized over a considerable range of motion. There is a somewhat similar device in De Puydt's pattern of arc lamp.

*Abstract from Cantor Lecture delivered before the Society of Arts, London.

*The tension on the insulating material, tending to pierce it with a spark, is proportional to the square of the difference of potentials (per unit thicknes) to which the insulating material is subject. It is incorrect to talk about the tension of the conductor or about the tension of the current; for the tension or electric stress is always an action affecting the di-electric or insulating material.

HIGH PRESSURE ALTERNATING MAINS.—*Industries* says: "Reports have of late been freely circulated that the Deptford electric light mains show a very much higher pressure at the London than at the Deptford end. Several eminent scientific men are said to be investigating this phenomenon. We should like to know more about this apparently impossible effect. We may mention another fact, which may be foretold on theoretical grounds, and which, while being apparently similar, is really quite different from that referred to above. For example, if a dynamo is excited to give, say, 5,000 volts at the termimals before the mains are connected, it will give considerably more directly they are thrown on, especially if the load is very light, but the increased pressure will be at Deptford as well as in London. The rise of pressure can be roughly calculated beforehand if the particulars of the dynamo and mains are given. A higher pressure in London than Deptford at a given time appears quite incapable of explanation with our present knowledge."

BROKEN ARC LAMP GLOBES.—One of the most frequent causes of breaking of arc lamp globes is the undue heat produced after the carbon has burned close to the holder.

ON THE ILLUMINATION OF A HORIZONTAL PLANE.*

BY F. LOPPÉ.

The writer considers the problem of lighting a horizontal plane by means of a number of similar lights arranged so that the illumination at no place on the ground shall be less than a given quantity, E, and so that the energy expended in producing the light shall be as small as possible.

Two special cases are treated. In the first a large area is supposed to be illuminated by means of many lamps placed in rows, so that the poles stand at the corners of squares of equal size. In the second a street is supposed to be illuminated by means of lamps placed alternately on each side of the road, in the manner usual in practice.

It is assumed for simplicity that the energy required for producing the light is proportional to the amount of light produced. The problem may, therefore, be stated in the following way: Given a certain amount of light, which, with certain limitations, may be distributed in any manner, how shall this light be apportioned so that the minimum illumination of the surface may be as great as possible?

The author first considers the illumination of a square (side $2a$), lighted by four lamps (height h) placed at the corners. It is shown that the light at the centre of the square is

a minimum if $h < a\sqrt{3}$

and a maximum if $h > a\sqrt{3}$

As in practice the first condition always holds since lamps are placed farther apart from each other than from the ground, the illumination at the centre of the square is a minimum; and in the problem of lighting an area in the manner stated above, the quantity E refers to the centres of the squares.

In working out the condition that the total light used to produce the minimum illumination E may be as small as possible, it is shown that $L/4a^2$ must be a minimum where L is the candle-power of each lamp, and where the relation expressed by the following equation:—

$$2a^2 = \left(\frac{4h}{E}\right)^{\frac{2}{3}} L^{\frac{2}{3}} - h^2$$

connects the three unknown quantities, a, h, and L, with the quantity E, which is supposed given. If we assume one of the former three quantities known, we can find the best relation between the other two. By assuming L, or the candle-power of the lamps used, to be known, the best value for h is shown to be

$$h = 0.87\sqrt{\frac{L}{E}}$$

where E is measured in terms of the illumination produced by a candle placed at unit distance from the surface lighted.

If, on the contrary, h is assumed known, the best value for L is given by the equation

$$L = 1.30\ E\ h^2$$

The second case, that referring to street lighting, is then considered, and it is shown that if L is fixed, the best value of h is

$$h = 0.62\sqrt{\frac{L}{E}}$$

while if h is known, the best value for L is

$$L = 0.92\ E\ h^2$$

RATIO OF TEMPERATURE AND LIGHT.—As the temperature of an incandescent body increases, not only does the actual quantity of radiant energy increase, but its wave lengths diminish. Experience has shown that after incandescence is reached, increasing the temperature in a given ratio increases the light emitted in a much greater ratio.

SAFETY DEVICES.—The best safety device for high potential current circuit is perfect insulation.

L' Electricien.

INDUCTION AND INDUCTION COILS.*

The phenomena exhibited by the variation of the number of lines of induction through the core of an ordinary induction coil may be divided into two parts. Firstly, when the discharge is non oscillatory, and, secondly, when it is oscillatory. It is with the former of these divisions only that I deal with in this paper.

If l, lines of induction, are threaded through the core of a coil of n turns, joined up to a circuit of resistance R, then the quantity q of electricity produced in the circuit will be

$$q = \frac{n\,l}{R} \qquad (1)$$

Also, if an E. M. F., capable of producing a steady current C, is put in a circuit, then each time the current is started a quantity of electricity

$$q = L\frac{c}{R} \qquad (2)$$

will be kept back that would have been generated but for the existence of the coefficient L.

Owing to this factor L impeding the starting of the current in the circuit in a similar manner to that in which the inertia of a body opposes the force setting it in motion, it has been aptly called the electro-magnetic inertia of the circuit. But the shorter but less expressive term of inductance is now more generally used.

The quantity q in (1) is quite unaffected by the presence of any other circuits upon the same electro-magnet. For if l_1 of the same lines of induction are threaded through another coil of n_1 turns, then the quantity

$$q_1 = \frac{l_1 n_1}{R_1} \qquad (3)$$

will be induced in this second circuit while q remains unaltered.

Also when the current, c, is started in the primary circuit the quantity

$$q_1 = m\frac{c}{R_1} \qquad (4)$$

will be induced in the secondary circuit, while the value q in (2) will also remain unaltered.

From (1) and (2) we get

$$l = c\frac{L}{n}. \qquad (5)$$

And, thus, the number of lines of induction threaded through a coil can be determined when the inductance and number of turns upon the coil are known.

Also from (3) and (4)

$$l_1 = c\frac{m}{n_1} \qquad (6)$$

And from (5) and (6) we get

$$\frac{l_1}{l} = \frac{m}{L}\frac{n}{n_1}. \qquad (7)$$

A formula by which can be determined the fraction of the whole number of lines of induction generated by the primary circuit that are usefully threaded through the secondary circuit.

If l equidistant lines of induction cross an area a then the tension along those lines of induction, that is, the pull across the area a

$$= \frac{l^2}{8\pi a} = \frac{c^2}{8\pi a}\frac{L^2}{n^2}. \qquad (8)$$

The energy absorbed from the primary circuit in generating the lines of magnetic induction through the core of simple electro-magnetic $= \frac{E\,q}{2}$ where E is the E. M. F. of the battery.

*W. MOON, in London *Electrical Review*.

From (1) and (2)

$$\frac{E\,q}{2} = \frac{c\,n\,l}{2} = \frac{L\,c^2}{2} \qquad (9)$$

To get as great a pull with as little expenditure of energy as possible in creating the lines of magnetic induction, we must make the quotient of (8) and (9) a maximum

$$\frac{l}{4\pi a c n} = \frac{L}{4\pi a n^2} \qquad (10)$$

This last expression is useful in the construction of rapidly responding apparatus such as telegraph relays. But in other apparatus it is necessary to get as great a pull with as small a rate of expenditure of heat in the coils as possible; in that case

$$\frac{L^2}{8\pi a n^2 r}$$

must be made a maximum, where r is the resistance of the coils of the electro-magnet.

The energy expended by a battery of E. M. F., E, during a time, t, sufficiently long to admit the current arriving at its permanent state

$$= E\,(c\,t - q). \qquad (11)$$

where q is the quantity of electricity damped back by L on starting the current.

Filling the value of q in (2), in (11) the energy expended by the battery becomes.

$$\frac{E^2}{R}\left[t - \frac{L}{R}\right] \qquad (12)$$

But since from (9) the part of this energy absorbed from the primary circuit in creating the magnetic field.

$$= \frac{E^2}{R}\frac{L}{2R}$$

It follows that the difference between the values (12) and (9) gives the amount expended in heat.

$$= \frac{E^2}{R}\left[t - \frac{3}{2}\frac{L}{R}\right]$$

If there is no secondary circuit this heat will be expended by the current in the primary circuit. But if a secondary circuit exists part of this heat will be expended in that circuit also.

If the same lines of induction are discharged through several secondary coils then the energy embodied in the lines of induction will be divided between the several coils in proportion to the number of turns of each, and inversely proportional to their resistances. Thus the energy expended in the coil of n_1 turns and resistance R_1 would be

$$\frac{E^2}{R^2}\frac{L}{2}\left[\frac{\frac{n_1}{R_1}}{\frac{n_1}{R_1} + \frac{N}{R}}\right]$$

Obviously it is immaterial whether the coil of n turns is a secondary or a primary circuit, and since $\frac{E^2}{R^2}\frac{L}{2}$ is the energy embodied in the lines of induction threaded through the two coils, the sum of these last two values, or

$$\frac{E^2}{R^2}\frac{L}{2}\left[\frac{2\frac{n_1}{R_1} + \frac{n}{R}}{\frac{n_1}{R_1} + \frac{N}{R}}\right]$$

will represent the energy absorbed from the primary circuit on starting the current.

Thus it will be seen that the whole energy

taken from the primary circuit on starting the current cannot be twice as great as when there is no secondary circuit, but approaches more closely to that value as $\frac{n_1}{R_1}$ becomes great as compared with $\frac{n}{R}$.

The time of discharge is important in induction phenomena, as it is by the variation of this factor that the laws of conservation of energy are maintained. Let t be a time of sufficient duration to incude nearly the whole of the discharge. And e and e_1 the mean E. M. F. in the primary and secondary circuits during this time, then

$$e = \frac{n\,l}{t} = \frac{L\,c}{t} \qquad (14)$$

$$e_1 = \frac{n_1\,l_1}{t} = \frac{m\,c}{t} \qquad (15)$$

And the energy given off in the discharge of the secondary circuit

$$= e_1\,q_1 = \frac{n^2_1\,l^2_1}{t\,R_1}$$

$$= \frac{m^2\,c^2}{t\,R_1} = \frac{E^2}{R^2}\,\frac{m^2}{t\,R_1} \qquad (16)$$

By adding this last quantity to the energy expended in creating the magnetic field and to that expended in heat in the primary circuit, and equating the result to the energy expended by the battery, the value of t can be determined.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRIC AGE,
74 FEDERAL STREET,
BOSTON, Dec. 27, 1890.

The Standard Electric Supply Company report large and increased sales.

The factory of the Thomson-Houston Electric Co., in Lynn, has been shut down through the holidays.

The Eastern Electrical Supply and Construction Co. report a large increase in their sales for the month of December.

The Bell Rock Electrical Conductor Company are to add a large number of braiders to their plant in Maplewood.

P. A. Stewart, fireman for the Wright Electrical Engineering Co., was presented on Christmas evening with a gold watch by the men in his "gang."

A new fire alarm system has just been completed in Westboro. Danvers is also to have a small system erected, which will cost about $1,500.

Mr. H. Seaverns, formerly with the H. E. Swift Electric Company, has connected himself with the Eastern Electrical Supply and Construction Company as salesman.

Melville S. Brigham, constructing electrician, has on hand a contract to equip the houses of the members of the fire department in a suburban town with a system of tappers.

A crusade is being instituted against "dead" wires in Boston. It is estimated that there are over 5,000 miles of overhead wires in the city, of which 525 miles belong to the fire alarm system.

The C. & C. Motor Company have just installed a 20-horse power motor in the works of the Tremont Rubber Company at 65 Franklin street, this city. This motor will run nearly 200 sewing machines.

The men who were injured by the explosion of the boiler, at the factory of the Johnston Electric Train Signal Co., in Woburn, something like a week ago are doing nicely, and are expected to be out in a few days.

The telephone company is offering to take entire charge of the fire alarm systems in the suburban towns. The charges varies from $200 to $1,500 per annum, according to the number of boxes and miles of wire.

At an adjourned meeting of the Lowell Board of Aldermen, last Monday night, the Commercial Telegraph Company was granted locations in a number of streets throughout the city, the company to be responsible for all damage caused by the use of the wires.

The Western Union Telegraph Company will occupy part of the new Stock Exchange building on State street, which is now in course of erection. The building will be ready for occupancy February 10th, 1891, and is one of the largest and most beautiful structures in Boston.

C. J. Van Depoele has been granted a patent for a magnetic shield for electric motors, the combination, with an electric motor and a vehicle upon which said motor is mounted, of a sheet iron casing constituting a magnetic shield and permanently interposed between the motor and the interior thereof, whereby the passage of magnetic lines from the motor to the interior of the vehicle is prevented.

Superintendent E. W. Rice, Jr., of the Thomson-Houston works has patented a method of regulation for the preventing injury to an electric motor upon starting from a state of rest, which consists in maintaining in series circuit with the armature of the motor a counter-potential generator until the speed of the armature becomes such as to generate of itself sufficient counter electro-motive force to render injury from the passage of an excessive current no longer liable, and then shunting or disconnecting from circuit the counter potential generator.

The New England Printing Telegraph Co. have completed the erection of their line from Donaldsonville, Conn., to this city. This line is about 100 miles long, and is one of the finest built lines in the country, the poles averaging forty-two to the mile. The cross arms used are of the best selected pine, and are fitted with locust pins placed twenty inches apart. The two No. 6 wire which forms the lines are tied to the insulators with No. 8 wire ties. The work has been done under the supervision of Mr. C. F. Hutchinson, the superintendent of the company, and reflects great credit upon him.

The Baltimore (Md.) City Council, here on a trip to inspect the electric street railway system, visited the factory of the Thomson-Houston Electric Company in Lynn the past week. Special cars were provided on the Revere Beach and Lynn Railroad and electric cars from West Lynn to the factory. The party was in charge of H. B. Prindle, of the Thomson-Houston Co. Besides the Baltimoreans, Supt. of Streets Jones and his assistant were present, as were Chief Electrician George W. Mansfield and H. L. Cargill of the Thomson-Houston Co. On the return to Boston a lunch was served at Young's Hotel. The party left for Baltimore on a special train over the southern division of the Boston and Maine Railroad. W. J. P.

NEW YORK NOTES.

Mr. Alexander Mac Gruthar, late superintendent of the Edison Phonograph Works, Orange, N. J., left last week for Detroit, where he will be interested in the manufacture of pearl buttons.

It is authoritatively announced that the North American Phonograph Company will hereafter give the option of purchasing phonographs and phonograph-graphophones. The practice heretofore has been to rent only.

Mr. James F. Kelly, general manager of the wire department of the Edison General Electric Company, has returned home after an extensive business trip throughout the West, including San Francisco and Portland, Oregon.

The annual meeting of the stockholders of the Edison General Electric Company will be held at the office of the company, Edison Building, 44 Broad street, at noon, Monday, January 19th, 1891. Trustees for the ensuing year will be elected. The meeting will also take action on the question of ratifying the action of the Board of Trustees in declaring a dividend on the stock paid in trust by the Farmers' Loan and Trust Company, and dissolving said Trust. The transfer books were closed on December 29, 1890, and will be reopened on February 3, 1891. R. J. G.

PHILADELPHIA NOTES.

The business of the de Kosenko & Hetherington Manufacturing Company having expanded to such preportions, they have been compelled to find more ample quarters, and they have just moved into the *Times* annex building on Sansom street.

Messrs. Patrick & Carter, the well-known manufacturers of electrical supplies, at 114 South Second street, will remove from their present quarters about January 1st, 1891, to the large buildings, No. 125 South Second street, and No. 131 Gothic street, both of which have been altered and fitted for the firm's occupancy. The largely increasing business of the firm has rendered more spacious quarters absolutely necessary.

Considered in the light of its relations to the great commercial interests of the world, no line of American railways is more comprehensive, and few so far-reaching in their vast ramifications as the Philadelphia and Reading Railway system. Its lines, direct or allied, reach every nook and corner of the great State of Pennsylvania, and take within their mighty scope the great cities of the country, and by direct connections reach one hundred and ninety-three summer resorts situated in the Eastern, Middle, and Southern States.

NEW PUBLICATIONS.

The Edison Manufacturing Co., of Orange, N. J., has just issued a new and enlarged catalogue of the Edison-Lalande battery. It is very complete in its description of the various uses to which this famous battery is applicable, and several fac-similies of letters from users are given speaking in flattering terms of the merits of the battery. Various diagrams of curves are also given, and each type of all is illustrated.

The Phonogram is the title of a new monthly magazine published by the Phonogram Publishing Company, World Building, New York. *The Phonogram* will be devoted to the service of sound and recording of speech. Mr. D. H. McRae is the manager, who, in his salutatory, announces that it is also a part of his company's plan "to keep pace with the progress of electricity in its application to the most useful ends." No. 1 of *The Phonogram* is quite interesting.

Mr. Wm. J. Hammer, well-known through his connection with successful electric displays, has just issued and is sending to his friends a very artistically gotten-up pamphlet desciptive of and illustrating the various electrical exhibits over which Mr. Hammer had supervision. In his pamphlet also are given fac-similes of letters from Mr. T. A. Edison, Prof. Elihu Thompson, Edward H. Johnson, and others, all testifying in terms of highest praise to Mr. Hammer's ability as a consulting and supervising electrical engineer. Mr. Hammer's office is in Temple Court, 5 Beekman street, New York City.

PURE COPPER.—In electrical work it is always more economical to use the purest copper obtainable.

THE ELECTRIC AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS ISSUED DECEMBER 16 AND 23, 1890.

442,617. Electric-Arc Lamp. John E. Giles, Hazleton, Pa. Filed Aug. 21, 1889.

442,623. Electric Trolley Switch and Trip. Richard C. Hopson, Saginaw, Mich. Filed May 5, 1890.

442,649. Electric Heater. Charles H. Talmage, Kansas City, Mo. Filed Apr. 11, 1890.

442,654. Portable Electric Motor and Cloth-Cutting Machine. Elbert D. Weyburn, Chicago, Ill., assignor to the Weyburn Special Machine Company, same place. Filed Apr. 5, 1890.

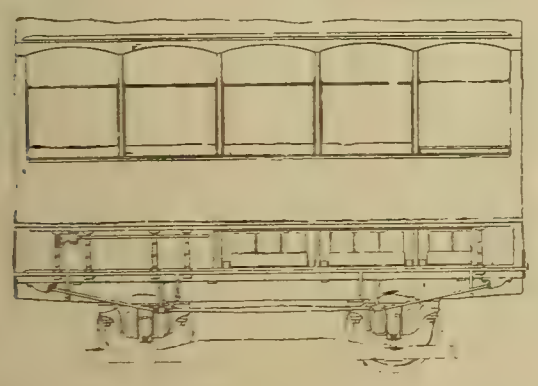
442,666. Bracket for Combined Electric and Gas Lighting. John Gunn, New York, N. Y. Filed Mar. 12, 1890.

442,668. Regulation of Electric Motors. Edwin W. Rice, Jr., Lynn, Mass. Filed Oct. 20, 1890.

442,705. Electric Meter. Alexander W. Meston, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, same place. Filed July 22, 1890.

442,734. System of Telegraphic and Telephonic Exchange. John R. Smith, Neosho, Mo., and Wallace Childs, Fort Smith, Ark. Filed Sept. 27, 1889.

442,744. Storage-Battery Electric Car. John Stephenson, New York, N. Y. Filed Aug. 2, 1890.



NO. 442,744.—STORAGE BATTERY ELECTRIC CAR.

442,746. Pendant Cleat. Arthur P. Bush, Boston, Mass., assignor to Paine & Francis, same place. Filed June 4, 1890.

442,799. Train-Telephone. Robert S. Carr, Hamilton, Ohio, assignor of two-thirds to W. B. Carr and George P. Stevenson, both of same place. Filed Feb. 17, 1890.

442,816. Safety Device for Overhead Conductors. Robert A. Morgan, Jr., Boston, Mass. Filed May 14, 1890.

442,843. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed July 1, 1890.

442,856. Means for Reducing Inductive Disturbances in Telephone Circuits. John J. Carty, New York, N. Y. Filed Sept. 18, 1890.

442,868. Underground Conduit for Electric Conductors. Josiah S. Du Bois, Camden, N. J. Filed Mar. 15, 1886.

442,870. Dynamo-Electric Machine or Motor. Nathan H. Edgerton, Philadelphia, Pa. Filed Oct 22, 1890.

442,881. Means for the Transmission of Meteorological Indications. Henry J. Haight, New York, N. Y. Filed Nov. 29, 1889.

442,882. Multiple-Circuit Closer. Henry J. Haight, New York, N. Y. Filed Mar. 14, 1890.

442,883. Combined Electric Indicating and Telephone System. Henry J. Haight, New York, N. Y. Filed May 9, 1890.

442,932. Electric Cooking Apparatus. Ernest Abshagen, Chicago, Ill., assignor, by direct and mesne assignments, of five-eighths to George M. Clark, Henry M. Hubbard and William H. Hubbard, all of same place. Filed Aug. 4, 1890.

442,933. Electric Steam and Hot Water Generator. Ernest Abshagen, Chicago, Ill., assignor, by direct and mesne assignments, of five-eighths to Geo. M. Clark, Henry M. Hubbard, and William H. Hubbard, all of same place. Filed Aug. 4, 1890.

442,954. Method of Welding Metals Electrically. Charles L. Coffin, Detroit, Mich. Filed June 9, 1890.

442,969. Portable Electric Lamp. Desmond G. Fitzgerald and Arthur H. Hough, London, England, assignors to the Mining and General Electric Lamp Company, Limited, same place. Filed Sept. 9, 1890. Patented in England.

442,996. Electric Switch. John O'Brien, New York, N. Y. Filed Aug. 28, 1890.

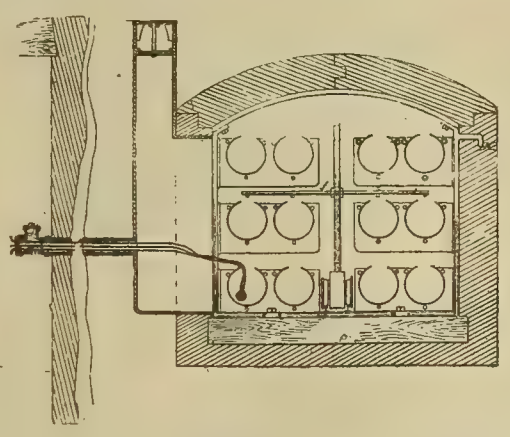
443,004. Trolley Line Switch. William M. Ramsey, Allegheny, Pa. Filed Aug. 7, 1890.

443,005. Trolley Line Insulator. William M. Ramsey, Allegheny, Pa. Filed Aug. 7, 1890.

443,042. Magnetic Ore Separator. George S. Finney, Chicago, Ill., assignor to the Rotary Magnetic Ore Separator Company, same place. Filed Mar. 25, 1890.

443,043. Magnetic Separator. George S. Finney, Chicago, Ill., assignor to the Rotary Magnetic Ore Separator Company, same place. Filed Mar. 25, 1890.

443,044. Magnetic Ore Separator. George S. Finney, Chicago, Ill., assignor to the Rotary Magnetic Ore Separator Company, same place. Filed Mar. 25, 1890.



NO. 442,868.—UNDERGROUND CONDUITS FOR ELECTRIC CONDUCTORS.

443,048. Method of Protecting Buildings from Lightning. Nathaniel D. C. Hodges, Plainfield, N. J. Filed Sept. 28, 1889.

443,068. Electric Cut-Out. David J. Cartwright, Boston, and John S. Potter, Newton, Mass.; said Cartwright assignor to said Potter. Filed July 14, 1890.

443,074. Electric Signaling Device for Moving Vehicles. Otis J. Depp and Schuyler J. Munn, St. Louis, Mo., assignors of one-fourth to Peter M. King, same place. Filed Aug. 4, 1890.

443,081. Trolley Switch for Electric Railways. John Jones, New York, N. Y., assignor of two-thirds to C. P. Stevens, Denver, Colo. Filed Sept. 25, 1890.

443,084. Electric Railway. Edward M. Bentley, New York, N. Y. Filed Apr. 9, 1887.

443,097. Electric Street-Light. George M. Kim, Allegheny, Pa. Filed May 19, 1890.

443,111. Printing-Telegraph. Frank B. Rae, Chicago, Ill. Filed Aug. 9, 1888. Renewed Apr. 15, 1890.

443,134. Printing-Telegraph. Samuel V. B. Essick, Brooklyn, N. Y. Filed Nov. 7, 1888.

443,135. Printing-Telegraph. Samuel V. Essick, Brooklyn, N. Y. Filed Mar. 10, 1890.

443,136. Printing-Telegraph. Samuel V. Essick, Brooklyn, N. Y. Filed July 5, 1890.

443,145. Telephone Circuit and Apparatus. James L. McQuarrie, Boston, Mass., assignor to the New England Telephone and Telegraph Company, same place. Filed June 27, 1890.

443,157. Electrical Signaling Apparatus. Ambrose B. Wyckoff, Washington, D. C., assignor of three-fifths to Joseph Warren Coulston, Philadelphia, Pa. Filed May 5, 1890.

443,167. Electrically-Operated Railway-Switch. Samuel L. Powell, Lewiston, assignor of one-half to Frederick D. Morrison, Baltimore, Md. Filed Feb. 21, 1890.

443,174. Insulator. William L. R. Emmet, East Rockaway, N. Y. Filed Sept. 18, 1890.

443,181. System of Electrical Distribution. Henry A. Rowland and Louis Duncan, Baltimore, Md. Filed Sept. 10, 1888.

443,187. Electric Insulator. Forée Bain, Chicago, Ill. Filed Mar. 25, 1890.

443,195. Cut-Out. George W. Mingle, Philadelphia, Pa. Filed Aug. 1, 1890.

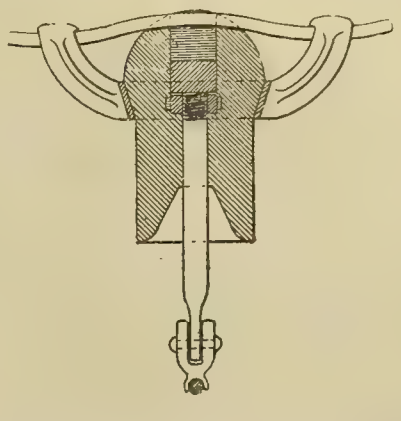
443,219. Galvanic Battery. Horatio J. Brewer, New York, N. Y. Filed June 16, 1890.

443,224. Electric Welding Apparatus. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Aug. 6, 1890.

443,227. Mounting for Electric Motors. Andrew L. Riker, New York, N. Y. Filed Apr. 23, 1889.

443,282. Electric Safety Device for Elevators. Herbert E. Holmes, West Springfield, and Charles F. Grosvenor, Ludlow, Mass. Filed Mar. 26, 1890.

443,283. Electric Safety Device for Elevators. Herbert E. Holmes, West Springfield, and Charles F. Grosvenor, Ludlow, Mass. Filed Apr. 14, 1890.



NO. 443,005.—TROLLEY LINE INSULATOR.

443,291. Electro-Mechanical Central System for Regulating Clocks. Carl A. Mayrhofer, Berlin, Germany, assignor, by mesne assignments, to the Electro-Pneumatic Time Company, New York, N. Y. Filed Dec. 29, 1888. Patented in Switzerland.

443,360. Recording Pressure-Gage. Jarvis R. Edson, New York, N. Y. Filed June 12, 1890.

443,381. Telegraph-Transmitter, Samuel W. Smith, New York, N. Y. Filed June 2, 1890.

443,407. Dynamo-Electric Machine. Chas. P. Scheuritzel and John L. Hess, Brooklyn, N. Y. Filed February 5, 1890.

443,435. Watchman's Time-Recorder. Isham D. Fuller, Chicago, Ill., assignor, by mesne assignments to the Fuller Watchman's Electrical Detector Company, same place. Filed July 2, 1890.

443,451. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed October 4, 1886. Divided and this application filed September 5, 1890.

443,452. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed September 23, 1886. Divided and application filed June 1, 1887. Again divided and this application filed September 5, 1890.

443,454. Electrode for Secondary Batteries. Isidor Kitsee, Cincinnati, Ohio, assignor to Mayer Sulzberger, trustee, Philadelphia, Pa. Filed February 11, 1890.

TRADE NOTES.

The Pope Manufacturing Company of Boston, New York and Chicago has issued a convenient calendar, called the "Columbia Desk Calendar," for 1891. There is a leaf for every day in the year and ample space on each for memoranda. There is also printed on each leaf a little paragraph of useful information. The calendar will be found very useful to business men.

Queen & Co., of Philadelphia, have recently taken an order for a "magnetic vane" ammeter, capacity 1,350 amperes. The instrument will have a dial some 12 inches in diameter, encased in a heavy japanned iron circular box. This is the largest ammeter that the firm has undertaken, and will, no doubt, be a handsome addition to the switchboard of the Central Passenger R. R. Co, at Louisville, Ky. Queen & Co. are also making "magnetic vane" ammeters with capacities of 300, 400, and 500 amperes for such companies as the Brush and Edison. These instruments have dials about 8" across and are mounted in iron or brass cases as ordered. They are used by the above companies on their finest switchboards, where it is desired to have meters in harmony with the other work. On the magnificent switchboard of the steamer "Plymouth" may be seen two of Queen's "magnetic vane" ammeters, capacity 400 amperes each. These instruments have been advertised but little as yet, but the demand is large and increasing, as the makers of dynamos are beginning to realize that in order to show up their apparatus in the most advantageous manner it is necessary to send out with each installation, first-class ammeters and voltmeters. Queen & Co. also report a brisk demand for Ayrton & Perry ammeters and voltmeters, which are largely used as portable instruments.

FOR SALE.—Eight Second-hand C. & C. Motors; good as new; 9½ amperes, ⅓ horse power, 13 volts; price, $18 each. Address,
"MOTORS," ELECTRIC AGE OFFICE,
World Building, City.

IF YOU HAVE A BATTERY,

Gravity or Leclanche, use the DELANY BATTERY STRIP. It prevents salts from creeping, keeps batteries and shelves clean, prevents local action and prolongs life of battery. *Warranted.* Per dozen, Gravity, 60 cents; Leclanche, 50 cents.

PATRICK B. DELANY,
SOUTH ORANGE, N. J.

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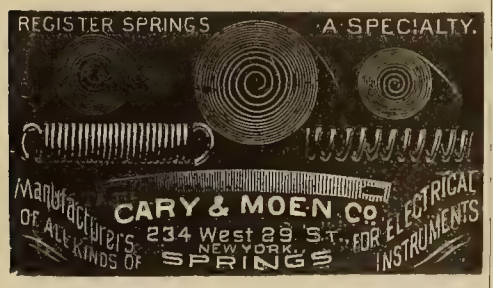
Duralite Company,

No. 85 WATER ST.,

BOSTON, MASS.

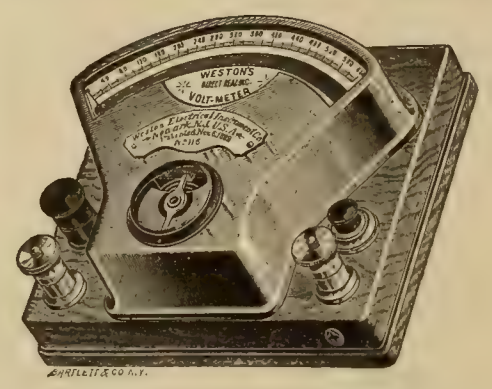
BUSINESS NOTICES.

Advertisements under this head not occupying over one-half inch of space, $1.00 per each insertion.



THE WESTON STANDARD

Voltmeters and Ammeters.



These instruments are the most accurate, reliable and sensitive portable instruments ever offered. A large variety of ranges to meet the requirements of all kinds of work. Address:

Weston Electrical Instrument Co.,

Send for Illustrated Catalogue. 114 & 116 William St., NEWARK, N. J.

INTRODUCING ENTIRELY NEW PRINCIPLES.



Pat. Mar. 19, 1889. THE OLD STYLE.

THE ACME LINK BELT

IS MADE ONLY BY THE

Page Belting Company, Concord, N. H.

BRANCHES: Boston, New York, Chicago, San Francisco. Also, manufacturers of all the staple grades of Leather Belting and Lacing. Send for Illustrated Catalogue—a valuable treatise on belting, Free.

Telephone Companies, Supply Houses, Bell Hangers, Physicians, and all users of open circuit batteries are requested to write the

LAW TELEPHONE CO.,

85 John street,

NEW YORK.

We have something to interest you.

THE CLARK SYSTEM OF ARC LIGHTING,

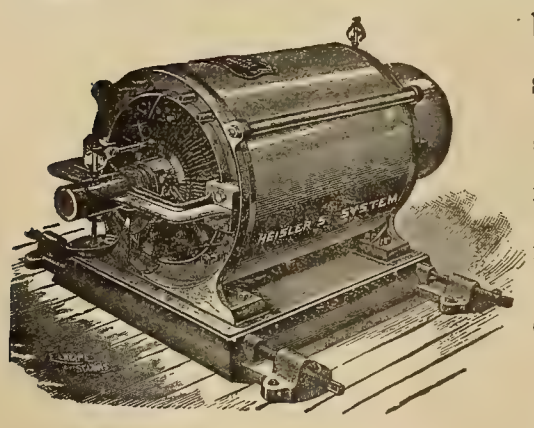
The Safest, the Most Economical, Durable and Perfectly Regulated System in the United States.

Manufactured by the CLARK ELECTRIC CO., 192 Broadway, New York.

Awarded the Highest Distinction, a Gold Medal, by the International Jury at the Universal Exposition, Paris, 1889.

THE HEISLER PATENT LONG DISTANCE

INCANDESCENT ELECTRIC LIGHT SYSTEM.



Unequalled for Distribution over Wide Areas.

SPECIALLY ADAPTED FOR

STREET, COMMERCIAL AND DOMESTIC ILLUMINATION FROM CENTRAL STATIONS.

SAFETY, RELIABILITY AND FINANCIAL SUCCESS FULLY DEMONSTRATED.

Plan of Wiring the Simplest, Cheapest and Most Efficient.

—: STRICTLY SERIES. :—

Noted for the Brilliancy and Beauty of the Light. Lamps, 10 to 100 Candle Power. Long Life without Blackening.

Greatest Production of Candle Power per Horse Power.

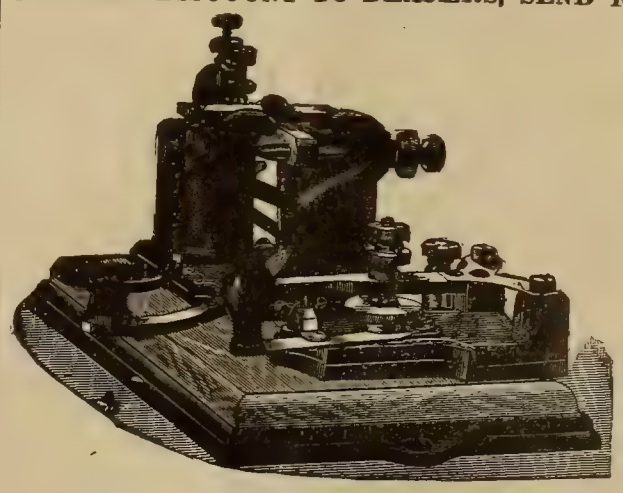
Dynamo Self-Contained and Perfectly Automatic.

Plant may be located where Power can be secured Cheapest, even if Miles Distant from the Lighting.

SEND FOR CIRCULARS. - CORRESPONDENCE SOLICITED.

HEISLER ELECTRIC LIGHT CO., 809-817 South 7th St., ST. LOUIS, MO.

LIBERAL DISCOUNT TO DEALERS, SEND FOR REDUCED PRICE



No. 2 O. K. OUT

WITH SOUNDER AND KE

On same base, or separate, as or

Complete Outfit, - - $

Sounder, - - -

Key, - - - -

Sounder and Key on one Base. - - -

The above Outfit consists of a beautiful Sounder wound to 20 ohms, and one of my valed Nickel Plated, Legless, Steel Lever Keys; One Cell 5x7 Battery (or 6x8 Battery extra); 15 ft. Insulated Office Wire, 1 lb. Vitriol, 1 Instruction Book, all safely packed an be shipped on receipt of price, or sent C. O. D., subject to inspection, if you send me with order. State whether you wish Key and Sounder on same Base or separate. Write address plain and full, also state by what Express Co. wish goods shipped. Address,

A. B. LYMAN, 34 and 36 South Water Street, CLEVELAND, OHIO

THE UNIVERSAL ARC LAMPS

FOR INCANDESCENT CIRCUITS.

The best arc lamps on the market to be operated from central incandescent lighting stations or isolated plants.

Give a beautiful, steady, noiseless light, using only from 8 to 9 amperes, and can readily be adjusted for any direct current circuit of 100 to 125 volts. Additional resistance unnecessary. ***Safe, Simple, Satisfactory.***

The Universal Theatrical Arc Lamp

Is a great success for stage and scenic uses, yielding vastly superior effects to calcium. Can be installed wherever constant, direct currents exist. Much cheaper than the old fashioned methods. Outfits furnished at shortest notice. Prices and testimonials on application. Write at once for prices and further information, mentioning voltage of station or plant, to

THE UNIVERSAL ARC LAMP CO.,

Executive Office, 16 & 18 Broad St., New York
J. H. McCLEMENT, Prest.

Salesroom, 49 West 22d St., New York.
E. S. MENDELS, Genl. Manager.

Or to THE ELECTRICAL SUPPLY CO., Chicago, Ill.; ST LOUIS ELECTRICAL SUPPLY CO., St. Louis, Mo.; SOUTHERN ELECTRICAL MFG. AND SUPPLY CO. (Limited), New Orleans, La; WALKER & KEPLER, Philadelphia, Pa.; PETTINGELL ANDREWS CO., Boston, Mass.

GENERAL ELECTRICAL DIRECTORY.

BALTIMORE, MD.

Viaduct Manufacturing Co. District Telegraph Supplies.

BOSTON, MASS.

American Bell Telephone Co., 95 Milk Street.
American Circular Loom Co., Insulated Wires and Cables, 620 Atlantic Avenue.
American Conduit and Construction Co., Clement Conduits, Jamaica Plain.
American Electric Register Company, Electric Registers for Street Cars, 620 Atlantic Avenue.
American Fire Alarm Co., Thermostats and Fire Alarms, 51 Kilby Street.
The Holtzer-Cabot Electric Co., General Electrical Supplies, 111 Arch Street.
Wilson, R. D. and Co., 113 Devonshire, W. Electric Securities.
Zeigler Bros., Annunciators, etc., 73 Pearl Street.
Dunraitte Company, 85 Water Street.

BROOKLYN, N. Y.

Elektron Manufacturing Co., 79-81 Washington Street.
Mason, J. H. Primary Batteries, 114-120 Park Avenue

CAMDEN, N. J.

Applegates Electric Floor Mat Manufacturing Co., Electric Mats, 37 Market Street.

CHICAGO, ILL.

Central Electric Co., General Electrical Supplies, 118 Franklin Street.
Bain, Furee, Electrical Expert, 84 Market Street.
Bumpelly Storage Battery Co., 229 La Salle Street
Electrical Supply Co., Annunciators, etc., 171 Randolph Street
Eickert & Nelson, Electric Light and Combination Fixtures, 83-87 Fifth Avenue.
Electric Merchandise Co., Electric Railway Supplies, 11 Adams Street
Adams, Waldo P., Electrical Constructor, 144 Adams Street

CLEVELAND, O.

Fletcher & Fletcher Electric Co., Annunciators, 13 South Water Street
Forest City Electric Works; Switches and Cut Outs
Lyman, A. B., Electrical Instruments, 34-36 South Water Street

CONCORD, N. H.

Page Belting Co., Link Belts.

DETROIT, MICH.

Detroit Electrical Works, Woodward Avenue and Railroad Crossing.
Detroit Motor Co., Motors, 212 Griswold Street.
Fisher Electric Co, Dynamos and General Supplies, 187 Larned Street.
Brownlee & Co., Poles,
Commercial Electric Co., 55 and 57 Gratiot Avenue.
Lockwood Instrument Co., Electrical Measuring Instruments, 61 Buhl Block.

FITCHBURG, MASS.

Colburn, I. W., & Co., Dynamos.

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Ansonia Brass and Copper Co, 19 Cliff Street.
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Binney, H., Patents and Litigation, 245 Broadway.
Bogart, A. L., Electrical Gas Lighting Apparatus, 22 Union Square.
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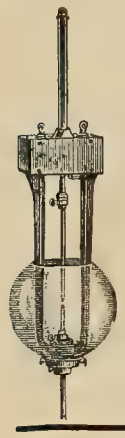
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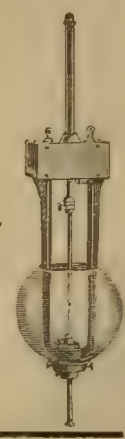


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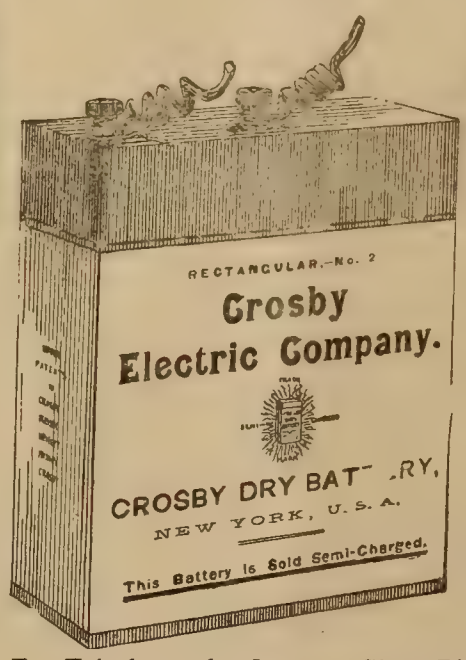
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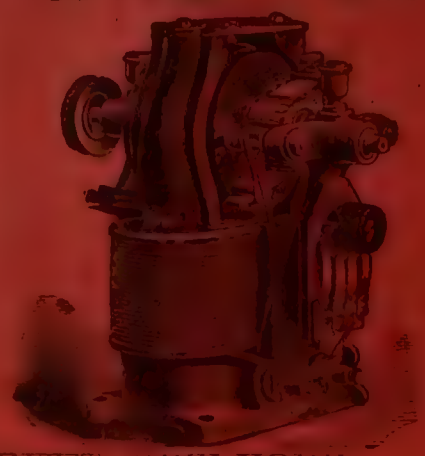
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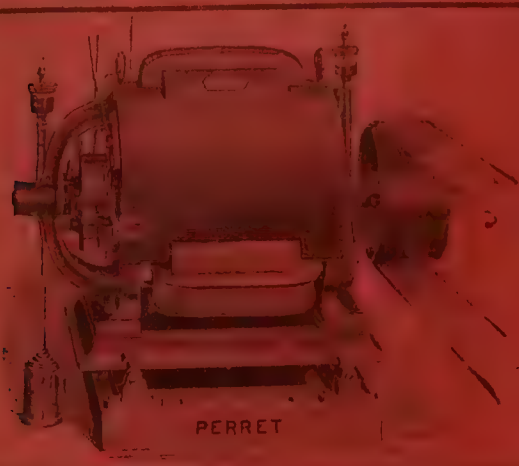


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NEW YORK, JANUARY 10, 1891.

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IMPORTANT ANNOUNCEMENT.

Mr. Walter T. Hunt, who for the past seven years has been manager of the advertising department of our contemporary, the *Electrical World*, has severed his connection with that paper and assumed a like position with the ELECTRIC AGE. Mr. Hunt is so well-known in the electrical trade that it is hardly necessary now to formally introduce him.

WESTINGHOUSE BUSINESS IN 1890.

On another page we print an interesting statement concerning the business done during the past year in electrical apparatus by the Westinghouse Company.

The figures indicate one thing, and that is, that the Westinghouse system of lighting is growing in favor and in use. In 1890 the shipments of alternating current incandescent dynamos were 217, with an aggregate capacity of 348,150 sixteen-candle power lights. The first year of the company's experience in the electric field (1886) the shipments of alternating current apparatus had an aggregate capacity of 2,400 16-candle power lamps; during the next year (1887) the number of lamps increased to 106,200 and the rapid increase has been maintained ever since, until up to the present time the company has turned out a total of 730 incandescent light machines, with a total of 720,800 16-candle power lamps. During the year 1890 the company entered the electric railway field with a new motor. On July 1st the first shipment of a railway motor was made, and since then 211 15-horse power motors have been turned out of the shops going to forty different railways. These facts show unmistakably that the company's motor is, too, growing in popularity. The year 1890 also marked another departure in the business. The manufacture of alternating current arc light apparatus was begun at the beginning of the year. Since then 107 arc light dynamos have been shipped, with an aggregate capacity of 5,680 2,000-candle power lamps. The company now has 30,000 converters in use, and also 20,000 Shallenberger meters.

CHIEF OF THE ELECTRICAL BUREAU OF THE WORLD'S FAIR.

A Chicago daily paper prints an interview with Director-General Davis of the World's Fair, in which he expresses his views regarding the electrical department. He is disposed, offhand, to think it unnecessary to appoint a chief for the bureau at the present time, but to depend rather upon the department of installation to do what is desirable in the way of awakening the interest of home and foreign electricians for the next year or eighteen months. At the end of that time he proposes to appoint a superintendent of electricity and to promote the business of getting up an exhibit by any method agreed upon by the electrician.

"But," said Mr. Davis, "if the electricians want the appointment made and will give me any good reason why it should be made now rather than a year hence, I shall feel like inaugurating the bureau at once and appoint the electrician."

It strikes us that it would be unwise to defer the appointment of a chief of the electrical bureau for a year or more. That the electrical exhibit will be one of the most important of all at the Fair is generally conceded. It will be no side-show; and the fact that a building is to be erected for the electrical exhibit exclusively, is evidence that the managers of the Fair have an appreciation of the vast importance of electricity in the industrial world.

In two years and a half hence the Fair will be opened to the world. It seems like a long time to look forward to, but when we consider the vast amount of labor involved in this great display, and the time necessary to get everything in readiness by the appointed time, two years and a half after all dwindles into insignificance. We venture to say that whoever receives the appointment will wish he had twice two years and a half in which to lay his plans and carry them iuto execution.

The electrical department will necessarily require a man of recognized ability at its head. He must, of course, have the proper technical knowledge and experience to carry on the work successfully. It is a department that will not take care of itself, and the general officers of the Fair certainly cannot manage it along with the others. It should be put right into the hands of a practical electrician, or electrical engineer. It is none too soon to begin the work, and to carry it forward properly it should have a head.

THE TELEPHONE PATENTS.—Many stories have been going the rounds of late predicting what will likely take place in 1893 when the Bell Telephone patent runs out. The general impression seems to prevail that opposition telephone companies will spring up everywhere, and that telephones may be had for next to nothing. This is all a mistake, and if any one desires a telephone put in his premises but is holding off until Fair year when the telephone will be cheaper, our advice is, do not wait, as the telephone service will probably not be much if any cheaper than it is now, as there will be no more opposition then than there is now. It is true that a telephone patent does run out in 1893, but how about the many other patents which the company controls? There are many parts to a telephone, and many of them are patented. The fact is, it will be many years yet before all the important patents expire, and it is only one of the many, and, we believe, the earliest, that expires in 1893. Therefore, those who are counting on a "Hello" war in 1893, will, we think, be greatly disappointed. There is no reason to believe that there will be any sanguinary contest then. As is well known, the Bell Telephone Company buys up every patent of any value that is brought out, and it is in that way that the company got such a hold on the telephone. It owns all the improvements in telephony, the patents on which run for many years yet.

LIGHTNING RODS.—An ingenious application of the well-known property of static electricity to distribute itself over surfaces, thereby reducing its potential, is recorded on another page. Mr. N. D. C. Hodges, of Plainfield, N. J., has invented and received letters patent on a method of constructing lightning rods based on this property of electricity, and if the theory is borne out by experience his invention will be classed as one of great value.

It is a well-known fact that lightning rods as ordinarily constructed seldom prove to be of any protection against the damaging effects of lightning strokes. Mr. Hodges seeks to make lightning rods more efficient by interposing in their continuity, above the roof of the protected building, a box filled with soot, the idea being that electric discharges conveyed through the rod will be dissipated over the large surface presented by the soot. If the discharge is not wholly dissipated, its potential will, at least, be greatly reduced, thus removing the element of danger to buildings.

Mr. Hodges also proposes to employ rods made of such substance that will be destroyed or dissipated by the lightning discharge. He argues that if something must be destroyed it better be the rod than the house.

The main idea of his invention is to interpose in the probable path of a lightning discharge some substance on which the discharge can spend its energy and become dissipated.

It will be extremely interesting to know how Mr. Hodges' invention works in practice. Theoretically, it seems to be all right.

ELECTRIC LIGHT LITIGATION.—In the suit of the Brush-Swan Electric Light Company against the Brush Electric Company, which is pending in the United States Circuit Court, and in which certain patent rights are concerned, Judge Coxe, on January 2d, made an order permitting the defendant to make any sales of electrical machinery, apparatus and supplies in territories mentioned in a previous decree, provided it sets aside a commission of 20 per cent. on all moneys received pending the final adjudication. This fund will be paid into the hands of the plaintiff company, provided it files a bond $25,000; otherwise it must be turned over as registry of the court.

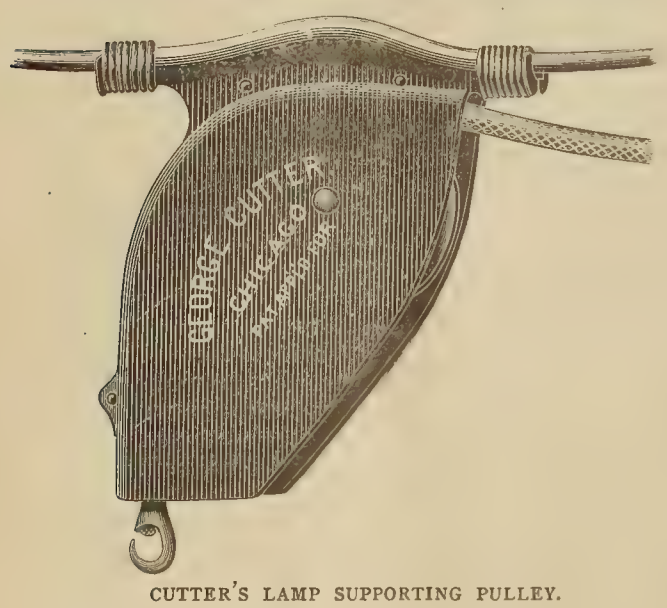
ELECTRICAL INDUSTRIES IN CANADA.—Generally speaking, we on this side of the Canadian Border know very little about what is going on on the other side. This is probably true to a greater extent in the electrical industries than in any other, and for that reason we think that the article we publish on another page about the generation and application of electricity to useful purposes in Canada will be read with interest.

TO REMOVE UNAUTHORIZED WIRES.—Mayor Grant intends to again soon wage war on poles and wires in the city. Those not authorized will be removed, and for the determination of this class of wires and poles the Mayor is having a list prepared.

ELECTROLYSIS ON WIRES.—Wires of unlike material, copper and iron, for instance, should never be spliced together, on account of the tendency to electrolytic action at the joints.

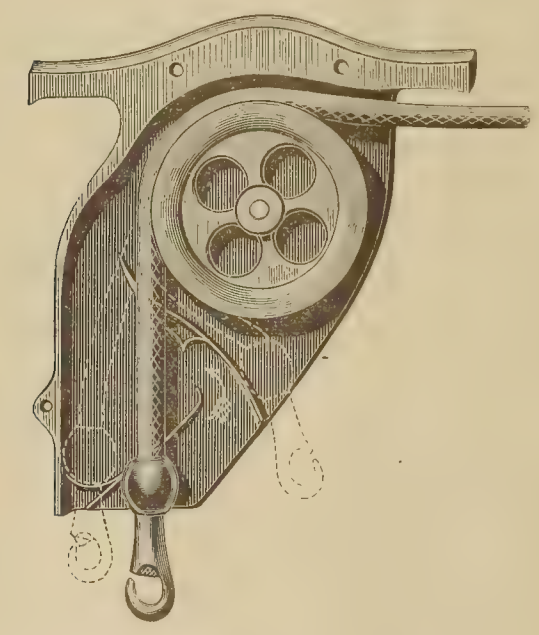
CUTTER'S LAMP SUPPORTING PULLEY.

This is one of those ingenious devices which are the more needed because they are simple and well made, and which are destined to quickly become popular with electrical people. It is a sleet-proof pulley which supports the lamp when raised, thus taking the strain off the hoisting rope, which may be loosened or even cut without letting the lamp drop into the street. The arrangement is such that the mere raising of the lamp by pulling on the hoisting rope leaves it supported by the pulley. Then by pulling on the rope again the lamp is released and can



CUTTER'S LAMP SUPPORTING PULLEY.

readily be lowered. The supporting and releasing is accomplished without the addition of any moving parts, by the simple arrangement shown in our cut. The sides of the pulley have ridges which serve as guides for the knob of the hook from which the lamp is hung. On raising the lamp the knob is guided (as shown by the arrow) up to the curved stop; then on slackening the rope the weight of the lamp pulls the knob down into the recess at the left. This leaves the lamp supported entirely by the pulley, so that the hoisting rope may be left slack. On pulling at the hoisting rope again and then slackening it, the knob is guided out as shown by dotted lines, thus releasing and lowering the lamp. This arrangement is positive in its action



MECHANISM OF LAMP SUPPORTING PULLEY.

and has no cams or catches to get out of order. Another new feature of Cutter's Lamp-Supporting Pulley is the method of fastening it to the suspension wire. Binding wires wrapped around the ends of the pulley fasten this to the suspension wire which rests in the grooved upper edge of the pulley. As the cut shows, this puts a kink into the suspension wire and thereby keeps the pulley from slipping. As the pulley combines the advantages of an independent support in a simple pulley, and holds the lamp a securely as a mast-arm, it would seem to be adapted for use with street lamps everywhere. It is among the new specialties made and handled by George Cutter, 333 "The Rookery" Chicago.

THE UNITED PRESS IN ITS NEW OFFICES.

On January 1st The United Press formally opened its handsomely fitted up offices in the *World* building, and entertained its friends in a very hospitable manner.

The new quarters of The United Press consist of a suite of 7 rooms on the 11th floor, which are fitted up in the most elegant and convenient manner. The officers' rooms are furnished and papered with great artistic taste and the general telegraph operating room is a model of its kind. The electrical plant is most unique in its character and is full of interest to the electrician. It was installed by Mr. George W. Gardanier, electrician for the Western Union Telegraph Company. An illustrated description of this plant will be given in a later issue of the ELECTRIC AGE.

Mr. Walter P. Phillips, General Manager of The United Press, formally opened the offices with an address in which he traced the history of the concern of which he is the head from its beginning, twenty years ago, up to the present time.

Many persons called during the afternoon and evening and received a hearty welcome.

In the evening an orchestra discoursed music for the entertainment of the association's guests and a thoroughly enjoyable time was had.

Many persons of prominence, in and out of journalism, were in attendance and many others sent letters and telegrams of regret at their inability to be present. Letters of regret were received from President Harrison, Private Secretary Halford, and Governor Hill of New York.

ELECTRIC RAILWAY IN POTTSVILLE.

Pottsville, Pa., rejoices in an electric railway. The Schuylkill Electric Railway was formally opened for business on December 23d. The entire construction and equipment of the road was done by Chadbourne, Hazleton & Co., and the United Electric Equipment Company, of Philadelphia, Charles R. Eberle, general manager.

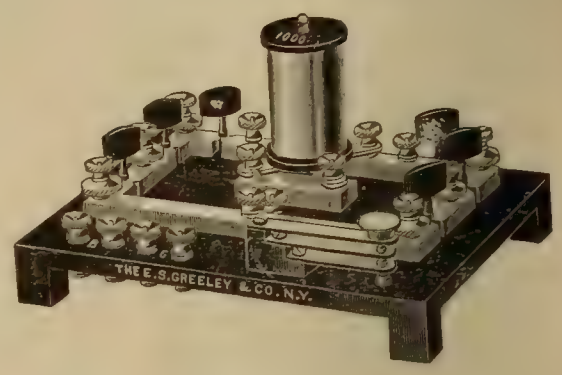
The first work of construction was commenced on August 19th, 1890. The power of the dynamos is furnished by an immense Ball engine, which is located in the Edison Electric Light Station, and was installed under the supervision of Supt. R. W. Kear of the Edison Co. The entire contract has been under the direct general supervision of Mr. C. R. Eberle, general manager of the United Electric Equipment Company, of Philadelphia. The length of the line is 1¾ miles and extends from Yorkville to the center of the town, with spurs to the several railway depots. Each car has two 15-horse power motors mounted on Peckham trucks. The motors and dynamos are of the Short Electric Railway Company's make. The cars are sixteen feet long and have a seating capacity of thirty persons. They were built by the Lamonkin Car Co., Chester, Pa., and are of the vestibule pattern. They are handsomely and comfortably furnished and lighted by electricity.

It is said that this plant is one of the most substantially constructed of any in the country and many flattering comments have been made on the superior work in connection therewith.

STORAGE BATTERY CARS IN WASHINGTON.—The storage battery system of propulsion is to be introduced on the lines of the Metropolitan Street Railroad Co., Washington, D. C. Mr. C. O. Mailloux, the well-known electrician, has been engaged to establish the plant, which will embody all of the latest improvements in methods of construction and operation.

THE FREY ELECTRICAL BALANCE OR REVERSIBLE BRIDGE.

The accompanying illustration is that of an electrical balance or reversible bridge, designed by Mr. Charles P. Frey, chief electrician of The E. S. Greeley electrical laboratory, and is especially adapted for rapidly measuring both high and low resistances, with unusual precision. It is to be used in connection with an adjustable resistance box or a B. A. pattern standard coil, and takes the place of the bridge coils which form part of the rheostat of conventional pattern. Its peculiar feature is that its bridge coils can be



tested by reversing or interchanging them, an operation that can be speedily performed. Should any inequality exist it can be quickly corrected. Both bridge coils are shunt wound upon one spool and can be removed to give place to others of higher or lower resistance. A wire bridge with subdivided half-meter scale can be attached. This apparatus is being placed on the market by The E. S. Greeley & Company, New York, proprietors of the Greeley electrical laboratory.

CORAL GROWTHS ON SUBMARINE CABLES.—Submarine cables have before now rendered unexpected services to science, and the following, says the London *Electrician*, is one of the latest: Very little, it seems, is as yet known as to the rate of growth of corals, but some very interesting details have been published by M. Alexander Agassiz in the August number of the *Bulletin of the Museum of Comparative Zoology at Harvard College* with regard to a series of specimens which were taken in June, 1888, off the Havana and Key West cable, from a portion repaired in the summer of 1881; so that the growths could not be more than about seven years. It must be noted that this portion of the cable was laid at a depth of only from six to seven fathoms, and that the district in which it was laid was most favorably situated as regards food supply to the corals. Some of the specimens belong to species whose rates of growth have not yet been recorded. Verrill mentions that the thickness of the *Orbicella annularis* coral formed in 64 years was not more than about 8in.; the specimens from the Havana cable grew to a thickness of 2½in. in about seven years. *Manicina areolata* has grown to a thickness of 1in.; while *Isophylla dipsacea* shows a still more rapid growth, projecting 2½in. above the cable. Of course it is quite possible that these corals are of less than seven years' growth, but it is not probable that more than a short time passed before some of the swarms of pelagic coral embryos which must have floated past the cable found a place of attachment thereon.

THE TELEPHONE.—A dispatch from Erie, Pa., says that the New York and Pennsylvania Telephone Company has commenced action against the Erie Motor Company for trespassing, laying damages at $50,000. The telephone people allege that the Motor Company's wires have damaged the value of their franchise, and that by induction the telephone service in Erie has been greatly damaged. The right to claim damages is attached to priority privileges. The Telephone Company has expended large sums of money to correct the interference, but without avail.

NEW METHOD OF PROTECTING BUILDINGS FROM LIGHTNING.

A novel and ingenious method of protecting buildings from the destructive effects of lightning strokes has been invented by Mr. N. D. C. Hodges, of Plainfield, N. J.

Heretofore protection has been sought against such effects by the use of a metallic conducting rod, which, being a good conductor of electricity, was applied to the outside of buildings and was expected to take up constantly whatever excess of electricity there might be in the surrounding atmosphere, whether diffused or in the form popularly known as a "bolt," and transmit the same to the earth, where it would be dissipated without doing harm. Protection from such rods has proved to be wholly inadequate, and in many cases buildings have been struck by lightning and seriously damaged or destroyed in spite of the presence of such rods.

The basis of all the theories that have been suggested to explain the high potential exhibited in lightning discharges is that, having a given quantity of electricity on the surface of a given quantity of matter in a finely divided state, the potential of the charge will be increased if the particles of matter coalesce into larger particles, thereby reducing their aggregate electrical capacity. Mr. Hodges argued that if this theory



HODGES' METHOD OF PROTECTING BUILDINGS FROM LIGHTNING STROKES.

were true it ought to be possible to receive a lightning discharge on some larger body, which would then break into particles whose aggregate electrical capacity would be considerable, and the potential of any charge received on the large body would thus be materially reduced.

It is well known that the potential or striking force of any given quantity of electricity with which a body is charged is very largely dependent upon the surface of said body over which said quantity of electricity is forced to spread itself in charging the same. Thus a given quantity of material in the form of a solid mass when charged nearly to repletion will exhibit a very high potential, while if the amount of electricity remains the same and the quantity of material remains the same, but divided into a granular mass, like fine powder, the potential of the electric discharge there stored practically disappears.

Mr. Hodges' invention is based on this property of extended surface present in pulverized substance, and in practice he places a finely divided substance in the probable path of the lightning discharge in such a manner that the electricity will pass into this substance in preference to attacking the threatened building.

In charging the interposed substance, providing the aggregate surface of its parts is sufficiently large, the potential of the most violent bolt of lightning becomes destroyed or so greatly reduced that the current will readily be carried off by the rod or even dissipate itself harmlessly in the surrounding moist air.

The illustration given herewith shows one method of interposing the finely divided substance. E is a thin box made of some non-conducting material and filled with soot. The lightning rod does not pass through this box but is connected at the top and bottom of the box with plates, and these are connected with each other by fine vertical wires, a, running through the soot.

The electricity, therefore, in passing along the rod must pass through the soot, and in doing so the particles fly apart, some or all of them being charged with portions of the electricity. In this way the potential of the electric discharge will be greatly reduced, in the manner already indicated, and probably no further harm will result.

In ordinary cases one cubic foot of soot would be found sufficient for the purpose intended. Mr. Hodges also contemplates the use of a rod of such a character as is known to be easily destroyed by a lightning discharge, arguing that if the energy of the lightning can be expended in destroying the rod, or a portion of it, the building will be saved.

MAGNETIZATION OF THIN PLATES OF STEEL.*

BY W. DOULE.

The plates experimented on were squares (the side being from 10 to 20mm. in length), rectangles of various sizes and circles, cut from springs from 0.25 to 0.3mm. thick, or from sheets 0.35mm. thick. They were magnetized by means of two thick bobbins of 8,000 square centimetres surface, through which was passed the current from a dynamo. In order to produce an anomalous magnetization, the current was gradually reduced by the insertion of resistance, as suggested by Von Waltenhofen.

The discs were first suspended by a silk fibre in order to determine the position they took up with regard to the magnetic meridian. Magnetic figures were then produced by sprinkling iron filings on a thin sheet of paper, and the spot indicated as poles by the arrangement of the filings were investigated with a small compass-needle 4mm. long.

For all the specimens tried, a magnetization at right angles to their plane seemed to be impossible. Two poles always appeared, and they were so arranged as if, in the case of the squares, the magnetizing force had acted along a diagonal, and in the case of the rectangles, parallel with the longer side.

When 80 square plates 0.25mm. thick and 10mm. length of side were placed together so as to form a square prism 20mm. long, and magnetized, the iron filings showed a perfectly regular distribution of magnetism, similar to what occurs in a solid magnet. As soon, however, as they were separated, the individual plates were found to be magnetized as above mentioned.

A series of steel cylinders, 22mm. in diameter, and of lengths varying from one to 20mm. were then experimented on. They were of Bessemer, tool, and manganese steel, and were supplied by Dr. M. T. Edelmann. Cylinders of a height of 10mm. and more showed a perfectly defined magnetization in the direction of their axes. As the height was reduced the polar axis became more and more inclined to the geometrical one, until, at a thickness of 1mm., the same state of affairs as was observed with the thin square plates occurred.

It would therefore appear to be in the highest degree probable that a permanent magnetization of thin steel plates at right angles to their planes is impossible when the ratio between their thickness and their other dimensions becomes reduced below a certain value.

*Wiedemann's Annalen, Vol. XII, Part 10.

NEW CORPORATIONS.

Grand Junction Electric and Manufacturing Company, Denver, Col. Capital, $100,000.

Montclair Electric Light Company, Denver, Col. Capital, $20,000.

San Diego Electric Transit and Power Co., San Diego, Cal. Capital, $200,000.

Universal Power Co., Chicago, Ill. Capital, $1,000,000; for the manufacture of motors, etc.

Quincy Electric Manufacturing Co., Quincy, Ill. Capital, $1,000; for the manufacture of electro-galvanic insoles.

Bear Magneto-Electric Co., Chicago, Ill. Capital, $3,000,000; for the manufacture of magneto-electrical apparatus.

Chicago Gas and Electric Fixture Manufacturing Co., Chicago, Ill.; Capital, $50,000; for the manufacture of gas and electric light fixtures.

Cherokee Electric Light and Power Company, Cherokee, Iowa. Capital, $25,000.

Avoca Electric Light and Power Co., Avoca, Iowa. Capital, $10,000.

Idaho Electric Light and Power Co., Wallace, Idaho. Capital, $500,000; to conduct a general electric light and power business.

American Electric Machinery Co., Portland, Me. Capital, $100,000; for the manufacture of all kinds of power, heat and light machinery.

Empressa del Alumbrado Electrico de Cartegena of Barranquilla, Jersey City, N. J. Capital, $60,000; for the manufacture of electric lights, etc.

West End Railway Co., Charleston, S. C. Capital, $200,000; to construct an electric railway.

Ogden Electric Railway, Ogden, Utah. Capi- $200,000.

Idaho Electric Light and Power Co., Wallace, Idaho. Capital, $500,000.

Stiger-Newhall Electric Light Co., Chicago, Ill. Capital, $20,000.

Monticello Supply Co., Monticello, Ill. Capital $15,000; for the purpose of supplying electric light, power, etc.

International Aluminum Co., Chicago, Ill. Capital, $10,000,000.

Electric Light and Power Co., Centralia, Ill. Capital, $10,000; to deal in electric light supplies and operate plants, etc.

Sterling Electric Power Storage Car Co., Sterling, Kans. Capital, $100,000.

Improved Pulsion Telephone Supply Co., Portland, Me. Capital, $200,000; for the purpose of operating telephones, etc.

Stanley Electric Manufacturing Co., Pittsfield, Mass. Capital, $25,000; to manufacture electric apparatus.

Laclede Power Co., Elizabeth, N. J. Capital, $30,000; to furnish electric power for manufacturing and other purposes.

Sharpsville, Electric Co., Sharpsville, Pa. Capital, $15,000.

HEATING OF CONDUCTORS.—In installing an electric light or power plant it is a matter of great importance to determine beforehand what rise in temperature is to be expected in the conductors in each given case.

THE STORAGE BATTERY PATENT CASE.

The daily papers of December 28th contained an item from Cleveland, purporting to give the facts in Judge Brown's recent decision in the suit of the Electrical Accumulator Company against The Brush Electric Company, on the question of interference between the Faure and Brush Storage Battery patents, which makes it appear that the Brush Company had won a victory and was entitled to a decree.

Mr. D. H. Bates, the Vice-President of the Accumulator Company, was seen in reference to this matter, and being asked to explain the actual position of his company in this case, made the following statement:

First, it should be remembered that the Faure patent is the only storage battery patent which has so far been adjudicated in the United States Courts, where the plaintiff and defendant were really on opposite sides.

In March, 1889, Judge Coxe in the U. S. District Court for the Southern District of New York rendered a decision sustaining the Faure patent. The newspapers, and the public, were, however, informed that the Faure method, known as the "paint, paste or cement" method, was inefficient and had been abandoned by the Julien Company. In June, 1889, however, the Julien Company petitioned the Court for a re-hearing of the case, which was denied, Judge Coxe in his decision asking:

"If it be true that Faure's batteries are inferior "to or no better than others, the question nat- "urally suggests itself why are not the defendants "content to use the other batteries?"

The Julien Company answered this conundrum by stating that they had just found a method, greatly superior to that of Faure, but Judge Lacombe, in October, 1889, decided that all the various methods the Julien Company had so far employed infringed the Julien patent.

It was then announced that this decision was a great relief to the Julien Company, as they knew exactly what they could do, and what they could not do, in the making of storage batteries; but all the same the experimental plant of cars installed by them on the Fourth Avenue road, in New York city, was shut down until the Summer of 1890, by which time they had evolved another modification of battery, which they said was unmistakably clear of the Faure patent.

Meanwhile, the suits instituted by The Electrical Accumulator Company against the Brush Company in the Ohio District to determine the respective standings of the Faure and Brush patents had, owing to dilatory proceedings instituted in great part by the defendants, progressed no farther than the preliminary pleadings, and the merits of the case have not been brought into question, and no testimony has been taken.

It is in this case that Judge Brown has made an interlocutory decision, involving three questions of law and fact, as follows:

The Accumulator Company applied to the Court for leave to dismiss the two interference suits, alleging that, owing to the construction placed upon the Faure patent by Judge Coxe there no longer remained any interference. In one of these cases, namely, the one in which the Faure patent was in interference with the Brush patent, 337,298, the Court decided the action in favor of the Accumulator Compaay; in the other case, Judge Brown held that the question of the expiration of the Brush patent, by reason of the prior grant of the Italian patent, could not be decided until full hearing, and hence sustained the demurrer of the Brush Company to that portion of the Accumulator's bill, leaving the case to proceed on its merits.

In the same case the Accumulator Company filed a supplemental bill, setting up that since the disclaimer filed the Faure patent there was no longer any interference between the first claims of the Faure patent and the formerly interfering claims of the Brush patent. The Brush Company filed a demurrer to that supplemental bill on the ground that this question could not be tried in that case, and Judge Brown also decided this question in favor of the Accumulator Company.

The facts are, therefore, that in the recent case three points have been decided, two in favor of the Accumulator Company and one in favor of the Brush Company, leaving the case still to be tried on its merits.

The Accumulator Company claims, and its claims are based upon a long and wide experience in the business, that no form of storage battery so far made has proved or can prove successful except that made by the Faure process where the active material is applied to the support plate in the form of a paint, paste or cement, prior to immersion in the battery fluid, and that there, according to Judge Lacombe's construction of Brush's experiments, a perfectly dry powder compacted upon the grid by a hydrau ic pressure and no fluid added until the plate goes into use in the battery, the absorption of the fluid by the active material causes it to expand and to exhibit a tendency to disintegrate, such tendency being accelerated on the occasion of each succeeding charge and discharge. In other words a battery so constructed is not durable and breaks down when subjected to any but ordinary strain.

COMPLEX NATURE OF ELECTROLYSIS.*

Faraday applied the term *electrolyte* to those substances which, like hydrochloric acid, are resolved into their elements by the passage of an electric current. To the act of decomposition by the voltaic battery he gave the name *electrolysis*. In most cases, if a liquid permit the passage of a current of electricity through it, it is decomposed by the conductor, or, in other words, most liquids which posses conductivity are also electrolytes. Of course, there are exceptions to this rule; some liquids, such, for instance, as alcohol and ether, although they are not absolutely non-conductive, are not capable of being decomposed by the passage of a current. The number of these apparent exceptions to the rule is becoming more and more limited as time goes on and they become better understood. Once people thought that acidulated water was the only liquid which could conduct the electric current; but now it has been proved that a vast number of binary and ternary, and even more complex substances, are amenable to the general law.

The decomposition of a binary substance like hydrochloric acid (H Cl) is comparatively simple. One of the elements goes to the positive and the other to the negative pole.

The decomposition of a ternary salt is more complex. It was formerly explained by saying that the acid was liberated at the positive electrode and the base at the negative. Thus sodium sulphate, $Na_2\ O\ SO_3$, was considered to be resolved into sulphuric acid SO_3 and soda $Na_2\ O$. But now the way of regarding this change has been modified. The sodium sulphate is supposed to split up into potassium, K, and the electro-negative group, $S\ O_4$; the metal, K, being liberated at the negative electrode, decomposes the water, and in effecting the solution of the salt, forming potash and liberating free hydrogen. Similarly, the electro-negative group, $S\ O_4$, which cannot of itself exist in a free state like $C\ O_2$, can, for instance, decompose into free oxygen gas (O) which is evolved, and into anhydrous sulphuric acid ($S\ O_3$), which immediately combines with water to form ordinary sulphuric acid, thus,

$$S\ O_3 + H_2\ O = H_2\ S\ O_4.$$

When we come to deal with still more complicated substances, the decomposition which ensue on their being subjected to the action of voltaic electricity are of a very involved nature. Berthelot, and some of the other French scientists of his school, have carried their researches into many an unexplored direction, and in connection with such research, the names of Kolbe, Kaempf, Brazier, Gossleth, Wurtz, Schloslemmer, and Kekuli, cannot avoid mention.

The latest work upon the electrolysis of complicated substances is reported from Russia, where, before one of the learned societies of St. Petersburg, N. Burp has read an important paper.

Burp considers that the reaction which takes place when fatty acids are subjected to elecrtolysis is a very complicated one, and cannot be represented by a simple chemical equation. He does not, however, support Kekuli's views. This scientist represented the decomposition of the fatty acids by the following general formulæ:

$C_n\ H_{2n}\ (C\ O\ O\ M)_2 = M_2 + 2\ C\ O_2 + C_n\ H_{2n}$ and $2\ C_n\ H_{2n+1}(C\ O\ O\ M) = M_2 + 2\ C\ O_2 + (C_n\ H_{2n+1})_2$

But these equations do not represent facts according to Burp. He says the complicated groups are not decomposed into their negative constituents, but that they enter into reaction with water, reforming the original acid and oxygen, and that the latter, on being liberated, oxidizes the electrolyte, and thus forms the different products.

The original paper contains a detailed description of Burp's apparatus, the preparation of the pure substances, and a large set of tabularly arranged analytical data of the gaseous products. It is shown also that the nature and relative quantity of the products obtained at the anode vary very considerably with varying concentrations, intensity of current, size and surface of the electrodes and especially with the temperature of the electrolyte.

The opinion on the complexity of the chemical process in the electrolysis of most substances was first pronounced by Bourgouni, and Burp says that his experiments entirely confirm this view.

*London *Electrical Review.*

EXPANDING TRADE.—In almost every issue for some time past we have recorded the enlargement of the quarters of one electrical concern or another in some one of the various cities. The electrical business is a rapidly expanding one, and it is gratifying to us to note this prosperity. Not long since a certain house made some extensive alterations, and the proprietors thought they would then have room enough to accommodate their business for a long time to come, but it is recorded that before the alterations were completed the business increased to such an extent that the concern very soon again found itself cramped for space. Such reports as these are frequent and we hope they will continue to be.

VARIATION OF CONDUCTIVITY UNDER DIFFERENT ELECTRICAL INFLUENCES.—In a paper on this subject read recently before the Académie des Sciences, M. Ed. Branly stated that if a circuit be formed with a Daniell's cell, a high-resistance galvanometer, and a very thin layer of copper deposited on a ground glass or ebonite plate, 7 cm. long and 2 cm. wide, only an insignificant current passes. An abrupt diminution of resistance is experienced, however, when electric discharges, from a Wimshurst machine or a Ruhmkorff's coil, are produced in the neighborhood of the circuit. The action diminishes as the distance of the sparking apparatus increases, but it may be very easily observed, without special precautions, at several metres.

BARE CONDUCTORS.—One advantage attending the use ot bare electric conductors is the greater facility afforded by them for the radiation of heat as compared with covered conductors.

JOINTS.—Much electrical power is expended at imperfect wire joints. Therefore, great care should be exercised in making joints.

GENERATION OF ELECTRICITY IN CANADA.

The following particulars concerning the generation, distribution and measurement of electricity for light and power purposes, as practiced in Canada, will be of interest to our readers. Mr. A. J. Lawson read a paper on this subject before the Canadian Society of Civil Engineers, in Toronto, from which our facts are taken.

In regard to the Royal Electric Company's dynamo, Mr. Lawson says: Sometimes the machines of the Royal Electric Company for A. C. work are made with the exciter on the same shaft, but more frequently the exciter is separate. In the 1,200-light dynamo with separate exciter, the active iron in the fields weighs about 3,400 lbs., and the iron rings of the armature (which is a hollow cylinder built up of laminated wrought iron) weigh 1,250 lbs. The radial depth of these rings is 5-inch. When turned up ready for winding the armature is 24⅝-inch diameter and 18½-inch long. The diameter when wound is 25⅛-inch over the bands, and, as the internal diameter of the field bobbins is 25½-inch, there is a clearance of full $\frac{3}{16}$-inch all round. The fields are wound with 845 lbs. of No. 8 B & S. gauge wire; the armature winding consists of 32 lbs. of No. 11 B. & S. gauge wire. The speed of the machine is 1,200 revolutions per minute, and the exciting current at full load is 24 amperes and 90 volts—say, 2,160 watts, or nearly 3 E.H.P. The standard output of the machine is 70 amperes and 1,020 volts, or 7.5 watts per lb. gross weight; 81.41 watts per lb. of the total copper wire, and 2,231 watts per lb. of the wires on the armature.

RATE OF ALTERNATION OR PERIODICITY.

In the Brush dynamo the periodicity is 110, while in the Fort Wayne, Westinghouse and Thomson-Houston machines the periodicity is from 125 to 136.

The European practice as to the rate shows considerable variation. Messrs. Ganz & Co., of Buda Pesth, in the Zipernowsky system use 42 cycles; Mr. Ferranti uses 68; Lowrie-Parker work their machines at 80, and Mr. Morley runs his at 100.

CONVERTERS.

Westinghouse Converter.

The Westinghouse converter is of the shell type. In the 40-light converter, the core is built up of plates .017-inch thick, of which the total weight is 81 lbs. The primary winding of No. 16 wire weighs 10½ lbs., and the secondary wire is No. 3 gauge, 13¼ lbs. in weight, At 50 volts and 40 amperes this converter gives an output of 19.09 watts per lb. of active material. The P. D. required between primary terminals is 1,000 volts, developing an E.M.F. of 50 volts at the terminals of the secondary coil.

Brush Converter.

The Brush converters are of the core pattern, with the exception of the two of smallest size. The wire in the core of the 50-light converter weighs 92 lbs., the primary wire weighs 20 lbs., and the secondary winding 11 lbs. At 100 volts and 30 amperes its output is thus 24.39 watts per lb. of active material. The case weighs 100 lbs. The 75-light converter core of iron wire weighs 115 lbs., primary winding of copper wire 21 lbs., and secondary winding 15 lbs. At 100 volts and 45 amperes the output is 29.8 watts per lb. of active material. The case weighs 110 lbs. These converters are made in standard sizes of 5, 10, 20, 30, 40, 50, 75, 125, 250 lights, and up to 1,000 lights capacity. They are also made for primary circuits of 1,000 volts pressure, with a ratio of conversion of 1 to 10 or 20 to 1. The core consists of the finest Swedish iron wire, insulated by cotton winding or braiding wound into an octagon form, by having pieces of wood placed under and through the coils. The secondary wires are then wound over the sections between the wood blocks with insulated pads between them and the iron wire at the corners. Over the corners of the secondary winding are placed other insulating pads, over which are then wound the fine primary wires. There is thus an air space for insulation all round the different coils, except at the corners where the wires lie on the insulating pads. The efficiency of a 75-light converter varies from 98 per cent., with 75 lights attached, to 93 per cent., with 38 lights.

THOMSON CONVERTER.

The Thomson converter, manufactured by the Royal Electric Company, is similar in construction to the Westinghouse. The following are the particulars of the 30-light size: Iron discs, 108 lbs.; primary wire, 920 feet No. 18 B. & S. gauge, 4¾ lbs.; secondary wire, 44 feet B. & S. gauge, two in parallel. 4 lbs.; total active material, 16¾ lbs., with an output of 13.20 watts per lb.; case, 59½ lbs.; weight complete 176 lbs.

METERS.

Edison Meter.

In the Edison system of distribution an electrolytic meter has been employed. A disadvantage connected wit its use is that nobody except an *employé* of the company can find out what the meter has registered, and even he has to take every precaution in the washing and drying of the electrodes, and in their accurate weighing in a chemical balance. This meter has been very extensively used, and has evidently given fair satisfaction, but statements from some of the superintendents of Edison stations show satisfaction is not general.

Sir D. Salomons, in the last edition of his work on electric lighting, describes the Edison meter as a thing of the past.

It is but fair to the Edison Company to say that they do not recommended their meter being used in stations of less than 1,000 lights capacity.

ARON METER.

The Aron three-wire meter is used in all the large Edison stations, and by some other companies in Germany. It is a most admirable and reliable instrument, and it is one from which the consumer himself can learn what he is using. The registering apparatus consists of two sets of two sets of clockwork, which will run 40 days with one winding, but which it is intended to wind up every 30 days, when the readings are taken. The pendulum on the left is an ordinary pendulum, uninfluenced by the current; but that on the right consists of a coil of very fine wire, which is connected direct to both the positive and negative wires of the system, while one of the main wires, either the positive or negative, forms a solenoid through which the main current passes, enveloping the fine wire pendulum core.

Before any current is passed through the meter, it should be tested in plate to see that the pendulums swing synchronously. If they do not. the indications of one pendulum will gain upon those of the other. The exact adjustment to perfect synchronism is obtained by raising or lowering the weight on the left hand pendulum. If found correct the current is passed through the meter, and the right hand pendulum's movement being accelerated by the action of the current, causes the registering gear to work.

The chief obstacle in the way of the more general employment of this meter is its comparatively high first cost, but it appears to be well worth the money.

SHALLENBERGER METER.

The Shallenberger meter is the one which has been the most extensively used in America for the measurement of alternating currents, having been exclusively used in the Westinghouse stations, and being now largely used in those of other companies. About 12,000 are now in use. It is simply a small alternating current motor with registering gearing, and attached vanes placed on the shaft to retard the movement to a degree necessary for adjustment and regulation. Its chief disadvantage is that it does not work readily with a small current, but it tells against the company and not against the consumer, the latter will probably not have any objection to it.

STORAGE BATTERIES.

Storage batteries have not been applied on this continent to any such extent as they have been in Europe. Wherever they are employed, except for propulsion of about a dozen street railway cars, perhaps fewer, it has been for the purpose of securing light after engines and dynamos have been stopped at night, and for railway car lighting. For the latter purpose they have not hitherto been a success, and have been discontinued on the Pennsylvania Road, on the Canadian Atlantic, and on the Grand Trunk Railways, the Julien battery having been used in these cases. On the Intercolonial Railway a great number of cars have been fitted up with these batteries, and it is said several additional charging stations are to be erected, it having been found that the two at present in operation, one at Levis and the other at Moncton, together with such current as may be obtained at Halifax, N. S., and Montreal, have been insufficient, or otherwise expressed, the capacity of the batteries supplied has not been enough to last during the runs between the various stations. The fact that the coal oil lamps, which were wisely left in position, are used on nearly every trip, proves the inadequateness of the batteries which have been supplied for this work.

Outside of these plants storage batteries have been used in five or six places in Canada, among which may be mentioned McGill College, the lights which we have here being run from a Gibson battery in the basement. The battery is charged from a small shunt wound dynamo, driven by an Otto gas engine.

MEASURING INSTRUMENTS.

The Ayrton and Perry instruments have been used to a very considerable extent in this conntry, and until recently were the most accurate of all really portable electrical measuring instruments.

They are only suited for direct currents, and are open to the objection that they have considerable friction and a high temperature error if kept in circuit, which they should never be except only for a few seconds when taking readings.

The Weston voltmeter has the great advantage of extreme accuracy and very high resistance, averaging about 20,000 ohms, so that the quantity of current passing is extremely small. They may be kept continuously in circuit without any material variation in their readings. They require careful handling, of course, as do all electrical instruments, but they are the most accurate and reliable of all portable testing instruments for continuous currents. The voltmeters contain a calibrating coil by which their constancy can be at all times tested. The writer has used quite a number of these instruments, which he has checked with each other, end has sometimes compared the higher and lower scale by taking the P. D. difference between terminals of single cells of secondary batteries, and then, putting the whole of the cells in series, compared the reading of total E. M. F. of the battery. Several tests of this nature have come out within one quarter of a volt. The calibrations are in single volts on the higher scale, and thirtieths, twentieths, or tenths of volts on the lower scale. The ammeters read to tenths of amperes in the small sizes. In both the divisions of the scale are so wide that one-quarter of these values can be read with perfect ease.

For the most perfect readings by these instruments they should be set quite level, and five feet away from any other instrument, or from any mass of iron or steel, and so placed that the index will point due west when at the centre of the scale, but these precautions are not necessary for ordinary testing of pressure in buildings, as the error can seldom be more than half volt if otherwise placed.

The Cardew voltmeter is used for both direct

and alternating currents, and is made to be used either vertically or horizontally.

The horizontal pattern has the advantage of being steadier than the vertical instrument, owing to the disturbance caused by currents of air passing up the tube of the latter. All the more recent forms of this instruments have an adjusting screw outside of the case to bring the needle to zero, which should be done before the current is turned on. No adjustment should be made while the wire remains warm, as the section of the wire may be altered by any tension put upon it while in this condition and the calibration destroyed.

For alternating and direct currents Sir Wm. Thomson's latest instruments are the finest yet produced, but are more suited for standard or station use than as testing instruments. In the electrostatic instruments no current passes through the instrument at all, and so the conditions of a battery or dynamo on open circuit can be found with perfect accuracy. The electrical balances are adapted for both alternating and direct currents. To anybody desiring a fine standard laboratory or station set of large range, none are better than these instruments, expensive though they be. All stations for alternating current work should have a Cardew or Thomson voltmeter, a portable Thomson multicellular electrostatic voltmeter for testing pressure in consumer's premises, &c., and a Thomson ampere gauge. For direct current stations Weston or Cardew voltmeters for station work and line testing should be used, and Thomson ampere gauges for current measurement.

LIGHT AND POWER IN ITALY.

An important installation for the transmission of electrical energy for lighting and motive power purposes, says the London *Electrical Review*, is now being carried out by the Italian Edison Company, near Intra, in Italy, for Mr. Carlo Sutermeister. This gentlemen has a concession of 840 effective H.P. situated near the latter town, which is about six miles distant from Pallanza. The fall of water is 135 feet, and the quantity about 440 gallons per minute. It is obtained from a canal which is fed from the St. Bernardino River, near Cassagno. and runs for some distance in tunnels. The installation, when completed, will comprise four Girard turbines, each of 150 H.P., and each being coupled direct to a dynamo having an output of 96,000 watts (32 ampères at 3,000 volts), and an exciter of 4,000 watts capacity (40 ampères at 100 volts), and one Jonval turbine of 150 H.P., which also actuates an alternator and exciter of of the same capacity. The turbines are fitted with an automatic regulator recently designed by Messrs. Ganz & Co. The plant will be used for supplying light and power to Intra, Pallanza and neighboring districts. The considerable distance between the generating and distributing stations rendered it necessary to use the same conductor for transmitting energy for both lighting and power purposes. The Edison Company therefore adopted the alternators, turbines and motors made by Messrs. Ganz & Co., of Buda-Pesth, while the remaining electrical apparatus—transformers, lamps, meters, etc., are being supplied by the former company. The conductor, which is of bare copper wire, is being carried overhead on oil insulators, attached to standards, and the loss in transmission from one station to the other is estimated at 10 per cent. The efficiency of the turbines is guaranteed to be 75 per cent., of the alternators 88 per cent., and the transformers from 90 to 95 per cent. The motors will range from 3 to 50 H.P, Those from 3 to 20 H.P. will be energized from separate transformers, while the larger motors will receive current from the primary conductor at 3,000 volts, these motors being arranged in series. The current will be measured by Blathy wattmeters, and the installation is to be in full operation in March next.

THE TELEPHONE PATENTS.

Much is said these days about the probable effect of the expiration of certain Bell telephone patents in 1893. The Washington correspondent of the New York *Sun* has been looking into the matter, and sends the following interesting story to his paper :

The Bell telephone patent expires in 1893, and not a few people think that after that date many telephone companies will spring up throughout the country, and that competition will make the service as cheap as any other upon which no patent is held. This is a very pleasing outlook, but it may not eventuate at the time expected, nor for a long time thereafter. The original Bell patent is for the simple principle of telephoning—a patent upon the transmission of sound waves. Starting from that point, many improvements have been made and patented. Inquiry at the Patent Office developed the fact that nearly every one of them, at least every one of real value, has been bought by the Bell Company outright, or has by other means come under its control. The records of the assignment division of the office are sprinkled over with entries showing that this or that patent has been assigned to the Bell Company. The best transmitter yet invented, and one regarded by many experts as nearly perfect, is the Blake. The patent upon it does not expire until 1895, and it is under the control of the Bell people. Thus it is through a long list. The Bell Company has its hands upon a large number of almost invaluable patents, which do not expire for years after its original one. A prominent patent attorney said that the situation reminded him of the time that the original sewing machine patents expired fourteen or fifteen years ago. It was heralded around that people would be able to buy machines for but little more than the cost of the materials of which they are made. The prophecy was not fulfilled, for the sewing machine people had done in regard to improvements upon their patents what the Bell Company has done. The attorney also said that it looked as though the company was going to accomplish its object in the Government suits against it to annul the patent, on the ground that it was obtained by fraud and had been anticipated by Drawbaugh and others. That object was to stave off a final decision until the expiration of its patent.

SUPPRESSION OF SPARKING.

In concluding his lectures on the "Electro-Magnet," delivered by the Society of Arts, London, Prof. Silvanus P. Thompson referred to the different methods of suppressing sparking. Sparking is such a common evil, and one hard to get rid of, that we reproduce what Prof. Thompson has to say on the subject for the benefit of those who are not familiar with the different methods adopted to accomplish this end.

There are some half-dozen different ways says Prof. Thompson, of trying to get rid of the sparking that occurs in the breaking of an electric circuit whenever there are electro-magnets in that circuit. Many attempts have been made to try and get rid of this evil. For instance, one inventor employs an air blast to blow out the spark just at the moment it occurs. Another causes the spark to occur under a liquid. Another wipes it out with a brush of asbestos cloth that comes immediately behind the wire and rubs out the spark. Another puts on a condenser to try and store up the energy. Another tries to put on a long thin wire or a high resistance of liquid, or something of that kind, to provide an alternate path for the spark, instead of jumping across the air and burning the contacts. There exist some half-score, at any rate, of that kind of device. But there are devices that I have thought it worth while to examine and experiment upon, because they depend merely upon the mode of construction adopted in the building of the elccto-magnet, and they have each their own qualities. I have here five straight electro-magnets, all wound on bobbins the same size, for which we shall use the same iron core and the same current for all. They are all made, not only with bobbins of the same size, but their coils consist as nearly as possible of the same weight of wire. The first one is wound in the ordinary way; the second one has a sheath of copper wound round the interior of the bobbin before any wire is put on. This was a device, I believe, of the late Mr. C. F. Varley, and is also used in the field magnets of Brush dynamos. The function of the copper sheath is to allow induced currents to occur, which will retard the fall of magnetism, and damp down the tendency to spark. The third one is an attempt to carry out that principle still further. This is due to an American of the name of Paine, and has been revived of late years by Dr. Aron, of Berlin. After winding each layer of the coil, a sheath of metal foil is interposed so as to kill the induction from layer to layer. The fourth one is the best device hithertho used, namely, that of differential winding, having two coils connected so that the current goes opposite ways. When currents flow in both circuits there is no magnetism. If you break the circuit of either of the two wires the core at once becomes magnetized. You get magnetism on breaking, you destroy magnetism on making the circuit ; it is just the inverse case to that of the ordinary electro-magnet. There the spark occurs when magnetism disappears, but here, since the magnetism disappears when you make the circuit, you do not get any spark at make, because the circuit is already made. You do not get any at break, because at break there is no magnetism. The fifth and last of these electro-magnets is wound according to a plan devised by Mr. Langdon-Davies, the bobbin being wound with a number of separate coils in parallel with one another, each layer being a separate wire, the separate ends of all the layers being finally joined up. In this case there are fifteen separate circuits ; the time-constants of them are different, because. owing to the fact that these coils are of different diameters, the coefficient of self-induction of the outer layers is rather less, and their resistance, because of the larger size, rather greater than those of the inner layers. The result is that instead of the extra currents running out all at the same time, it runs out at different times for these fifteen coils. The total electromotive force of self-induction never rises so high, and it is unable to jump a large air-gap, or give the same bright spark as the ordinary electro-magnet would give. We will now experiment with these coils. The differential winding gives absolutely no spark at all, and second in merit comes No. 5, with the multiple-wire winding. Third in merit comes the coil with intervening layers of foil. The fourth is that with copper sheath. Last of all, the electro-magnet with ordinary winding.

NOTES ON THE CHEMISTRY OF SECONDARY CELLS.

In our last two issues we gave abstracts of a paper entitled "Notes on the Chemistry of Secondary Cells," by Prof. W. E. Ayrton, Vice-President, C. G. Lamb and E. W. Smith, associates, read before the Institution of Electrical Engineers, London. The discussion which followed the reading of this paper was interesting, and many new facts were brought out.

Mr. Crompton said that the gassing of cells was due in a great measure to light. Both sunlight and arc light increased this action, and quantitative experiments were now being made. In endeavoring to measure the resistance of the cells with a view to determining the best proportions of plates and liquid, he had met with great difficulties, and he now believed that what is usually measured is of the nature of a back E.M.F.; this he supported by saying that the so-called resistance did not seem to vary, either

with the thickness of the plates, or their distance apart, or with the density of the acid. During his investigations a rosy coloration of parts of the liquid had been noticed in some cells; the colored portions may either appear as strata, lines, or in tree-like forms, and in some cases resemble the shapes of magnetic lines of force. These peculiarities, he hopes, may give some idea of the electric stresses and strains within the electrolyte. The recuperative power of discharged and reversed cells was very marked, for he had observed it in cells that were half charged in the reversed direction, and on cutting up the plates, layers of different materials could be seen. This fact shows how important it is to thoroughly charge cells of the Planté type during formation by reversals. Until quite recently negative plates had been considered faultless, and the positives blamed for defects which were in reality due to imperfections in the negatives. He knew of no case in which positives had gone bad when their negatives had sufficient capacity, and for this reason the negatives ought to be made thicker or larger than the positives. "Sick cells," he said, get partially sulphated and the negatives run down; when the E.M.F. falls below 1.3 heavy sulphating of the positive occurs, and so-called "irreducible sulphate" is formed. In his opinion the reducibility or irreducibility is merely a question of its position, or of its contact or want of contact with the conducting material.

Mr. Reckenzaun said that the question of efficiency was not likely to be settled, since, according to the authors of the paper, it may vary between 105 and 58 per cent., depending on the previous history of the cells. In his own experiments on the effect of prolonged rest, he had found a similar loss of efficiency, and he believed this to be due to the sulphating of the negatives. The negatives were always played out first, and this defect could not be got over by making them abnormally thick, or by increasing their surface; for if thickening be tried, the interior is not acted on, whilst greater surface gives no advantage on account of the material being at different distances. To test the deficiency of negative plates, he had discharged cells as low as possible, and then put the positive with a newly charged negative; from these a fair E.M.F. and discharge were obtained. He had also tried amalgamated zinc instead of a newly charged negative, and got 40 per cent. of the original capacity. These facts account for the existence of 30 per cent. of PbO_2 in the positive plugs when the cell was supposed to be completely discharged. In his opinion it would be better to say that the negatives discharged about 30 per cent. too soon. The negative of Planté cells, especially those formed by the nitric acid process, soon lose their virtue, and this was attributed to the difficulty in removing all the forming acid.

Mr. D. G. Fitzgerald inquired by what authority and for what reasons the authors called the peroxidized plate the positive, and the spongy lead the negative. He himself had good reason for reversing the designations, and in this he was following the example of Volta and Berzelius. Speaking of the chemical constitution of the negative (peroxide) plate, he said it was generally believed that PbO_2 enters largely into its composition; there is, however, reason to doubt whether any of this compound is present, for the behavior of the active substance on the plates is quite different from that of the pure peroxide of commerce. If a plate be made up of 80 per cent. of pure peroxide and 20 per cent. of the so-called peroxide produced by electrolysis, the E.M.F. falls when the electrolytic product is spent, and the subsequent action of the cell is unsatisfactory. In his analysis of the electrolytic peroxide he had always found some percentage of moisture present, even after it had been dried at a temperature above 212° Fah. He believes the chemical changes produced by electrolysis is represented by the equation $(PbO_2)_{10}$, $(H_2O)_5$, $PbSO_4 = (H_2Pb_2O_5)_5$, $PbSO_4$, and that electrolytic peroxide is $H_2Pb_2O_5$. As regards the best kind of support or grid for the spongy lead, he said it was a mistake to use lead, for copper is in many cases much better. If the copper be left exposed local action takes place, but this is retarded by the addition of any alkaline sulphate. The beneficial effect of soda in secondary cells he attributed to the formation of a double salt, which is easily reduced. Sulphate of magnesium has an extraordinary influence on lead plates, and by using a solution of it as electrolyte he had got discharges 30 or 40 times greater than those obtainable from sulphuric acid. The strength of acid required attention when dealing with heavy discharges. Recently he had used acid having a maximum density 1.252, so that its specific resistance diminished as the cell discharged. In this way, and by the aid of copper supports for the spongy lead, he obtained a comparatively steady discharge of two amperes per pound gross weight of cell for two hours. With ordinary lead grids this would have been impossible.

Prof. S. P. Thompson was interested to learn that, like any other battery, the greatest action occurs at the upper parts of the plates. This might perhaps have been expected, because of its being the path of least resistance; but as the variation of the resistance of sulphuric acid with density is peculiar, and as the denser acid falls to the bottom, the action might have been modified thereby. The details relating to the formation of plates, given in the second paper, were, he thought, not new, and were practically what any one having a knowledge of the properties of the substances used, and of the reactions which it was desired to bring about would have arrived at theoretically. For example, to oxidize the positive one would aim at producing the most powerful oxidizer in the shape of ozone, the formation of which is facilitated by strong acid, large current density, and low temperature; on the other hand to reduce the litharge on the negatives it was known that a large current density mainly produces gas, and that production is best effected by small current density at a fairly high temperature. Bearing in mind these opposite conditions, one readily realizes that the plates should be formed separately, and that the negatives will require a much longer time.

Prof. Ayrton said: To investigate the effects of light, darkness, and sulphate of soda on the liberation of gas from idle negatives, they had experimented on three similar E.P.S. cells. The fully charged negatives designated by A, B and C respectively, were put in three different vessels of acid, one of which contained 0.8 per cent. of sodium sulphate and the gases collected. A powerful arc light illuminated one set of plates, whilst the others were kept dark. Plate A, when illuminated, gave off gas very rapidly, whilst B and C in the dark produced very small quantities which were about equal. On interchanging the plates, however, it was found that neither light or sodium sulphate had any marked effect on the rate at which gas was given off, for whether A was illuminated or kept dark, or put in ordinary acid or in the sodium sulphate solution, gas was liberated rapidly at about the same rate, whilst B and C were equally inactive under all the conditions. They therefore conclude that the rate at which gas is liberated depends on some peculiarity of the plates themselves. Some speakers, he said, had remarked that many of the facts brought forward in the papers were previously known. To this he replied that none of the facts given as new were known to the authors before they discovered them experimentally. Manufacturers might have been aware of them, but if so, they had kept them secret and never published them. For example, Dr. Gladstone, one of the highest authorities on secondary cells, was not aware of the differences in the hardness of the plugs at different parts of the plates until the appearance of their paper. Another case in point was the fact that Dr. Thompson said there was nothing new in the methods of forming the plates, whereas Mr. King apparently did not know of them. Mr. Swinburne had also called their attention to a prediction of the cooling of cells during discharge made in 1887, but at that time he admitted that he had not observed it. Speaking of the efficiency of cells, he said some people think the very perfect testing apparatus gave the cells their high efficiency; this of course was not true, for their figures merely express the results obtained when cells are used in a proper manner. Referring to a criticism on the Edinburgh paper which appeared in one of the leading technical papers of July 25th, he said the writer had only partly understood the early part of the paper, for they (the authors) had there explained that one of the objects of the investigation was to see what error could be made by neglecting the previous history, and the resuscitating power of cells. The same writer had also stated that the results of laboratory tests were not applicable to ordinary working conditions. Here, again, he had fallen into error, for a secondary cell is a thing complete in itself, and if two or three selected at random give good results under proper treatment, so any number, if similarly treated, will show equal efficiency.

FOREIGN NOTES OF INTEREST.

An English firm are devoting attention to a process for lengthening the life of incandescent lamps. Discolored bulbs can be opened and cleaned without interference with filaments or mounting, and it is said that when a lamp is thus treated, and re-exhausted and sealed, it is more durable than a new one.

A panic was produced recently in the town of Trente (Germany). After a heavy snowstorm, the lightning struck the building which supplied the electric light to the town, and darkness immediately followed. There was, however, more fear than danger, as the light was again available within a few minutes. A perfomance was taking place at the Teatro Sociale. The audience remained quiet, and the actors, preserving their presence of mind, continued their parts, without interruption, in the darkness.

A recent issue of the *Bulletin International de l'Electricité* contains a description of the successful lighting by electricity of the National Powder Mill of St. Médard-en Jalle, France.

A telephone line, about five miles long, has been established in Iceland. It is regarded as a great curiosity, being the first ever established on the island.

Collais, near Nimes, France, a village of 465 inhabitants, is lighted by electricity. The motive power for the 1,600 light dynamo is derived from a small waterfall. The streets are lighted by 25 lamps of 16 candle-power each. Besides lighting the village, the current is employed during the day in putting in motion the pumps for supplying certain parts of the village with water.

Globular Lightning Experiments.—Planté, as is well known, used a huge secondary battery in his globular lightning experiments. Herr von Lepel states that similar effects may be observed by placing a sheet of mica, ebonite, or glass between the poles of a powerful influence machine, the best results being obtained with glass or paper discs rubbed with paraffin. If the tension is not too great, little luminous red balls may be seen moving about on the discs. Herr von Lepel is of opinion that small particles of dust or liquid are the chief causes of the phenomenon. A slight puff suffices to extinguish the glow, which disappears with a hissing noise.

The Uses of Electricity are limited only by the want of intelligence in producing fitting apparatus for its application.

MUNICIPAL OWNERSHIP OF INDUSTRIES.

BY ALLEN R. FOOTE.

[NOTE.—This paper was written with the expectation that an opportunity would offer to read it before the American Economic Association, at its fourth annual meeting, held in Washington, D. C., December 26–30, 1890. After Prof. Edward W. Bemis had read his paper on "The Municipal Ownership of Gas Works in the United States," no such opportunity occurred, for want of time. We present it to our readers with the suggestion that it receive careful consideration and well-thought-out criticism.]

Those who know me, know that this is a subject in which I take a deep interest and on which I have an opinion. As I had no opportunity to learn what Prof. Edward A. Bemis, of the Vanderbilt University, of Nashville, Tenn., would say in his paper on "The Municipal Ownership of Gas Works in the United States," it has not been possible for me to prepare a review or a discussion of his presentation of the subject. I shall therefore discuss it in general terms.

So far as I am aware, the policy of the municipal ownership of the manufactured gas industry, is advocated by professors of economy on the broad ground that it is a means of securing an economic advantage for society. I presume professors will agree with me in the general statement that—

That system of economy is best which most surely tends to enable the poorest member of society to become richer.

To reach a solution of this problem it is necessary to inquire, in what way does the policy of municipal ownership tend to enable the poorest member of society to become richer? Two differing methods for manifesting the economic advantage to be gained by such ownership, are in operation.

First. Operating the plant for the purpose of creating a profit; the profit being used to reduce taxation for special or general purposes.

Second. Operating the plant without the intention of making a profit, for the purpose of supplying consumers at actual cost of production.

For the purpose of the present inquiry, I will not consider any question relating to the initiative of the ownership, or to the administration of the plant. For the sake of the argument, I will concede that everything in that direction is all right, and that the plant and its operation is an exposition of the best attainments possible to municipal ownership. This enables thought to concentrate upon the direct question in issue. To solve the problem, the effect of each method of economic manifestation must be considered upon its own merits.

Operating a municipal plant for a profit, the use of the profit being to reduce taxation.

Gas for illuminating or heating purposes is a commodity of consumption,-therefore the profit made by a municipality on the sale of gas is a tax on consumption. It is self-evident that the higher the price of the gas, the greater the profit will be, up to the taxable limit of the industry. The greater the profit, the larger the fund to be used for the reduction of special or general taxation.

The selling price is the same to all consumers. The profit per 1,000′ on the gas consumed by the poor is exactly the same as the profit per 1,000′ on the gas consumed by the rich. Under this system the poor not only pay the same rate of tax per 1,000′ as the rich, they also consume much more gas per dollar of their income than do the rich. These two facts fairly considered fully justify all the fine frenzy of denunciation of indirect taxation to be found in the fourth chapter of "Taxation in American States and Cities," by Prof. Richard T. Ely. The character of indirect taxation, as described by this author, may be sufficiently indicated by a quotation of some of the headlines of the subdivisions of this chapter. They are as follows: "Indirect taxes are chiefly taxes on commodities." "Indirect taxes violate the principle of equality." "Indirect taxes and pauperism." "Indirect taxes obstruct trade." "Indirect taxes congenial to despotism and aristocracy."

In view of such teaching one must conclude that the economic results of operating a municipal plant to create a profit, tends to make the rich richer and the poor poorer, a result the reverse of that which should be realized by an economic system designed to secure "the greatest good for the greatest number."

In this result may be found a logical reason why "the best people" in a community, where such a system is in vogue, desire its continuance. Under such conditions any man having a large income can afford to pay twice or three times the price he does for the gas he consumes, since the amount saved to him, through the reduction of his taxes by the profit on the gas bills of a thousand other consumers, is far greater than his share of the excess of price. This is why the citizens of Philadelphia are to-day paying one dollar and a half per 1,000′ for gas, when, if the plant were owned and operated as a private industry, the price would be but one dollar per 1,000′. Every wealthy man in Philadelphia has a thousand poor people assisting him to pay the just taxes of wealth. The poor, deluded creatures are content to do this, because they think by owning their own gas works, they have slipped from under a grinding monopoly. This criticism shows that an apprehension of—wherein lies the economic advantage in any problem—is an instinct with the rich while, if the poor have it at all, it is with them an acquired taste. It further explains why there are two classes of people, the rich and the poor.

Operating a municipal plant for the purpose of supplying consumers at the cost of production.

Of the two methods considered, this is the most equitable. By it, the rich gain only the advantage of the saving on the gas they consume, and the gain of the poor is on the same basis. The gas bills of the poor being a larger percentage of their income than are the gas bills of the rich, the economic advantage gained by the poor under this method affects a larger percentage of saving for the poor in proportion to income than it does for the rich. Therefore this method "tends to enable the poorest member of society to become richer." It obtains "the greatest good for the greatest number." It causes, so far as the economic advantage is concerned, the poor to grow richer and the rich to grow poorer, because it leaves the taxes for the rich to pay. This would be the result of an equitable distribution of wealth.

It is evident from the foregoing, if the economic advantages obtained by the community through the price paid for the service is to decide policy of municipal ownership of industries, then those who advocate private ownership must accept the issue on this basis, and be ready to show that they can and will perform the same service for the same price that the community pays for it under municipal ownership and administration.

A condition precedent to the settlement of this question is an agreement on what constitutes cost of service under municipal ownership. It was to establish this agreement, that I offered the resolutions Saturday evening last, after Prof. Henry C. Adams had read his admirable paper on "Statistics as a means of correcting corporate abuses." Please notice carefully the wording of those resolutions, they are:

"*Resolved, First.* That a committee be appointed to designate the divisions of accounts, and the items to be included in each, that should be kept by corporations performing quasi-public services."

"*Resolved, Second.* That said divisions be so made that the effect of each essential economic actor will be shown, to the end that correct statistics may be obtained through a uniform method of accounting, as a basis for intelligent, economic discussion and legislation."

We must first agree on what items constitute cost, then we must see to it that these items are honestly included in all statements of cost. This done, we are in a position to take intelligent action, and may then award the contract to the municipality or to private enterprise, whichever, in the light of the facts so obtained may appear to be, to the best economic advantage of the people, those who toil and are poor.

Assuming that no economist will take issue with me regarding this fundamental basis for an agreement, I will advance one step farther and claim, until such a basis is agreed upon and the accounts are made in accordance with the requirements, there shall be a suspension of judgment and action. By adhering to this policy all parties will not only avoid the liability to get into positions from which they will have to recede when the statements of cost are correctly made, but large invested interests will cease to suffer from attacks that would not be made if those who utter them were better informed.

I urge this claim upon you for another reason. I, like all not to the manor born, have a lofty ideal of nobility. I feel it to be a personal belittlement to be obliged to lower it. According to my ideal the noblest men are they who worthily fill the station of teacher. What wonder is it then that I should feel hurt when I see some that occupy such stations giving currency to statements that tend to lessen the respect for, and therefore the influence of, those who utter them. When professors of economy give currency to statements of the cost of production which practical men, in the light of the accounts they are daily keeping, know are not true, they must not wonder if they find themselves and the educational institutions with which they are connected, held in small estimation. The profession cannot afford this any betrer than business interests can afford to suffer from the attacks of the uninformed. Here again, I think, we have a point of agreement. Let us join hands upon it and take as our guide to action—whose cause truth will not serve, is lost. That truth may be established, no statement of a demonstrable fact should be made without an analysis of the conditions to show that the conclusion reached is correct.

Having in part explained my views and position to you, I feel it right to tell you I look upon statistics as being as potent *a means of correcting the abuse of corporations*, as for correcting abuse by corporations. To sustain myself in opposing the principle of governmental ownership of industries, in whatever form it may take, I invoke the same power as do those who favor that principle.

Take the accounts of all the industrial plants owned by municipalities, and write them up completely from the date of their initiative until now, and you will find that the communities that have entered upon those experiments have not gained an economic advantage. Private enterprise stands ready to-day to take over every one of these plants and perform the service at the same price such accounts will show it is costing the community where it is rendered, provided the municipality will grant the same economic advantages assumed by itself, which are:

An untaxed investment, an untaxed, exclusive and perpetual franchise.

TRANSMISSION OF ENERGY.—Electrical energy can be transmitted in either of three ways: 1st, by keeping the current constant and varying the electro-motive force of the generator in accordance with the demand for power at the receiving station. 2d, by keeping the electro-motive force constant and varying the current in accordance with the demand for power. 3d, by varying both current and electro-motive force.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRIC AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., Jan. 3, 1891.

THE SUNBEAM INCANDESCENT LAMP COMPANY of this city has increased its capital stock from $25,000 to $100,000.

The street car, electric light and gas companies, of Danville, Illinois, have been consolidated and will hereafter be known as the Danville Gas, Electric Light and Street Railway Company. The incorporators are W. P. Cannon, F. W. Penwell, and A. C. Daniel. Capital stock, $400,000.

MR. G. A. EDWARD KOHLER, who has been representing the Eddy Motor Company in this section of the country, has severed his connection with that company, and accepted a position with the Illinois Electric Material Company. Mr. Eddy will give most of his attention to out of town trade in connection with this company, and will undoubtedly prove a valuable acquisition.

THE ILLINOIS ELECTRIC MATERIAL COMPANY promise a catalogue of electric light and street railway supplies in about two weeks that will be something of a novelty and a very desirable addition to trade literature.

Orders for Okonite and improved Candee wires continue to flow to the Central Electric Company, and these standard articles seem to have no dull season, such as is expected in other lines of electrical supplies.

An unexpectedly large demand has arisen for the new Bain glass and break insulators recently illustrated in these columns. The Central Electric Company has just received its first stock order of these articles, and report that every insulator was sold before the shipment arrived. These insulators have a very practical appearance, and construction men speak highly of them.

THE CHICAGO ELECTRIC CLUB gave the first of the winter's season of dancing parties on the evening of December 26th, which was well attended and a very enjoyable time had. Three other parties of this character will be given during the season, and it is proposed by the management that the succeeding ones be held at some of the leading hotels, in order to give the club members an opportunity of judging of the service afforded by the various hotels. The next party will probably be held at the Auditorium Hotel. Mr. Wm. Peyton Sullivan has just been installed as manager of the club, Mr. Noyes the former manager having returned to his old home in Boston. Mr. Sullivan was formerly connected with the paper trade in this city.

INCORPORATIONS.

The Riverside (Cook County) Edison Co., to furnish electric light and power, etc.; capital stock, $40,000; incorporators, W. W. Hutchinson, Lewis Lusk and M. C. Meyers.

H. Phillips Company, to manufacture gas and electric fixtures; capital stock, $5,000; incorporators, D. H. Robbin, E. F. Abbott and Geo. S. Baker.

Chicago Battery and Traction Company, Chicago, to manufacture electric, primary and storage batteries, dynamos, etc.; capital stock, $300,000; incorporators, Frank G. Holton, Henry R. Gurkee and Edward Atfield.

Burnap Automatic Telephone Exchange Co., to own and control the Burnap automatic telephone exchange patent or patents, etc.; capital stock, $1,000,000; incorporators, Chas. E. Burnap, Alfred W. Brewerton and C. F. Congleton.

Walsh Torch Company, to own and control patents of gasoline torches, blow pots, etc., and to manufacture same; capital stock, $50,000; incorporators, John C. Walsh, Edward J. Hanley and Ole A. Johnson.

Prouty Street Car Motor Company, to manufacture motors and establish motor street car lines in the United States; capital stock, $300-000; incorporators, Enoch Prouty, J. L. Francis and W. S. Gooding.

Stevenson and Hogson Electric Company, St. Louis, Mo., capital stock $10,000; incorporatois, W. H. Stevenson, Henry W. Oernz, James B. Johnson, Samuel H. Hogson, William E. Fisse.

MR. H. F. GRIER, of 83 Lake street, Chicago, has taken a number of contracts for mineral wool during the past month.

The Hyde Park Electric Light and Power Company commenced business on March 1st, 1870, with 17 arc lamps in circuit, and the manager, Mr. C. E. Gregory, reports that they now have 109 lights in use. Hyde Park is one of the villages annexed to Chicago about a year ago, and the entire territory covered by the plant does not exceed a square mile in area.

THE CENTRAL ELECTRIC COMPANY has presented itself with a new set of offices for Christmas. On account of the increase in its various departments, the company finds it necessary to have the business divided up so that each department will be in charge of some one person, who will give it exclusive attention. The president and secretary, under the new arrangement, each have a private office which is very neat and attractive, and will repay a visit from any one interested in electrical work who may happen to be in the city. The appearance of the salesroom is also vastly improved.

MR. J. E. WILSON has connected himself with W. B. Pearson & Company, room 403, Home Insurance building, this city, who are agents for the Ball engine. Mr. Wilson is well known in this section of the country as an engine man, having been one of the organizers of the Western Power Construction Company, who made a specialty of the McIntosh & Seymour engine, and prior to that having represented the McIntosh & Seymour engine in Chicago. When the Western Power Construction Company went out of existence recently, Mr. Wilson transferred his services to the interests of the Ball engine, as stated.

THE INTERIOR CONDUIT AND INSULATION COMPANY recently conducted a series of tests of their conduits before the Illinois Chapter of Architects in this city, which demonstrated very strongly the value of such conduits. Mr. W. A. Willard, the treasurer, and Mr. H. M. Underwood, assistant sales agent, conducted the tests. Among other tests a No. 16 B.W.G., cotton covered flexible wire was short-circuited inside a conduit tube without doing any damage, and then short-circuited outside the tube with the result of setting fire at once to the insulation, thus proving to the architects the safety of tubular conduit over other systems of concealed electric light wiring. The architects were very favorably impressed with the Interior Conduit Company's system. A similar test was conducted a short time before at the dynamo room of the Chicago Edison Company, at which a number of tests were made with similar satisfactory results. The Interior Conduit Company has opened offices in this city, at 1,105 Owings Building.

F. M. I.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRIC AGE,
74 FEDERAL STREET,
BOSTON, Jan. 1, 1891.

Mrs. E. J. Newhall has applied to the Supreme Court for an injunction restraining the Boston Athletic Association from using two steam engines and other machinery used in operating an electric plant. This is a new plant recently put in at a large cost and the club will make quite a battle before giving it up.

The Atlantic Covering Co., Plymouth, Mass., report a large increase in their business, being taxed their utmost to fill orders.

The Essex Electric Railway Company have been granted permission by the Salem Board of Aldermen to lay its tracks to the Willows.

The Aldermen and Council of Worcester in joint convention last Monday night, elected William H. McClure city electrician to succeed C. M. Mills.

The manufacturers of a storage battery for street cars is negotiating for the old works of the Brayton Petroleum Engine Company at East Bridgewater.

At a recent town meeting held in Marblehead the petition of the Naumkeag Street Railway for leave to stretch wires and operate their road by the overhead system was refused by a vote of 150 to 100.

The Kimball Mfg. Company, manufacturers of electrical wood work, have moved their factory from Portland street this city, to Arlington avenue, Charlestown. The company will retain their office at the old place.

John A. Duggan has resigned his position as superintendent of the Quincy and Boston Street Railway, to take effect as soon as his successor can be appointed. The reason given is that his business demands all his attention.

This week the Eastern Electrical Supply and Construction Co. started two additional men on the road. Business with this lively concern is booming and their quarters at 65 Oliver street, which were supposed to be large enough for the next two years are already greatly crowded and before many months they will have to seek new quarters.

The Electric Light Company's plant in Monson is now in operation and is running smoothly. The building is of brick and is about 42x54 feet. It is equipped with a new automatic cut-off compound condensing engine rated at 130 horse power. The company will put in more dynamos as soon as the construction work demands it. It also intends to supply power to local industries by means of motors, and built the station with a view to doing the business.

The Board of Aldermen at their meeting last Monday took action on the petition of the New England Printing Telegraph Co. for leave to erect and maintain poles for the support of their wires on Tremont street, Shawmut avenue, and other streets in Boston, and which petition was reported favorable by a majority of the Committee on Electric Wires. This petition involves the erection of 317 poles and is the largest scheme that has come before the board for some time. The petition was laid over until the next meeting.

A Bridgeport, Conn., despatch says: The embarrassed Graphophone Co. of this city has many carloads of machines which are being held for freight by the various railroads. The failure is due to the falling out with Edison, the inventor of both machines. It is said he agreed to sell out the patent to the stockolders of the machine in this city for a consideration of $600,000. In the transaction he received only $300,000. The machines were to be leased, not sold. When the $300,000 was presented to Mr. Edison he became indignant at not receiving the full amount and immediately invented the phonograph, which is supplanting the graphophone.

The West End Street Railway, of Boston, has increased the wages of the motor men and conductors on the electric cars from $2 to $2.25 per day.

The Bird and Sloane Electric Construction Co., have taken the agency for the sale of the I. W. Colburn dynamos.

W. J. P.

REDUCING HEATING.—By increasing the sectional area of a conductor the temperature, with a given current, is reduced.

NEW YORK NOTES.

A novel and effective Christmas entertainment was held in the Madison Avenue M. E. Church, corner 60th street and Madison avenue, this city, at the Christmas season. The customary Christmas tree was rendered more brilliant and attractive than ever by the use of incandescent electric lamps. The tree was lighted with 40 4-candle power lamps, run by eight accumulators, and the effect was most charming. The brilliant little lights flashed from behind the green branches with sunlight intensity. The great power, however, that made this beautiful scene possible was the accumulators, which were hidden from view. On 55th street, near Madison avenue, there was a similar plant in operation, but less extensive. The tree in this case was illuminated by 15 4-candle power lamps fed by 3 accumulators, and the effect was no less beautiful than in the first case. In each instance the lights were kept burning nearly 4 hours. The cells used were from the Accumulator Company, 44 Broadway.

The McCreary Electrical Specialty Company has gotten up a very neat and convenient desk calendar for 1891. It is a very heavy glass frame, to the under side of which is attachable, by means of a spring, a monthly calendar. This is seen through the clear glass and the whole thing makes a very neat desk ornament. A calendar for each month in the year is provided.

Mr. A. D. Page has been appointed assistant manager of the lamp works of the Edison General Electric Company, at Harrison, N. J.; vice W. H. Meadowcroft. Mr. Meadowcroft has been transferred to the Law Department of the same company, in New York.

A list of all electric wires running over the tops of buildings is to be prepared for the Board of Electrical Control. Mayor Grant announced at the meeting of the Board, January 2, that all unauthorized poles and wires would be removed.

An application has been presented to the Board of Electrical Control by the Harlem Bridge, Morrisania and Fordham Railroad Company for permission to operate an electric railroad by the trolley system, which necessitates the erection of poles and the stringing of wires. Expert Wheeler said that the system was mechanically safe, and Corporation Counsel Clark said there was no legal impediment to its use. The matter was laid over for two weeks.

Mr. Ogden Mills has applied to the Board of Electrical Control for permission to string a couple of wires from Seventy-second street and Fourth avenue to his home at 2 East Sixty-ninth street, where there is to be a dance on January 12. Expert Wheeler was authorized to grant the permit if he thought it advisable.

Mr. C. G. Foster, the secretary and treasurer of The McCreary Electrical Specialty Company, was suddenly taken ill recently in Kansas City. His friends will be glad to know, however, that he is on the mend and has gone to Hot Springs to recuperate.

R. J. G.

TRADE NOTES.

The Electric Gas Lighting Company, of 195 Devonshire street, Boston, is issuing to its friends and patrons a very neat calendar for the year 1891.

W. H. Tucker and J. P. Hall have associated themselves in business as contractors for general electric work and opened an office in Room 8, *World* Building. The firm name is Tucker & Hall, and both gentlemen have had many years experience in the line of work they have embarked in on their own account. They have both been in the service of the United States Illuminating Company for many years, and are familiar with every detail in electrical work Mr. Tucker had entire charge of the work of installing the electric light plant in the *World* building, which is probably the most complete plant in the country, and the work was done in the most approved manner. The firm has secured the contract for the electric light wiring of the new Stokes building on Cedar street.

The conduit system of the Interior Conduit and Insulation Company will be used in the new Stokes building on Cedar street, this city. The same building will be lighted by the United States system.

The Brown & Sharpe Mfg. Co., the well-known makers of machinery and tools, Providence, R. I., are sending to their patrons a neat paper weight. On the top surface is an excellent engraving, on celluloid, of the extensive works of the company.

Mr. H. T. Paiste, of 128 Market street, Philadelphia, the maker of the well-known Paiste Lamp Switch, is beginning the business of the new year by sending to his friends and patrons a neat calendar for 1891.

Mr. T. W. Ness, the enterprising manufacturer and importer of all kinds of telegraph, telephone, medical and general electrical supplies, 644 Craig street, Montreal, Can., has just issued a very complete catalogue of the many things he deals in. It is fully illustrated and gives much valuable information on electrical and kindred subjects. This is the Canadian headquarters for electrical supplies, and is the largest supply house in that country. This house is prepared to furnish anything in its line on short notice. Their principal manufacture is telephones and annunciators, and they have fitted up a number of towns with complete local exchanges. At the present time the house has orders on its books from New Foundland and as far West as British Columbia, thus showing the extent of the reputation of the business.

M. Camille A. Faure, of Paris, France, of storage battery fame, is in the city.

WESTINGHOUSE BUSINESS IN 1890.

The Westinghouse Electric and Manufacturing Company has just completed the most successful year in the history of the organization.

According to the report of shipments made up to December 31, 1890, the company shipped 217 alternating current incandescent dynamos of a capacity aggregating 348,150 sixteen-candle power lights during that year. This makes a total of 730 alternating current incandescent light machines, with a total capacity of 720,300 sixteen-candle power lamps which have been shipped by the company since its organization in November, 1886.

During the first year, *i. e.* 1886, the shipments amounted to A. C. apparatus aggregating 2,400 sixteen-candle power lamps; during 1887 they were 106,200 lights; during 1888, 119,960; during 1889, 228,150, and during last year 248,850.

The figures prove the year just closed as the greatest record the company has ever made, and it also shows that the reputation of the apparatus manufactured by the Westinghouse Company is constantly increasing.

During last year the company, however, added another branch to its business, in the manufacture of electric street railway apparatus. In that branch the record of the shipments show perhaps the most phenomenal which has ever been achieved by any concern in the electrical industry. The company did not commence to ship motors until the first of July. Since then 211 15-h.p. motors have left the shops for the equipment of forty electric railways. This makes an average shipment of over thirty-five motors per month.

The company also commenced the manufacture of alternating current arc light apparatus during the last year. The first shipment of these machines was made in January, 1890. Since that time the company has shipped 107 alternating current arc light dynamos aggregating a capacity of 5,680 2,000-candle power lamps.

The Shallenberger alternating current meter and the converters utilized in connection with the Westinghouse system of alternating current electric lighting are now well known all over the globe. There are now over 20,000 Shallenberger meters and more than 30,000 converters in use.

During the month of December the company received orders to increase the capacity of seven central station plants, where its alternating current system is already in operation and, in addition, a number of new contracts were obtained for the installation of incandescent as well as arc light apparatus. Among the latest orders are:

An increase of 750 lights for Olean, N. Y.; 3,000 lights for St. Louis, Mo.; 1,500 lights for Keokuk, Ia.; 3,000 lights for Louisville, Ky.; 500 for Wilmerding, Pa.; 750 for Mansfield, Pa,; 750 for Albion, N. Y.; 750 for Berlin Falls, N. H.; 750 lights for Windsor Locks, Conn.; and 500 for White Water, Wis.

RE-HEARING IN PATENT CASE DENIED.

In the interference case of Forbes vs. Thomson involving the patent on a method of measuring electricity, Commissioner of Patents Mitchell on December 13th last denied the motion for a re-hearing, on the appeal from the decision of the Primary Examiner dissolving the interference, upon the ground that the application of Thomson was not technically a division of a prior application by him, the Commissioner reversing the decision of the Examiner.

The substance of the decision is that "where the earlier of two applications described an apparatus and a process and claimed the former, and without claiming the process stated that it formed the subject of another application which was identified by serial number and date, and the other and later application declared itself to be a division of the application first filed, which was identified also by serial number and date it is *held* that the later application was technically a division of the earlier.

A supplemental oath is required to justify the insertion of a claim through the medium of a divisional application where it would be requisite if the claim were to be inserted in the parent application."

INCREASING ITS PLANT.—The Louisville Electric Light Company, of Louisville, Ky., has just contracted with the Westinghouse Electric and Manufacturing Company for the third increase in the capacity of its alternating current central station electric lighting plant. The company commenced operations about two years ago with a plant containing Westinghouse alternating current apparatus of 1,500 lights capacity. With the latest addition of two 1,500-light Westinghouse A. C. dynamos, the plant will have a total capacity of 6,000 sixteen-candle power incandescent lamps.

TELEGRAPH SERVICE SUFFERS BY FOG.—On the night of December 31st a dense fog prevailed over many of the Middle and Northern States. So extensive was it that the telegraph service in those sections was completely paralyzed while the fog lasted. Chicago and other of the large Western cities were practically cut off from the rest of the world, telegraphically speaking.

OIL INSULATION.—The efficacy of oil insulation may be appreciated by the experiment made by Mr. Brooks at the Philadelphia Centennial. He connected two wires to a Holtz induction machine and their extremities held one-quarter of an inch apart were dipped into a heavy mineral oil, and afterwards held in air 1½ inches apart. On turning the machine the spark passed through the air space, but not through the oil, although the distance was much less.

THE ELECTRIC AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS ISSUED DECEMBER 16 AND 30, 1890.

443,455. Electrode for Secondary Batteries. Isidor Kitsee, Cincinnati, Ohio, assignor to Mayer Sulzberger, trustee, Philadelphia, Pa. Filed February 11, 1896.

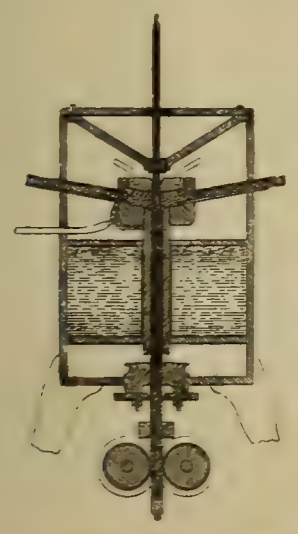
443,456. Secondary Battery. Isidor Kitsee, Cincinnati, Ohio, assignor to Mayer Sulzberger, trustee, Philadelphia, Pa. Filed February 11, 1890.

443,457. Secondary Battery. Isidor Kitsee, Cincinnati, Ohio, assignor to Mayer Sulzberger, trustee Philadelphia, Pa. Filed February 27, 1890.

443,475. Electric Cash-Register. Willard L. Bundy, Auburn, N. Y. Filed September 30, 1889.

443,478. Fire-Alarm System. Frederick T. Fearey, Newark, and John Speicher, Jersey City, N. J., assignors to the Newark District Telegraph Company of New Jersey. Filed July 30, 1889.

443,487. Gas and Electric-Light Fixture. Charles Felton, Denver, Col., assignor of one-half to Thomas P. Hughes, same place. Filed December 23, 1889.



NO. 443,506. COVERING AND INSULATING WIRES.

443,493. Telephone. Sigmund Bergmann, New York, N. Y., assignor to Edward H. Johnson, same place. Filed December 31, 1884.

443,494. Telephone. Sigmund Bergmann, New York, N. Y., assignor to Edward H. Johnson, same place. Filed October 26, 1885.

443,497. High-Resistance Compound. William G Bremer, St. Louis, Mo., assignor to the United Electric Improvement Company, Gloucester City, N. J. Filed June 6, 1890.

443,505. Telegraph-Blank. John O. Donnell, Lowville, N. Y. Filed October 2, 1889.

443,507. Phonograph. Thomas A. Edison, Lewellyn Park, N. J. Filed December 27, 1889.

443,508. Pole-Top for Trolley-Wire Supports. William L. R. Emmet, East Rockaway, N. Y. Filed September 18, 1890.

443,526. Telephone. Edward H. Johnson, New York, N. Y. Filed April 24, 1884.

443,527. Apparatus for Automatically Grounding or Cutting Out of Circuit Exposed Electrical Conductors. Francis W. Jones, New York, N. Y. Filed August 15, 1890.

443 530. Socket for Electric Lamps. Charles A. Lieb, New York, N. Y. Filed September 24, 1890.

443,536 Art and Means for Covering and Insulating Wire. Thomas W. Norman, Boston, Mass. Filed April 29, 1890.

443,543. Key Turner for Gas and Electric Lights. Lewis H. Rockafellow, Philadelphia, Pa. Filed Jan. 17, 1890.

443,556. Secondary Battery. Harry H. Wardwell, Lake Village, N. H. Filed Sept. 2, 1890.

443,557. Arc Lamp. Alonzo W. Whitcomb, Worcester, Mass. Filed Mar. 27, 1890.

443,562. Incandescent Lamp Socket. Sigmund Bergmann, New York, N. Y. Filed Jan. 10, 1890.

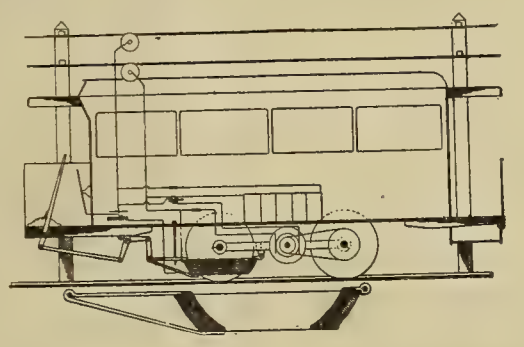
443,563. Shade Holder for Incandescent Lamps. Sigmund Bergmann, New York, N. Y. Filed Jan. 25, 1890.

443,565. High Resistance Compound. William G. Bremer, St. Louis, Mo., assignor to the United Electric Improvement Company, Gloucester City, N. J. Filed Oct. 31, 1890.

443,580. Electrical and Vapor Face Bath. Nathaniel Lyke, Williamsport, Pa. Filed Apr. 25, 1890.

443,632. Electric Arc Lamp. Edward Heymann and Frank W. Heymann, Boston, Mass. Filed Nov. 5, 1888.

443,633. Electric Arc Lamp. Edward Heymann and Frank W. Heymann, Boston, Mass. Filed Nov. 5, 1888.



NO. 443,677 BRAKE DEVICE FOR ELECTRIC RAILWAY.

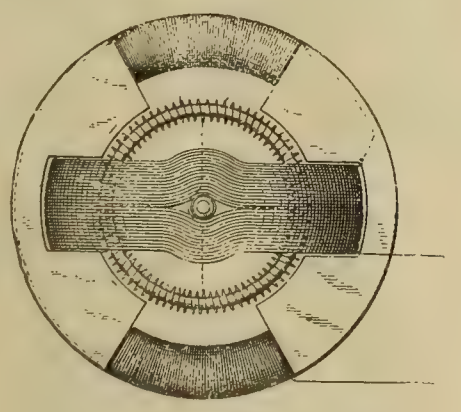
443,674. Electric Stop-Motion for Warping-Machines. Philipp Goldschmidt, Paterson, N. J. Filed January 11, 1890.

443,677. Traction and Brake Device for Electric Railways. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed September 23, 1889. Divided and application filed June 1, 1887. Again divided and this application filed July 2, 1890.

443,693. Electric Switch. James J. Wood, Brooklyn, N. Y. Filed May 28, 1890.

443,716. Electric Damper-Regulator. Jeremiah O'Meara, New York, N. Y. Filed May 2, 1890.

443,724. Electrical Fire Alarm and Extinguishing System. Charles E. Ongley, New York, N. Y., assignor of one-half to Thomas W. Robertson, same place. Filed April 12, 1890.



NO. 443,536. ELECTRIC MOTOR.

443,636. Apparatus for Measuring and Registering Electric Currents. Camille A. Faure, New York, N. Y., assignor to Edward C. Davidson, same place. Filed Nov. 1, 1888. Patented in England, France, and Belgium.

443,642. Electric Meter. Chaimsonovitz P. Elieson, London, England. Filed March 18, 1890.

443,646. Magneto-Electric Stop Mechanism. Washington H. Kilbourn, Greenfield Mass., assignor to Herbert O. Edgerton, same place. Filed June 4, 1890.

443,671. Electric Locomotive. Rudolf Eickemeyer, Yonkers, N. Y. Filed January 28, 1889.

443,725. Non-Interfering Signaling System. Charles E. Ongley, New York, N. Y. Filed May 9, 1890.

443,726. Electrical Signal System. Charles E. Ongley, N. Y. Filed May 13, 1890.

443,727. Safety Device for Dynamo Stations. Charles E. Ongley, New York, N. Y., assignor of one-half to Thomas W. Robertson, same place. Filed June 30, 1890.

443,747. Electric-Lamp Socket. John T. Dempster, Summit, N. J., assignor to Bergmann & Company, New York, N. Y. Filed May 24, 1890.

443,772. Electric-Magnetic Clutch. Charles E. Kells, Jr., New Orleans, La. Filed Mar. 31, 1890.

443,787. Watchman's Electric Time-Recorder. Charles E. Ongley, Yonkers, N. Y. Filed Jan. 20, 1890.

443,788. Watchman's Electric Time-Recorder. Charles E. Ongley, New York, N. Y., assignor of one-third to Thomas W. Robertson, same place. Filed Mar. 17, 1890.

443,789. Electric Valve-Controller. Charles E. Ongley, New York, N. Y. Filed Apr. 4, 1890.

443,790. Electric Protective and Signaling System. Charles E. Ongley, Yonkers, N. Y. Filed Nov. 26, 18890. Renewed Nov. 8, 1890.

443,814. Electrical Attachment for Railway Switches. Arthur W. Berne, New Orleans. La., assignor, by mesne assignments, to the Electrical Safety Railway Switch Company, Limited, same place. Filed July 5, 1890.

443,944. Attachment for Electric Lamps. James A. Manning, Ashtabula, Ohio. Filed Sept. 24, 1890.

443,976. Galvanic Battery. George A. Smith, Halifax, Canada. Filed July 14, 1890.

443,980. Electric Motor. Charles J. Van Depoele, Lynn, Mass. Filed Mar. 8, 1889.

PHILADELPHIA NOTES.

The name of the old and well-known electrical supply house of Partrick & Carter has undergone a slight change, and will hereafter be known as the Partrick & Carter Company. The company has moved into its new quarters in the large buildings, Nos. 125 South Second street and 131 Gothic street, where, with greatly increased space, machinery, and force, they will be better equipped than ever before to meet the demand for the electrical apparatus and supplies made by the concern.

H. T. Paiste, the manufacturer of the well-known Paiste Specialties, is now placing on the market a switch, the handle, cover and base made of English ivory china. The switches are very neat and artistic, and designed for fine residence installations. They are furnished in all colors to match wall paper and felts. Those with the dull gold finish are particularly fine. The demand for these goods has been so great that 500 are being imported weekly. One noticeable feature is that the cap screws on the base, with a thread cut in the china. Mr. Paiste claims for these switches that they will always present a fine appearance, as the china cover will not tarnish, as all metal caps do in time, when exposed to atmospheric changes.

The rhymes on the calendar issued by Mr. H. T. Paiste, which are attracting so much favorable comment, showing, as they do, much enterprise and ingenuity, were written by Mr. Paiste's personal friends, he having offered prizes for the same. On the back of the calendar is printed an illustrated description of the various specialities that this firm manufactures.

THE WESTINGHOUSE FUND.—Mr. Andrew Carnegie has subscribed $25,000 to the Westinghouse Guarantee Fund. This makes the total amount ot the fund, $546,000.

ELECTRICAL BOOKS.

The Elements of Electric Lighting. By Philip Atkinson, A. M., Ph. D. 260 pages; 104 illustrations. $1.50.

This is an excellent book and includes chapters on Electric Generation, Measurement, Storage and Distribution.

Electricity in Daily Life. $3.00.

This book is just published and is the best of its kind ever produced. It includes chapters as follows: "Electricity in the Service of Man," by Prof. C. F. Brackett, of Princeton College; "The Electric Motor and its Applications," by F. L. Pope; "The Electric Railway of To-day," by Joseph Wetzler; "Electricity in Lighting," by Henry Morton, president Stevens Institute, Hoboken, N. J.; "The Telegraph of To-day," by Charles L. Buckingham; "The Making and Laying of a Cable," by Herbert Laws Webb; "Electricity in Naval Warfare," by Lieut. Walter P. Hughes, U. S. N.; "Electricity in Land Warfare," by 1st. Lieut. John Millis, U. S. A.; "Electricity in the Household," by A. E. Kennelly, and "Electricity in Relation to the Human Body," by Dr. M. Allen Starr.

A, B, C, of Electricity. An explanation of the various ways electricity may be generated and usefully applied. By William H. Meadowcroft. Cloth, 108 pages, 35 illustrations. 50 cents.

Bell-Hanger's Hand-Book. By F. B. Badt. Flexible cloth binding. 106 pages, 97 illustrations. $1.00.

The name of this book is unfortunately too narrow in application. The book gives complete information on batteries, of the different kinds, uses and method of application to different classes of work; bell work, including fire alarms, annunciators, etc., and a good deal of instruction about electrical things in general.

Induction Coils, How Made and Used. By Dyer. Boards. 50 cents.

The Electric Motor and its Applications. By Martin and Wetzler. Second edition; 292 large quarto pages, 316 illustrations. $3.00.

This is the only complete and reliable work on this important and interesting subject, and is brought up to date. The second edition has four newly added chapters covering American and European motors, alternating current motors, and the pyro magnetic motor. Anyone interested in electric railway progress will find this work very valuable.

Dictionary of Electrical Words, Terms and Phrases. By Edwin J. Houston. 656 pages, 397 illustions. $2.50.

This book is virtually an electrical cyclopedia, and was compiled after great research and labor. It includes nearly 2,500 distinct words, terms or phrases. It is the most complete work of the kind in existence and has filled a long felt want. One possessing a copy of this book need not remain in ignorance concerning anything pertaining to electricity.

Principles of Dynamo Electric Machines. By Carl Hering. 279 pages, 59 illustrations. $2.50.

This book gives practical directions for designing and constructing dynamos. An appendix contains several articles on allied subjects, and a Table of Equivalents of Units of Measurements.

Practical Information for Telephonists. By T. D. Lockwood. 192 pages. $1.00.

Mr. Lockwood is entirely qualified to give the information contained in this book, and he does it in a manner that is as interesting as it is valuable. Everyone interested in the telephone service should study this book, as it is full of matter, some of which at least will be new to everyone, however familiar he may be with the telephone.

Elementary Treatise on Electric Batteries. By Alfred Niaudet. Translated from the French by L. M. Fishback. 266 pages, 55 illustrations. $2.50.

The Galvanometer and its Uses. By C. H. Haskins. Third edition; 74 pages, illustrated. $1.50. A manual for Electricians and Students.

This is an invaluable work for any one whose duties require the use of this very important instrument.

For sale by THE ELECTRIC AGE PUBLISHING CO., *World* Building, New York.

Send for our catalogue of books.

ELECTRIC POWER NOTES.

The Industrial Building, which is to be at once erected in Anniston, Ala., will be supplied with power from the Anniston Electric Light Works. The cost of the power, it is said, will not exceed the rent of the rooms.

NEW PUBLICATIONS.

Messrs Funk & Wagnalls, Publishers, 18 & 20 Astor Place, New York, have in course of preparation a standard dictionary of the English language. The various departments of the vast undertaking are in charge of persons eminently qualified to supervise the work. The department of physics is edited by Arthur L. Kimball, Ph. D., Associate Professor of Physics in Johns Hopkins University.

ELECTRICAL ENTERPRISE is the title of a new weekly paper devoted to electricity and kindred interests. Its home is in Boston, and its staff consists of John G. Lynch, Editor, Frank M. Gilley, Associate Editor, and Albert P. Bicknell, business manager.

THE TELEPHONE IN ICELAND.—The natives of Iceland were recently given something to talk about and wonder over, and no doubt they will exercise these functions abundantly for some time to come. A telephone line, five miles in length, has been built and it is regarded with considerable curiosity by the natives. This is the first line established in this cold country.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.—At the twelfth convention of the National Electric Light Association held at Cape May, last August, the constitution was amended. The new constitution went into effect on 1st inst., and Secretary Allen R. Foote is now sending out a neat little pamphlet containing the new constitution together with a prospectus of the association. In paying dues for 1891 members are requested to make application for membership under the new constitution on the blank form which accompanies the pamphlet.

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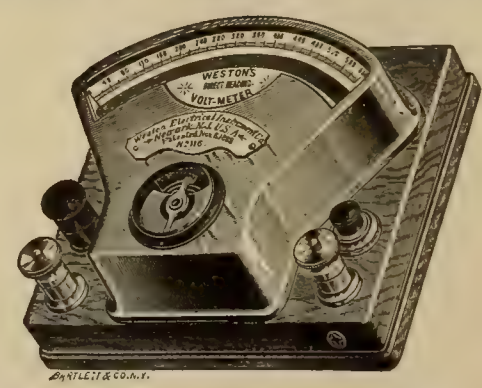
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PUBLISHED EVERY SATURDAY.

BY THE ELECTRIC AGE PUBLISHING CO.

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THE DYNAMO IN TELEGRAPHY.

We publish on another page an illustrated description of the electrical plant installed in the new offices of The United Press in this city. This plant is the first of its class, and possesses many interesting features. The ordinary batteries, usually found in telegraph offices, are conspicuous by their absence in this instance, and the method of supplying the current for the operation of the telegraph sounders and transmitters is effected in a more economical and satisfactory manner. Two accumulator cells, joined in multiple, furnish all the power necessary for the various instruments, and the accumulators are charged each day, or as often as is necessary, by a small dynamo. The dynamo is run by a motor which derives its power from the electric light circuit in the building. The motor and dynamo are combined on a common base, and the armature of both machines are fitted on one shaft. This combined apparatus is in one sense a direct current converter, and its efficiency is remarkably high, being between 27 and 30 per cent. As compared with the ordinary blue stone battery, a great saving is effected by the use of the combination of the two machines. The dynamo is wound to charge the accumulators with 25 ampere current at 2½ volts, and when the potential of the cell has reached 2.3 volts, an alarm is automatically sounded to indicate that the process of charging has been completed. Provision is made to work the sounders direct from the dynamo in case of trouble with the accumulators, the current being reduced to the proper proportion by the insertion of lamp resistances. The plant possesses many other interesting and new features, which are fully and clearly set forth in our article. Our special artist has succeeded admirably by the aid of the camera and his pen in bringing out prominently all of the most interesting points of this most interesting plant.

ELECTRIC CARS IN THE WINTER.—Electric railways have been put to a severe test so far this winter. Snow has been very plenty, and the electric cars, in common with all others propelled by one means or another, have had the common enemy to battle with The electric snow plows, however, have admirably served the purposes for which they were built, and demonstrated once again the vast superiority of the electric system of propulsion in overcoming all ordinary obstacles incident to the changes of the weather. For all this, however, there are some people who are inclined to look upon electric cars with some degree of dissatisfaction because the system is subject to natural laws. These people seem to think that because the cars are dependent upon electricity for their motive power the same electricity should have the power to urge them along at their usual speed, hindrance or no hindrance. Some people think that anything with which electricity has to do is possessed of extraordinary power, and can overcome obstacles of all kinds. If the electric cars should become blockaded in a snow storm, the fault, in their opinion, lies with the electric system. They forget that horse car lines, and cable lines yield to the storm's power long before electricity is compelled to give up. So far as we have learned, the electric cars have to a greater degree than ever sustained their reputation for their ability to battle with the elements.

STABILITY OF ELECTRICAL HOUSES.—It is satisfactory to note how well electrical houses have pulled through the recent financial crisis. This fact indicates that their trade is a healthy one, and that they have a good, substantial foundation. The trade, however, felt, and does yet feel, the effect of the tightness of money, which condition still prevails. While trade in all electrical lines is very good, yet we constantly hear that money is hard to get. "There is plenty of business," the dealers say, "but little money coming in." Fortunately, electrical houses have good credit, and they are thus enabled to keep on turning out their goods to supply the demand. However, confidence is gradually finding its way into business, and money is becoming correspondingly easier to obtain. As general confidence is being restored, the electrical trade will be one of the first to benefit thereby.

MEETING OF ELECTRICAL ENGINEERS.—The next meeting of the American Institute of Electrical Engineers, January 20, promises to be one of unusual interest. The discussion of Mr. Kennelly's interesting paper on "Inductance and its Proposed Unit, the Henry," which was read at the last meeting of the institute, will be open for discussion. Dr. Cary T. Hutchinson will open the discussion, and it is likely that many valuable points will be developed before the subject of the evening is exhausted. All members should not fail to be present.

SECOND CENTURY OF THE PATENT SYSTEM.—It is proposed to hold a celebration of the beginning of the second century of the American patent system during April, 1891, at Washington, D. C., and Mr. J. Elfreth Watkins, of the U. S. National Museum, Washington, and secretary of the committee on celebration, has issued a call to inventors and manufacturers of patented inventions, asking their co-operation in this celebration and in forming a national association of inventors for mutual benefit.

OVERHEAD WIRES AND SUBWAYS.

Mayor Grant, of this city, in his annual message to the City Council refers to wire and subway situation as follows:

"The work of removing the poles and overhead wires has been continued without interruption during the past year, and in every instance in which the companies have contested the right of the municipal government to compel the removal of these poles and wires the city has been successful. The Board of Electrical Control during the past year has constructed for the reception of telegraph and telephone conductors 178 miles of single duct in nine miles of street trench, making a total construction of telephone and telegraph subways of 697 miles of duct in 38 miles of street trench. There have been constructed 132 miles of duct in 39 miles of street trench for electric light conductors, making for electric light service constructed up to date 647 miles of duct in 85 miles of street trench. There have been placed in the subways 10,150 miles of telephone and telegraph wire and 340 miles of wire for electric light service, making in all now in the subways, telephone, telegraph, and electric light wires, 23,797 miles. There have been removed during the year 1,361 poles and 18,949,645 feet of overhead wire.

At the present time many of the departments operate separate systems of electric wires, which are largely maintained through separate cables. In several of the large cities of the United States a central electrical exchange, through which intercourse can be had between the different departments of the city government, is in existence, under the control of the local authorities. It is a question for serious consideration whether such a system should not be adopted in this city. If it should be ultimately concluded to adopt such system it could be extended to enable the city to furnish its own electric lights."

EARTH CURRENTS.—The lecture of Mr. William Finn before the Buffalo Electrical Society, January 5th, on "Earth Currents," of which we print the first instalment on another page in this issue, makes exceedingly interesting reading. It is interesting because it is on a subject that has as yet not received very much consideration at the hands of scientific investigators, but which some day may be harnessed to man's use as easily as electric currents obtained by other processes. Mr. Finn brings out many points in relation to earth currents, which possess much interest for knowledge's sake if for no other. For instance, he points out the fact that it has been determined by careful and systematic observation that there exists some relation between the rise and fall of the tides and earth currents, but that it remains yet undetermined whether earth currents are due directly to this cause, or to the force that causes the tides. It has, however, been established that earth currents have a periodic regularity in their appearance and magnitude, and that they flow in one direction during the first half of the day, and in the reverse direction during the second half. Man's ingenuity may some day devise a way to utilize this natural force. The variability and small magnitude, of these currents as manifested on ordinary telegraph wires, of course, are objectionable features in the present state of our knowledge. Different means of course, will be necessary to harness the power and make it perform some of our work. We commend the paper to our readers as one of interest. It gives many suggestions that may be developed by some young investigator who is ambitious to create a name and fame for himself.

SULPHATING.—If the strength of the acid solution in storage cells is above 1.700, bad sulphating rapidly ensues, with great loss of capacity, although giving a good E. M. F.

AN INTERESTING TELEGRAPH PLANT.

In our last issue we briefly referred to the electrical plant installed in the new offices of The United Press located in the *World* building. We are now enabled to give illustrations and full details of the same. The most interesting part of the plant is the method adopted of supplying the current necessary to work the sounders and transmitters, 28 in number. Ordinarily some sort of battery is used for such purposes, generally the gravity, or Callaud battery. The United Press, however, has not a cell of battery in the entire establishment, two accumulator cells being used instead. The cells are of the Accumulator Company's make, and each has a capacity of 150 ampere hours, making a total of 300 ampere hours capacity.

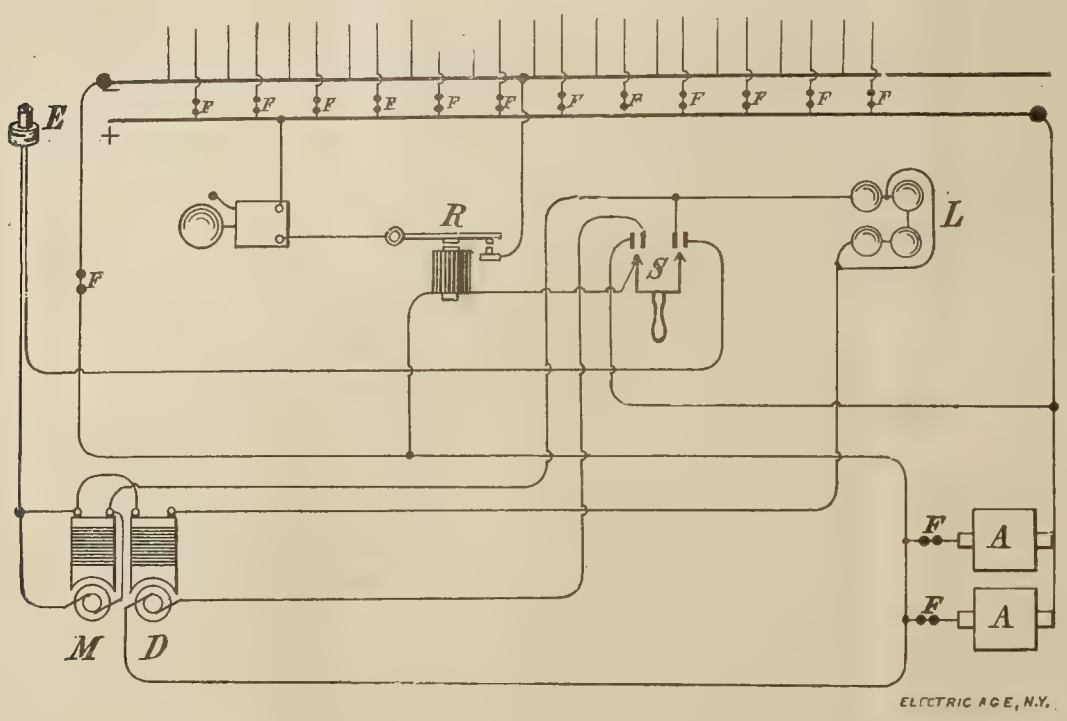


FIG. 1.—DIAGRAM OF THE UNITED PRESS ACCUMULATOR PLANT.

A—Accumulator Cells.
D—Dynamo.
M—Motor.
F—Fuses.
R—Regulator.
S—Switch.
L—Lamps.
E—Attachment plug to fit lamp socket.

The method of charging these cells is unique and effective, and reflects great credit on the ability of Mr. George W. Gardanier, electrician for the Western Union Telegraph Company, who planned and installed the electrical plant.

The cells are charged by a small dynamo which is driven by a motor taking its current from the electric light circuit in the building. The dynamo, D, and motor, M (see diagram), are placed together on one common base, and the armature shaft is common to both machines; hence it will be understood that both necessarily run at the same speed. The dynamo and motor are of the C. & C. Motor Company's make, and the base on which the two machines are set covers a space of about a foot square.

Tho dynamo delivers a charging current of 25 amperes with a potential of 2½ volts at the brushes when the motor is run at 106 volts and 2½ amperes, and the combined efficiency of the machines is between 27 and 30 per cent., depending on the load. For the benefit of those who may think that this is rather a low efficiency, we may state that it is about as good as can be attained in such an arrangement, and that there is a great saving over the gravity battery in this combination.

Every day the accumulators (A in diagram) will be charged by the dynamo for about one or two hours and thus kept full. By an ingenious device an alarm bell is sounded when the electromotive force of the accumulators has risen to 2.3 volts. When the alarm rings a hand switch is used to cut off the charging current and the bell ceases to ring. (See S in diagram.)

The switch S is a double one and closes two separate circuits, namely, that of the electric light to drive the motor, and the charging circuit. The closing of the two circuits is not affected simultaneously, however. By the greater elevation from the switch base of the two legs representing the terminals of the motor circuit, that circuit is closed before the dynamo or charging circuit is, thus giving the motor sufficient time to attain its normal speed before the load of charging the accumulators is put on.

The indicator, or alarm circuit, is also opened and closed by this switch, so that when the alarm rings the opening of the switch disconnects the alarm and the charging ceases. In the diagram the operation of the inductor R will be readily understood. The magnets of the indicator are wound to 26 ohms, and the instrument is so delicately constructed that it has been found, by tests, that when the armature is properly adjusted it will stay open on a current of 2.27 volts, but will close on 2.30 volts. This makes a very accurate indicator. The armature pivots are provided with jewelled bearings to prevent wear, and the instrument is hung on delicate spiral springs to counteract the effect of any vibration. This method of hanging is rendered necessary on account of the delicate adjustment of the instrument.

In case both accumulators should become disabled, the sounders can be worked direct from the dynamo. Under these circumstances the potential at the brushes goes up to 6 volts, but this is reduced to 2.2 volts by the insertion of lamp resistances in the field circuit of the dynamo. These lamps L and their connections are plainly shown in the accompanying diagram. One lamp is always in circuit during the process of charging in order to reduce the charging current to 25 amperes, and when it is necessary to supply the current directly from the dynamo to the sounders the three additional lamps are cut into the circuit by disconnecting one terminal of the shunt wire to reduce the voltage to 2.2 volts, as already mentioned.

Without the resistance of the one lamp during the charging of the accumulators the current would run up to 32 amperes, which would be too heavy for the motor armature, and would cause over heating.

A 10-ampere fuse is placed in circuit with the negative pole of each accumulator, so that if either cell should be short circuited the fuses would be burned out, thus preventing the discharge of the other cell.

It is calculated that by charging the cells daily in the manner already described a charge sufficient to last 4 or 5 days will be maintained, and in case of the failure of the electric light current there will be an ample supply in the cells to bridge over any ordinary stoppage. It is estimated that the daily consumption of current is about 60 ampere hours. Thus it will be seen that, fully charged, the two cells will contain a five days supply at that daily rate of consumption.

It will be of interest to state that the Western Union Telegraph Company is using a combination C. & C. motor and dynamo, similar to the one just described, in the main office, for supplying current for the operation of 50 sounders.

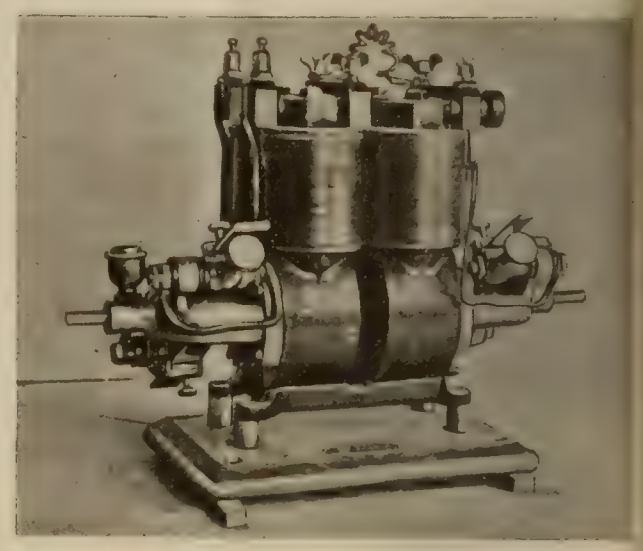


FIG. 2.—COMBINATION C. & C. MOTOR AND DYNAMO.

The motor and dynamo armatures, like the United Press machine, are on one shaft, and, we understand, the machine is giving great satisfaction.

In the United Press machine the fields of the motor and dynamo are connected together in parallel and are both excited by the electric light current used to drive the motor. The four lamps already spoken of are connected in series between the two field magnets, as shown in the diagram. There are no connections with the dynamo brushes save those leading to the accumulators. In other words the entire current generated in the dynamo armature is used to charge the accumulator cells.



FIG. 3.—VIEW OF ACCUMULATOR PLANT (FROM A PHOTOGRAPH).

The resistance of each of the fields is 350 ohms, and that of the dynamo armature is about $\frac{1}{1000}$th of an ohm. The resistance of the motor armature is about 20 ohms plus its inductive resistance which is equal in effect to about 56 ohms.

It will be noticed that the wires running to the various instruments are brought directly to the leads at the switchboard as shown in the diagram. The reason for this is that in the original plans it was intended to use ordinary gravity batteries, and all the necessary wires had been

run before the change of plans was made.

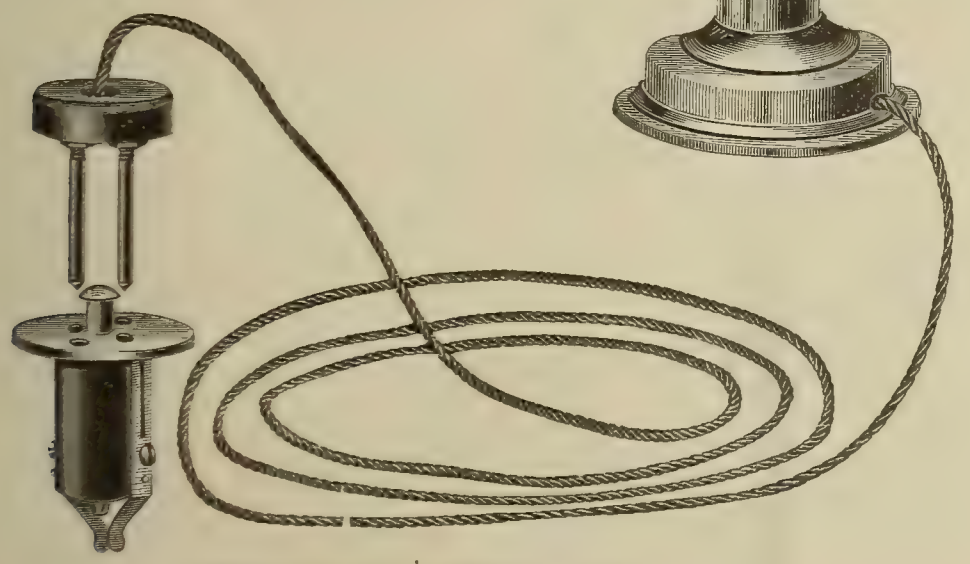
Each wire connected with the positive lead is provided with a fuse, as indicated by F in the diagram.

This plant, we believe, is the first of this character ever installed, and it is full of interest to the electrician and telegraph people in general. It is full of suggestions, and for moderate sized telegraph offices it is far superior to batteries both in efficiency and convenience. It is, besides, more economical than batteries, which, as is well-known, are wasteful.

IMPROVED ELECTRIC PUSH.

It would seem that the limit of improvements in electric pushes, etc., had been reached, but the enterprising electrical manufacturing firm of Stanley & Hall, at 34 Frankfort street, has proved that this is not the case. They have recently brought out a push that has considerable merit, and of which we give below an illustration and a general description.

Floor pushes are good things as far as they go, but sometimes it is not always convenient, in sitting at the table, for instance, to be located where it would be possible to use the foot push, and at the same time maintain a dignified attitude.



STANLEY AND HALL'S IMPROVED ELECTRIC PUSH.

Messrs. Stanley & Hall have very successfully devised a way to overcome the objections to floor pushes, and the illustration we give herewith is quite clear enough to tell its own story.

The plug attachment immediately above the figure of the floor push is for the purpose of establishing a connection between the electrodes of the floor push and the coil of conducting cord. At the opposite end of the cord is what looks like an ordinary push. It differs from the ordinary device in that it is made of sufficient weight to permit its being placed on the table, by the plate, or in any other convenient position. It is operated like any other push, and the cord passes through a small hole provided in the base, which allows the push to lay flat on the table.

This portable push is gotten up in a very artistic manner, being made of oxidized bronze. It is quite ornamental, and can be easily placed out of the way, yet within easy reach, on the table.

The firm of Stanley & Hall has quite a reputation for its ability to produce new and useful things, and the one we have just described certainly possesses the latter merit to a considerable degree.

EFFICIENT ELECTRIC MOTORS.

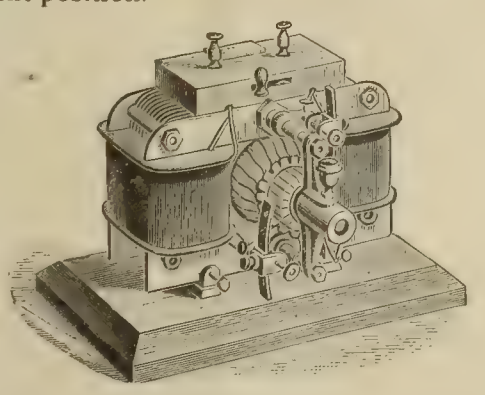
The constantly growing demand for electric power machinery is a great incentive for electrical engineers to produce electric motors constructed on new ideas. The aim always is, of course, to get the greatest return of the original power for the least expenditure of money. Every motor designer and builder has his own ideas as to what constitutes an efficient motor. The result is there are as many varieties of these machines as there are differences of opinion on the point just mentioned. It may be said of most every motor on the market that each one has some special feature that no other possesses. The electric motors manufactured by the A. B. C. Motor Company, 44 Gold street, New York, have many good points in their favor.

The accompanying illustrations are of Type A and Type B, respectively, of these motors, and it will be seen the machines have every appearance of being constructed in a simple and substantial manner.

The special features claimed for these motors are: 1. Laminated field magnets of the softest and purest iron; 2. High efficiency; 3. Slow speed; 4. Constant speed under all loads; 5. No sparking at the brushes; 6. No noise; 7. Simplicity of construction; 8. Durability; 9. All parts interchangeable; 10. General mechanical excellence.

These are all most excellent features, and the perfect attainment of them would certainly leave nothing more to be desired in a motor.

Type A, of the construction shown in Fig. 1, embraces the sizes ⅛ to ⅙ h.p., and can be wound for any voltage up to 110. A ¼ h.p. of the same type is also made, but is wound only for use with a battery current. The $\frac{1}{12}$ and ⅛ h.p. sizes can be had with fan attached, and these outfits are very desirable in warm weather. The small size of these motors, with fan attachment permits of their being placed in any convenient position.



A. B. C. MOTOR, TYPE A.

Type B (Fig. 2), embraces the following sizes: ¼, ½, and ¾ h.p., and they can be wound for any voltage up to 220.

The company also makes larger motors, which are known as Type C. They embrace all powers from one horse upwards, and can be wound for any voltage up to 500. The armatures used on these motors are of the toothed pattern. The weight of the ¼ h.p. machine is 50 lbs., and the speed of the armature 2,400 revolutions. The weights and speeds of the ½ and 1 h.p. machines, respectively, are: 85 lbs., 2,000 rev., and 100 lbs., 1,800 rev.

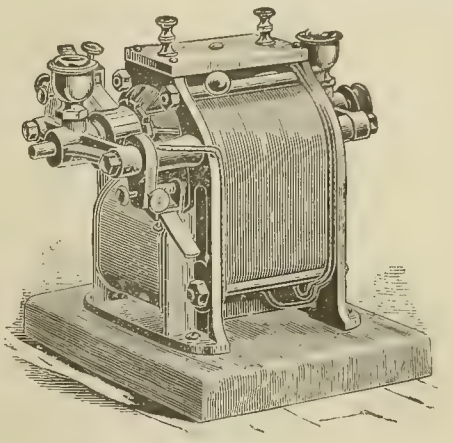
These motors, we understand, are very efficient, and, judging by the figures given us, the A. B. C. Motor Company have every reason to believe that their machines are second to none.

The A, B, C motors can be used for any purpose whatever on any direct current circuit.

VARIATION OF CONDUCTIVITY UNDER DIFFERENT ELECTRICAL INFLUENCES.

At a meeting of the Paris Academy of Science, held on November 24th, Monsieur Branly read a paper, in which he described some experiments upon the variations of conductivity observed in their metallic layers when subjected to electrical influences.

The layers of metal were prepared by spreading metallic dust upon a plate of ground glass or ebonite of dimensions 7 cm. × 2 cm., and then polishing with a burnisher. In the case of copper, a little tin was added to facilitate adherence. Such a layer is capable of a resistance which may vary from several ohms to several millions for the same weight of metal.



A. B. C. MOTOR, TYPE B.

If a circuit be formed containing one of these prepared layers, a high resistance galvanometer, and a Daniell cell, only a very insignificant current is able to pass. An abrupt diminution of resistance, accompanied by a marked deviation on the galvanometer, is exhibited when electric discharges are produced in the neighborhood of the circuit by the action of a small Wimshurst machine or a Ruhmkorff coil. The effect diminishes when the distance of the losses of discharge is increased; but it is easily observed, without special precautions when the distance is increased to several metres. By making use of a Wheatstone bridge, it has been observed when the distance has been 20 metres.

Besides the behavior of a thin layer of copper, that of similar layers of iron, aluminum, antimony, cadmium, zinc, bismuth, and several other metals were examined.

Check experiments were devised by Branly, and carried out, in which a capillary electrometer played an important part; but the results were in every respect confirmed.

Branly has examined the condition necessary to produce the observed phenomena, and with the following results:

It is not necessary that the circuit be closed, but the diminution of resistance is best produced if the metallic layer is bound by its extremities to the conducting wires.

The passage of an induced current through the layer produces the same effect as that of a discharge in its neighborhood.

When working with continuous current, the passage of a strong current renders the metallic layer better able to transmit a full current.

The best results were obtained when, in these experiments were substituted for the plate of glass and ebonite covered with metallic layers; what M. Branly calls "tubes a limailles," i.e., is, tubes of glass or ebonite w[illegible]
treated with the meta[illegible]
non-cond[illegible]

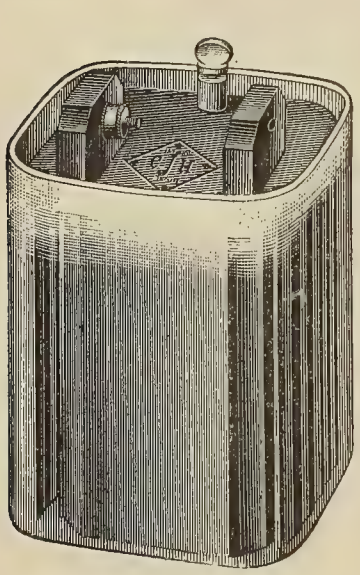
NEW PRIMARY BATTERY.

The accompanying four cuts illustrate a new primary battery of sal ammoniac base, put upon the market by Mr. C. J. Hirlimann, of 91 Greene street, this city.

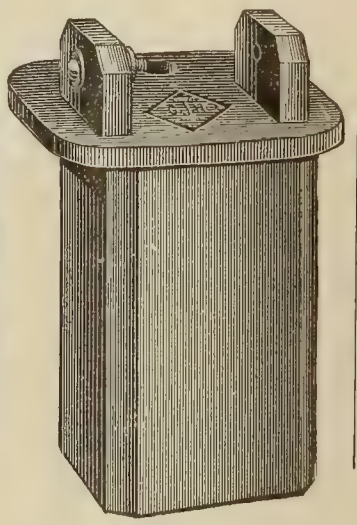
Mr. Hirlimann's long experience and successful career in the invention and manufacture of improved forms of primary batteries of this class, is such that his name alone is quite sufficient to justify careful examination into his claim for the new type of cell which is to be commercially known as the new "Champion" battery.

The battery is made up in two distinct patterns, the difference, however, lying only in the form of the zinc, and it will be seen by referring to the illustrations that one of the zincs consists of the ordinary rod Leclanche zinc, while the other is a large surface corrugated sheet zinc.

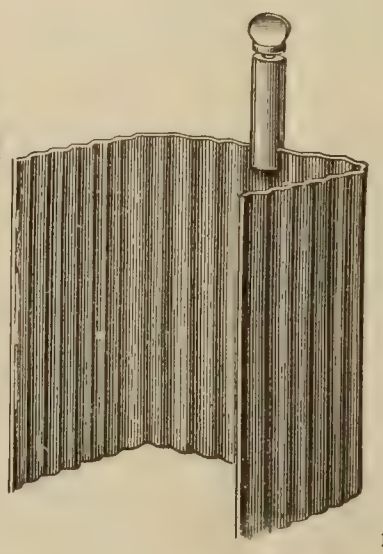
When the rod zinc is employed the battery is most suitable for telephone work and where a constant output of energy is required, while the corrugated zinc is used where large quantities of current for a short time is the desideratum, as in gas lighting work, electric bell ringing, etc. In further support of the merits of the battery an official measurement of the cell by the distinguished electrician, George d'Infreville, of this city, is submitted, in which the following figures are set forth : Electro-motive force, 1.4 volts ; internal resistance, .17 ohms ; current, 8.3 amperes.



COMPLETE CELL OF CHAMPION BATTERY.



CARBON RESERVOIR OF CHAMPION BATTERY.



CORRUGATED ZINC OF CHAMPION BATTERY.



ROD ZINC OF CHAMPION BATTERY.

It is needless to say that if these figures can be depended upon uniformly in all cells of this battery, the "Champion" battery will be a valuable acquisitton to the trade, and Mr. Hirlimann so far from having any doubts in this regard, states that by a special process through which the carbons are put after baking, that if anything there will be an increase in the amperage of the cell beyond the official report above given.

The carbon reservoir is quadrangular in shape, and charged with ingredients under a secret formula, and is provided with a neat top, fitting closely into a glass jar, to prevent evaporation and facilitate sealing.

The "Champion" battery, both with rod zinc and with corrugated zinc will be on sale at all prominent supply houses in this country, and patents in Europe, we understand, are applied for.

PERMEABILITY OF IRON.—The permeability of a rod of iron decreases as the lines of force pass through it increase, so that beyond a certain point considerable increase in the strength of the current makes but little difference in the magnetic force developed at the pole. Iron is said to be magnetically

SOCIETIES.

The Department of Electricity of the Brooklyn Institute will hold their next meeting in the lecture room, Y. M. C. A. Building, Brooklyn, N. Y., on Friday, January 16th, at which Mr. William S. Barstow, superintendent of the Brooklyn Edison Illuminating Company will lecture on "An Outline of the Three-Wire Low Tension System."

The 53d meeting of the American Institute of Electrical Engineers will be held at eight o'clock Tuesday evening, January 20th, at the rooms of the Institute, No. 12 West 31st street, near Fifth avenue. The session will be devoted to the discussion of Mr. A. E. Kennelly's paper on "Inductance and its Proposed Unit, the Henry." Reports of the following committees will also come up for action : The Standard Wiring Table Committee, Committee on the Value of the "Henry" and the Committee on Amendment of the Patent Law. The 54th meeting will be held at the same hour and place February 17th.

The Franklin Experimental Club, which was organized one year ago by several gentlemen of Newark, N. J., for scientific research, has been increasing its membership so rapidly that it bids fair to become one of the largest organizations of the kind in the country. They have a complete laboratory equipped with the best electrical and mechanical appliances and all members are entitled alike to all the facilties of the club for such scientific work as they may select. Membership is open to scientists and experimentalists in other States and we find the names of some of the most noted experts in the country among them. The following are the officers of the club : W. J. Hammer, President; T. W. Corwin, Vice-President; F. W. Hillard, secretary and treasurer; George C. Sonn, professor, curator and historian. The club rooms are at 6 Bloomfield street, Newark, N. J.

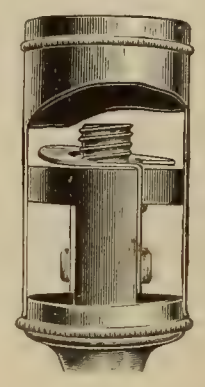
THE H. E. LAMP SOCKET.

In incandescent lighting a good deal depends upon the efficiency of the lamp sockets. Many of these are complicated in their construction and are liable at any time to cause trouble by short circuiting, loose or poor contacts, etc. These annoyances do not tend to develop much enthusiasm for the electric light in the minds of those who suffer from these irregularities.

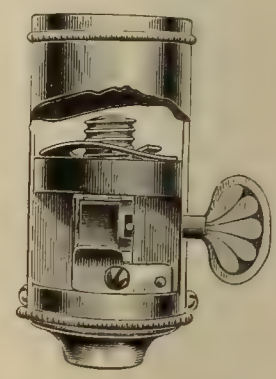
The Hunt Engineering Company, of 238 Washington street, Brooklyn, were quick to perceive the necessity for a socket that would be free from these possible troubles and constructed the sockets we illustrate herewith.

The advantages of these sockets are simplicity of construction, easy to wire and large conductivity, and in every way they are electrically perfect. They are, moreover, guaranteed to carry 5 amperes of current without heating.

As is well known the sockets of usual make are difficult to wire and possess poor conductivity. The latter necessarily adds resistance to the line wire in the installation of electrical light plants. The sockets described here, are the result of experience in construction work, and are intended to take the place for the ordinary sockets. The sockets shown in the illustrations it will be noticed are designed fror the T. H. lamp. One of the special features of these particular sockets is a strong contact between the lamp and socket which insures a perfect frictional connection. In the key socket a particular advantage is gained in the length of the spring, which, by its peculiar shape, is three times as long as that in any other socket. This



T. H. KEYLESS SOCKET.



T. H. KEY SOCCET.

decreases the liability of breaking, which is greater in short springs, and at the same time gives a frictional contact. The insulated parts of this socket are made of a new composition which receives a high polish and gives a very high insulation resistance, while all of the conductors of the socket are made of tempered copper of sufficient size to increase their capacity without heating; as the terminals are on each side of he insulating material in the centre of the socket they require no tapeing to keep the terminals from short circuiting against the shell. This feature is particularly advantageous for wiring as there are no eyeholes to push the wire through. This socket possesses many other important advantages which are readily perceived by an examination.

The Hunt Engineering Company are doing a good trade in these goods which commend themselves to contractors and others through their simplicity and general efficiency.

CONDENSERS.

A condenser, to be of much use in laboratory work, must be not only adjustable but also have as large a range as possible between its lowest and highest capacities. It is a great convenience to be able to adjust a condenser so as to give about the same deflection as the wire to be measured, and any arrangement whereby this end can be reached must be appreciated. Wm. Marshall's multiple-series method of adjusting gives a very large range, some of his condensers having capacity from .00985 microfarads to 4 microfarads.

These condensers have one section of 2 microfarads ; one of 1 microfarad, and ten of .1 microfarad each. The sections can be used as separate condensers if desired. They are placed in series by means of short pieces of wire diagonally connecting the series, but among his latest improvements he secures the same end by means of plugs, which allows the changes to be made more rapidly. Mr. Marshall's factory is in Rooms 2 and 4 University Building, Washington Square, New York. The condensers manufactured by Mr. Marshall are world-renowned for their accuracy and give the utmost satisfaction to users.

STORAGE CELL PLATES.—When the positive plates get into a bad condition, the negatives generally are in as bad state.

THE ELECTRIC LIGHT IN AGRICULTURE.*

In Hungary, where, until very lately, agriculture was almost the exclusive employment of the majority of the population, the electric light met with its earliest application in agriculture. It was used to thresh out the grain by night by means of movable light apparatus, driven by the locomotive of the steam threshing machine, in order to complete the threshing more quickly on large farms. Strangely enough, however, this arrangement, in spite of its great convenience, has still met with only a relatively small application. Baron Von Steiger Münsingen has therefore taken the trouble to explain the advantages of threshing by the electric light on the basis of actual figures as obtained from his own practical experience.

Where the farmer is limited to a certain number of laborers, and cannot procure more, it is no small convenience if they can be rendered available for other duties by a more rapid completion of the threshing. The economy of fuel is not to be despised, as the consumption is considerably less if the boiler is kept constantly hot than if it is let cool down, and steam has to be got up afresh every morning.

Night work is particularly advantageous for the posses-or of threshing machinery, which can be hired out, as the machine can thus, in a single season, earn half as much more hire.

Much of this advantage can indeed be also secured by using more powerful machinery. But we must not forget *e.g.*, an eight horse power machine costs more than ten times as much as a lighting installation such as is needed for threshing.

In the work this season there was used an 8 H. P. threshing machine by Clayton and Shuttleworth, which had already served for eight seasons. The illuminating installation consisted of a dynamo, an arc light (in a bye-circuit) of 800 normal candles and their accompanying fittings. The cost of the entire installation, including the cart built at home, was 500 florins.

The first question was whether the engine, whilst working the threshing machine at full power, could supply at the same time the necessary power for the dynamo. My anxiety proved quite needless, as the requisite 1,400 rotations of the dynamo were obtained with the utmost ease without any higher pressure of steam. The engine, therefore, whilst working the threshing machine, had still a larger excess of power than was needed for the production of light.

The electric light installation connected with the threshing engine has been in action on my estate for 206 hours in 32 nights, or an average of 6.43 hours per night. The whole work effected this season in 922 hours was 751,900 kilos., or an hourly average of 815 kilos. Of this total there were obtained in 716 hours of daylight 589,000 kilos, or 822 kilos. hourly, and in 206 hours in the night by the electric light 162.900 kilos., or 790 kilos. hourly.

The ordinary hours of work in threshing begin at 5 a. m. and last, with half an hour off for breakfast, an hour at noon, and half an hour (time not stated), till 8 p. m., or 13 hours, which I may call a normal threshing day. If calculated into such days, the performance of the above-named plant would be 55.07 normal days by daylight, and 15.85 normal days by electric light, with an average result of 10.602 kilos per normal day. Including Sundays and holidays, time lost by bad weather, removing the machinery, &c., there was a clear saving of three weeks effected by the use of the electric light.

If we suppose a constant light installation, working without disturbance, which is quite practicable, the proportion of the night work to the day work comes out more favorable. We have taken the normal day at 13 hours (from 5 a. m. to 8 p. m.). The night work from 8 p. m. to 5 a. m., is 9 hours, from which 1½ hour has to be deducted for lubrication and other stoppages, so that there remain 7½ hours of night work.

On using the night for threshing, changing the workmen of course at noon and midnight, the effective time for work would come to 20½ hours per calendar day of 24 hours. Of these, on account of the short summer nights, 6 hours would be by electric light and 14½ hours by daylight. The resulting gain of 1½ hour of daylight work results from the relay of workmen. We know that the average yield of and hour by night is 790 kilos., and that of an hour by day 822 kilos., so that the total yield of an 8-H.P. installation will be 16,659 kilos. per calendar day, as against 10,602 by daylight only.

Taking the present total yield of 751,900 kilos. of the above described installation as a datum, it appears that a threshing season of 45 calendar days, with the aid of the electric light, is equal to 71 calendar days with daylight alone. Hence, in the present case, there is the important economy of 26 days, or, in round numbers, a month.

As regards the remunerating character of the process, the author does not indulge in hypotheses of a threshing season without drawbacks, but takes the figures as resulting from this season's work, though it took place under unfavorable circumstances.

On the whole, 162,000 kilos. were actually threshed out by the electric light. If, in order to effect the work in the same time, this quantity had been threshed with a hired plant, it would have cost, on the usual hire of 4 per cent. in kind of the threshed grain, 6,516 kilos., or at an average price of 7 florins per metric cwt. on all the grain, 456.12 florins. Fuel and lubricants are not taken into account, as they remain substantially the same, whether the plant works without intermission, or if two work simultaneously. The lubrication for the dynamo has to be taken into account, as also the carbon rods, and the sinking fund for the lighting plant.

The consumption of lubricants for the dynamo for the entire 206 hours was 1½ kilo. of oil, of the value of 63 kreuzer. A pair of carbon rods, lasting 10 hours, cost 22 kreuzer, or per hour 2 2 kreuzer, or per metric cwt 0.27 kreuzer, or for the entire season 4.53 florins.

As for the sinking fund, it may be reckoned in two manners. We may place the cost price of the installation of 500 florins opposite to the 450 florins earned by a hired installation. Next year, therefore, the plant would only have to earn 50 florins, and it would then work gratuitously, with the exception of the trifling cost for carbons and oil.

Or we may deduct from the cost price 20 per cent. sinking fund, and 5 per cent. interest, or, together, 125 florins.

*Correspondence in London *Electrical Review*.

MAGNETIC PERMEABILITY.—The relative capability possessed by any substance for conducting magnetic lines of force, is known as its permeability, and it is desirable that some method of definitely comparing this property in various substances be employed. The permeability of a vacuum is taken as the unit, but that of air is almost exactly the same, and being a more convenient standard it is generally used as such. The permeability of other substances are measured by comparison with the permeability of air.

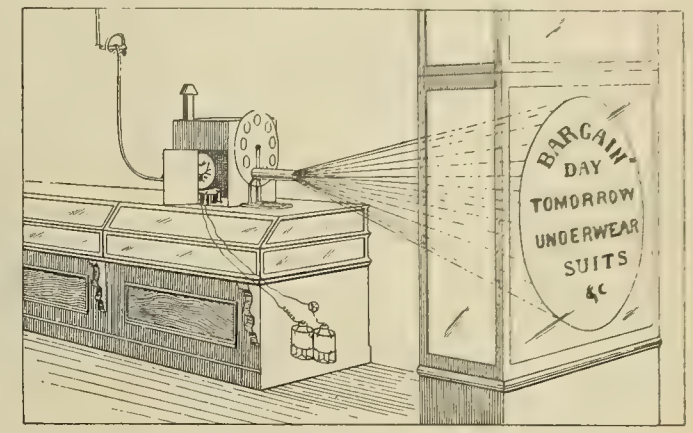
HARD STEEL FOR MAGNETS.—While it is desirable to have good hard steel for permanent magnets, some specimens have been so hard that all efforts to magnetize them have proved ineffectual. The horse shoe form of magnet is the one generally adopted when it is desired to exert the maximum attraction of a piece of iron put near it.

ELECTROMOTIVE FORCE IN ARMATURES — Electromotive force is generated in dynamo armatures, not current. Current is an effect of electromotive force.

DYNAMOS —The primary object in a dynamo is to generate a difference of electrical potential.

AN ELECTRICAL STEREOPTICON.

The Broadway Electric Company, 703 Broadway, New York, manufacturers of electrical novelties and dealers in electrical supplies generally, are bringing out many ingenious advertising electrical specialties such as window tappers of every conceivable form applicable to all varieties of business from the shoemaker to the professional on the stage. These goods are having a big sale. The company has lately put on the market a very ingenious automatic stereopticon with twelve different views, operated by an electric motor, for advertising at night in stores, show windows, etc. The accompanying illustration shows the application of the latest device.



The motor is placed in a small compartment underneath the body of the lantern, and the revolving disc, or slides, are shown at the front of the lantern. The disc is revolved by the motor, effecting a change of slides in the easiest possible manner. The superiority of this method of changing over the old hand method is obvious, and we venture to say that tradesmen will take to this idea in advertising in a lively fashion.

AMATEUR JOURNALISM.—The first number of a gossipy little paper, *The School Bell*, published by the children of school No. 3, Arlington, N. J., indicates good sound foundations, to what it is hoped will be solid structures. The editor, Ernst P. Fredericks, a boy of 15, writes a well composed article on "Journalism." He starts in the right path when studying to please and interest his readers. Another interesting article is that by Master T. E. Tuderly, a boy of 16, on "Electricity and its Uses. The little paper speaks well for the school children of Arlington.

E. M. F. OF DYNAMOS.—Dynamos give different E. M. F.'s for different currents taken from them, when running at one speed.

CHARGING ACCUMULATORS.—The first charge differs in some respects from charging in the general way. There should be a steady run of thirty hours without stoppage, if possible; or not less than ten hours a day for three consecutive days, for the size of cells commonly in use. The electrolyte will then commence to boil.

INDUCED CURRENTS.—Induced currents bear a very simple ratio to the currents producing them. The E.M.F. in the secondary wire is proportional to the number of lines of force which cut it, and also to the rate at which they cut it.

AMPERE TURNS.—The number of turns of wire in a coil multiplied by the current in the wire gives the number of ampere turns in the whole coil.

VALUE OF A VOLT IN LINES OF FORCE. — One volt electromotive force is generated for every 100,000,000 lines of force cut per second.

LINES OF FORCE act as though they were elastic, tending to make their complete circuit as short as possible.

SOME EXPERIMENTS WITH SELENIUM CELLS.*

Selenium exists in two allotropic forms, the one vitreous, as structureless as glass, closely resembling black sealing wax, and when in thin films is capable of transmitting ruby colored light; the other form is amorphous, and exists as a red powder. If left for half an hour at a temperature of 200 deg. it becomes black. The amorphous variety is a non-conductor. The author observed that it was pretty generally stated in books that selenium in this condition was a good conductor, but this he had not found to be the case; for example, the specific resistance of one specimen, which had been carefully annealed, was as high as 2,500 megohms. When the annealing took place in contact with copper, the specific resistance fell to some 900,000 ohms, and he considered that the diminution of the resistance of selenium cells during the so-called annealing process was due, not to the effect of annealing but to the formation of a conducting selenide of copper throughout the mass of selenium, beginning at the copper electrode.

The author observed that Willoughby Smith, in the year 1873, first discovered the variation in the resistance of crystalline selenium under the influence of light, and that the name selenium cell was due to Graham Bell. Graham Bell's photophone cells had a resistance of several megohms, and some ten years ago the author had suggested the following modification of Bell's cells in order to diminish this resistance. A strip of mica a few centimetres in length had copper wire wound over it from end to end, the distance between adjacent coils being about one-twentieth of an inch. The wire was wound in two parallel coils, the two coils being carefully prevented from touching each other at any point, and forming the positive and negative electrode respectively.

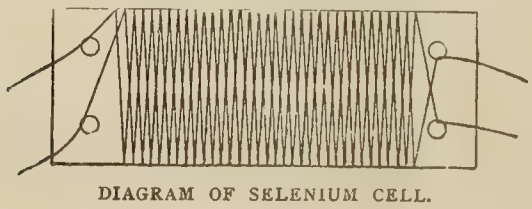


DIAGRAM OF SELENIUM CELL.

Melted selenium was poured on to the strip, and pressed in between the wires. The cell was then kept for some time at a temperature of about 227 degs., and the resistance was found to fall gradually to about 50,000 ohms. The author had made a number of these cells in the years 1880 and 1881, and had noticed that their sensitiveness to light gradually diminished, and in 1882 he laid aside a number of cells until 1885, when the greater number of them was found to be practically insensitive to light. He then in (1885) laid aside 13 cells until the present year, and of these only one retained its sensitiveness. The resistance of this cell remained as high as 400,000 ohms, while the resistances of the others had all very greatly diminished. The resistance of another one was about 6,000 ohms. This cell was sensitive to light when employed in a circuit with a single Leclanché cell; but with a number of cells the resistance broke down, falling to about 100 ohms, the cell at the same time becoming insensitive to light.

The resistances of the remaining 11 cells varied from 4 to 11 ohms and they were all quite insensitive to the influence of light.

Professor W. G. Adams had found that the resistance of the selenium cells which he had constructed fell in the course of a year to about one-fortieth of their original value, this fall being in all probability due to the formation of selenide of copper.

The author mentioned that the resistance of one of his own cells had fallen in the course of ten years from 80,000 ohms to 10 ohms. In a paper previously read before the Society he had expressed the opinion that the presence of selenide of copper was necessary to the action of the cells, and that this was always formed during the so-called annealing process which was found to be essential to make the cells sensitive to the action of light.

It had occurred to him that the effect of passing a strong current through one of the selenium cells might be to liberate selenium more rapidly than it could combine with the copper anode, and to test this he had connected one of the cells with a 26-volt battery. The result of this experiment was the formation of moist red tufts, consisting mainly of amorphous selenium all along the copper wire forming the anode. It was shown to consist of amorphous selenium, by turning black when warmed, and exhibiting the characteristic blue flame of selenium when burned.

The moistness of the tufts seemed greater than was to be expected, simply from the selenium being in the state of a fine powder. The red powder, when examined under the microscope, was found to be mixed with white lumps, which might consist of an oxide, or hydroxide of selenium, but he was not aware whether this was deliquescent.

In the discussion of the author's former paper the late Mr. J. W. Clark had objected to the hypothesis that the diminution of resistance was due to the electrolytic formation of selenide of copper, that in this case the selenide would only be found in the neighborhood of the anode; but the author considered that it spread from the anode until it extended to the cathode wire. The selenium cells, he pointed out, showed polarization effects, and developed an E.M.F. under the influence of light, forming photo-electric cells.

The author then exhibited some very striking experiments, to which he did not attach any serious importance, but which he thought were suitable for lecture demonstrations. The usual arrangements of indicating the presence of an electric current by means of a galvanometer and a spot of light is convincing, but not impressive, and might often be replaced by a selenium cell with advantage. A selenium cell was connected up with a delicate relay and electric bell in such a manner that the diminution in the resistance of the cell on exposure to light diminished the current through the relay, and caused the bell to stop ringing.

Different colored plates of glass were then interposed between the cell and the source of light—a gas-burner—and red, orange and yellow glasses were found to exert no screening effect, but when a green glass was employed, the light was screened off, and the bell began to ring.

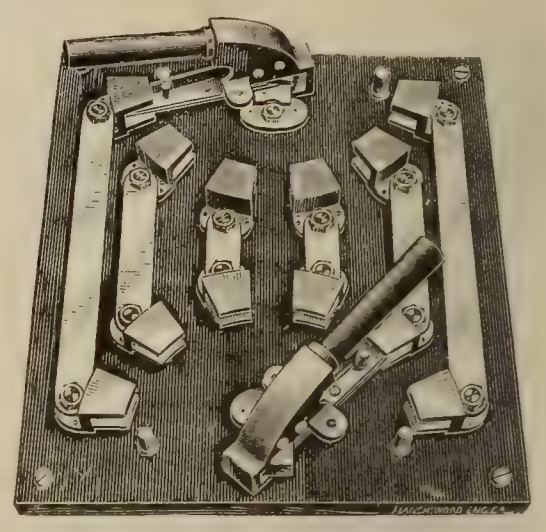
Two blue glasses were then tried, and the light blue was found to exert a screening effect, while a much darker blue did not. The reason of this, as shown by spectroscopic examination of the glasses, was that the dark blue glass, being colored with cobalt, allowed a good deal of red light to traverse it, but the red light was entirely cut off by the light blue glass. The author suggested that an arrangement of this kind might possibly be employed to ring a bell in case of the extinction of a ship's light or of a railway signal light, or to turn on electric light when daylight falls below a certain point, or apparatus arranged to ring a bell when the cell was exposed to light might be employed in a safe or strong room, and made sufficiently delicate to be thrown into action by the lighting of a burglar's lantern.

*Communication of Shelford Bidwell read before the Physical Society, London, Dec. 12.

CURRENT STRENTH.—As the current strength in any circuit is the same in all parts or at all points of that circuit the electro magnetic field developed by any unit length, say one inch of the wire, is equal to that developed by any portion of the circuit of equal length.

ACCUMULATOR REGULATOR.

The following illustration shows a regulator for use on accumulator circuits, manufactured by an English firm. We reproduce it from the London *Electrical Review*, and it will undoubtedly be of interest to all engaged in that line. The change in the number of cells being



ACCUMULATOR REGULATOR.

charged or discharged is obtained in such a manner that the cells are never short-circuited, and the step-by-step motion is instantaneous, even when the handle is moved slowly, this result being obtained in a simple manner, without triggers or complications.

AN ENTERPRISING SUPPLY HOUSE.

The enterprising electrical supply firm of J. M. Lane and Company, of 58 Smith street, Brooklyn, is making for itself an excellent name, and its business is increasing correspondingly. The firm's reputation is based on the conscientious manner in which it carries out its contracts. Their work is of the highest order, and gives the best satisfaction. It is the old story—good work brings good trade—and the firm started in business with a determination to give satisfaction in whatever they undertook to do.

There is nothing in the electrical field that this firm does not understand and undertake. They are constructors of electric lighting, telegraph and telephone lines, and dealers in electrical apparatus of every description, from dynamos and motors down to electric bells. They have also abundant facilities to effect repairs on all classes of electrical apparatus.

The firm has a branch establishment at 90 Court street, which is more centrally located. They are getting a good share of the Brooklyn trade, and considerable outside of that city.

CONFIDENCE IN THE WESTINGHOUSE COMPANY.

A press dispatch from Pittsburgh, on the 5th instant, stated that the employés of the Westinghouse Electric Company proposed to take some action with a view to lending a helping hand to Mr. George Westinghouse, Jr., during his financial embarrassment. A paper, of which the following is a copy, was to be presented to the employés for their signatures:

"We, the undersigned, having confidence in the present condition of our company, recognizing it to be our duty as employés to express our esteem toward George Westinghouse, Jr., and our confidence in the stability of the company. We agree to accept part payment for our services such amounts as will meet actual necessities of life, or half pay, until the present difficulties of the company are over."

There are, says the despatch, about 1,200 employés, and the amount saved if each one would agree to accept half pay would aggregate about $30,000 a month. While a good many of the workmen are willing to make the sacrifice there are others who can scarcely afford to do so, and there is some doubt expressed as to its being generally adopted.

THE PHENOMENA OF EARTH CURRENTS.*

BY WILLIAM FINN.

The subject for your consideration to-night is one that possesses considerable interest for the student of natural phenomena and one that has engaged the earnest attention of scientists in general and electricians in particular for many years past, especially in Europe.

If you place a sensitive galvanometer in any well insulated telegraph line from which the regular battery has been withdrawn and ground the opposite ends of the wire, the chances are that you will find a current in the wire of sufficient strength to deflect the galvanometer needle. After repeating this experiment a number of times, you will probably conclude that the current is not a constant one, but on the contrary varies more or less in strength and sometimes in polarity also. The movements of the needle may be very sluggish at one time and play over but a few degrees of the scale, while at other times the needle may oscillate in the liveliest manner over a considerable portion of the scale on both sides of zero, showing great variations in the magnitude as well as in the direction of the current. When you open the wire at either end these manifestations instantly cease and do not reappear until the ground connection has been again established.

It will be evident from this that the effects observed do not proceed from induction, or stray currents from neighboring wires, either of which would tend to act more strongly upon the galvanometer on opening the wire at the distant end.

The effects observed are in reality caused by currents of natural electricity flowing from place to place over the surface of the earth, and which find their way into the telegraph circuits by means of the ground connections which form a part of every telegraph line.

These currents are not sufficiently strong as a rule to interfere with the ordinary working of telegraph lines, though I shall endeavor to show later on that there are times and conditions when they cannot but impair the efficiency of working.

This investigation, at various periods and by different observers, into the cause of these currents, has led to some very interesting and important scientific discoveries and deductions.

The apparently confused mass of data furnished by different observers on this subject, made it exceedingly difficult at first to derive any tangible results therefrom, but a careful analysis of the records has since shown that the earth current is not so erratic as might at first appear, but is on the contrary comparatively regular in its variations and amenable to law. Here, for instance, is a plotted record of some observations taken at Valentia upon about 300 miles of the Atlantic Cable which was lost in 1857. These early observations which extend over a period of 36 hours, were taken at short intervals apart, and the result as reproduced in the form of curves, affords a very fair idea of their regularity and periodicity. But the most important point was the close connection observed between the variations of the earth current on the one hand, and the periods of high and low water marks on the other, as may be seen from the plotted current and tidal curves represented on the screen. In this was found a coincidence which at once suggested a clue to the possible cause of these mysterious earth currents, and the questions at once arose: Were the rising and falling waters of the ocean *directly* responsible for their appearance, or were the same causes which created the tides to be held accountable for the earth current phenomenon also?

The tides as you know are mainly due to the influence of the moon's attraction for the waters high and low water. And very much in the same way it was contended that the moon of the globe; the relative position of the earth and moon determining the times and places of affects the distribution of the earth's electricity also, and creates electric tides or currents of electricity which flow over the earth's surface. This appeared quite plausible and agrees exactly with our knowledge of what would occur experimentally with two electrified spheres arranged to imitate the relative motions of the earth and moon.

This theory was apparently confirmed by the records obtained from subsequent observations, the result of one of which may be given. On a wire extending from London to Cardiff some years ago, a systematic course of observations was maintained every fifteen minutes for a month, and the curves of the figures so obtained were as remarkable for their regularity, as for the clearness with which they appeared to indicate the lunar origin of the variations.

On the other hand this theory was so incompatible with the results of many other observations, that recourse was taken to the consideration of the next question, viz:—Did the undulations of the waters of the globe, by friction or otherwise, produce those inequalities of potential at various points of the earth's surface which gave rise to the generation of electric currents?

The first consideration relative to friction was not favorably or seriously entertained; but it was thought highly probable that the moving mass of waters across the earth's magnetic lines of force might account for the phenomenon.

If you take an ordinary bar magnet and scatter iron filings over the surface of a piece of paper laid upon the magnet, the filings will arrange themselves in symmetrical curves extending from one pole to the other. These curves map out the lines of force of the magnet, and if a small freely suspended magnetized needle be brought near the magnet it will set itself along these lines of force. Now the earth acts just like a magnet, and there is consequently a field of magnetic force extending from one magnetic pole of the earth to the other. A suitably suspended magnetic needle ought therefore to set itself in the direction of the terrestrial lines of force, and this point is very clearly illustrated by the inclination of this dipping needle. Their direction is such that were we to scatter a mass of iron filings in the atmosphere of this room, and cause the small particles to float like dust in the air, they would arrange themselves in a direction parallel to the dipping needle. Now, whenever a conductor moves across any of these lines of magnetic force, an electric current is set up in the conductor, and should the latter be moving very rapidly in an intense field of force the current generated may be very great indeed. An illustration of this is afforded by the dynamo machine, which is nothing more or less than a combination of magnets and conductors so arranged that the rotation of the latter cuts the dense lines of magnetic force created by the former.

I have here an apparatus which will prove to you that the same principle holds equally good in the case of the terrestrial lines of force. The instrument is called a terrestrial induction coil, and consists essentially of a wooden ring 6 inches in diameter, upon the circumference of which has been wound an insulated wire measuring 320 ohms. This coil is made to rotate around a horizontal axis, and is placed in such a position with respect to the earth's magnetic lines of induction that the greatest number of them pass through the space bounded by the encircling wire. This position is obtained when the plane of the coil is at right angles to the direction assumed by the dipping needle.

If I now connect the ends of the coil with a sensitive galvanometer and make the coil revolve, the convolutions of the wire will move across or "cut" the earth's lines of force, which in this instance may be likened to a shower of rain falling at an angle of 172°. The result is that induced currents are generated in the coil, which, as you notice, produce marked deflections on the galvanometer.

You will readily see that the principle involved in this experiment is analogous to that which finds its application in the dynamo; inasmuch as the revolving coil of the inductive apparatus may be taken to represent an armature rotating in a portion of the field of force created by the north and south magnetic poles of the earth.

The manner in which the great tidal waves of the ocean in their movements to and fro, effect this magnetic field, and how induced currents are thereby generated and circulated over the earth's surface, will now be more clearly understood.

It is not at all improbable that local currents may even be developed by rivers and running streams flowing over these imaginary lines of force, and some experiments made by the writer on wires running parallell with, and at right angles to, the Niagara river appears to demonstrate the correctness of this view.

Of the two theories under discussion the latter appears to be mostly in accordance with the result of observations taken by the writer both here and in England. There is considerable difference in the limits of the variations and strength of the earth current in this section of the country as compared with records of the same features in England. For instance, the average strength of the British earth current is said to be about one-tenth of a milliampere, while here it is certainly not less than double that amount, and very often exceeds one and two milliamperes, and occasionally rises as high as four milliamperes, with a difference of potential at opposite ends of the wire in some cases of nearly 10 volts.

My experience with earth currents deflections in England was, that it usually required a sensitive astatic needle upon which to take the readings. Here on the contrary they can be read on any wire at almost any time by inserting the 200 ohms coil of the tangent galvanometer.

This difference may be accounted for by the fact that the intensity of the magnetic field due to the earth's magnetism is not alike at the two places. For instance, the total force or intensity of terrestrial magnetism in Buffalo is about 0.6 dyne, whereas in London it is but 0.4 dyne. In other words a magnetic pole of unit strength in Buffalo, would be urged in the line of dip with a mechanical force of about two-tenths of a dyne unit greater than it would be in London.

Now, since the strength of an induced current depends—other things being equal—upon the intensity of the field of force, it follows that for the same amount of disturbance created in the respective fields of the two places, the stronger current would naturally be developed in the more intense field at Buffalo, which we find to be actually the case.

But even this hypothesis failed to satisfactorily account for all the vagaries exhibited by the earth current, and as a consequence other theories more or less plausible were invented, the least unsatisfactory of which is perhaps the following: It is a well-known fact that a difference in temperature maintained at the opposite ends of a heterogeneous conductor will cause a steady current of electricity to flow through it. Take for example a bar of copper and one of iron and solder them together at one end, leaving their opposite ends free, and connect these free extremities with a galvanometer. If now the point of junction between the two bars be heated, a current will circulate through the system, and its strength will be proportional to the difference in temperature between the soldered and free ends of the conductors.

Now the earth is a huge heterogeneous conductor whose opposite sides are kept at unequal

*Paper read before the Buffalo Electrical Society January 5th, 1891.

temperature by the heat of the sun, and it is quite within the range of probability that thermo-electric currents are established and maintained in the earth the same as in a thermo-electric pile.

The unsteadiness of the earth current, together with the variations in direction, do not, however, sufficiently harmonize with this theory to make it generally acceptable, though it is interesting to note that the circulation of thermo-electric currents around the earth present a very plausible basis upon which to account for the magnetic condition of the earth, and in that way these thermo currents may be the indirect means of producing the effects observed.

But from whatever source these currents of natural electricity flow, they are always to be found in the ground and ready to be tapped, and the question arises, can they in any way be harnessed and utilized in the service of man as is now the case with the flow of natural gas? The currents are certainly far too weak and unreliable to be of any practical advantage in any telegraphy with the style of apparatus at present employed; but, as I stated at the outset, I believe they are sufficiently powerful at times to interfere with the regular working of that service. This opinion is based upon the result of numerous tests made of the value of working currents on certain telegraph lines passing through Buffalo. For instance, the actual value of some of the signaling currents taken on certain polar duplex circuits as well as on the polar sides of quadruplex systems, varies from eleven to thirteen milliamperes, neither of which can be expected, even under favorable circumstances, to satisfactorily operate these systems, and for which, as a rule, a great deal more current is allowed. But the appearance of an opposite earth current in the wire under such conditions would aggravate the case by an amount proportional to its strength, and might not only destroy the uniformity of signals but render them altogether unintelligible.

I have taken readings from a distant battery whose reversals of polarity have indicated a difference in strength of from one to four milliamperes, when neither the state of the wire nor condition of the apparatus appeared to warrant any such variation. On these occasions the wires have nearly always given evidence of strong disturbing forces emanating from the ground. Their influence can of course be counteracted by increasing the working strength of the battery or by substituting wires of smaller resistance, either of which would increase the margin of the battery current beyond the variable limits of the earth current.

There are certain characteristics connected with earth current variations, which make the study of that phenomenon not only exceedingly interesting, considered from a purely scientific standpoint, but which are also regarded as possessing features calculated to render them of considerable commercial importance. It has been shown by certain investigators that, when uninfluenced by outside interference, these currents ebb and flow over the surface of the globe like the tides of the ocean; and that the variations observed on any given wire, afford a sort of index to the variations which may be looked for on other wires. In illustration of this point, I have mapped out on the blackboard the result of certain experiments made in London some years ago on a number of telegraph wires extending from that centre to various points of the compass The polarity and strength of the current on each wire were carefully and simultaneously noted once every hour for a certain length of time, and the readings thus obtained are reproduced in the form of curves. These show a remarkable coincidence in the rise and fall of the current in each line, and indicate beyond doubt that a wave of electricity was passing over that section of the country which affected all wires proportionately alike.

The curve demonstrations not only show its wave-like character, but also clearly define the course of the path taken by the current, which in the case under consideration was from a point N. E. to S. W., and happens to represent the prevailing direction of these currents in England.

One other significant fact noted during this particular series of observations was this: there were readings obtained from several other wires at the same time as the above, which did not harmonize either in strength or direction with those already given.

A study, however, of the plotted curves made by these irregular currents in conjunction with those mapped out by the more regular ones, plainly shows that the discrepancy in the agreement of the results is the outcome of some local disturbing force, the area over which it manifests itself being clearly discernible, as is also the length of time during which the disturbance lasted.

It will be evident from this then that the study of the comparative results upon a number of wires around a given point may lead to most interesting and instructive features having an important bearing perhaps on some of those natural phenomena affecting the condition of the globe or of certain localities upon its surface. For example, the disturbance noted in the London records may have been occasioned by some convulsion more or less violent, or other lateral forces at work below the earth's surface, due either to local strain—such as upheaval or contraction—or brought about by chemical changes, a knowledge of which might be of the utmost importance. In certain volcanic regions the discovery and study of these internal forces are materially assisted by means of telephonic, and recording apparatus attached to buried wires which instantly convey the intelligence of any unusual commotion happening beneath.

During the course of several months' observations on various wires radiating from Buffalo, I have had many opportunities of noting exceptional fluctuations in the intensity and polarity of earth currents in this vicinity, and though I have been unable in the majority of cases to connect these with anything of a definite character, there have been times when the appearance of earth current disturbances has coincided with the occurrence of unusual solar or meteorological phenomena, which fact would appear to establish a close identity between them.

From the result of other observations made here I am quite convinced that there remains little room for doubt as to the truth of the general law affecting the distribution and direction of the normal earth current.

It occasionally happens that a wire grounded at some terminal office will exhibit totally opposite results as compared with those derived from intermediate points on the same wire. Thus, for example, on a wire grounded at Cleveland on October 1st, the earth current deflection was of an electro-positive character; that is to say, one whose polarity indicated that the direction traversed by the current was from Cleveland to Buffalo; but upon having the wire cut and grounded at Erie and Dunkirk respectively, these two sections of the wire presented an electro-negative appearance of about the same strength as the Cleveland current, and this anomaly existed in the wire for nearly five hours, after which the direction of the current coincided in all three cases. It thus appears that for some reason or other during the period named, Buffalo was at a lower electric potential relatively to Cleveland, but at a higher potential with respect to the intermediate points, though all these points may be considered as being in the same geographical straight line, and this singular result has appeared on subsequent occasions over the same route, as also on lines extending in other directions.

In fact the local records up to date may be said to be more remarkable for the amount of variation and unreliability displayed, than for the steadiness and regularity which as a rule appear to characterize the English earth current. It is possible, however, that we have been experiencing the preliminary effects of those unusual electrical disturbances generally ascribed to sun spots, the advent of which is also more or less associated with the appearance of aurora, and the variations in the phenomenon of terrestrial magnetism. From reliable information I learn that during the months of October and November last, a number of solar disturbances were noted, the most extended and energetic of which occurred about the 17th and 18th October and 21st and 22nd November. On these dates the strength and irregularities exhibited by the earth current as shown by our records, are very much more marked than usual, and suggest a possible connection, to say the least, between these two sets of phenomena. It is, however, during the periods of maximum sun spots that the more violent fluctuations in the earth currents are felt. The effects observed on the wires at such times are of an entirely different character from those we have been discussing, and are usually classified in the category of magnetic or electric storm current effects. These electrical hurricanes come and go without any warning, and while they last are extremely irregular in direction, and of such enormous magnitude as to almost invariably upset the working apparatus. They also exert a direct influence upon delicately suspended magnetic needles without the aid of any conducting wire. The direction in which they flow is usually a straight line from one ground connection to the other, and not by the actual course taken by the wires; and they sometimes attain a current strength of 30 or 40 milliamperes which is more than is necessary to operate our duplex circuits, and almost powerful enough to maintain quadruplex working.

It is customary in the British telegraph service for the wire chiefs to note particularly the period and extent of these abnormal earth currents at all points where observations can be made without interfering with the regular service, and the date thus obtained is forwarded to London where it is analyzed, plotted out when necessary, and the result made public before some of the scientific societies.

There are many difficulties in the way of securing records of this description in America owing principally to the "closed circuit" system in vogue here; but it would be possible on such occasions to take note at least of the circuits that are not affected by the disturbing forces, for the direction of such circuits would mark the course of the equipotential lines, which are always at right angles to the path taken by the disturbing elements. Mr. Preece, the well-known English government electrician, who has made the subject of earth currents a favorite study for years past, has always entertained the idea that they are directly due to the action of the sun, which, by indication, brings about a variation in the distribution of the lines of potential on the earth's surface. It appears quite certain that there is a close relationship between the condition of the sun spot period on the one hand and these great temporary electric storms on the other, and all information obtained as the result of accurate and systematic observations on telegraph wires at times of unusual excitement, cannot but help to bring about important additions to our knowledge of the physical condition of the earth.

Tremendous Energy of Lightning. — It has been calculated that the electromotive force of a bolt of lightning is about 3,500,000 volts, the current about 14,000,000 amperes, and the time to be about 1/20,000th part of a second. In such a bolt there is an energy of 2,450,000,000 watts, or 3,284,182 horse-power.

NEW YORK NOTES.

The B. & S. Electric Equipment Company has lately been organized and opened offices at 115 Broadway this city. The company will deal in supplies for electric light stations, electric railways and electric power plants and have some equipments in these lines of excellent quality. The company is also the sole New York agent for the Russell arc lamp adapted for use on all systems, and the American Circular Loom Company's patent woven wires and cables. Mr. E. T. Birdsall, M. E., and Lemuel W. Serrell, M. E., the initial letters of whose names compose part of the company's title, are the organizers, and are both of large experience and in every way qualified to successfully carry on the business they have undertaken.

The Hunt Engineering Company has moved into the building No. 238 Washington street, Brooklyn. This company is engaged in general electrical construction work and has an extensive trade. One of the articles the company is now engaged in manufacturing and selling to the trade is a new lamp key and plain socket designed especially for the Thomson-Houston lamp. A socket which fits the Westinghouse lamp has also been brought out, also some single and double pole main line switches designed to avoid sparking on breaking the circuit. Among other specialties to be brought out is a new line of covered branch blocks. The new establishment is near the bridge and it is a very desirable and convenient location. The president, Mr. Geo W. Hunt, is the business manager, and Mr. A. E. Rich is the general manager and is well known through his successful management of other electrical enterprises in the past. The construction department is under the charge of Mr. Henderson, who has rendered valuable service in the installation of many large plants throughout the country, and Mr. T. J. Fay is manager of the supply department and will also give his attention to the manufacturing department. Among the plants the company is now engaged in installing are those of the Republican Press Association Building, Concord, N. H.; the East Shore Terminal Company's Cotton Warehouse, Charleston, S. C. Their Jamaica, L. I., town plant of 1,000 lights operated on the alternating system of the National Electric Manufacturing Company was started last week under most favorable auspices.

Messrs. Alexander, Barney and Chapin have taken the general agency for the new socket which has been brought out by the Hunt Engineering Co., of Brooklyn, for the Westinghouse lamp, and have given orders for several thousand.

Mr. A. B. Lawrence, 225 Pearl street, New York, manager of the Shultz Belting Company, is experiencing much success in the introduction of the Shultz pulley coverings. During the past year Mr. Lawrence has sold over 35,000 feet of Shultz patent fulled leather belts for dynamos The New Jersey and Pennsylvania Concentrating Works, at Ogden, N. J., the Edison system, are using 309 feet of this belting; 150 feet were sent to Japan, and the Lakewood Hotel, at Lakewood, N J, has 200 feet of it in use. Several hundred feet of the Shultz belting were also sent to the Edison laboratory, Orange, N. J.

The Elektron Mfg. Co., of 79 and 81 Washington street, Brooklyn, N. Y., are now filling orders for Perret low speed motors from four different builders of elevators. These low speed machines are rapidly coming into favor for this class of work, some being connected directly to the screw shaft of passenger elevators, and some being belted to power elevators in the ordinary manner. They are giving great satisfaction under all these methods. The company has just placed in the Hamilton Club building, Brooklyn, a 20 H.P. Perret multipolar low-speed motor to operate the pump of the hydraulic elevator. The Elektron company now equips all motors, unless otherwise ordered, with self-oiling bearings and self-feeding carbon brushes which require practically no attention or adjustment. This valuable feature obviates all of the difficulties with brushes experienced by those unfamiliar with the handling of motors.

Mr. Nelson V. Titus, of the Economic Electric Company, Boston, was in town last week.

Nearly 200 union carpenters, painters, housesmiths, framers, steam fitters and iron workers, employed on the Edison building in Broad street, went on strike January 8th. The strike is against the firm doing the marble work in the interior of the building, and is essentially union against non-union labor.

Cable, Bayley & Co., the proprietors of the well-known restaurant 130 & 132 Broadway, this city, have decided to abandon the use of their isolated electric light plant on account of the lack of room for boiler service. The present boiler is not of sufficient power to supply the demand made upon it, and there not being space enough to admit a larger boiler, the firm have decided to dispose of the plant, which consists of one Edison No. 6, 200 light dynamo, one 400 ampere switch, and one Amington & Sims engine, with cylinder 8x9 in size.

Mr. James Brady, well-known through his connection with the original Fuller-Wood Machine Company, which it is said, brought out the first dynamo for electric arc lighting, is now consulting engineer for the Rogers typograph.

An 800 ton hydraulic press, manufactured by John Robertson & Co., of Brooklyn, N. Y., has just been shipped to Manchester, England. Included with the machine are Mr. Robertson's patent attachments for covering wires, and cables of any diameter, with lead or alloys. The press complete weighs 39,760 pounds. This is the first machinery of the kind sent abroad. This firm, under the name of Robertson's Lead Incasing Works, constantly use three of these presses, covering wires and cables with lead or alloys for wire and cable manufacturers. The company's works are at No. 131 Water street, Brooklyn.

The well known law firm of Carter, Hughes & Cravath having been dissolved, Paul D. Cravath and John W. Houston have formed a partnership for the practice of law. They are located in the Equitable Building, 120 Broadway, New York, under the firm name of Cravath & Houston.

The Niagara Steam Pump Works, 118 and 122 Plymouth street, Brooklyn, N. Y., three blocks below the Bridge entrance, was established in 1862 by Charles B. Hardicks. Mr. Charles G. Allen took the management of this concern some few years since and the business has improved under his careful guidance The pumps of these works are noted of late for their many improvements. The working parts are of such simple and perfect mechanical nature that it is an impossibility through any carelessness to injure them. Every part is duplicated and numbered so that it can be ordered by any ordinary engineer or mechanic. The company makes a special Electric Light and Power Pump.

The Riker Electric Motor Company, 45 York street, Brooklyn, N. Y., two blocks below the Brooklyn Bridge, are making an excellent line of motors and dynamos in all sizes from 1/8 H P. up to 25 or 50, desirable for all purposes. Mr. A. L. Riker, the electrician of the company, has given this department of the art careful study since boyhood, having everything necessary at his command to facilitate his work. It may be said, to Mr. Riker's credit, that very few young men who have unlimited means at their command, as he has had, ever adopt a course in life which will result in making an honorable name for themselves. He is one of the very few. Some years ago he produced a fine line of small motors and dynamos and exhibited them at the American Institute fair where they received the highest encomiums from electrical engineers and others. Since this time he has been improving his various sizes of motors and dynamos, adapting them to all classes of work. He devised one of the finest ideas of placing a motor direct to the shaft of a powerful exhaust fan, the armature being a part of the shaft of the fan. Many of these fans and blowers have been put out by J L. Wing & Co., 82 John street. Mr. Riker's latest idea is low-speed multipolar dynamos and motors for continuous current which he devised while in Europe last summer. These machines are meeting with a large felt want. The company is very busy putting in machines generally. They also make to order motors and dynamos, for electric railway use, of any design required, designing and drawing up the specifications of the same. They are also doing model and experimental work.

Mr. J. W. Godfrey, general manager New York Insulated Wire Co., 649-651 Broadway, on Christmas day received a beautiful present from the Southwestern Supply Co., of St. Louis, Mo. It was an elk's head to hang up on the wall. The antlers on the head were very large, extending three feet across. Mr. Godfrey has his present hung up on the wall in his office and it attracts great attention. It is very seldom that such objects are seen in this section.

The Manhattan Electrical Supply Co, 36 Cortlandt street, are meeting with unprecedented success with their Electrical Alarm Clocks, which are a sure cure for the turn-over-and go-to-sleep-again class of morning slumberers. One has to get up to stop this alarm; there is no waiting till it stops. They are gotten up in a most convenient form at very reasonable prices, and include two cells of dry batteries, guaranteed to be the best in the market. The company is producing a large line of household electrical specialties of the best workmanship. They also make a very good acoustic telephone. Catalogues sent on application. W. T. H.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRIC AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., Jan. 9, 1891.

The suburban town of Windsor Park will soon be lighted by electricity.

The Secretary of State has licensed the incorporation of the Kankakee Electric Railway Co., to build and operate a street railway in the city of Kankakee and in connection therewith a plant for the commercial distribution of light, heat and power.

The Central Electric Company are distributing among their friends of the trade a very attractive calendar for the year of 1891, which is very useful, each leaf containing the days of the month in large figures and in the margin an entire calendar for the year in smaller figures. A handsome electrical design is at the head of the calendar.

The Erwin Hydraulic Engine and Steam Pump Company, of 51 South Canal Street, Chicago, have shiped two of their hydraulic engines to Honduras, Central America. A number have been placed in various parts of this country, and seem to be all that is claimed for them. Those sent to Central America are for use in a gold mine.

Mr. George Cutter is fitting up a factory in the Springer building on Canal street, where he will manufacture a number of the specialties he handles. Mr. Cutter returned this week from a trip East, and reports having made arrangements while there for the handling of a number of desirable electrical specialties. His offices will continue to be in the Rookery building.

The following table, taken from the National Corporation Reporter of this city, is compiled from the files of the United States Corporation Bureau, and may be regarded as reliable. The list gives the number of companies incorporated in the United States during the six months, from July 1st to December 31st, 1890. Total corporations, 4,646. Total capitalization, $2,693,167,853, distributed under the following general heads :

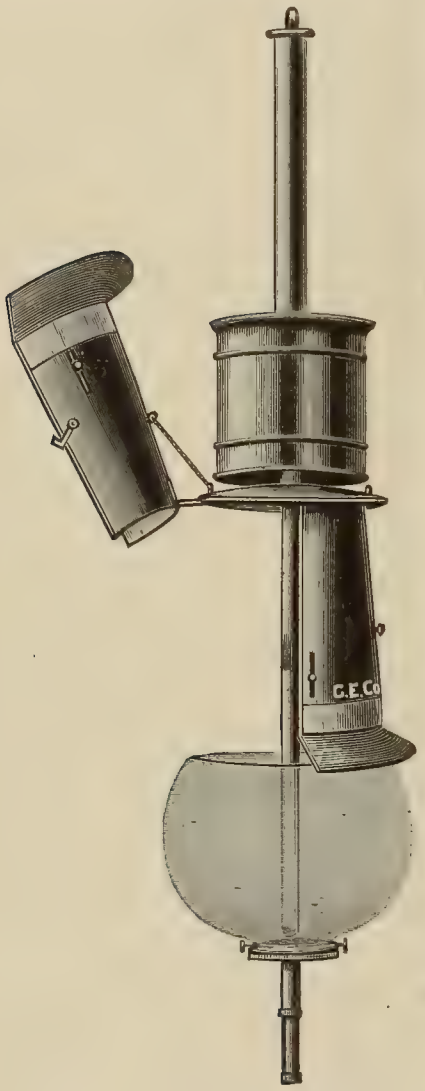
Gold and silver and other mining and smelting companies, 403..	$419,739,501
Coal and Iron companies, 174....	126,606,900
Banks and Investment, 213.....	113,040,500
Municipal, Light, Heat, Power and Transportation, 390.....	367,247,375
Mercantile and Manufacturing, 1,783....	380,907,285
Building and Loan Associations, 116.....	334,230,000
Miscellaneous, 1,569.....	951,396,292

F. M. I.

THE ROBERTSON CARBON PROTECTOR.

The cut shows an ingenious device for protecting carbons and carbon rods from the effects of sleet and snow. The protector is made of galvanized sheet iron and japanned, and is strong enough to withstand a great deal of hard usage.

At the bottom is an extension feature that permits the protector to be adjusted to almost any size of lamp, and the cut shows one side thrown



ROBERTSON CARBON PROTECTOR.

up to allow the trimmer to give the lamp necessary attention. The lower flange is also shown partly extended. Several hundred of these protectors have been in use in Minneapolis for some time and have given perfect satisfaction. The device can also be used as a spark arrester.

The Central Electric Company of Chicago are introducing the article.

MAGNETIC FIELD.—The field developed by an electro-magnet varies directly as the current strength and directly as the number of convolutions of wire.

GOLD MEDAL FOR INTERIOR CONDUITS.

The recent demonstration and tests of the conduit system of wiring made by the Interior Conduit and Insulation Company, of New York, in the city of Chicago before the city authorities, electrical experts, insurance representatives and later before the Illinois Chapter of Architects, were very elaborate in detail and were the means of convincing all who were fortunate enough to be present of the superiority of the system over all other known methods of electric light wiring.

Prof. John P. Barrett, superintendent of city telegraph of Chicago endorses the system as follows :

CHICAGO, Ill., Dec. 24, 1890

INTERIOR CONDUIT AND INSULATION CO.

Dear Sirs :—After careful examination I beg leave to say I thoroughly endorse the system of the Interior Conduit and Insulation Company for inside wiring. I further would state that the method of running the two branch wires in a single tube for incandescent electric wiring is approved by me and I will cheerfully pass any electric installation that is equipped with this system, believing it to be the safest method of interior wiring yet devised.

The appliances of the system are worked out in a manner which insures not only safety but easy accessibility at all times.

Yours respectfully,
J. P. BARRETT, Supt.

T. A. Bowden, Supt. of Surveys, Chicago Fire Underwriters Association, was so much pleased with what he saw that he wrote as follows :

INTERIOR CONDUIT AND INSULATION CO.,
NEW YORK.

Dear Sirs :—I have also examined the system of the Interior Conduit and Insulation Company and agree in every respect with Mr. J. P. Barrett, and highly recommend your system of interior wiring.

T. A. BOWDEN, Supt. of Surveys,
The Chicago Fire Underwriters Ass'n.

The Interior Conduit and Insulation Co. have recently received a gold medal—First Award—at the Mechanics' Fair Association, of Boston, Mass., for their admirable system.

TRADE NOTES.

The Gate City Electrical Supply and Construction Company, which was recently organized in Atlanta, Georgia, has become one of the institutions of that enterprising city. There is every reason to believe that this company has a prosperous career before it, and its success is doubly certain from the fact that it is managed by Mr. J. B. Hollis, whose ability to successfully carry on a great and enterprising concern is well-known. The company has just issued a very handsome 40-page catalogue of dynamos, motors, and general electrical supplies, which is profusely illustrated. This company is doing a very nice business in the Central Southern States.

PHILADELPHIA NOTES.

The United Electric Equipment Co., of 706 Walnut street, have just placed an automatic fire alarm on the market. As it is but four by eight inches in size and is complete in itself the "Iske" will be a great boon to travellers as it can be carried in their satchels.

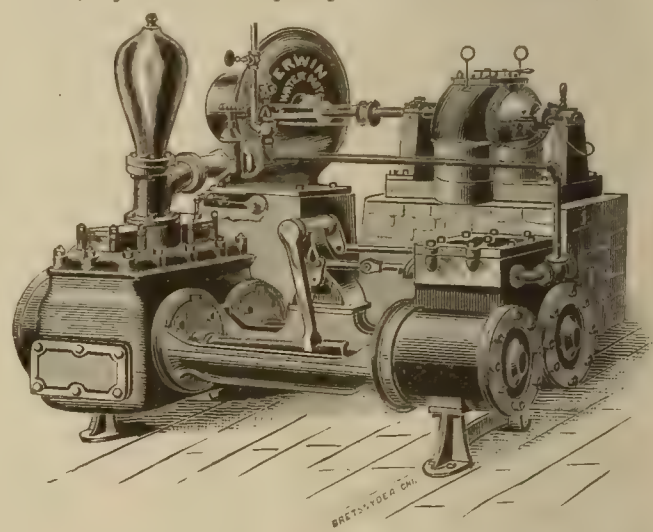
Owing to the their rapid increase of business Messrs. Queen and Co., the well-known manufacturers of electrical test instruments, have been compelled to add a new and ful y equipped testing laboratory to their already large establishment. With their efficient corps of electricians and skilled workmen they will be better able than ever to supply the increasing demand for their testing sets.

Queen & Co,, have just finished "taking stock" and are congratulating themselves that in spite of the general dullness in business during the past three months, their sales have been greater than ever before and the demand for their specialties is increasing month by month. Their standard resistance boxes, portable testing sets, ammeters and voltmeters, photometers, both portable and stationary, are of such a quality as to demand at least careful consideration, and large orders are received from all parts of the United States, as also for export. In addition to manufacturing a full line of instruments of the regular types, they are continually engaged in designing new apparatus to meet the ever varied wants of the electrical engineer. Queen & Co.'s factory is probably one of the finest in America, devoted to the manufacture of scientific instruments. Skilled workmen are employed, and the lathes and other tools are the best and most complete. Close attention is given to the making of apparatus for special work after designs or specifications furnished, or they will design instruments to fulfill special requirements. With Prof. Anthony as consulting electrician in addition to the competent corps at their headquarters they are certainly well prepared to handle their large and increasing business.

A NEW DEVICE FOR RUNNING A DYNAMO.

The accompanying cut represents a new and simple device for running a dynamo and is formed by the combination of an Erwin water motor, a Thomson Houston dynamo, and a Fairbanks, Morse & Company's steam pump, (manufactured by Smith & Vail) the pump being used to feed the boiler at the same time.

As will be observed the dynamo is attached direct to the shaft of the water motor ; all belts, balance wheels, etc., being dispensed with. Even stone foundations were omitted in this case, and motor, dynamo and pump rest on an ordinary



ERWIN WATER MOTOR AND DYNAMO.

store floor of pine boards. The entire absence of vibration was noted by all who saw it. We can but think the above combination a good one as it reduces the first cost greatly, forms a plant a child can operate, utilizes fire and other pumps seldom used, and opens up a new field for steam pumps. The question might naturally be asked why would not such a plant be a good thing for railroad pumping stations, the light being used for lighting the depots, offices, grounds, yards, etc. of the company.

The above is on exhibition at 51 South Canal street, Chicago, the headquarters of the Erwin Hydraulic Engine Company.

LITERARY NOTE.—The January number of the *Journal of the Franklin Institute*, Philadelphia, contains the lecture delivered before that society by Mr. Ralph W. Pope, Secretary of the American Institute of Electrical Engineers, entitled "Electricity : its Past, Present and Future."

SELF-INDUCTION in armature coils is proportional to the square of the number of windings in the coil.

RESEARCHES IN THERMO-ELECTRICITY*

BY MESSRS. CHASSAGNY AND H. ABRAHAM.

We have already shown† that the electromotive forces of thermo-electric couples, the junctions of which are kept at 0° and 100° may be determined within $\frac{1}{10000}$th of their value.

We must observe that when, as in our experiments, the equilibrium of electromotive forces is shown by a galvanometer of low resistance, this degree of accuracy is retained for the lesser electromotive forces given by these couples at the intermediate temperatures; the resistance introduced into the circuit of the galvanometer diminishing with the electromotive force to be measured, the absolute sensibility of the instrument increases, and the relative accuracy of the measurements thus remains almost constant.

We see, then, that thermo-electric couples employed as thermometers for registering very minute variations of temperature show the hundredth part of a degree between 0° and 100°, and they have this advantage over the ordinary thermometers that the smaller the variation of temperature is, the more accurately is it indicated.

In order to find the relation between the electromotive forces of the iron-copper couple and the scale of temperatures of the hydrogen thermometer, we measured these electromotive forces at different temperatures between 0° and 100°, one of the junctions being in ice, and the other in a bath of water stirred continually and placed in a regulating stove.

A thermometer placed beside the joint shows at each moment the temperature of the bath. The thermometer is of toughened glass, and was supplied by M. Tounelot, and the readings taken on this instrument were corrected and reduced to the scale of the hydrogen thermometer by means of the tables published by the International Bureau of Weights and Measures, where this subject has been studied.

We found, moreover, that the indications of this thermometer and those of a second thermometer of the same type, placed in the same bath, in no instance differed from one another to the extent of $\frac{1}{100}$th of a degree. The temperature of the baths varied very slowly, and these slight variations were indicated almost simultaneously by the thermometer and by the thermo-electric couple, the latter, however, always acting first.

A parabolic formula of two terms is quite incapable of showing the relation between the electromotive forces and the corresponding temperatures of the hydrogen thermometer, the discrepancies between the temperatures calculated by means of such a formula for 50° and 100° and the temperatures actually observed, amounting to + .12 of a degree at 25° and — .13 of a degree at about 75°. The following empirical formula, although still not representing the measurements with absolute accuracy, will give their values within $\frac{1}{50}$th of a degree, between 0° and 100°.

$$E = \frac{at + bt^2 + ct^3}{t + 273},$$

$$a = 10^{-3}.\ 3.56604$$
$$b = 10^{-6}.\ 8.3827$$
$$c = 10^{-7}.\ 3.265$$

as shown by the following figures, taken from the same experiments:—

Value of E_{100} = .0010932 of a volt.

Temperatures.	Electromotive Forces. Observed Volts.	Calculated Volts.
65.13°	.0007656	.0007654
32.49°	.0004043	.0004045
15.48°	.0001981	.0001980

Comptes Rendus, November 17, 1890.

†*Comptes Rendus*, vol. cxi., pp. 427 and 602; 1890.

FOREIGN NOTES OF INTEREST.

For the past twelve months a small 8 horse power experimental plant, due to M. de Meritens, has been in operation at the Bercy works of MM. Pollet, where M. de Meriten's method of treating wine by electricity has been exhaustively tested and pronounced satisfactory by competent authorities. The dynamo employed is a 25 volt alternator, having a frequency of 116. The wine to be treated by electricity with a view of increasing its "keeping" qualities is passed through a small tube containing a series of silver discs connected to the poles of the alternator. The wine as it flows through the tube is thus traversed by a rapidly alternating current, which it is supposed destroys the ferments. The experimental plant is capable of treating 22 gallons of wine per hour. The process has been tried on wines of all kinds, and the results have been most marked with the light Algerian wines, whose bad keeping" qualities have hitherto prevented their "exportation.

M. Comille Gonzy, the proprietor of numerous small farms in the commune of Millas (Western Pyrenees), having an area altogether of nearly 1,500 acres, has, for some time past, been utilizing a neighboring stream for electric lighting purposes. He has now applied electric power to the working of a wine-crushing plant. Besides providing the power for lifting and driving purposes, electricity is made to work the pumps for irrigating the vines. The 180 16-candle power lamps employed are distributed over all the farms, and the area which they cover may be judged from the fact that the length of telephone wire connecting the buildings is 62 miles.

It has been decided to intrust the lighting of the Royal Naval Exhibition to be held in England to Messrs. Siemens Bros. & Co,, who will furnish the dynamos and lamps. Some 200 arc lamps and 2,000 glow lamps will probably be required to illuminate the buildings and grounds, and the dynamos will also have to supply current for several interesting applications of the transmission of power, and for the lighthouse of Messrs. Chance Bros., which will form one of the features of the exhibition.

An Edison-Swan lamp of 100 volt, 16 candle-power type, was recently taken from its holder after being in use for 11,561¾ hours in London, prior to removal. The total power consumed was 16.6 watts, and the filament was still unbroken. Another lamp of the same type has already made a record of 11,361 hours use and can still do service.

It is said that the authorities contemplate installing the electric light in the Bristol general post office. The sorters and other officials, who are obliged to work long hours, complain of the considerable discomfort caused by the heat of the numerous gas jets in the various departments.

A leading French Company proposes to effect the electrical transmission of 10,000 horse power to a distance of 120 miles at a pressure of 12,500 volts. The sea is being used as a return. The site of this proposed installation is stated to be in Spain.

The municipality of Brussels has definitely resolved not to grant a concession to any company for the electric lighting of that town, but to reserve to itself the right of exploiting the lighting.

The counting of the population at the taking of the next census in Austria will be effected by means of the electrical counter, as was done in the recent American census.

In his report to the Dover Town Council, Mr. J. A. Timmis recommends the adoption of the three-wire system and the erection of a 20,000-light plant.

A well-known carpet factory in Durham has been fitted with the electric light.

ALTERNATE CURRENT CONDENSERS.*

It is generally assumed that there is no difficulty in making commercial condensers for high pressure alternating currents. The first difficulty is insulation, for the dielectric must be very thin else the volume of the condenser is too great. Some dielectrics 0.2mm. thick can be made to stand up to 8,000 volts, when in small pieces, but in complete condensers a much greater margin must be allowed. Another difficulty arises from absorption, and whenever this occurs the apparent capacity is greater than the calculated. Supposing the fibres of paper in a paper condenser to be conductors embedded in insulating hydro-carbon, then every time the condenser is charged the fibres have their ends at different potentials, and a current passes to equalize them, and energy is lost. This current increases the capacity. One condenser made of paper boiled in ozokerite took an abnormally large current, and heated rapidly. At a high temperature it gave off water, and the power so wasted and current taken gradually decreased.

When a thin plate of mica is put between tin foils, it heats excessively; and the fall of potential over the air films separating the mica and foil is great enough to cause disruptive discharge to the surface of the mica. There appears to be a luminous layer of minute sparks under the foils, and there is a strong smell of ozone.

In a dielectric which heats there may be three kinds of conduction, viz.: metallic, when an ordinary conductor is embedded in an insulator; disruptive, as probably occurs in the case or mica, and electrolytic, which might occur in glass. In a transparent dielectric the conduction must be either electrolytic or disruptive, otherwise light vibrations would be damped.

The dielectric loss in a cable may be serious. Calculating from the waste in a condenser made of paper soaked in hot ozokerite, the loss in one of the Deptford mains came out 7,000 watts. Another effect observed at Deptford is a rise of pressure in the mains.

There is, as yet, no authoritative statement as to exactly what happens, and it is generally assumed that the effect depends on the relation of capacity to self-induction, and is a sort of resonator action. This would need a large self-induction, and a small change of speed would stop the effect. The following explanation is suggested. When a condenser is put on a dynamo the condenser current leads relatively to the electromotive force, and therefore strengthens the field magnets and increases the pressure. In order to test this the following experiment was made for the author by Mr. W. F. Bourne. A gramme alternator was coupled to the low pressure coil of a transformer, and a hot-wire voltmeter put across the primary circuit. On putting a condenser on the high pressure circuit the voltmeter wire fused. The possibility of making an alternator excite itself like a series machine, by putting a condenser on it, is pointed out.

MUNICIPAL OWNERSHIP.—The Mayor of New Haven, Conn., in his inaugural message sets forth a grand scheme for beautifying the city and advocates doing many things for the benefit of the city and its inhabitants. One of the things he recommends is the municipal ownership of all of the gas and electric light plants operated within the limits of the town.

The alternating current central station erected at Venice by the Edison Company of Milan has, in consequence of the still growing demand for the electric light, been again enlarged by the addition of a fourth alternating current machine for 80,000 watts and the accompanying transformers. The electrical works at Venice are thus raised to the total capacity of 320,000 watts.

* Paper read by Mr. James Swinburne before the Physical Society, London.

CAPACITY AND SELF-INDUCTION IN ALTERNATE CURRENT WORKING.*

BY GISBERT KAPP.

The peculiar interaction between capacity and self induction of a circuit traversed by an alternating current has long been known to scientists, and as far back as 1884, Dr. Hopkinson gave in his paper on "The Theory of Alternating Currents," read before the Society of Telegraph Engineers and Electricians, a practical example, in which he showed that with a certain capacity, periodic time, self-induction and resistance in circuit, the potential difference between the plates of the condenser may be 80 times the E.M.F. of the alternator. Startling as such a result must naturally appear, it failed at the time to attract much attention from practical engineers who, no doubt, pre-occupied with other problems relating to continuous-current work, were content to let such an intricate and apparently abstruse problem lie at rest until such time as its consideration should be forced upon them. This time has now come, and what in 1884 was merely an interesting laboratory experiment, having no further application than perhaps the breaking down of a condenser, is at present an intensely practical problem which the electrical engineer has to face. Phenomena arising from the effects of capacity in alternate-current circuits are forcing those who have to do with such circuits to give attention to the problems connected with these phenomena. As a case in point, I may mention that about a year ago I had to test a short underground line for a 2,000-volt alternating current, and although the bridge test gave several hundred megohms with a steady E.M.F. of 2,000 volts, a Cardew voltmeter inserted between one of the terminals of the alternator and the corresponding main showed a small but unmistakable deflection, indicating the passage of a current. This was, of course, due to the fact that the line acted as a condenser, a small current flowing into and out of the line through the voltmeter. The capacity of the line was found to be .037 of a microfarad, and to this corresponds at the pressure and frequency used a current of 45 milliamperes, a value quite high enough to give a slight deflection on the voltmeter. To neglect taking account of the capacity of the line would in such a case lead to a serious error in determining the insulation resistance in the manner described, whereas with a steady E.M.F. no such error would be possible. Other problems of much more importance and on a much larger scale have since then cropped up, notably that which Mr. Ferranti has so successfully faced, of transmitting high-pressure currents from Deptford to London through a line which has considerable capacity. It is, therefore, not surprising that we find questions connected with such problems treated in the current literature.

An excellent article on the subject has been published by M. Boucherot a few weeks ago in *L'Electricien*. He considers there the following cases. (*a*) An alternate current circuit containing an inductionless resistance and a condenser placed in series; (*b*) such a circuit containing a resistance and a self-induction placed in series; and (*c*) such a circuit containing a resistance, a condenser, and a self-induction placed in series. In the latter case, he shows that with a very moderate E.M.F. over the terminals of the self-induction coil and that between the plates of the condenser may, under certain circumstances, become almost infinite. The case investigated by M. Boucherot is, however, not the case we meet in practice. When the line is at work, that is to say, when more current than required to satisfy its electrostatic capacity is flowing through it, the condenser is not in series with, but forms a shunt to the lamps or whatever translating device is employed at the distant end. Under this condition M. Boucherot's solution does not apply, and I propose therefore in what follows to supplement his article by an investigation of the general case here mentioned.

Before entering into this subject it may perhaps be useful to state, for the benefit of the younger readers, what is the general aim of the investigation. The effect of self-induction and capacity combined is, broadly speaking, to produce somewhere in the circuit a pressure higher than intended, and it will easily be seen that where we already deal with high pressures such an increase may become a serious matter. It is therefore necessary to know what determines this increase of pressure, and how it can be kept within safe limits. Another effect due to the combined action of capacity and self-induction is an increase of current above the value which would suffice for working the lamps at the far end of the line if both self induction and capacity were absent. It comes therefore to this, that if we design the alternator, whilst omitting to take account of the self-induction and capacity of the line, we shall find that we must work the machine at a lower E.M.F., and at a higher current than originally intended. Here let me draw the reader's attention to what I believe to be a popular error. An impression seems to be abroad that the effects of self-induction and capacity are only felt at one particular frequency, or, what comes to the same thing, at one particular speed of the alternator. It is supposed to be that speed at which the natural period of oscillation coincides with the period of the machine producing resonance between the machine and the circuit. This view was very clearly expressed in Mr. Swinburne's otherwise excellent paper read at the last meeting of the Physical Society, when he said that a variation of 5 per cent. in the engine speed would at once destroy the interaction between self-induction and capacity—would in a word obviate all difficulties arising from these causes. I shall endeavor to show in this article that the difficulty exists at all speeds, but is either greater or smaller, according as the speed is nearer to or farther away from that speed at which resonance obtains.

To facilitate the investigation it will be best to attack the problem piecemeal, taking first a circuit with resistance and self induction, then a circuit with resistance and capacity, and finally a circuit having resistance, capacity, and self-induction. We assume that in all cases E.M.F. and current follow the sine law. We also assume that the coefficient of self-induction and the capacity are constants. The former assumption is not quite correct as far as relates to that part of the self-induction which is due to the armature of the alternator, since it depends to a certain extent on the relative position of the armature coils and field magnet poles, which is constantly changing. It would, however, enormously complicate the investigation if we were to attempt to make a correction on this account, and the correction could in any case be but trifling. The second assumption regarding the constancy of the capacity would certainly be correct if we had to deal with an ordinary condenser consisting of tinfoil and paraffined paper. In such a condenser there is considerable electrostatic attraction between the coatings causing a compression of the paper, and consequently a diminution of distance between opposite coatings. The capacity must then increase with the potential difference on the terminals of the condenser, and cannot be a condenser when, as an alternating E.M.F. this pressure is continuously varying. When, however, the condenser takes the form of a concentric main of stout copper, or of two heavy cables drawn into a pipe, it is inconceivable that there should be any movement altering the relative position of the conductors, and we may, therefore assume the capacity of such a main as constant.

The E.M.F. due to a self-induction L is

$$e = L\frac{di}{dt},$$

and since i may be expressed as simple sine function, such as $i = I \sin w t$, $w = 2\pi\frac{1}{T}$, we can also write

$$e = L w \cos w t.$$

The E.M.F. becomes a maximum at such times as the current passes through its zero value. Writing E_s for this maximum value of the E.M.F. of self-induction, we find therefore,

$$E_s = L w I.$$

In making measurements of current and E.M.F. we obtain, of course, not the maximum but the square root of mean squares, and it is, therefore desirable to have a formula giving the effective value of E.M.F. Since the effective and maximum values, both as regards E.M.F. and current, are the ratio of 1 to $\sqrt{2}$, it is obvious that the formula

$$E_s = L w I$$

will give the effective value of the E.M.F. if I be taken to represent the effective value of the current. The formula is based on C.-G.-S. units. If we wish to obtain E_s in volts we must divide the right side by 10^8. If I is taken in amperes, we must further divide by 10, and if L is given in quadrants (or secohms) we must multiply by the ration of the quadrant to the centimetre, namely, by 99.777×10^4. As, however, extreme accuracy is not of very great importance in treating problems, in which other and more important corrections must be neglected, we shall, for the sake of simplicity, assume that a quadrant is $100{,}000 \times 10^4$ centimetres, and must therefore multiply the right side by the equation of 10^9. Hence the equation as it stands is right for practical units, and we have

Volts due to self-induction = $\pi \times$ frequency $\times$ quadrants $\times$ amperes.

Thus to force a current of 10 amperes through a coil having a self-induction of .1 quadrant with a frequency of 80 would require an E.M.F. of 500 volts.

Let the capacity of a condenser be C then an increment of E.M.F. of de will in the time dt add to its charge the amount

$$C\,de = i\,dt,$$

being the rate of current at which the additional charge $C\,de$ is supplied. Let E_c be the maximum P.D. between the condenser plates, then $C E_c$ is the total charge, or the $\int i\,dt$ taken over a quarter period, that is, from $t=0$ to $t=\frac{T}{4}$.

Now $i\,dt = -\frac{1}{w} d(I \cos w t)$ and $C E_c = -\frac{1}{w}[I \cos w t]_{t=0}^{t=\frac{T}{4}}$ from which we obtain $I = w C E_c$.

Here, again, the values of current and E.M.F. may be taken to represent either the maxima or the effective values, whichever is more convenient. The above formula is given in C.-G.-S. units. If we want to have it in practical units we must remember that a microfarad is smaller than a C.-G.-S. unit of capacity in the ratio of $10^{15}:1$; that a volt is larger than a C.-G.-S. unit of E.M.F. in the ratio of $10^8:1$, and that an ampere is the tenth part of a C.-G.-S. unit of current. We find thus the formula connecting capacity, volts and amperes as

$$I = C E_c w 10^{-6}.$$

As an example, assume that we have a concentric cable of capacity $C = 2$ microfarads, $E_c = 10{,}000$ volts and $w = 500$ ($n = 80$). The current flowing in and out will be

$$I = 2 \times 10{,}000. \quad 500. \quad 10^{-6} = 10 \text{ amperes.}$$

Having thus established the fundamental relations between capacity, self-induction, current and E.M.F., we can now proceed to show their practical application to problems of alternate current distributions, which shall be done in a subsequent article.

* London *Electrician*.

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KIND WORDS FROM FRIENDS.

Our esteemed contemporary, *The Electrical Engineer*, in its issue of January 14, 1891, contains the following complimentary notice of the addition to our staff of Mr. W. T. Hunt:

'The following notice in THE ELECTRIC AGE of last week will interest a very large circle of electrical readers:

"Mr. Walter T. Hunt, who for the past seven years has been manager of the advertising department of our contemporary, the *Electrical World*, has severed his connection with that paper and assumed a like position with THE ELECTRIC AGE. Mr. Hunt is so well known in the electrical trade that it is hardly necessary now to formally introduce him.'

This news will probably not surprise anyone who has watched the course of events during the past year in electrical journalism, and Mr. Hunt is to be heartily congratulated on making this change of base while he can still point to the evidences of his good work and to the success he achieved in the special sphere of labor that he now deems it prudent to quit. A more loyal, energetic and wide awake advertising agent than Mr. Hunt cannot be found in this city, and though he can only at this juncture carry his reputation and his friends with him, if nothing else, he may depend upon it that before long a large share of his old business will naturally have followed him, too. The fault will not be his if it doesn't, and he is fortunate, moreover, in being associated with the Messrs. Taltavall, who have already shown their ability, before enlarging their field, by conducting the brightest and best telegrapher's journal ever seen in America. Mr. Hunt will be accompanied in his new departure by the wishes of many who, like ourselves have watched his career, and know the sterling stuff he is made of. He may count on finding his services appreciated ungrudgingly and without any of the sneering discouragement that often besets honest endeavor and takes the heart out of even the best of us. Mr. Hunt, we understand, is Vice-President and Manager of the Advertising Department of the AGE."

The *Electrical Review* of Jan. 17, says thereanent: "Mr. W. T. Hunt, many years identified with the business department of the *Electrical World*, has purchased an interest in the ELECTRIC AGE, and hereafter will devote his time and energy to building up that journal. Mr. Hunt is an untiring worker, and has our best wishes for success."

POSSIBLE USES OF SELENIUM.—Selenium cells will no doubt at some future time be put to many valuable uses. The remarkable and well known property of that metal—*i. e.*, sensibility to light and consequent variation of electrical conductivity—is a characteristic that promises to lead to many valuable applications. At a recent meeting of the British Physical Society a selenium cell was so arranged with reference to an electric circuit that on the approach of darkness, a small lamp was rendered incandescent, and as daylight appeared the electric light was extinguished. A most valuable and important use for selenium cells has been suggested. It could be used to give notice, by ringing an alarm, or otherwise, of the extinguishing of lights in railway signals or side lights on ships. Other uses, more or less valuable, suggest themselves. Among them may be mentioned the protection it would offer against burglars. If these offenders against good order and society should attempt to carry on their nefarious work by the aid of a dark lantern or other light, the selenium cell would tell on them through an alarm. It will be necessary, therefore, for the future burglar to devise some way of silencing the tell-tale selenium cell. Dogs can be silenced but it will be a difficult matter to poison or in any way subdue the coming invisible watchman.

THE TROLLEY SYSTEM IN THE ANNEXED DISTRICTS.—A morning paper of this city is greatly exercised over the fact that Mayor Grant has returned from Boston an advocate of the trolley system of electric railway, and is in favor of using it in the annexed districts at the northern end of the city, above the Harlem river. The paper even goes so far as to charge the Mayor with being influenced in favor of electricity, because the president of the West End road in Boston is a brother of Ex-Secretary of the Navy, W. C. Whitney, and the latter is the head of the syndicate operating the Broadway railroad. Several other relationships, blood and otherwise, are cited to prove inferentially that Mayor Grant is not a man who has a mind and will of his own, and who usually exercises them when occasion requires. The fact of the matter is, it seems to us, that when the Mayor took the time and opportunity to investigate the trolley system, as operated in Boston, he was convinced that it was a practical and valuable system, and one particularly adapted to use in outlying or sparsely settled districts. Mayor Grant simply formed a correct and reasonable opinion of what he saw, and we see no reason why he should be suspected of being influenced by improper motives, simply because he acknowledged something that is very generally accepted as a fact.

The writer of the article in question makes a vigorous effort to show that electric railway currents are dangerous to human life, but when he came to interview persons who knew something about the subject, and knew what they were talking about, he found that these currents were not so deadly as he thought. It was a very weak argument against the introduction of the trolley system in the uptown districts, and the object of the article is quite apparent on its face.

MAYOR GRANT'S SUGGESTION.

That was a good suggestion made by Mayor Grant in his annual message that the city operate its own system of electric communication between the various city departments, but he did not stop there. "If it should be ultimately concluded to adopt such a system," continues the Mayor, "it could be extended to enable the city to furnish its own electric lights." If the city operated its own electric light plants it would have no more fights with private corporations who now supply the light. This seems to be about the only benefit that the city would derive if Mayor Grant's suggestion were adopted.

If it is proposed to go into the electric lighting business, a clean sweep might at the same time be made and the city might lay gas mains and manufacture gas for street illumination. Then for the further benefit of its citizens the elevated roads and the horse car lines might be absorbed, and the various lines of ferry might also be brought under the municipal wing.

Mayor Grant's experience in electricity has been warlike in the main, and he evidently knows little about the practical part of the business.

As we have said before, electricity and politics do not combine well. Politicians cannot run electric light stations, and if the city attempted to do its own lighting, that department of the government would be dominated by politics just as every other department is.

No; the city authorities have all they can properly attend to to govern the city without meddling with outside matters. There are many duties within the government's legitimate sphere that are sadly neglected. The authorities should see first that these duties are performed before reaching out for something beyond.

In a city like New York, much greater satisfaction is given by private corporations in lighting the streets than the city itself could give. Under the city's control, the light would be as fickle and uncertain as are its politics.

OVERHEAD WIRES.—The city authorities unquestionably have the right to say whether the electric wires shall or shall not be strung along the streets within the corporate limits, but have they the right to interfere with existing lines running from housetop to housetop, that is, on private property? The Board of Electrical Control seem to be making a move in that direction, but it is a question whether they have any authority in the premises. We do not understand that their jurisdiction extends to the roofs of buildings and electric wire supports thereon. In the first place, permission had to be obtained from the owner of the property before these structures could be erected, and as private rights are involved, we do not see how the Board of Electrical Control can remove such lines unless it can be proved that they are a menace to life and property. To force these wires from the roofs into the subways would be an act that would not be entirely free from suspicion.

STEEL FOR MAGNETS.—According to experiments by Mr. W. H. Preece, the electrician to the British Post Office, the French steels of M. Marchal and M. Clemandot are far superior to English Steels for the construction of magnets. Bars of Marchal steel gave a mean magnetic induction at their ends, represented by the figure 2,540; those of Clemandot, compressed steel, 2,265; whereas Ashford steel gave 1,704, Wall steel 1,519, and Jowitt steel 1,503.

ELECTRIC POWER FOR ELEVATOR WORK.

The Perret Multipolar low speed motors, which we described in a previous issue, are rapidly coming into use on account of their extremely low speed, high efficiency and close regulation without excessive weight and bulk. For the operation of elevators they are particularly applicable, some being connected direct to the screw shaft of the elevator and some being belted in the ordinary manner. They have self-oiling bearings and the carbon brushes are self-feeding requiring practically no adjustment or attention, reducing the care of the apparatus to a minimum. These self-feeding carbon brushes have, it is said, run for nearly a year without any attention to either brushes or commutator, showing at the end of that time but one-sixteenth of an inch wear, while no wear whatever on the commutator was noticed.

Our illustration shows one of these motors, of 10 h.p. operating a freight elevator at the warehouse of Leavy & Britton Brewing Company on Front street, Brooklyn. It is supplied with a 220 volt current from the Edison Illuminating Company's circuit. As will be seen the motor and accessories occupy a very small space; a point appreciated by those having an installation of this kind in charge.

The elevator is of the A. B. See Manufacturing Company's make, and is equipped with every improvement.

Power of Niagara Falls.—According to Herr Japing, the hourly rate of water falling over Niagara Falls is 100,000,000 tons, representing 16,000,000 horse-power, and the total production of coal in the world would just about suffice to pump the water back again.

AN INTERESTING EXHIBITION.

The Brooklyn Institute will hold a Geographical Exhibition in the Arcade building, Fulton, Washington and Tillary streets, Brooklyn, N. Y., beginning March 2d, and closing March 28th, 1891. The remaining space of the building will be devoted to a general trade, building material and machinery exhibit.

There is every opportunity to establish a permanent electrical exhibition in these buildings, as there is plenty of space, and the manager of the Arcade, Mr. F. Lesher, is willing to carry out the project. Such an exhibition particularly at this time, would establish renewed confidence in electrical enterprises. The gentleman is energetic and pushing and anything he undertakes could not fail of success.

Those wishing to aid in the enterprise will find Mr. Lesher at his office in the Arcade buildings. He desires applications for space for exhibits at the March exhibition to be sent to him before February 21st.

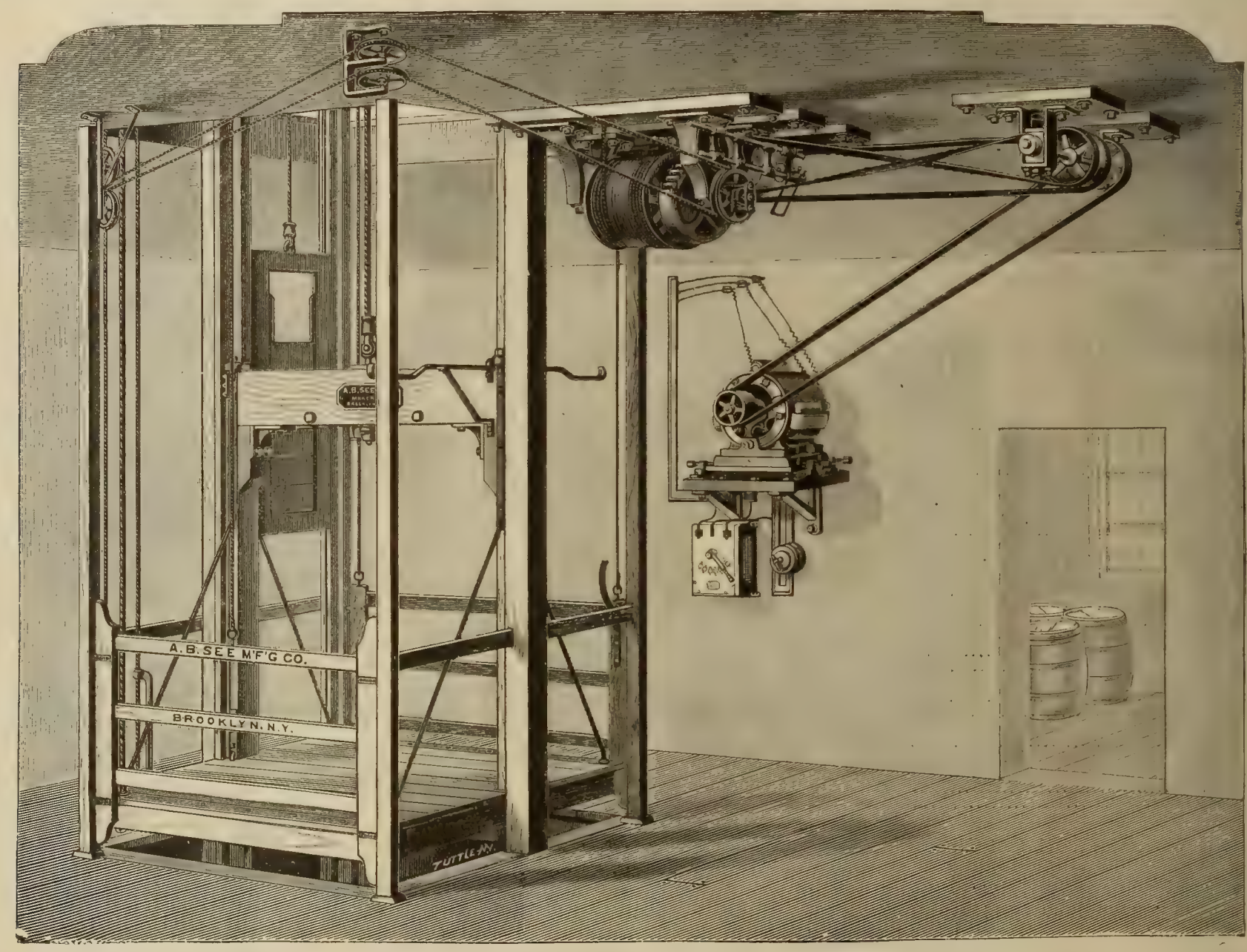
Portability of Electricity.—Electricity, as compared with other forces, has the great advantage of being extremely portable, and capable of having its direction and intensity changed with greatest ease. No mechanical force can be detected in the conductor carrying the electrical energy, such as appears during purely mechanical transmission with shaft, belts, wire ropes or pipes conveying steam, water or air. The conductor is clean, does not move, and altogether appears inert. It is possible to bring energy into rooms and places awkwardly situated for mechanical transmission, and there is no noise, smell, dirt or heat during the transmission—nothing to burst or give way.

RAPID TRANSIT FOR NEW YORK.

Mr. Joseph Wetzler, the well known authority on electric railway matters, was interviewed a few days ago by a reporter for an afternoon paper on the question of rapid transit for New York. Mr. Wetzler advocates, of course, the use of electric power, and believes that an arcade road would be vastly superior to the elevated structures. Electric locomotives could attain high speed and, in an arcade, the air would be pure. There would be no coal smoke and none of the objectionable features incident to the use of the ordinary locomotives.

Mr. Wetzler refers to the City and South London Railway, (which was described and illustrated recently in the Electric Age) as in one sense, a model, and thought that such a road (underground) could be constructed in New York with greater facility. He would have four tracks, two for through express trains, and two for way trains.

Many others share the same opinion with Mr. Wetzler on this question, and no doubt the materialization of this idea is one of the things of the future, and, we may add, as our belief, the near future.



PERRET MULTIPOLAR LOW-SPEED MOTOR OPERATING AN ELEVATOR.

NEW PUBLICATIONS.

The *Amateur Electrician*, a monthly journal for amateurs and beginners in the study of electricity, has been born at Ravenswood, Ill. The editor, in his salutatory, thinks there is a demand for such a paper as he proposes to issue, and he thinks the *Amateur Electrician* will be a great help to the student. Very likely it will. It is neatly gotten up. Nowhere in the paper, however, can be found the names of any individuals connected with the business.

ELECTRIC WATCHMAN'S CLOCK AND REGULATOR.

The greatest objection to the numerous clocks and regulators for watchmen's service records, is the complicated mechanism necessary to fill all the requirements of alarm and patrol service, and the consequent expense in installing a system of stations. The more complicated the movements, the greater is the liability to get out of order and extra expense is entailed to keep the clocks in repair. One of the latest and best devices of this character is the Electric Watchman's



ELECTRIC WATCHMAN'S CLOCK AND REGULATOR.

Clock and Regulator, manufactured by the National Electric Manufacturing Company of 14 and 16 Vesey street, New York. All their clocks with the same safeguards and checks against willful or accidental negligence are, from the manner of their construction, necessarily high priced, but we believe that this one is the first of its kind offered to the trade at a reasonable cost. It cannot be surpassed by any clock manufactured as a time keeper and is a faithful recorder of a watchman's performance of his duty.

There is a double registry of the watchman's visit to each station—one at the station itself, and one on the dial of the clock. The record on the dial must correspond with the register at the station; any discrepancy indicating negligence on the part of the watchman. With the majority of clocks a skilful manipulation of the wire will register on the dial as if from the regular station, but here one registry is an infallible check against the other.

Some of the advantages of this clock are :

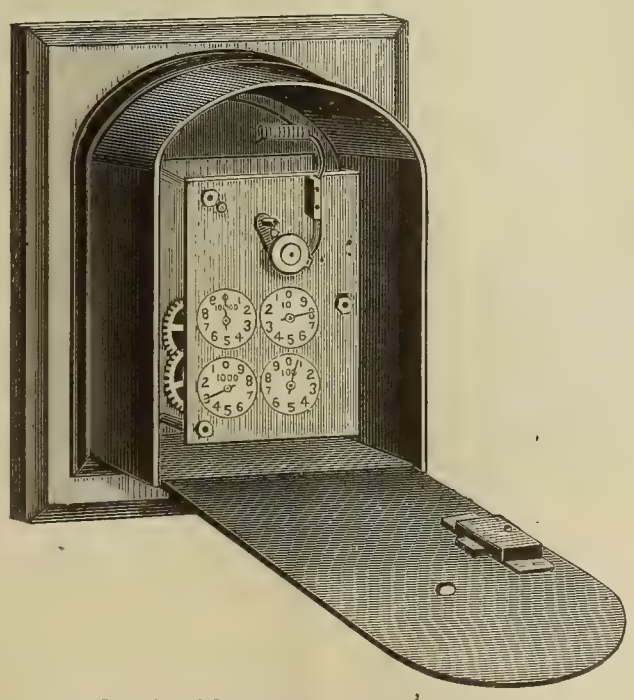
1. It indicates the time of each signal, and the interval between signals.

2. If the clock fails to register from accidents to the wires, or from any stoppage of the clock, the boxes will show the visits of the watchman.

3. It will record the visits of the watchman for seven days without attention or change of dial. This in itself is a great advantage over other clocks requiring a change of registration dial each day.

4. The registration boxes require no special attention. They may be inspected once a week or once a month as circumstances may require. The boxes are made entirely of metal, and, if carefully placed would indicate after a fire, whether or not the watchman had faithfully performed his duties, even though the clock had been destroyed.

5. The register which is independent of the time movement, is run by a movement of its own. These movements are run by weights with pendulum, consequently they may be relied upon for accurate time.



STATION BOX FOR WATCHMAN'S CLOCK.

There is no complicated mechanism to get out of order. The electrical machinery and circuits are of the simplest kind, but one magnet being used for one or twenty stations. The cases are made in black walnut, mahogany and oak, with a handsome finish, and as the accompanying cut shows, they are adapted for office clocks. The simplicity of the whole apparatus recommends itself to all who are in need of such service. The clocks are furnished with or without regulator time movement.

The station box, which is here shown open for inspection, has four dials with pointers, the upper right hand dial (numbered 10) records each visit of the watchman, the one directly under this, numbered 100, records every ten visits, thr lower left dial, numbered 1000, records every hundred visits, and the one numbered 10,000, every thousand visits. The record is read by taking each figure indicated by the pointer to the left of the previous one, beginning at the lowest numbered dial. By comparing this with the paper dials used during the same period of time and seeing that each night shows punctures to correspond, a guarantee of the faithful performance of the watchman is had. It will be seen that it is impossible for the watchman to neglect his duties without being detected.

PROPORTIONS OF CURRENT AND CARBONS.—With the proper proportions between the amount of current and the diameter of the carbon of arc lamps, the increase of light is in the direct ratio of increase of diameter.

THE BERGMANN SHADE HOLDER FOR INCANDESCENT LAMPS.

The majority of lamp shades are non-adjustable, making them very inconvenient under some circumstances. As a device for extending or contracting the radius of the incandescent light has been a long felt want, it is surprising that more improvements have not been made in this line. The main difficulty is in getting mechanism that is not too bulky and inconvenient, but Mr. Sigmund Bergmann of New York, has overcome this by means of concentric segmental sections elongated in the direction of the length of the lamp-socket.

In the accompanying drawings, Figure 1 shows the shade-holder applied to a socket, while Figure 2 is a top plan view of the holder.

A in Figure 1 is the outer shell of an incandescent lamp socket, shown as cylindrical and of uniform diameter from its annular bead a to the annular bead a^1 of the cap. The outer shell is secured to an inner shell by means of screws a^2.

B, Figure 2 designates the shade-holder having the tubular collar b, adapted to engage

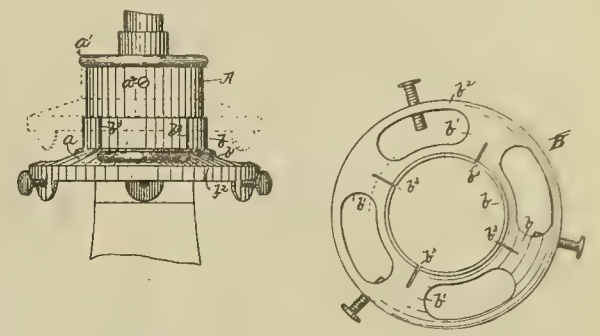


FIG. 1. FIG 2.

BERGMANN'S SHADE HOLDER.

around the lamp socket the flat metal radial arms b^1 and the rim b^2, provided with a downwardly-turned portion to engage around the top of a shade. These parts may be formed of one piece of metal. Kerfs or slits b^3 divide the collar b vertically into sections, elongated in the direction of the length of the socket and concentric throughout their length, the kerfs extending well into the radial arms b^1, so that the compression or spring action will be exerted from the arm portions.

The kerfs need not extend into the arms, as the sections of the collar have a slight yielding pressure against the socket without the aid of the arms.

The downwardly-turned portion of the rim b^2 is provided with the ordinary thumb-screws to hold the shade.

In placing the shade-holder on the shell the shell is first removed from the inner shell, and when the holder is placed thereon the shell is again secured in its place over the inner shell.

The shade-holder may be adjusted along the socket to bring the shade nearer to or farther from a lamp and the spring collar will retain the holder as adjusted. In Fig. 1 the holder is shown in full line in one of its extreme positions, and in dotted line its other extreme position. The beads a and a^1 prevents the holder from sliding off at either end of the socket.

MAGNETIC INDUCTION and electric induction are reciprocal, one with the other.

ARC AND INCANDESCENT LIGHTS.—In arc lighting the series is found to be the only system in which proper regulation can be made practical. In incandescent lighting the parallel system is found to be the most practical. This rule is, however, not strictly adhered to, the series and parallel systems being, to a certain extent combined. It is found convenient sometimes, though not desirable, to place both arc and incandescent lamps on the same circuit, the arc lamps being placed in series and the incandescent lamps in parallel.

A NEW BLUE STONE BATTERY.

We thought that the limit of improvement had been reached in blue stone batteries, but the new Hussey patent blue stone battery is a decided change for the better. It consists of a glass cell at the bottom of which is a star shaped copper having its corners turned up so that the blue stone will hold it down firmly. The main feature of this battery is the porous cup, which is porous only on the bottom, the sides being glazed. The porous cup holds the zinc electrode of the cell. There is no acid used, pure water being all that is necessary in the porous cup or the glass jar. This battery can be used for either open or closed circuits for telegraph, telephone, fire alarm, train signalling or medical work. It will charge storage batteries at the rate of eight-tenths to one ampere per hour.

All that is necessary to maintain is to draw off from the bottom one-half the contents of the porous cup, and refill with pure water.



HUSSEY BATTERY SUPPLYING POWER FOR DIFFERENT APPARATUS.

Our illustration shows eight of these batteries charging two storage cells which furnish current for a large Paillard music box, a phonograph motor, and motors for a fan and a sewing machine, also a small incandescent lamp to illuminate a doll in a glass case.

These batteries are for sale by the Crosby Electric Company, Nos. 87 and 89 South Fifth avenue, New York, N. Y.

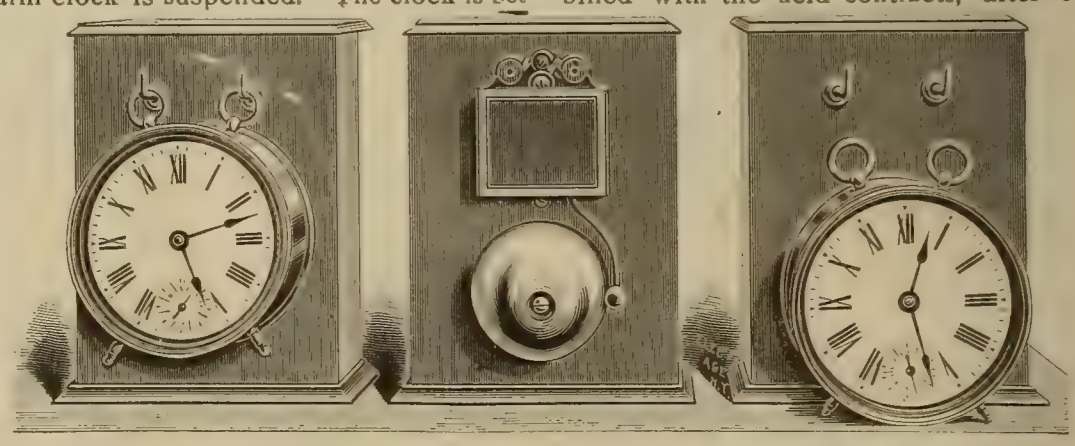
The improvements in them can be applied to all forms of blue-stone jars at present in use.

THE ELECTRIC LIGHT CONVENTION.

Gen. C. H. Barney, chairman of the committee on exhibits at the next convention of the National Electric Light Association, which is to be held at Providence, R. I., next month, expected to spend Monday, the 19th inst., in Providence, for the purpose of arranging matters of detail in connection with the exhibits. He reports that all of the available space has been taken by exhibitors, and he could utilize much more room if it could be had. Among the arrangements General Barney proposes to make while in Providence, are the following, which will undoubtedly be much appreciated by those intending to have a display of their goods. He proposes to arrange with an expressman, a carpenter, a sign painter, etc., to do the necessary work in their respective lines in connection with the exhibition, and will send the names of these persons to each person or firm intending to have an exhibit. The idea is to save exhibitors all the work and inconvenience of hunting up workmen to do such jobs. By making a special arrangement with some particular one exhibitors can communicate directly with him and give all necessary orders without going to all the inconvenience and annoyance which would necessarily result if each exhibitor made independent arrangements. General Barney's efforts to make everything as easy and convenient as possible for exhibitors, will no doubt be greatly appreciated.

A NEW ELECTRICAL ALARM CLOCK.

The Broadway Electric Company of New York, manufacturers of electrical novelties, have had unprecedented success in unique contrivances lately as well as many valuable and useful inventions. The latest is a complete electric alarm clock composed of a very neat cabinet about 9 inches in height, 6 inches in width, and about 3 inches in thickness. Enclosed in this cabinet are two cells of the best dry battery. On the back of the cabinet is a very fine iron box electric bell, as shown in the centre cut of illustration. On the face of the cabinet are two electrical contacts, in the form of hooks, on which the alarm clock is suspended. The clock is set to ring at any hour desired and then hung on the connections as shown in the figure on the left. No oversleeping is possible as the alarm will ring until the clock is removed from the contacts as shown in the right-hand illustration.

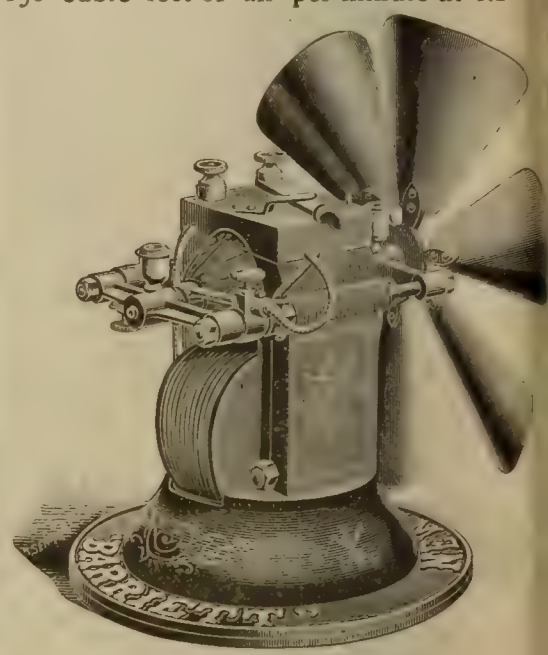


NEW ELECTRICAL ALARM CLOCK.

OBITUARY.—Mr. William Lant Carpenter, one of the managers of the School of Electrical Engineering, London, died by his own hand at his residence at Harlesden, on Tuesday, Dec. 23, last. It is said that the deceased had lately suffered from some mental affection, and was under the care of an attendant.

THE BARRIETT ELECTRIC FAN OUTFIT.

The Barriett Electric Company, of New York, have designed a small electric-fan outfit, which is not only neat in design, but is also small and compact enough to be set on any desk. The motor is $\frac{1}{16}$ h. p., and as the armature is of very low resistance, very little energy is wasted in heat. For the 110 volt circuits the field magnet, which is laminated with the softest charcoal annealed iron, is wound to 105 ohms, and the armature to but 5. What makes this low armature resistance possible is the unique method of using spirally cut teeth on the armature, which lessens the resistance of th air gap. This feature also makes the moto noiseless, which is a sideratum when placed on one's desk. As it generates a counter electro-motive force of 55 volts it requires but ½ ampere of current when in operation. It exhausts 156 cubic feet of air per minute at its normal speed of 2500 revolutions. It is cool, silent, very effiient, and as to its appearance the illustration speaks for itself.



BARRIETT FAN OUTFIT.

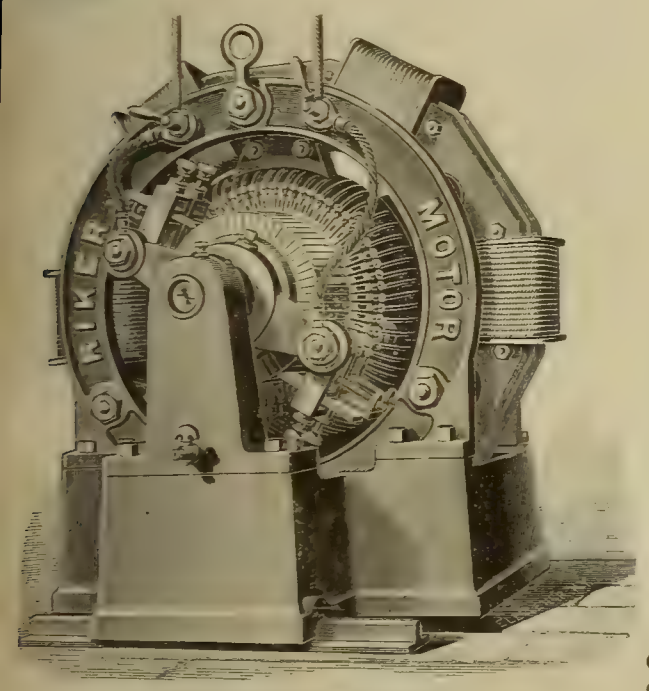
CHEMICAL FORCES.—When sulphuric acid is mixed with water great heat is developed, with a great condensation of the molecules of the water. The first equivalent of water thus combined with the acid contracts, after cooling, from its original volume of 18 to that of 11.408. The vastness of the chemical forces involved in such action may be faintly conceived when it is considered that almost an incalculable power would be required to compress the water to this extent mechanically.

ARC LIGHTS.—The purer the carbon in the arc lamp the purer will be the light.

LENGTH OF ARC.—The length of the arc should be adjusted to the amount of illumination for which the lamp is intended.

THE RIKER LOW SPEED MOTORS AND DYNAMOS.

Since electrical engineers have had their attention turned to low speed electric motors and generators for the economical transmission of energy, they have gone from bi-polar to multipolar machinery in an endeavor to secure the greatest power from the least number of revolutions or the most work per revolution. But there is also a desire to economize in space, wear and tear of machinery, friction, and numerous other points. These features make a high speed machine objectionable as the majority of them must be coupled to the engines by belts of longer or shorter lengths, which occasionally require as much room as the machinery, besides causing more friction than is necessary. There are numerous uses for motors where such a speed as 1,800 or 2,000 revolutions would be detrimental both to the machinery and to the work. In an endeavor to reduce the speed, engineers have designed multipolar machinery, and it seems the more the poles, within certain limits depending on their strength and an economical size of motor, the more energy per revolution.



RIKER LOW SPEED MOTOR.

One of the latest of this class of electric motors and dynamos is that of Mr. A. L. Riker of the Riker Electric Motor Co., 45 and 47 York street, Brooklyn, N. Y., of which we give an illustration. It has six consequent poles, produced by a field of six magnetizing coils. The path of the lines of force form almost a complete circle. The entire field is of soft sheet iron plates built upon six non-magnetic bolts passing through the pole pieces, three of which are bolted to the rings that support the machine. The magnetic circuit is very short, completely surrounding the armature and concentrating the lines of force. The armature is a toothed ring with the ordinary Gramme winding.

Mr. Riker's method of cross-connecting diametrically opposite brushes so as to prevent any danger of short-circuiting, and still have a compact commutator, as well as his method of lubricating the armature shaft, is unique.

The cross-connection is made by a ring stamped out of sheet copper and then let into and soldered to three bars placed respectively, 120, 240 and 360 degrees apart in the commutator, the whole ring being entirely enclosed within the commutator and insulated. This method allows diametrically opposite brushes to be used as in a two-pole machine.

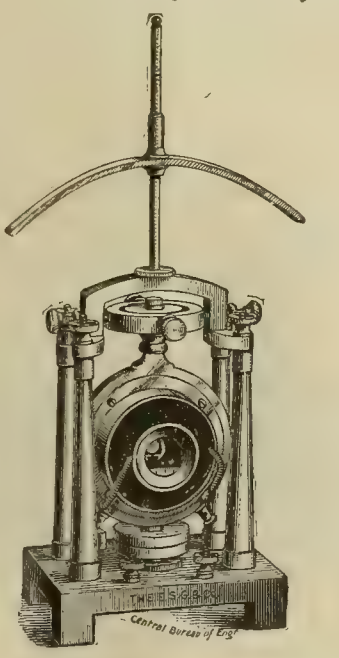
The machines have hollow bearings and slotted bushings, exposing the armature shaft, over which, and dipping into an oil well below, runs a chain acting on the principle of the chain pump, which thoroughly and automatically keeps the shaft oiled.

The speed of these machines is very low, ranging from 650 revolutions a minute for those of half horse power, to 550 for the 20 horse power machines. The dynamo can be coupled direct to the engine, or the motor to the machine in use. There is no necessity for counter shafting.

The low speed of these machines insures a saving in operation by minimizing friction, vibration, wear, noise and other points that make high speed machines objectionable.

FREY PORTABLE REFLECTING GALVANOMETER.

This instrument, the invention of Mr. Charles P. Frey, chief electrician of the E. S. Greeley & Company Electric Laboratory, embodies the essential features of Thomson's Reflecting Galvanometer, and is extremely sensitive. Its principal feature is that it can be instantly prepared for use by releasing the coils, which are suspended by means of a universal joint, and thus require no leveling. When not in use the fibre suspended magnet and mirror, as well as the pendant coils, are securely locked by means of a



FREY REFLECTING GALVANOMETER.

compound bolt operated by one turn of an independent key, doing away with the danger of breaking the fibre, a danger to which the ordinary type of fibre, suspension is extremely liable when at all roughly handled, and one which may be a serious annoyance.

This galvanometer is especially adapted for rapid subway testing, since it may be rendered direct reading by attaching a pointer. For more delicate tests, by using a lamp, stand and scale, a high figure of merit may be obtained.

This galvanometer, protected by letters patent, is being placed on the market by the E. S. Greeley & Co., of New York.

RATING OF ELECTRIC GENERATORS.

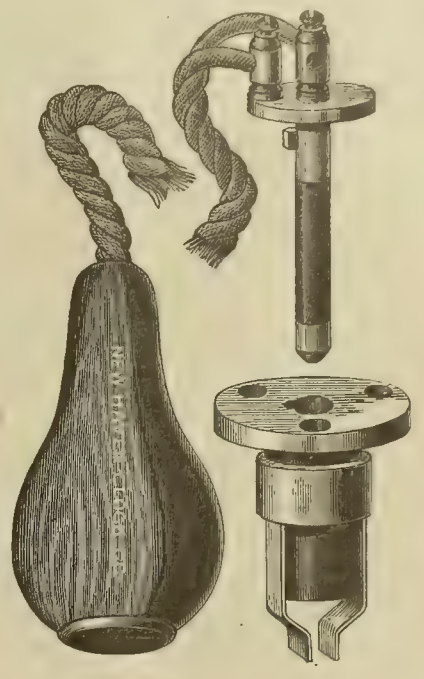
Mr. T. G. Grier, on Monday, January 19th, read a paper before the Chicago Electric Club, entitled "Commercial Rating of Electric Generators." Mr. Grier argued against the general practice of rating generators by so many candle power, or so many horse power, which terms are, to a great extent, meaningless in this application. He advocated specifying the capacity of generators in the units that measure the energy in the form in which it is developed. Electrical generators should have their capacity specified in volts or amperes or in watts, giving the pressure in volts at which this specified power is produced.

CHARGING ACCUMULATORS.—Charging should begin immediately the cells have been filled with the electroyte. After a good charging the accumulator can be left to itself for many months without injury to the plates.

DINING TABLE FLOOR PUSH BUTTON ATTACHMENT.

We give below an illustration of a neat dining table attachment for a floor push button, manufactured by the National Electrical Manufacturing Company, of 14 and 16 Vesey street, New York. The floor push button is made with a removable key which can be exchanged for another key having a conducting cord and a pear push button attached to it. The push button can be placed on the table anywhere, as it is heavy enough to maintain its position wherever put.

As is well known, it is not always convenient to use the floor push, which is necessarily permanently fixed in the floor. This method of attaching the flexible cord and hand push thereto will be found very useful, particularly if it is de-



DINING TABLE AND FLOOR PUSH.

sired at any time to change the position of the table in the room. The hand push may be laid on the table in any convenient place, and the simple pressure of the button on the end of the pear-shaped handle summons the servant as readily and effectually as if the floor push were used.

The dining table attachment is ornamental and therefore unobjectionable on the table.

The operation of this push is so simple that it requires no particular explanation after once looking at the illustration.

THE RATE OF DISCHARGE OF THE ELECTRIC SPARK.—In a recent number of the *Journal of the Physico-Chemical Society of Russia*, M. P. Bakhmetieff states that he has repeated the experiments of M. Naccari on the loss of charge undergone by an electrified body when close to an electric spark, placing the whole arrangement under a bell-glass and filling it with different gases. Generally speaking the electric spark accelerated the discharge, but charges of positivsign were the more rapidly dissipated in carbonic acid, and in coal gas, while negative elec, trification disappeared the more rapidly in air-hydrogen, and oxygen. M. Bakhmetieff attribe utes these results to an unstable molecular allotropic modification of the gases by the electric spark which renders them conducting, but only to electricity of one particular sign. M. A. Nacarri states, with reference to some further experiments of his, that the influence of the electric spark on the rate of discharge of an electrified body is much diminished by the presence of vapor of water, alcohol, essence of turpentine, ether, and petroleum. He further calls attention to the fact that the presence of a piece of phosphorus near an electrified metal ball causes it to rapidly discharge. The phenomenon ceases in the presence of bodies like essence of turpentine, which cause phosphorescence to disappear.

PROPAGATION OF ALTERNATING CURRENTS THROUGH CONCENTRIC CABLES.*

BY DR. J. A. FLEMING, M. A.

Attention having been drawn of late to interesting phenomena in connection with the Ferranti trunk mains, it may be of utility to furnish very briefly the results of some measurements on these cables, reserving further facts for another occasion, and to point out how far these facts fit in with existing theoretical investigations. Particularly also to refer readers of *The Electrician* to some work of Mr. Oliver Heaviside, which will be found to contain a good deal which is pertinent to questions now being discussed. The employment of conductors having quite sensible, even if not very considerable electrostatic capacity in conjunction with alternators and transformers, brings into prominence phenomena which may be broadly called resonance effects, and which need careful study to avoid serious practical mistakes in laying out large systems of electrical distribution. It is convenient to adopt a telephonic nomenclature, and to speak of the alternator or transformer, or both together, placed at the generating end of a trunk main as the Transmitter, and to call the transformer at the distribution end the Receiver.

Let us consider a simple generating and pressure reducing plant consisting of a transmitter, concentric conductor and receiver. The transmitter and receiver may be considered to be transformers. There are then seven quantities which may be supposed to be given constants. The ohmic resistances of the transmitter, receiver and conductor; the inductances at given loads of the same three; and the electrostatic capacity of the cable. First, let us consider the cable, supposed to consist of two concentric conductors separated by a tubular dielectric sheath. The capacity C, a length l, of such a cable is capable of being calculated from the well-known formula:

$$C = \frac{R\,l}{2 \log_e \frac{R_3}{R_2}},$$

where R_2 is the half-diameter of the outside of the inner conductor, and R_3 is the half-diameter of the inside of the outer conductor, and R is the specific inductive capacity of the dielectric. For the Ferranti mains, the ratio $R_3 : R_2$ is about 2.27, and it appears that the specific inductive capacity of the compressed waxed paper of which the dielectric is formed is nearly 3.5. The experimentally measured capacity of one length of Ferranti cable of about one mile and a-third showed that the capacity of the cable as laid is .367 of a microfarad per mile.

The self-induction of a concentric cable of this type can be accurately calculated from a formula given by Lord Rayleigh in the *Philosophical Magazine* for May, 1886, and which is given in the form.

$$\frac{L}{l} = 2\log\frac{R_3}{R_2} + \frac{2}{R_2^2 - R_1^2}\left(\frac{R_2^2 - 3R_1^2}{4} + \frac{R_1^4}{R_2^2 - R_1^2}\log\frac{R_2}{R_1}\right) + \frac{2}{R_4^2 - R_3^2}\left(\frac{R_3^2 - 3R_4^2}{4} + \frac{R_4^4}{R_4^2 - R_3^2}\log\frac{R_4}{R_3}\right)$$

in which L is the inductance of a length l of the cable and R_1, R_2, R_3, R_4, are the half-diameters of inside of inner, outside of inner, inside of outer, and outside of outer copper conductor. From the carefully measured dimensions of the Ferranti cable I find that

$$L = 1.7755\, l.$$

Since one mile = 160931.5 centims., it follows that the self-induction of one mile of the Ferranti cable is .0002857 henrys. The measured ohmic resistance of the copper conductor, taking both inner and outer together, is .324 legal ohms per mile run of the cable at 0°C.

The frequency n or number of complete periods in the current used as has been hitherto 67. If we take p as usual to represent $2\pi n$, we have then,

$$n = 67,\ p = 421,\ p^2 = 177220.$$

Let R be the ohmic resistance, C the electrostatic capacity, and L the self-induction of the cable, all per mile run, then,

$R = .324$ ohm. $\quad R^2 = .1049.$

$L = .000286$ henry,

$pL = .1204.$ $\quad p^2L^2 = .0145.$

also $R + p_2 L^2 = .1194 = I^2$ and $\sqrt{R^2 + p^2 L^2} = .3455$ ohms $= I$, or the impedance per mile, and I exceeds R by about 7 per cent. Also $C = .367$ microfarads $= \frac{367}{10^9}$ farads, and we can calculate from the values above given other important quantities, such as

$$Cp = \frac{1545}{10^7}$$

$$P^2 = \sqrt{R^2 + p^2 L^2} - pL = .00001738,$$

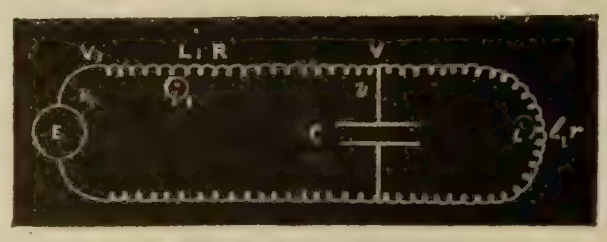
and

$$Q^2 = \sqrt{R^2 + p^2 L^2} + pL = .00003597;$$

thus $\quad P = .004 \quad Q = .006,$

and $\quad \frac{P^2 + Q^2}{I^2} = \frac{447}{10^6}(2PR + 2QLp) = .00415$

and $\quad (2PLp^2 - 2Qp R) = -1.216.$



These numerical quantities are required in calculating the current at the far end of the cable.

Let us first examine the simple case of a condenser of capacity, C, of which the terminals are short-circuited by an inductive resistance of inductance l and resistance r and let another inductive resistance L R connect the terminals of the condenser with a source of simple periodic alternating electromotive force see (*see* fig.) E of frequency n.

If v_1 and v are the potential differences at any instant of the generator and condenser ends of the line L_1 R, and if V_1 and V are the maximum values of these potentials, it is not difficult to show that

$$\frac{V_1^2}{V^2} = (A^2 + B^2) + (1 - C p^2)\frac{R^2 + p^2 L^2}{r^2 + p^2 l^2} + \frac{2 L l p^2}{r^2 + p^2 l^2} + \frac{2 Rr}{r^2 + p^2 l^2}$$

where $A = 1 - C L p^2$ and $B = C R p$, and p, as usual, $-2\pi n$.

This equation gives us the ratio of the potential differences at the generator and condenser end of the inductive line, L, R. Let us examine some particular cases.

(i.) Let $r^2 + p^2 l = \infty$, that is if there is no shunt, then

$$\frac{V_1}{V} = \sqrt{A^2 + B^2} = \sqrt{(1 - C L p_2)^2 + C^2 R^2 p^2}.$$

If the values of C_1 L_1 R and p are such as to make the quantity under the radical less than unity, then V is greater than V_1; that is, there is a rise of pressure as we proceed away from the generator end. This reduced case was first treated by Dr. Hopkinson long ago (see *Proc. Institution of Electrical Engineers*, 1884, p. 513.) It is easy to see that C, L, R, and p^2 may have such values that V_1 is greater, equal to or less than V.

(ii.) If $L = 0$, $l = 0$, $r =$,

then $\quad \frac{V_1}{V} = \sqrt{C^2 R^2 p^2 + 1}.$

This case, when there is no inductance and no shunt, is treated by Mr. Blakesley ("Alternating Currents," p. 32, second edition), and since $C^2 R^2 p^2 + 1$ is always greater than unity, V_1 in this case is always greater than V; that is, there can be no rise of pressure, but only a fall as we pass from the generator end to the condenser end of the line.

(iii.) Returning to the general case, it is easy to see that whatever be the values of $(1 - C L p^2)$ and $C R p$ it is possible to have such a small value for the impedance $(\sqrt{r^2 + p^2 l^2})$ of the shunt, that V must be less than V^1, and hence the pressure less at the condenser end than at the generator end. This investigation (given only in sketchy outline here) shows fully what takes place when an alternator is connected with a line, ending in such a short-circuited condenser, it indicates that the potential difference of the terminals of the condenser may be very much greater than that of the terminals of the generator. By trying different values of L, C, R, and p^2, we can see generally what the result is. We see at once that if l and L are both zero, and $r = \infty$, that V must be less than V_1, but that for critical values of L, C, R, and p^2, we may have V many times greater than V_1, as first shown by Dr. Hopkinson.

The general case of a line having capacity, resistance, and self-induction having a transmitting apparatus, having inductance and resistance at one end, and a receiver having the same qualities at the other end, has been fully and ably treated by Mr. Oliver Heaviside in the *Philosophical Magazine* for 1887 (Vol. XXIII., p. 21, January, 1887). If L_0 R_0 be the inductance and resistance of the transmitter apparatus, L_1 and R_1 that of the receiver, and if L, R, and C be the inductance, resistance and capacity of the line per unit of length, Mr. Heaviside has given the equation for the amplitude of the current C_0 at the receiver end of the line, when a periodic electromotive force of amplitude V_0 acts at the transmitter end. The cable having resistance R, inductance L, and capacity C per unit of length, and the transmitter apparatus having inductance L_0 and resistance R_0, and the receiver apparatus having inductance L_1 and resistance R_1. The equation for the current amplitude (leaving out of account for the present dielectric conductivity in the cable) is

$$C_0 = V_0 \frac{2\sqrt{C}\,p}{(R^2 + p^2 L^2)^{1/4}} [G_0 G_1 e^{2pl} + H_0 H_1 e^{-2pl} - 2(G_0 G_1 H_0 H_1)^{1/2} \cos(2Ql + 2\theta)]^{-1/2}.$$

In this equation p stands 2π times the frequency, or for $2\pi n$, P and Q are given by $P_2 = \left(\frac{pC}{2}\sqrt{R^2 + p^2 L^2} - Lp\right)$ and $Q^2 = \frac{pC}{2}\sqrt{R^2 + p^2 L^2} + Lp$, G_0, H_0 are certain complicated functions of the inductances, resistances, and capacity of the cable and of the transmitter apparatus, and G_1, H_1 the same for the receiver apparatus, and θ is likewise a function of all these quantities, whilst l stands for the length of the cable. This equation may be looked upon as a kind of glorified Ohm's law, by means of which the current C_0 at the far end of the cable may be calculated from the given constants and the volts V_0 at the home end. For further information readers must consult Mr. Heaviside's paper in the *Phil. Mag.* for January, 1887. Moreover, when we have the value of C_0. we have only to take the

London *Electrician*.

product of C_0 and $\sqrt{R_1^2+p^2L_1^2}$ to get the potential difference of the cable ends at the receiver end, and comparing this with the value of V_0 we are able to see if the pressure is greater at the receiver end. than at the transmitter end. Not to take up more space, I may say that I have attempted to get the necessary values of all these constants to test this theory in the case of the Ferranti mains. Taking it to be, as I think we may, correct, it is easy to employ it to calculate the rise of pressure at the receiver end in various cases. Thus, suppose a lamp of 10 ohms resistance and negligible inductance is placed at one end of five miles of the Ferranti cable, and an alternator of 10 ohms resistance and negligible inductance at the other end. Let the potential difference at the transmitter end of the cable be V_0, required to find the potential difference V_1 at the terminals of the lamp at the receiver end. It is not difficult to show that in this case V_1 should be *less* than V_0 in the ratio of 400 to 583.

If, however, the alternator has a resistance of 10 ohms and an inductance of .1 henry, and the receiver is a non-inductive resistance of 100 ohms, the cable being the same, then it appears there will be a *rise* in pressure, and that the potential difference at the receiver end will be greater than that at the transmitter end in the ratio of 100 to 70. I hope to treat this matter more fully on another occasion.

DINNER OF THE BOSTON ELECTRIC CLUB.

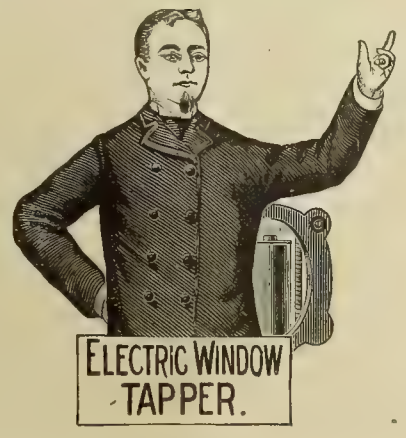
The Boston Electric Club had its regular monthly dinner at Young's hotel in Boston, Friday evening, January 16th. There were forty-two members present, and Vice-President C. J. H. Woodbury presided in the absence of President Griffin. Although the club entertained no guests, there were several outsiders in attendance as the guests of individual members. Among these was Mr. W. N. Colam, a member of the Institution of Civil Engineers, and of the Institution of Mechanical Engineers of Great Britain, and President of the Society of Engineers, who was the guest of Mr. George W. Mansfield. The company sat down about 7 o'clock, and after dinner there were pleasant speeches by Messrs. H. B. Cram, the retiring president, Col. C. M. Ransom, William N. Colam, of London, Eng., Thomas F. Goodrich, vice-president of the Niagara Insurance Company; Wm. D. Warner, Brown S. Flanders, inspector of the electrical wires; George W. Mansfield, the historian; R. D. Ross, Secretary, Dr. George L. Austin, William J. Denver, of the New England Telephone and Telegraph Company, and Frank Ridlon. Electrical topics were discussed, the evening being passed very pleasantly. The names of those present follow: C. A. Baldwin, J. L. Kimball, T. Stebbins, George R. Lean, F. E. Pettingell, George W. Adams, Alex. Hill, C. M. Goddard, J. C. Wilson, W. I. Barker, W. S. Key, F. M. Gilley, A. P. Bicknell, C. J. H. Woodbury, William D. Warner, C. A. Hawkins, A. E. Howes, F. J. Boynton, R. F. Ross, H. B. Cram, W. C. Fish, George W. Mansfield, W. J. Clark, A. A. Glasier, W. N. Colam, C. M. Kansom, F. M. Ferrin, Wm. J. Denver, B. S. Flanders, S. E. Barton, Thomas F. Goodrich, Henry R. Turner, C. F. Pollard, George L. Austin, H. H. Eustis, R. T. Robinson, Frank Ridlon, W. E. Holmes, W. C. French, J. R. Magee, L. S. Dumonlin, A. L. Rohrer.

BOOKS.

Illustrations and Descriptions of Telegraphic Apparatus.—The second edition of Terry & Finn's book, giving illustrations and descriptions of telegraphic apparatus, is meeting with a large sale. The second edition is limited in number of copies, and it will soon be exhausted. The scope of the work is best described in the preface, which reads as follows: "In publishing this work the authors have sought to bring within the reach of all telegraphers a book illustrative and descriptive of the principal telegraph apparatus in practical use upon the lines of the different telegraph companies at the present day. * * * * An additional, and it is hoped valuable feature of the book will be found in the article explanatory of the elementary principles of ordinary circuit testing and of Wheatstone Bridge measurements." The section devoted to the various methods of testing lines, etc., is a very valuable feature of the book, and any operator with a little mechanical ingenuity might construct apparatus to enable him to master the science with great facility. The special features of the second edition are the descriptions and illustrations of the methods of F. W. Jones, Gerritt Smith, and Moffatt and Blakeney of increasing the efficiency of the quadruplex. The price of the book, which is very tastefully gotten up, is $1.50. For sale by The Electric Age Publishing Co., World Bldg., New York.

AN ELECTRIC WINDOW TAPPER.

Pedestrians have often noticed and probably often mingled with a crowd gathered in front of a store window watching some mechanical figure patiently tapping the window pane to attract the attention of passers-by to the display of goods in



plain view. Usually these tappers spoil the effect of a tasteful display by their manner of construction and the rough clothing they wear, but in a new electric window tapper, which we illustrate here, the Broadway Electric Company, of 703 Broadway, New York, introduce to the public a polished gentleman in a dress suit, who will add to the effect of any goods he may display.

Modern Views of Magnetism.—"In dealing with magnetic circuits," says Prof. Silvanus P. Thompson in his recent lecture before the Junior Engineering Society, London, "we must cut ourselves off from those medieval notions about magnetism which still haunt the text books of physics." These books contain many things which are supposed to be facts, but which in reality are not the facts which they purport to be, but are far from the truth. In his recent Cantor lectures, delivered before the Society of Arts in London (full abstracts of which were published in the Electric Age), Prof. Thompson shows in a very clear and able manner the innaccuracies which exist in the books referred to, and proved incontrovertibly that many facts stated therein were in reality quite the reverse. These misleading statements, of course, were not put into the books for the purpose of false teaching. At one time they were accepted by scientists in general as correct, but the light of later research and study has proved them to be otherwise. Prof. Thompson has done more than probably any other person to clear our knowledge of electricity and magnetism, and the various manifestations of these forces of doubts and uncertainties. He also has greatly aided us in forming different and clearer notions of these forces, thus enabling us to grasp with a better understanding the idea of their nature. Magnetism used to be regarded as a sort of fluid (or fluids) distributed over the end surfaces of poles of magnets. The alleged fluids are pure fictions and the existence of a polar surface is a pure accident. The strangest thing about magnetism as demonstrated by Prof. Thompson is the fact that the most highly magnetized part of a magnet is usually that part which shows upon its surface no trace of polar action. Magnetism is in truth, an internal rather than an external phenomenon. It is possible to have a steel ring so magnetized that the magnetism shall be entirely internal, the magnetic lines never coming up to the surface. Such a ring magnet does not possess the power of attracting iron filings or of perturbing a delicate compass needle. These tests prove most positively that there is no external manifestation of magnetism, and to prove that the ring is magnetized internally it is only necessary to cut the ring. At once the surfaces produced by the cut exhibit all of the well known magnetic phenomena, such as the power to attract iron filings, deflecting a compass needle, etc. A pole or polar region of a magnet is, therefore, simply that part of the surface where the internal magnetic lines emerge into the air. Only such parts —the surface of gaps in the magnetic circuit— exhibit any such properties as those to which formerly the virtues of magnetic fluid were attributed.

Condensers for Alternating Currents.—In the manufacture of commercial condensers for high pressure alternating currents, insulation is the first difficulty met with. The dielectric must be very thin or the condenser will be too bulky. In small pieces, a dielectric of a given thickness will stand up under greater pressure than large pieces of the same. Another difficulty in the line of condensers arises from absorption which gives the condenser an apparently greater capacity. Mr. James Swinburne, in his recent lecture before the Physical Society in London, gave many interesting facts in connection with this class of condensers. He showed that when a thin plate of mica is put between tin foils in alternating current condensers it heats excessively and a luminous layer of minute sparks appears under the foils. In a dielectric which heats there may be three kinds of conduction, viz.: metallic, when an ordinary conductor is embedded in an insulation; disruptive, as probably occurs in the case of mica, and electrolytic, which might occur in glass. The dielectric loss in a cable may be serious. Calculations showed that the loss in one of the Deptford mains in London was 7,000 volts.

Westinghouse Business Brisk.—The brilliant record which the Westinghouse Electric and Manufacturing Company made during the last year in the installation work of the company's alternating current electric lighting apparatus, and also in the supplying of electric street railroad equipments, has not in the least diminished since the first of the year. While, owing to the holiday season and the annual stock taking period, activity at the shops was temporarily impaired, the incoming contracts for new work have considerably accumulated. During the week ending January 14th the contracts for electric street railway equipments were alone in excess of $250,000, and the company has now sufficient work under contract to keep the shops in full operation until spring. The outlook is equally promising in the alternating current arc and incandescent work.

Induced Current System of Lighting.—The induced alternating current system of lighting was first brought to public notice in 1883 by the English electricians, Gaulard and Gibbs.

The Jablochkoff Candle.—This candle, or lamp, cannot be used in connection with continuous currents. It requires alternating current.

Resistance of Filaments.—The filaments of incandescent lamps when cold have nearly double the resistance of the same filaments heated.

CARE OF ACCUMULATORS.

There are two troubles which beset most accumulators, viz., buckling of plates and bad forms of sulphating. To these, all other difficulties, with few exceptions, may be traced. Buckling is almost unknown in well managed installations. When cells are left to rest for a long period, they should be thoroughly charged; and, once a month afterwards, a good charge should be given them. This will keep the plates from sulphating, which arises from total discharge by leakage and local action, always present in a small degree. If by any chance the positive plates should sulphate, which is shown by the chocolate color turning greyish all over the surface, or in patches, the action must at once be stopped, or the battery will be spoiled.

The color of the edges of the plates gives an indication of what is taking place over their surface; so that, if there is not a marked difference in color between the positive and negative plates, a careful examination should be made. The results of bad sulphating are scaling, the falling out of paste, buckling, and short-circuiting, and, in the last case, the grids generally become rotten; while the causes may always be traced to the acid solution being too weak or too strong, but more generally to the cells having been habitually discharged too much, or left standing for a long period with little charge in them. Short-circuiting will naturally do this also, since the plates become discharged. A leakage in the circuit may discharge the battery, without the knowledge of the user. Bad insulation of the cells themselves will produce the same result.

An easy test for the insulation of the accumulator is to wet the back of the hand with weak acid, and place it against the shelves; should the insulation be faulty, a pricking sensation is felt, which becomes painful if 100 volts are used. Should higher voltage be employed, it is not safe to make this experiment. At 200 volts the shock is strong, but varies with every individual; for some people do not object to 210 volts, whilst others cannot stand sixty, especially those who suffer from damp hands.

All currents may be regarded as dangerous to the person after 250 volts, but the pressures of 60 to 100 volts, which are harmless under ordinary circumstances, may prove highly dangerous under peculiar conditions. For instance, a man may be on a pair of steps placing a new lamp in a fitting, and unexpectedly get a slight shock, due to leakage or otherwise, and then the start it gives him may cause a fall from the steps. It is, therefore, always advisable to cut both leads when any one is attending to fittings, or doing any work on the circuit.

To return to the cure of sulphating, a continual charging below maximum rate, half to start with, for a prolonged period, will gradually reduce the unhealthy sulphate to the healthy form (*i.e.*, Pb_2SO_5 to $PbSO_4$) and finally charge the plates by conversion of the $PbSO_4$ to PbO_2. The task is tedious, but it must not be hurried, or the positives are certain to buckle. Most of the white sulphate will fall off in scales, but should any stick between the plates, it must be pushed down with a piece of wood or a flat strip of ebonite which is the best. But on no account should a piece of metal, or any other conducting substance, be employed for this purpose.

White sulphate is a very bad conductor, so that the exposed surface of the plates in the battery is much reduced by its presence. The maximum charging current is, therefore, too large; but the current may be increased as the white substance falls off or disappears. If the sulphating has become very bad, these scales often separate from the plate with the blocks of paste which they overlie. This is very vexatious, for the capacity of the battery becomes much reduced by loss of active material; and great trouble is experienced in getting from between the plates these pieces, which, if not removed, short-circuit the cell.

In the most recently improved cells, in which the plates are placed farther apart, the paste will occasionally stick between the plates, although it would appear at first sight to be impossible. It may occur in three ways. The first is when the plates are in bad order, they frequently lose their flatness; and, consequently, the original distance between them is no longer maintained. The second is that some samples of paste are apt to throw out short crystal needles, which entangle the paste in its fall. Finally, the opposite blocks of paste may so fall as to encounter one another.

It frequently happens, when a battery is first erected, that very large scales come off the positives. The plates in new cells must, therefore, be watched for a few weeks, and any scales that may be observed should be removed from between the plates. If this is done carefully the trouble soon disappears.

A good plan is to clear a little of the deposit off each positive with a stick, and so offer some healthy surface to the current, lowering the resistance of the battery, and facilitating the reducing process.

Where the fault is great, the best plan is to clean the battery properly. After bad sulphating the capacity of the cells must be less, in consequence of the loss of some of the active material. The cleaning of a battery consists in removing the sections from the cells, separating the sets of plates, and scraping the white deposits off the positives. There is no need to remove the plates from the lead strips, for by bending them apart plenty of room is allowed for manipulation. In cases where the plates cannot be parted, they must be reached as well as circumstances permit; and generally no difficulty occurs. The wire brush material, sold under the name of carding, will serve to do the work satisfactorily. A piece of this is cut to six by four inches, and nailed to a block of wood an inch thick. The brush is now applied to the positives until they appear their proper color, and they are finally washed with the electrolyte, and on no account with water, or sulphating will set in immediately. This done, the cells are again made up, and new solution is employed. They are then ready for immediate charging, and they should be regularly over-charged and watched for some time. The cells also should be cleaned from any deposit. The old acid answers well for washing the plates with, and for placing the negatives in whilst waiting; for these, being wet, are injured by exposure to the air.

There is considerable risk of accident from short-circuiting, if a cell is moved with the electrolyte in it. Therefore, unless skilled labor be employed, it is best to syphon off the liquid. So long as the electrolyte touches the plates there is possibility of short-circuit. This must, therefore, be drawn off completely, and then no accident can possibly arise.

If the positives are past recovery, it is cheapest to have a new set. The process just described for cleaning a battery is employed for buckled plates with the difference that these require to be straightened. This is effected by placing thin boards between every positive plate (or negative, if at fault), so that all the plates are parallel, and in the same position, as when in the cell, or the connecting strip of lead will be bent. The plates, with the interleaved boards, are then laid on their side, upon the ground, and pressed until they are quite flat. No attempt should be made to flatten by means of hammering, as this is sure to loosen the paste. As soon as the battery is reconstructed, charging should be commenced.

When the negatives are removed from the cells, they, on drying, become hot; and this is probably due to the finely divided lead they contain oxidizing in air.

Negatives exposed to the atmosphere for a length of time, especially if it be moist, show signs of blistering in use. This is very troublesome for the blisters frequently become detached in the form of scale, which sticks between the plates, thus partially short-circuiting them, and eventually causing the positives to sulphate.

Blistered negatives often exist which do not drop the scale, and, in this event, no evil consequences follow; but the risk should not be incurred. With new cells the negatives often blister, from careless manufacture. If a cell becomes completely exhausted, or by chance reversed, the negatives buckle; but, as a general rule, it is only the positive plates which are subject to this trouble.

It is always advisable to charge well before cleaning or straightening plates, because the air does not then act so prejudicially upon them.

If the positives sulphate, the surface becomes very hard; but, when in good order, the surface of the paste, as well as that of the grid, is soft; and the color comes off readily on the finger, like pigment.

When the positives get into a very bad state, the negatives are generally in a similiar condition.

Much loose scale, from positive or negative plates, may be removed by taking the sections apart, and agitating the sets of plates, separately, in a cell of liquid.

Buckling may be produced by too high a charging or discharging rate. It often arises from pieces of loose paste sticking between the plates, which cause an unequal resistance between the surfaces, so that expansion and contraction are not symmetrical. When this occurs, the plates are often of a good color. In all cases the framework, or other means employed to keep the sections together, must be so made as to allow for the expansion of the positives. The allowance need be very small, since the plates are generally put together in the expanded condition, *i. e.*, in the unformed state; but slight after-variations should be taken into account. Sometimes plugs of paste drop out when everything appears right, and the cause is usually found to be that a large discharge has been taken suddenly. Therefore, this proceeding should be avoided.

If a film appears all over the inside of the cell, partially obscuring the plates, the water mixed with the acid has been impure. When this occurs, much inconvenience arises from inability to see the edges of the plates properly; but no actual harm is done, and it can be entirely avoided by allowing the solution to settle after mixing and bailing it out, leaving the sediment undisturbed. A slight quantity of powder, at the bottom of the pots, will always be found; this consists chiefly of the white sulphate removed during the first few chargings.

Frost on Telephone Wires.—In Stockholm, the recent severe white frost proved very troublesome for the telephone company, and interfered materially with their business. The constantly increasing weight of the hoar frost broke a number of wires. Great efforts have been made to counteract the frost, and the company has tried to melt it by sending currents through the wires from the electric light installation. The remedy, however, proved worse than the disease.

Dynamos as Motors.—A series-wound dynamo when used as a motor, runs in the opposite direction to that in which it has to be driven when used as a generator. To make the machine run in the same direction, the coupling between the field and armature must be reversed. With a shunt machine this is not so. The coupling between field and armature remains the same when used as a motor.

Attaching Filaments to the Platinum Wire.—Incandescent lamp filaments are attached to the platinum wires by different methods. Edison forms the union by copper plating.

ELECTRO-MAGNETIC MECHANISMS.*

BY PROF. SILVANUS P. THOMPSON, D.SC., B.A.

Introductory.

To the mechanical engineer the study of the electro-magnet presents many interesting problems. By its means power transmitted electrically along a conducting wire produces a mechanical motion. The conditions of that motion constitute in one sense a purely mechanical problem, though the electric and magnetic conditions under which the power is supplied, and upon which the motion depends, belong to electrical science.

Consider at the outset in what an electro-magnet consists. The magnetic portion of it usually comprises two parts, a fixed iron core, straight or bent, and a movable piece of iron called the armature, the two being themselves portions of a magnetic circuit. The electric portion of it is a coil of insulated copper wire, usually encircling the iron core with numerous convolutions. When an electric current is switched on in the copper wire it produces upon the iron core a magnetic action. The magnetizing force of the coil is strictly proportional to the electric current that is flowing in the wire and to the number of convolutions which that wire makes around the magnetic circuit. But the amount of magnetism induced in the core is not simply proportional to the magnetizing force alone: it depends also upon the perfection or otherwise of the magnetic circuit. If the magnetic circuit constituted by the iron core and its armature, and the intervening air-gaps is of insufficient cross section, or of poor quality of material, or of inordinate length, or if the gaps in it are considerable, then its reluctance to magnetization may be so great that very little magnetism will be induced in it, even by the application of considerable magnetizing power. The principle of the magnetic circuit, about which much must presently be said, is of the first importance as a key to the behavior of electro-magnets. A second guiding principle is to be found in the tendency which a magnetic circuit exhibits to perfect itself. That is to say, a magnetic circuit when subjected to a magnetic force tends, if so arranged that any part of it can move, to so alter its configuration as to become as compact as possible. If the armature, for example, is movable, and placed at some little distance away from the ends of the core or cores, it will be mechanically urged into greater proximity, so that core and armature may together constitute, as nearly as possible, a closed circuit of iron. In doing so the armature performs mechanical work. The action of the common horse-shoe form of electro-magnet in drawing up its armature, as in the ordinary sort of electric bell, is an elementary illustration of this principle.

A second form of electro-magnet consists of a tubular coil of copper wire into the hollow of which a long iron plunger is drawn when the electric current flows around the coil. This coil and plunger species of electro-magnet possesses several mechanical characteristics which distinguish it from the horse-shoe form; but the principle of the magnetic circuit applies equally to both.

Modern Views of Magnetism.

Now, in dealing with magnetic circuits we must carefully cut ourselves off from those medieval notions about magnetism which still haunt the text-books of physics, according to which magnetism is regarded as a sort of fluid (or fluids) distributed over the end surfaces (or poles) of magnets. With polar distribution of supposed magnetic fluids we have nothing to do. The alleged fluids are pure fictions; the existence of a polar surface is a pure accident. The most highly magnetized part of a magnet is usually that part which shows upon its surface not a trace of polar action. The particular form of iron core which can be more highly magnetized than any other, namely, an iron ring closed upon itself, has no magnetic poles. Magnetism is, in truth, an internal rather than an external phenomenon. It is possible to have a steel ring so magnetized that the magnetization shall be entirely internal; the magnetic lines flowing around wholly within the metal, and never coming up to the surface. Of course such a ring magnet is incapable of attracting iron filings or of perturbing a compass needle. The evidence that such a ring is magnetized internally is very simple. If cut or broken across such a ring forthwith exhibits polar properties at the cut surface. A pole or polar region of a magnet is simply that part of the surface where the internal magnetic lines emerge into the air. Only such parts—the surfaces of gaps in the magnetic circuit—exhibit any such properties as those to which formerly the virtues of magnetic fluid were attributed.

The appropriate modern mode of regarding magnetic phenomena is to consider the various materials—iron, steel, air, and the rest—as being in various degrees *conductors of magnetic lines*, magnetic lines being stream-lines in the medium, conventionally taken to represent by their number and direction the quantity and direction of the flux of internal magnetization. Soft annealed

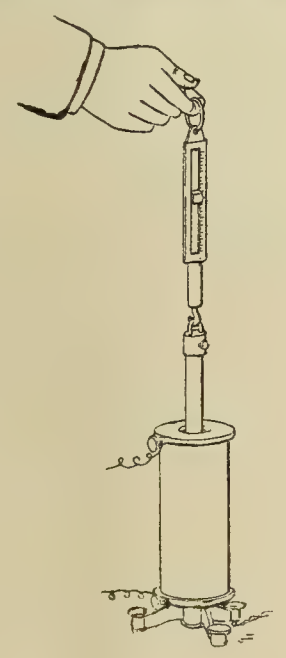


FIG. 1.

wrought iron is, for example, an excellent conductor of magnetic lines, being more permeable magnetically than any other known material. Magnetic permeability is a term to which a precise numerical notion has been attached, being the ratio between the magnetizing force and the resulting intensity of magnetic induction in the specimen. This mode of regarding the matter has resulted from the modern study of electro-magnetic apparatus. The necessity of such ideas did not occur to the earlier workers in magnetism who were dealing exclusively with magnets made of steel or of loadstone permanently magnetized. They thought of poles acting from a point, as it were, attracting a piece of iron at a distance from it. We, on the other hand, have rather to think of stresses in the path of the magnetic lines. Wherever there is a gap in the magnetic circuit between iron and iron there is a magnetic stress urging the configuration so to change as to close up the gap. This stress urges the armature of the electro-magnet toward the iron core. You may call this an attraction of the one by the other if you prefer that way of putting it. Only beware, for this attraction does not vary as the inverse square of the distance between iron and iron; it depends solely upon the intensity of the magnetic flux in the intervening medium being proportional to the square of that intensity. The space crossed by magnetic stream lines wherein such magnetic stresses are in action is known as a magnetic *field*.

Invention and Development of the Electro-Magnet.

Immediately following the discoveries in 1820 and 1821 by Oersted, Ampére, and Arago of the magnetic properties of electric currents came, in 1825, the invention of the electro-magnet by William Sturgeon, of Woolwich. The apparatus he first produced consisted of a bent iron rod, about 1 ft long and ½ in. in diameter, varnished over and then coiled with a single spiral of stout uncovered copper wire of 18 convolutions.

For the first time there was thus put into the hands of the electrician a magnet capable not only of being excited and discharged at will, but of being operated from a relatively great distance by means of the electric wire. Sturgeon constructed numerous electro-magnets, some of the bent or horse-shoe pattern, others with straight bars or rods of iron as cores. In those days, copper wire overspun with silk or cotton was unknown as an article of commerce, and gutta-percha coverings were as yet undiscovered. Sturgeon was content to use uncovered copper wire of considerable thickness wound in one layer only. To excite the power of electro-magnets furnished with so few convolutions of wire, it was necessary to work with relatively large electric currents: and to this end Sturgeon devised special forms of voltaic cell. Such currents cannot be conveyed to great distances through thin wires; hence the distance from which such primitive instruments can be operated is very limited. This objection was removed in 1828 by Prof. Henry, who discovered the great advantage to be gained in distant working by increasing the number of convolutions of wire. He employed copper wire from 25 to 40 mils in diameter, covered with silk, and coiled on in many successive layers. Shortly after Henry's modification of the apparatus to the purpose of efficient working at a distance through long lines of wire, Joule made further modifications for the purpose of obtaining the greatest adhesive or tractive power; the special forms of electro-magnet which he devised being distinguised by the compactness of their magnetic circuit. Other workers, such as Roberts, Radford, and Romershausen, followed in the track. In the United States, Page applied the coil-and-plunger form to the construction of electro-magnetic engines. Telegraphic needs led to the production of forms of electro-magnets adapted to rapid working. Other forms specially intended to secure a greater range of action or greater uniformity to pull within the range were developed under the necessities arising from the application of the electro-magnet in the mechanism of electric arc lamps. Of all these various matters I have lately treated at some length in my Cantor lectures before the Society of Arts.

Analogies between the Electro-magnet and the Steam Cylinder.

In moving, under the stress of the magnetic field, the armature of an electro-magnet may do mechanical work. The work done will, of course, be the product of the displacement into the average force. One is naturally led to institute a comparison between the work done in the stroke of an ordinary steam engine piston and the work done in the stroke of the armature of an ordinary electro-magnet. In neither case is the force uniform from end to end of the stroke. In the case of the engine piston the pressure rises very suddenly at the beginning of the stroke, remains at its maximum for but a very short period then falls continuously to the end of the stroke, the precise manner of diminution being dependent upon the mode in which the valve is constructed and adjusted, and upon the conditions of supply generally. In like manner the magnetic stress which urges the armature, varies from end to end of the stroke, but in a wholly different manner. At the beginning of the stroke, when the armature is some distance away from the fixed core, the stress is small. As it approaches, the magnetic field between them becomes more intense, and the stress, which is proportional to the square of that intensity, grows greater, becoming a maximum at the point of nearest ap-

* Presidential Address to the Junior Engineering Society.

proach at the end of the stroke The range of motion in the case of an ordinary electro-magnet is extremely limited, measurable in tenths, or more ordinarily in hundredths only, of an inch. This is due simply to the smallness of the stress when any considerable thickness of air is interposed. Herein arises so serious a disadvantage in the mechanical problem of utilizing electro-magnets for motive power that the late Robert Stephenson once gave this as an emphatic reason why electricity could never compete with steam power. Many devices have been suggested for increasing the range of action of electro-magnets, of which more must be said presently. The coil-and-plunger form of electro-magnet, which has a much greater range of motion though with feebler average force, presents a still greater similarity to the cylinder-and-piston mechanism of the steam engine. In this case the length of stroke and the distribution of the force between the beginning and end of the stroke depend not only on the length of the tubular coil, but on the length and shape of the plunger. With a cylindrical plunger of soft iron of a length greatly exceeding that of the tubular coil, the pull increases gradually as the end of the plunger enters the mouth of the coil, becoming a maximum just as it emerges at the further end, and thence falls off again rapidly. If plungers are used not greater than the length of the coil, they reach the position of maximum pull when they are immersed about half their own length into the mouth of the coil. A simple way of testing the fact is afforded by hanging the plunger to an ordinary spring balance, and noting the pull exerted by the coil as the plunger is immersed to various depths, as in Fig 1. A very short cylinder or a sphere of iron is only pulled just as it enters the mouth of the coil. With coned plungers, the range is extended, long coned plungers being pulled with a force that increases even after their tip has begun to protrude through the end of the tubular coil.

It is extremely important to note that whereas the steam cylinder is, in almost all modern engines, the electro-magnet is, in all ordinary cases, a single-acting mechanism. The armature is drawn magnetically up, but not driven magnetically back. It is simply allowed to return, the electric current being cut off to enable it to move away. The only exceptions to this rule are to be found in the few cases where so-called *polarized* armatures are used; that is to say, armatures previously magnetized in a particular direction. These can be alternately attracted and repelled by reversing the direction in which the current circulates around the electro-magnet core.

This analogy between electro-magnet and steam cylinder is no unimportant one. To the electric engineer the electric magnet with its armature constitute the central organ of all electric machinery. Just as the mechanical engineer must acquaint himself to the last detail with all that goes on in the cylinder, must experiment and study, by the aid of indicator diagrams, the expansion of the working agent, the effect of the lap and lead of the valves, of fluid friction in the port-holes, of rapid condensation of the exhaust steam, and the like, so the electrical engineer must follow the operations of the electro-magnet, must watch the progress of magnetic saturation of the core, ascertain its retentiveness, observe the effect upon its performance of varying the configuration of the parts, of throttling the induction by insufficiency of action and the like.

(To be continued.)

DECISION IN PATENT CASE.

On January 6th, Commissioner of Patents Mitchell, rendered a decision of general interest to electrical inventors. It was in the case of an appeal by Mr. Thomas A. Edison from the decision of the Examiners-in-Chief in reference to certain claims in an application by Mr. Edison for a patent on a phonogram blank.

The claims appealed are as follows:

"1. The combination, with a phonograph, of a removable phonogram blank, substantially as set forth.

"2. In phonographs, a phonogram blank carrier adapted to receive a removable phonogram blank, substantially as set forth.

"3. In phonographs, the combination, with a phonogram blank carrier, of a removable phonogram blank, substantially as set forth.

"4. In phonographs, the combination of a phonogram blank carrier adapted to receive a removable phonogram blank, with separate recording and reproducing instruments, substantially as set forth.

"5. In phonographs, the combination, with a phonogram blank carrier adapted to receive a removable phonogram blank, of a reproducer and means for adjusting the reproducer laterally across the track of record, substantially as set forth."

The references are patents to applicant, granted, respectively, May 8, 1888, No. 382,416, and July 31, 1888, No. 386,974.

The Examiners-in-Chief did not think that appellant's invention was disclosed with sufficient particularity in Patent No. 382,416 to make it a valid reference, but rejected the said claims on Patent No. 386,974, which issued on an application pending concurrently with the present application, upon the ground that said claims were for indivisible parts of the same invention covered by said patent. Applicant now appeals from this decision. The question to be decided then, is, is applicant's Patent No. 386,974 a sufficient reference?

The object of applicant's invention as stated in his application is—

"to enable the transmission of phonograph records from place to place and the reproduction of the sounds upon different machines."

He further states that—

"this necessitates the construction of a phonogram blank which will enable the phonogram blank to be removed from the machine upon which the record is produced and to be adapted to be again placed upon the same machine or another machine and have the sounds reproduced from the record. * * *

"I prefer to use cylindrical phonogram blanks made entirely or having a recording surface made of wax or a wax composition. These blanks have cylindrical outer or recording surfaces and are preferably provided with tapering bores which fit upon phonogram cylinders having a corresponding taper. The blanks hold themselves in position by the friction of the tapering surfaces.

"My invention, however, is not limited to any particular form of the blank or of the blank-carrier, or any special form of the phonograph apparatus, since the feature of the removable phonogram blank can be embodied in a great variety of forms of blank and constructions of apparatus and has been so embodied by myself."

The specification describes and the drawings represent the phonogram blank having a cylindrical exterior and a tapering bore, being the blank spoken of in the foregoing extract as the preferable one, and the generic claims which are appended to the specification are simply broad statements of the invention embodied in the described and illustrated blank and blank-carrier.

Now, precisely the same blank and blank-carrier, in all the respects specified, were described and shown in Letters Patent to Edison, No. 386,974, of July 31, 1888, and both carrier and blank were included in the appended claims. Among the claims referred to are the following:

"24. In a phonograph, the phonogram-cylinder tapering throughout its length, substantially as set forth.

"25. In a phonograph, the combination, with the cylinder shaft mounted in bearings and projecting at one end beyond such bearing, of a smooth surface phonogram-cylinder tapering throughout its length and carried by the shaft outside of its bearings, substantially as set forth.

"26. In a phonograph, the combination, with a tapering phonogram-cylinder, of two or more phonogram-blanks of different lengths having tapering bores adapted to fit said phonogram-cylinder and provided with cylindrical recording surfaces, substantially as set forth.

"27. In a phonograph, the combination, with a tapering phonogram cylinder, of a phonogram having a tapering bore and a cylindrical outer surface held upon said cylinder by friction, substantially as set forth.

Letters Patent to Edison, No. 382.418, of May 8, 1888, granted prior to the filing of the present application, and referred to in Patent No. 386, 774, contained the following claims:

"1. A phonogram blank or phonogram having a bore tapered throughout its length, substantially as set forth.

"2. A phonogram blank or phonogram having a cylindrical recording surface and a tapering bore, substantially as set forth.

"3. A phonogram blank or phonogram having a cylindrical recording surface of wax or wax like material and provided with a tapering bore, substantially as set forth."

The facts thus presented bring the case clearly within the doctrine of *ex parte Lord*, (50 O. G., 987) where, after citing special cases "where division is impossible." it was added:

"So, also, where claims based upon the same structure to secure the same invention are formulated, some to cover it in a broad or generic form, while others are drawn so as to be more specific in character. In all such cases one application only will lie, because manifestly broad and narrow claims for the same invention are not claims for different inventions. The failure to fully or adequately claim a given invention can be corrected by re-issue when a case is made out within the statute; but a second original patent for the same invention, whether contemporaneously pending or otherwise, cannot be allowed under any circumstances. An invention, restrictedly stated, does not become a different invention when claimed more broadly or generically."

So, also, in *ex parte Holt* (C. D., 1884, 43, 29, O. G., 171), where the purpose sought to be accomplished was—

"to divide the invention upon a line determined merely by the scope of the claim upon the same thing, claiming the species in the earlier patent and the genus in the later one,"

the decision held that such a course could not be permitted.

In *ex parte Mullen and Mullen* (50 O. G., 837) a class of cases is referred to in which the claims differ among themselves only as they constitute different statements of one and the same indivisible invention. With reference to such cases it was said:

"In all such cases one application only is permissible, whether pending concurrently or not, because only one patent can be granted for a single invention, and a second patent for the same invention under another guise would result inevitably in an illegal extension of the period of exclusive use."

To allow the present application would be, in effect to grant a reissue of one or both of the patents already granted, and in so doing to extend the monopoly to nearly twenty years. Of course such a result is not to be contemplated.

This case is to be clearly distinguished from that presented in *ex parte Edison*, (C. D., 1889, 234, 49 O.G., 1591.) In that case, after reciting the several facts upon which the decision was based, the Commissioner said:

"These facts should all be kept clearly in mind, as the question to be disposed of is, what is the law applicable to such facts, and not what is the law applicable either to divisional applications or to applications for two or more patents upon one subject matter which is incapable of division."

To grant the present application would be to prevent the public from having the benefit of the invention at the expiration of seventeen years from the beginning of Edison's monopoly thereof, and because the statute expressly limits the duration of the period of exclusive use of a given invention to seventeen years, the prior patents to Edison must be held to be adequate references, and the decision of the Examiners-in-Chief is affirmed.

NEW YORK NOTES.

The gas commission has awarded contracts for lighting 829 street lamps by electricity for the ensuing year. The cost will be 40 cents a lamp a night for nearly all except 19 in the upper district, which will cost 50 cents.

There was a trial of the Stewart-Hall electric train-order signal at Somerville, N. J., January 15th. A special train went out from Jersey City over the Central Railroad of New Jersey with a load of railroad superintendents to see how the signal worked. Robert Stewart, superintendent of telegraph of the Central, is the inventor of the device. The operator in the station presses a button and the semaphore arm is raised. The Central Railroad of New Jersey has adopted the system.

Mr. E. L. Bradley, contracting agent of the New York branch of the Brush Electric Co., 36 Union square, has resigned his position with them, and accepted that of manager of the firm of Prentiss Calendar and Time Co., of 40 Maiden lane, New York. Mr. Bradley has had an extended experience in the various departments of electrical specialties; and met with well-merited success with the Brush Electric in this district.

There has been a large volume of business done from the New York office of the Brush Electric Company lately. Among the contracts which Mr. E. L. Bradley, the company's late contracting agent, closed is one for a complete incandescent light plant for a large cotton mill in South America. They are also just completing an installation of 1000 incandescent lights for Fahy's Watch Case Company of Sag Harbor, L. I. This company is meeting with well-merited success in contracting for, and putting into successful operation, large installations of light and power. The New York offices, located at 36 Union square, are under the general management of Mr. S. M. Hamill, who is also the secretary of the company. John A. Cass is Superintendent of Construction.

The annual meeting of the Walker Electric Co., 50 Broadway, City, was held on January 13th, and the following officers and directors were elected: Edwin Scott, president; George W. Walker, vice-president and general manager; Lewis G. Tewkesbury, secretary and treasurer. Board of Directors, Edwin Scott, Austin W. Goodell, James M. Sigesus, George W. Walker, Lewis G. Tewkesbury, Edgar Elliott, Charles R. Truex. The business during the past year has been most encouraging and the future of the company is fully assured. The following sales of Walker Meters are reported: Narragansett Electric Light Company, Providence; Indiana University, Bloomington, Ind.; Steuben Electric Company, Hornellsville, N. Y.; Lebanon Electric Light Company, Lebanon, N. Y.; Mt. Holly Electric Light and Power Company, Mt. Holly, N. J.; Holtzer-Cabot Company, Boston; Gould's Manufacturing Company, Seneca Falls, N. Y.; Electro-Dynamic Company, Philadelphia; Pacific Electrical Storage Company, San Francisco. Mr. William Hood, of Chicago, has taken the general agency for the State of Illinois.

Within the past two years a number of arc lamps have come on the market to run on alternating systems of incandescent lighting, but it seems that none of them have met with very great success. Mr. B. B. Ward, the consulting expert electrician of the Electrical Supply and Construction Company, 18 Cortlandt street, has been experimenting for some time on an arc lamp for alternating currents for electric lighting, and has been successful in hitting upon a happy idea in a lamp for this service, and patented the same. This is the latest improvement in arc lamps for alternating currents. The lamp is so constructed in its vital parts as to avoid any possibility of derangement or heating, by a method entirely new which is also the invention of Mr. Ward. There is only one magnet used in the lamp to regulate the feed and there are very few parts to operate the carbons. This lamp will give a perfectly white light on 8 amperes of current and 50 volts and does not vary in giving an even steady light; there is no flickering or quivering.

C. C. Sibley & Co, 416 and 418 West 26th street, are manufacturing contractors of dynamos, motors, fire alarm supplies, etc. The firm consists of C. C. Sibley and J. H. Jahn, both gentlemen having had long experience in the manufacturing and engineering of electrical and mechanical industries. This firm was started some years ago in a small place further down town, and in their present location they started business nearly two years ago. They are manufacturing to-day a large line of electric light specialties for arc and incandescent lamps, sockets, switches, etc.

W. H. Gordon & Co., 115 Broadway, reports an excellent demand for the Star Electrix goods. The Electrix switches, sockets and cut-outs are among the best goods of their class in the market. The firm also report an unusually good demand for Ellis' oil filters, the excellence of which is well known and merited. Mr. Gordon is successfully bringing these filters to the attention of electric light and power companies, and their merits are beginning to be generally recognized. They are sold subject to thirty days' trial, and Mr. Gordon says that it is a remarkable fact that not one has yet been returned after a trial has been given; they have all been accepted. The firm is adding other specialties of interest to electric light and electric railway companies.

The Eureka Electric Company have installed a 1,000-light plant in the Manhattan Bank building, 40 and 42 Wall street. The installation consists of two 400-light dynamos of the latest design. Between 40,000 and 50,000 feet of Grimshaw's best White Core wire was used in wiring the building, and the steam power plant consists of two Beck automatic engines of 57 h.p. each, installed by Cook & Co., 22 Cortlandt st. Loomis' 16 candle power incandescent lamps are used throughout.

The company built a handsome marble switchboard for this plant, 2 x 10 feet, with 13 circuits. At each end of the switchboard is located an ampere meter, while in the centre are placed the voltmeter and ground detector. Three plugs open the circuits from the dynamos to the switchboard, the middle one being used to connect the two dynamos in multiple or so that they may be worked separately. Each dynamo can be cut in on all the circuits separately. The work on this installation was begun about two months ago and it is now in actual operation. The Eureka Electric Company feel proud of the results of their efforts in this case, and they certainly have good reason to exult.

The U. S. Electric Railways Company, which was organized a short time since, have attractive and comfortable quarters at 10 Wall street, this city. The company are contractors and engineers for electric railways, steam plants and power plants, and do all work connected with the installation of such plants, of any system whatever. The company also gives special attention to the reorganization of street railway companies desiring to adopt electricity as the motive power. Negotiations for the sale of street railway bonds also come within the limits of the company's field of operations. The officers of the U. S. Electric Railways Company are: Wolstan R. Brown, President; Lemuel Wm. Serrell, M. E., General Manager; William L. Clark, Counsel. The names of these well-known gentlemen at the head of the concern is sufficient guarantee of the high standing of the company, and their ability and knowledge, which is of the highest order, will find valuable application in their new undertaking. There is every prospect that the company will experience a prosperous and successful career.

Alexander, Barney & Chapin having added to their space the entire basement under their store, are now engaged in cutting a hole in the floor of the store to communicate by stairs with the basement. The basement is to be used exclusively as a store room and packing room, and it will relieve the main store of the accumulation of goods which are now lying all over the floor. The firm is also making extensive changes in the arrangement of their offices, with a view to securing more room and dividing up the space to better advantage. The offices are located in the rear of the main store.

Mr. B. F. Kelley & Son, 91 Liberty st., City, are the sole representatives in this section, including New York and New Jersey and part of New England, for the Berriman Feed Water Heaters. These gentlemen have been in this territory for a number of years and have successfully introduced these feed water heaters into the leading electric light, electric railway and power stations, as well as a number of isolated plants in this vicinity. These feed water heaters are sold on their merits entirely and are said to give a larger percentage of super-heated water for boiler feed than any other feed water heater. Among the latest installations of these heaters is two of 500 horse-power for the Rochester Street Railway Co., Rochester, N. Y., and four for the Newark Electric Light and Power Co., Newark, N. J.

S. Bergmann, 527 to 537 West Thirty-Fourth street, city, long known as a manufacturer of electric light specialties for the Edison Company, the introduction of which resulted most favorably to the interests of that company, some two years ago organized the Bergmann Gas & Electric Fixture Co. at the above address, and met with large success in this special field of business. He has found it necessary and more satisfactory to himself to give up this particular branch of business, and is now manufacturing electrical specialties. He has lately brought out a switch for cutting in and out incandescent circuits from one to any number of lamps. The object of this switch is to do away with long circuits of expensive wires running to switches. He has also brought out a new incandescent lamp switch operated by the simple pulling down of a cord which cuts the lamps in and out of circuit. Mr. Bergmann is also bringing out a number of specialties of great value to the electric light industry.

The Empire City Electric Co., 15 Dey street, some time since secured the building adjoining, No. 17, and made extensive alterations which are now completed. Gen. O. E. Madden, president of the company, has now one of the finest offices in this city, on the main floor of the new building. The new quarters are fitted out with all modern improvements, including the electric light and all necessary electrical equipments which can conveniently be used in office work. The main floor of the new building is also devoted to the book-keeping and commercial parts of the business. General Madden can be found at his office always, ready to give a good word and receive a good order in return. The company is improving the old store, 15 Dey street, fitting it out with a complete stock of electrical appliances. Everything needed in the electrical line can be found here now.

Mr. C. S. Van Nuis, the well-known electrical engineer and manufacturer of Ajax switches, is meeting with unprecedented success in the introduction

of his switches. He has been so busy on his large switches for electric light and railway work that he has been unable to bring out his line of small ones. He makes his Ajax switches for heavy duty in electric railway and electric light work, to carry any amount of current. They will be found to-day in some of the leading stations of the country. Lately he has fitted out a large marble switchboard for a station in this section with some 20 switches to carry over 500 amperes of current at 500 volts. He is making a specialty of these switchboards in connection with the Ajax switches.

The Ball Electric Light Company, manufacturers of the Ball system of arc and incandescent lighting, 27th st. and 9th ave., has met with large success in the introduction of their system. They have done in the past a large volume of business, and are introducing to-day their system in all sections of the country. Large orders have been shipped to foreign countries. Mr. R. E. Ball, electrician; C. E. Ball, manager, are still improving their sys em, and the company has lately obtained patents on valuable improvements in their dynamos.

E. P. Gleason, manufacturer, Mercer and Houston streets, is one of the largest manufacturers in this country of arc and incandescent lamps, gas and electric fixtures, and incandescent fittings of all kinds. They also make to order incandescent lamp bulbs and shades of any special design. This company is working on a number of new specialties and improvements of their goods, and will sometime the coming spring, introduce a new catalogue which they are now working on.

Mr. C. Perrez, of the Goodrich Hard Rubber Co., with office at 65 Reade st., is one of the first to engage in this line of business. His company has had unprecedented success in the introduction of rubber specialties for arc and incandescent systems of electric lighting, and the supply trade generally. Mr. Perrez is one of the most active and energetic salesmen in this section, and much credit is due to his enterprise in this department.

Messrs. Curtis & Dean, 115 Broadway, representatives of the Thomson-Houston Electric Co., are the enterprising young men who organized this office some years ago. They have met with great success in their endeavor to introduce one of the best systems of electric lighting in this country. Their installations can be found throughout New York State. A short time since they organized an isolated department at their offices, and they are meeting with well-merited success, which always comes to those who are ever on the alert for the good things in their line of business.

Cassidy & Co., 23d street, below 6th avenue, for a number of years located on Mercer street, are manufacturing gas and electric light fixtures of all kinds. Their business has so much increased that they found it necessary to enlarge their quarters, and they erected the present building on 23d street below 6th avenue, which they now occupy. The building runs through from 23d street to 24th street. They are manufacturing every line of electric fixtures, both combination electroliers, brackets and table lamps. They exhibit one of the largest lines of these goods in this city. The success of this firm is the reward of skillful labor and first-class workmanship.

Mr. A. T. Smith, 6 West 14th street, manufactures a grade of lava tips for electric multiple gas lighting in churches, theatres, halls, etc., which are said to be the best and cheapest in the market. Mr. Smith is said to be the first to introduce this special system, some years ago, and it has been the means of influencing a large volume of business in this particular line, as he contracts for multiple gas lighting for churches, theatres, halls and private residences. He can show references from the leading business and commercial business men in this city for this class of work.

The Standard Underground Cable Company, through its New York manager, Mr. George L. Wiley, is distributing among its patrons an elegant pocket handbook of useful information, etc., concerning the goods manufactured by that concern. The cover is made of strong red leather and is 4x7½ inches in size. Besides containing the book above referred to, the cover is divided into compartments for letters, bank bills, cards, stamps, etc., and will be found extremely useful to the fortunate possessor of one of the books. The volume contains price lists, telegraph code, etc., relating to lead covered electric cables, insulated wires, etc., and was written and compiled by Mr. Joseph W. Marsh, the secretary and assistant general manager of the company. Besides the information above enumerated, it contains much other data of value and interest, including electrical formulae and tables. tI also contains blank pages for memoranda.

The following named persons are recorded as callers at the Electric Exchange of Alexander, Barney and Chapin, during the past week: E. R. Gilman, of St. Paul, Minn.; H. P. Lucas, Chicago, Ill.. A. H. Eddy, A. D. Newton and H. C. Hibbard, of the Eddy Electric Manufacturing Company of Hartford, Conn.; Harry B. Cram, Geo. W. Adams, and W. C. Fish of the Bernstein Electric Company, Boston; A. H. Bauer, Detroit; E. P. Roberts, Cleveland, Ohio; C. G. Ferguson, Geo. M. Ayres, F. D. Phelan, C. R. Truex, B. Whitehorne, W. T. Hunt, C. E. Stump and T. C. Martin, of New York; C. D. Baker, Jr., Newark, N. J; W. H. Johnson, Philadelphia; Paul Leipke, Trenton, N. J.; S. Burnley, Bradford, Pa.; F. C. Mason, Brooklyn, N. Y.; C. H. McIntire, Newark, N. J.; and E. G. Bernard, Troy, N. Y. W.T.H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery:

Anglo-American Electric M'f'g. Co.	$
American Motor	5 00
American Telegraph and Cable	
Ball Electric Light	
Bell Telephone	225.00
Bentley Knight	
Brooklyn, Edison Electric Light	100.00
Brooklyn Citizens' Electric Light	12 00
Brooklyn Municipal Light	12 50
Brush Illuminating	75.00
Brush-Swan	25.00
Consolidated Electric Light	50.00
Dalt	
Edison General	90.00
Edison Illuminating	75 00
Edison Manufacturing	
East River Electric Light Company	80.00
Fort Wayne	10.00
Harlem Electric Light Co.	60.00
Julien	
Law Telephone	95.00
Mount Morris Electric Light	90.00
New York and New Jersey Telephone Co	88.00
North American Phonograph	25.00
Postal Telegraph	
River and Rail	20.00
Swan Incandescent	3.00
The Accumulator Co	
Thomson-Houston Electric Co.	50.00
United States Electric Co	40.00
United States Illuminating	70.00
Westinghouse Electric	
Welsbach Incandescent, Gas	6.00

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate but will be found very near the mark.

PERSONAL NOTES.

Mr. Louis Burnham, general manager of the Electric Gas Lighting Company, Boston, made a visit to New York on last Friday.

M. Charles Holtzer, of the Holtzer Cabot Electric Co., 111 Arch street, Boston, was in New York last Friday.

Mr. Thomas A. Edison has gone to Port Huron, Mich., to attend the funeral of his brother, Wm. Pitt Edison, who died on Tuesday, January 13th.

We are pleased to announce that Mr. A. O. Tate, Mr. Thomas A. Edison's private secretary, who has been quite ill for several weeks past, is now on the mend, and is fast regaining his health. He expects to be able to resume his duties, in part at least, next week, and his many friends will be very glad to hear that he is getting about again.

TRADE NOTES.

Mr. G. H. Fisher, formerly the Secretary of the American Leather Link Belt Co., has accepted the position of Philadelphia manager for Chas. A. Schieren & Co., manufacturers of the celebrated Patent Perforated Electric Belting. His office is at No. 226 North Third street.

After a long series of experiments, Messrs. Pass & Seymour, manufacturers of china for electrical purposes, Syracuse, N. Y., have succeeded in threading porcelain with all the accuracy and variety obtained in metal work. This will likely result in the extensive use of china for electrical work.

The Reading Company is making improvements all along the line of its road. It is widening all tunnels, replacing all wooden bridges with substantial stone and iron structures, and relaying the road with 90-pound steel rails and stone ballast. New and improved locomotives are also being constructed, and the rolling stock improved where it is necessary.

Wm. Schwarzwaelder & Company, corner of Fulton and Pearl streets, New York, have remodelled their entire line of office desks, making such changes in their construction that will make them more desirable than ever. To have a desk arranged with a place for everything and everything in its place is a convenience to be appreciated. This has been the aim of this well known firm, besides endeavoring to keep up their reputation of turning out the best made articles for the least money. Their desks will now be more in demand than ever.

The Magnolia Anti-Friction Metal Company, of 74 Cortlandt street, New York, are issuing a handsome calendar for 1891. It is on a large cardboard on which are several artistically designed pictures, giving views of a man-of-war, directing the beam of its search light on an approaching torpedo boat; the steamship City of New York; end pier of the cantilever bridge across the Firth of Forth, and the Tower Bridge, London. The whole is executed in delicate colors, and is very attractive. Magnolia metal is a scientific discovery, and is self-lubricating, non-heating, and of great durability. The whole mechanical world testifies to its superiority, and it is the best anti-friction compound for the bearings of locomotives, steamships, rolling mills, etc.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRIC AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., Jan. 17, 1891.

Among the specialties which Mr. George Cutter has arranged to manufacture and handle from his office and factory in this city is the Morris pole top, which has met with much favor since its introduction into the trade.

From a recent communication by the Secretary of State of Missouri to the State Legislature it appears that there are 8,884 corporations organized under the laws of that State including telegraph and telephone companies, 43, and street railways, 146.

Since the Central Electric Company divided up its offices and appointed heads to the different departments of the business they find that they can profitably assign one man to railroad supplies, and propose to vigorously push that department of the business in future. They already control some very valuable electric railroad specialties, which will be placed upon the market with the accustomed vigor of this company.

The Central Electric Company, who seem to be always on the alert for desirable specialties, will shortly place upon the market a direct reading volt-meter and ammeter. It is claimed that this new instrument is as good as any that has been produced. It will be elegantly finished, as well as thoroughly standardized, and will be sold at a price so low that every one connected with electrical work can afford to buy one.

The Central Electric Company will shortly present to the public a very handsome and complete catalogue of electrical supplies. The page will be 7½ inches by 11 inches, printed on heavy enameled book paper, and will be a fine sample of printing and bindery work, as well as an electrical encyclopedia. Each article will be described by a trade word, which will greatly facilitate ordering supplies, also save considerable expense when orders are sent by telegraph. The book will appear inside of 30 days.

THE WESTINGHOUSE COMPANY'S TROUBLES.

Developments in the affairs of the Westinghouse Electric Company, seem to have taken a decidedly unfavorable turn in the past few days. It will be remembered that, a couple of weeks or more ago, Pittsburg capitalists raised a fund of $500,000 to enable George Westinghouse, Jr., to meet pressing obligations due by the Westinghouse Electric and Manufacturing Company, and other concerns controlled by Mr. Westinghouse. An advisory board was appointed to manage the Westinghouse interests until the crisis had passed. On January 14th, the advisory board decided to return the $500,000 to the persons who contributed it on the ground that it was not sufficient to accomplish what it was raised for.

This action was followed on the next day, the 15th, by the entrance of three suits against the Westinghouse Electric and Manufacturing Company for the recovery of moneys due, aggregating less than $5,000. In a press despatch from Pittsburg on January 15th, Mr. H. S. Stewart, one of the members of the advisory board is reported to have said:

"If we had used the fund, Mr. Walker or some one appointed by us would have assumed the management of the business. We felt that we could not conscientiously invest the money having regard to the security of the subscribers, so we returned their money and throw all the responsibility for the present upon Mr. Westinghouse. We did not think that we could carry the company through the difficulties in which it is involved, so we decided not to have anything to do with it. We were asked to put off definite action for a few days. We waited as long as we could conscientiously.

"If the company should fail the effect upon Pittsburgh would be slight. Six weeks ago the effect would have been terrific. Now no banks would be shaken. It need cause no alarm to the public if steps should be taken for an assignment or the appointment of a receiver."

Paul D. Cravath, attorney in this city for the Westinghouse Electric Company, said in an interview on the 15th, that whatever the developments in regard to that company might be, the functions of the Advisory Committee appointed in Pittsburg were apparently at an end from the choice of the committeemen. "It is not likely," said Mr. Cravath, "that the money contributed to that fund will be needed, but if it is most of it will be available from other sources. Mr. Westinghouse's effort to float the preferred stock of the company has been largely successful. He secured assurances equal to the placing of $200,000 par value yesterday, and I think about $400,000 par value to-day. There is no more probability of an assignment now than there has been for months or is likely to be for months to come. Mr. Westinghouse is not on the eve of an assignment."

On Wall street it was reported on Friday that the electric company's preferred stock was being placed rapidly, and matters were progressing to the entire satisfaction of Mr. Westinghouse.

The sympathies of the general electrical trade are with Mr. Westinghouse during his trouble, and his friends hope he may be entirely successful in his efforts to carry his vast concern safely through the crisis.

ELECTRICAL NOTES FROM CORNELL UNIVERSITY.

The new electric lighting station of the University is now about completed. The Stanley alternating arc system has been substituted for the United States system for the campus lights. The lights have been rearranged and a considerable number added. The buildings are lighted with Edison incandescent lights. All the dynamos are driven from a single counter shaft, which is so arranged that it may be driven either by water or steam power. A full complement of friction clutches make it possible to instantly stop or start any one machine without affecting the others.

Frank C. Perkins, '91, is soon to publish a work entitled "Cornell University and Her Technical Courses." The book will contain photo-gravures of all the University buildings with inside views of the buildings of the engineering department and portraits of the professors, besides an advertising department. It will be circulated mainly among members of the great engineering societies of this country.

Thomas A. Edison has lately presented Dr. Thurston with two No. 6 Edison dynamos for the electrical department. They will be set up in the dynamo room and used to furnish current for the two 10 H. P. motors recently presented to the University.

The E. P. Allis Co., of Milwaukee, Wis., have received the contract for a 150 H. P. experimental engine for the Univerity. The engine will have three cylinders, and be so arranged that it may be run single expansion, compound or triple expansion, with or without the steam jacket, etc., and will be provided with all necessary appliances for experimental work.

Tinens, Olsen & Co., Philadelphia, are constructing a mammoth 300,000 pound testing machine for the mechanical laboratory. The machine when set up will extend through three stories of the laboratory. Samples of the modern iron electric light poles have been received by the department to be tested for stiffness, etc.

U. H. Genung, '90, and Hotchkiss, R. G., have been appointed instructors in the department of physics.

Preston, '88, has been made an instructor in the mechanical laboratory.

A. B. Parke, E.E. '92, has accepted a position with the Hygeus Water Works, New York.

L. L. Smith, '90, is engaged at the repair shops of the C. B. & Q. Railway at Aurora, Ill.

L. H. Parker, '87, is engaged with the Short Electric Railway Co. of Cleveland, installing a road at Pottsville, Pa.

N. R. Baker, C. U. '75, is now president of the National Car Heating Co., Chicago.

W. Nelson is assistant to the engineer in charge of putting in the Thomson-Houston road at Davenport, Iowa.

FILAMENTS.—The same illumination can be obtained from the round filament as from the rectangular with greater economy of current.

THE TAYLOR PRIMARY BATTERY.

Mr. Theodore F. Taylor, a well-known electrician and telegrapher of this city, is the inventor of a primary battery which, from all accounts, seems to be one of the most efficient and economical ever produced.

This is a zinc-carbon element, arranged to give the best results, at a minimum cost. The best material is used and special care taken to insure low internal resistance.

The zincs are so arranged that all of the zinc is immersed in a solution of 15 parts water to 1 of sulphuric acid. Thus at the outset about 30 per cent. is saved in the outlay for zincs, since the one-third is not, in this case, thrown away when new zincs are required. Ordinary commercial zinc is used, and if well amalgamated will keep clean, no bichromates being used in the solution.

The conducting electrodes in the No. 1 cell, consist of 16 carbon rods, made of selected carbon, free from silica, and specially prepared.

Carbon surface, 250 square inches.
Zinc " 216 " "

The carbons are surrounded by a solution which the inventor prefers to keep secret, but it is of the color of alcohol, is mostly oxygen, and will not stain the most delicate skin. It will keep indefinitely; is not explosive or inflammable, and is entirely unobjectionable.

It wipes out the hydrogen so completely that the maximum current is maintained at short circuit for hours, and the voltage is then found to be (on open circuit) two volts. This is accepted by electricians as a demonstration that this battery does not polarize.

One pint of this depolarizing solution, is found, on a practical test, to be good for 70 ampere hours, and 4 of the No. 2 cells, using 1 pint in each porous cup, will sustain an Edison 3 c. p. lamp 40 hours.

Four of the large cells run a one-eighth h. p. C. & C. motor with a large margin.

The used-up solution around the zinc by gravity falls to the bottom of the porous cup leaving the zinc held suspended in the clear solution, which is of uniform density. As a result of this the local action is almost *nil*. The zinc is held suspended in the cup in a wire basket.

In one type of cell the fluids are automatically removed and renewed, several gallons being placed in a tank at a higher level than the cells.

It is found that this depolarizing solution goes 40 per cent. further than the best bi-chromate of soda solutions.

Mr. Taylor has had large experience in the development of electrical inventions, and has himself produced many useful devices. Those who are acquainted with him know that he is a man who makes no claims unless he can substantiate them. His battery is a *bona-fide* one, and any one desiring to look into it may rest assured that they will receive fair and honest treatment.

Mr. Taylor has secured quarters at 39 Dey street, where he is now engaged in making preparations to exhibit the battery and show its valuable features. He is confident that his battery has every merit he claims for it, and will prove to the satisfaction of all interested that it is superior to all others.

THE FIRST ELECTRIC CAR.—Siemens was the first one to put it into practice. The idea of generating electricity at a fixed point by dynamos, and conveying the current through conductors and sliding contacts to a motor on a car in motion.

REVERSIBILITY OF MOTORS AND DYNAMOS.—The terms dynamo and motor are convertible, and, although there are cases when it is impracticable to work a motor as a dynamo, it is always perfectly easy to work a dynamo as a motor.

THE ELECTRIC AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS ISSUED JANUARY 6 AND 13, 1891.

443,992. Man hole for Underground Electric Conduits. William H. Hart, Brooklyn, N. Y. Filed Mar. 22, 1890.

444,005. Tightening Device for Suspended Electric Conductors. David Mason, New York, N. Y. Filed May 28, 1890.

444,006. Tightening Device for Suspended Electric Conductors. David Mason, New York, N. Y. Filed May 28, 1890.

444,067. Dynamo Electric Machine. Alfred G. Holcombe, Long Island City, assignor of one-half to Charles L. Browne, New York, N. Y. Filed Sept. 17, 1890.

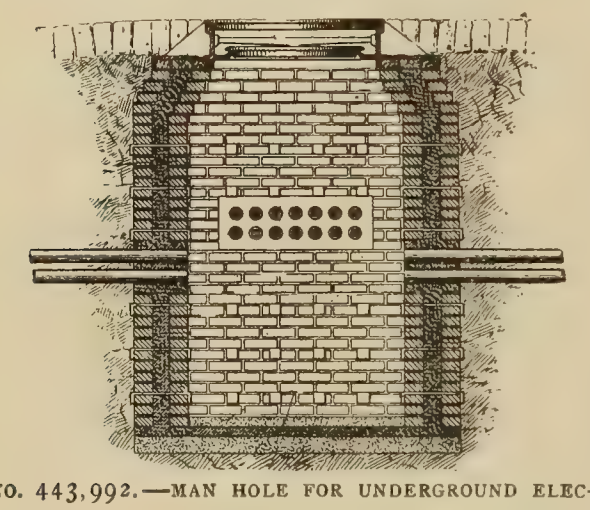
444,104. Electric Arc Lamp. Albert W. Reppy, Oakland Pier, Cal. Filed Sept. 27, 1890.

444,108. Signaling Apparatus. Isaiah H. Farnham, Wellesley, assignor to the New England Telephone and Telegraph Company, Boston, Mass. Filed Aug. 20, 1890.

444,110. Brake for Electric Cars. Belleville L. Randall, Boston, Mass. Filed Sept. 11, 1890.

444,154. Electric Arc Lamp. Joseph J. Skinner, Boston, Mass. Filed Apr. 27, 1886.

444,169. Electric Motor Attachment for Reed Organs. Levi K. Fuller, Brattleborough, Vt., assignor to the Estey Organ Company, same place. Filed July 19, 1889.



NO. 443,992.—MAN HOLE FOR UNDERGROUND ELECTRIC CONDUITS.

444,188. Electric Motor. Charles J. Van Depoele, Lynn, Mass. Filed Mar. 22, 1889.

444,217. Electrical Range Finder. Bradley A. Fisk, U. S. Navy. Filed June 25, 1890.

444,223. Magnetic Ore Separator. Clarence Q. Payne, Stamford, Conn. Filed Aug. 19, 1890.

444,245. Electric Annunciator. August Hormel, New York, N. Y. Filed July 29, 1890.

444,265. Electric Agricultural System. Edward M. Bentley, New York, N. Y. Filed May 11, 1888.

444,273. Swinging or Drop Arm for Electric Lamps. Edward Cliff, Castleton, N. Y. Filed Mar. 21, 1890.

444,317. Electric Wire Insulating Cleat. John S. Porter, Newton, and David J. Cartwright, Boston, Mass.; said Cartwright assignor to said Potter. Filed Aug. 16, 1890.

444,330. Support for Electric Lamps. James Chase, Rochester, N. Y. Filed May 17, 1890.

444,374. Electric Switch. Charles E. Wilson, Chicago, Ill. Filed Sept. 13, 1890.

444,377. Molding for Electric Wiring. George Cutter, Chicago, Ill. Filed July 21, 1890.

444,392. Electrode for Secondary Batteries. Stanley C. C. Currie, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed June 10, 1890.

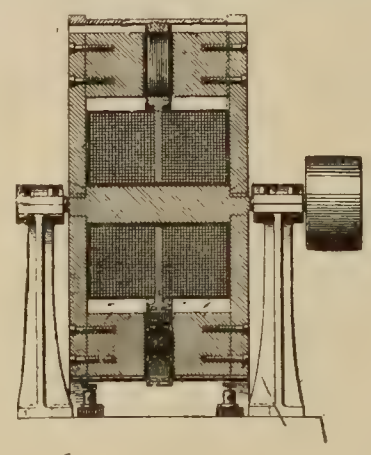
444,397. Current Collecting Device for Electric Railways. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Sept. 24, 1890.

444,416. Electric Motor. William A. Anthony, Manchester, Conn. Filed May 14, 1890.

444,424. Electric Light Support. Alfred Dawes, Chelsea, Mass. Filed Jan. 29, 1890.

444,433. Independent Electric Clock. Emil G. Hammer, Brooklyn, N. Y. Filed May 24, 1890.

444,447. Elastic Trolley. Charles A. Lieb, New York, N. Y. Filed Nov. 28, 1890.



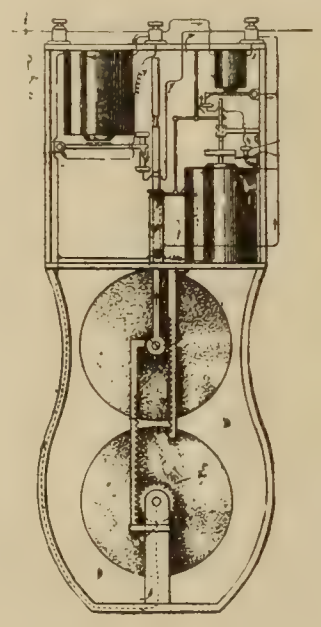
NO. 444,067.—DYNAMO ELECTRIC MACHINE.

444,452. Electrical Sporting Indicator. Samuel D. Mott, Passaic, N. J. Filed June 19, 1890.

444,453. Electrical Sporting Indicator. Samuel D. Mott, Passaic, N. J. Filed June 19, 1890.

444,454. Racing Indicator. Samuel D. Mott, Passaic, N. J. Filed Aug. 7, 1890.

444,461. Device for Inserting Branch Lines on Mechanical Telephone Lines. George F. Shaver, New York, N. Y., assignor to the Shaver Corporation of New Jersey. Filed May 22, 1890.



NO. 444,104.—ELECTRIC ARC LAMP.

444,462. Mechanical-Telephone Exchange. George F. Shaver, New York, N. Y., assignor to the Shaver Corporation, of New Jersey. Filed May 1, 1890.

444,463. Mechanical Telephone Exchange. George F. Shaver, New York, N. Y., assignor to the Shaver Corporation, of New Jersey. Filed May 6, 1890.

444,464. Molecular Sound Resonator. Geo. F. Shaver, New York, N. Y., assignor to the Shaver Corporation, of New Jersey. Filed May 12, 1890.

444,466. Electric Lamp Bracket. Thomas C. Smith, Philadelphia, Pa. Filed May 19, 1890.

444,471. Carbon for Arc Lights. Barton B Ward, New York, N. Y. Filed Apr. 4, 1890.

444,472. Electric Arc Lamp. Barton B. Ward, New York, N. Y., assignor to the Electric Construction and Supply Company, same place. Filed Apr. 11, 1890.

444,473. Electric Arc Lamp. Barton B. Ward, New York, N. Y., assignor to the Electric Construction and Supply Company, same place. Filed Apr. 11, 1890.

444,477. Conduit for Electric Wires. Alexander P. Wright, Boston, assignor, by direct and mesne assignments, to Arthur Lord, trustee, Plymouth, Mass. Filed April 18, 1890.

444,479. Electric Car Controlling Device. Edward M. Bentley, Brooklyn, N. Y. Filed July 10, 1885.

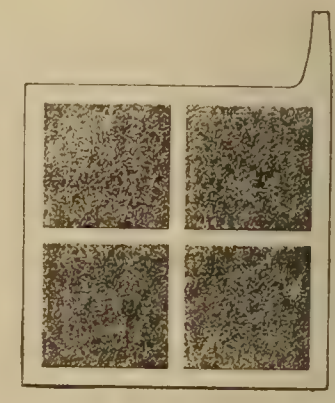
444,480. Electric Railway Car. Edward M. Bentley, New York, N. Y. Filed Sep. 8, 1888.

444,482. Electric Hand Setting Mechanism for Clocks. William W. Bradley and Willard N. Packer, Canton, Ohio. Filed Mar. 28, 1890.

444,486. Dynamo Electric Machinery. Justus B. Entz, New York, N. Y. Filed July 10, 1890.

444,512. Electric Locomotive. Montgomery Waddell and Justus B. Entz, New York, N. Y. Filed May 20, 1890.

444,530. Leading in Wire for Incandescent Electric Lamps. Thomas A. Edison, Llewellyn Park, N. J. Filed Sept. 15, 1890.



NO. 444,392.—ELECTRODE FOR SECONDARY BATTERIES.

444,539. Electric Railway Car. Lawrence A. McCarthy, Brooklyn, N. Y. Filed Sept 3, 1890.

444,552. Electric Indicator. John Hopkinson, Holmwood, England, assignor by mesne assignments, to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed Feb. 23, 1889. Patented in England.

444,553. Method of Controlling Currents upon Electric Circuts. John Hopkinson, Holmwood, England, assignor by mesne assignments, to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed Feb. 23, 1889. Renewed Nov. 10, 1890. Patented in England.

444,566. Current-Collecting Device for Electric Railways. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 12, 1890.

444,567. Incandescent Lamp Socket. Geo. R. Lean, Boston, Mass.; assignor to the Bernstein Electric Company, Portland, Me. Filed March 27, 1890.

444,587. Regulator for Dynamo Electric Machines. Royal E. Ball, New York, N. Y. Filed Feb. 26 1890.

444,597. Electric Magnetic Massage Kneader. David Lichtenstadt and Chas. Lichtenstadt, Chicago, Ill. Filed Dec. 8, 1890.

444,599. Electric Appliance for Trusses. Alva Owen, Chicago, Ill. Filed Oct. 11, 1890.

444,600. Magneto Bell. William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 27, 1890.

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NEW YORK, JANUARY 31, 1891.

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THE BELL TELEPHONE PATENTS.

According to a law on the statute books the life of an American patent is limited by the term of a foreign patent on the same invention. An American patent runs 17 years if the invention so patented is not patented in a foreign country, but if a foreign patent is taken out then the life of the American patent is limited by that of the foreign patent. If the latter runs out in 5 years, or 15 years, so does the American patent.

The law is explicit enough on this point, and reads "that a patent [American] shall expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, but in no case shall it be in force more than 17 years."

It is well known now that on the 9th of December last the English patent on the Bell telephone expired, and as far as that country is concerned the telephone to the extent covered by the aforesaid patent is now public property.

Now, if this is true, is not the same invention now public property in the United States? According to the law above quoted, the American patent on the same invention expired on the same date with the English patent, viz.: December 9, 1890.

If a foreign patent on the Bell telephone had not been taken out in a foreign country, the American patent would not have expired until January 15, 1894, but the fact that the English patent expired on the date mentioned, the American patent was at the same time terminated three years earlier than its full limit.

On Dec. 9, 1876, Alexander Graham Bell took out a patent in England on "Electric Telephony."

Claim 5 of this patent covers the principle of the apparatus, and reads as follows:

"The telephone is without a galvanic battery and consists simply of a permanent magnet with coiled poles; or electro-magnets may have secondary wires in the line wire circuit. The coiled poles of the former arrangement may be of a horse-shoe form; the whole may be placed in a sounding box, the metallic plate being secured by a cup-shaped block which has a central orifice and tube for speaking or hearing."

On January 15, 1877, the same gentleman took out a United States patent on an invention in "Electric Telegraphy," which is substantially described as follows:

"A plate, A, forms the diaphragm to be thrown into vibration, and the armature of the permanent magnet, F, which, with the coils, G, forms substantially a magneto-electric apparatus. A being thrown into vibration, currents are caused to circulate on the line corresponding in number of vibrations and intensity with the number and intensity and vibrations of A. These currents cause the like apparatus at other stations to be similarly affected, so that vocal sounds and speech are accurately reproduced without the use of any galvanic batteries."

It is evident from these two descriptions that the instruments so described are practically one and the same.

The Bell telephone, as described in the above extracts, is what is commonly called the "receiver." This consists of a long bar magnet, permanently magnetized, at one end of which is a helix, or coil of wire. In front of the end of the magnet, to which the coil is attached, is the diaphragm, a disc of thin, soft iron. These are the essential parts of the Bell telephone. If two of these instruments are included in a circuit, without battery, and we talk into one of them the vibrations of the air caused by the voice will be communicated to the diaphragm, and the movements of the diaphragm corresponding with the air vibrations will cause currents to circulate through the wire of the helix. These currents on reaching the other telephone will, in passing around its coil, reproduce on its diaphragm vibrations corresponding with those produced originally by the voice. These reproduced vibrations will be conveyed, through the medium of the air, to the ear of the person receiving the message. This is substantially the Bell telephone, and the instrument that, on December 9, 1890, became public property in the United States simultaneously with the expiration of the patent limit in England.

RATING ELECTRIC GENERATORS AND MOTORS.

The suggestion made by Mr. T. G. Grier in his paper read before the Chicago Electric Club that the capacity of electric generators should be specified in the units that measure the energy in the form in which it is developed is a rational one, and based on common sense. As he says, the practice of rating the capacity of generators by candle power or horse power is an unfortunate one, and such applications of these units practically mean nothing. To say that a machine has a capacity of so many nominal candle power does not give a very definite idea of its capacity. The candle power unit is in a measure open to criticism as to accuracy, and to sustain this assertion, Mr. Grier cites some recent experiments carried out with incandescent lamps with a view to the determination of their uniformity in the rates between the rated voltage and candle power. These experiments proved conclusively that there is great lack of uniformity in this respect. Incandescent lamps are in daily use that vary in the consumption of energy per candle-power produced from 3 to 7 watts. This variation, when the lamps are of the same voltage, means a variation in the amount of current necessary to produce the equal amounts of light.

And yet this is the basis, as unstable as it is, of rating the capacity of electric generators. It is therefore quite impossible to tell just what the capacity of a machine really is when it is rated in candle power.

It is important that the capacity and power of generators and motors should be stated in definite units, so that the purchaser may know exactly beforehand what energy he can depend upon his machine to produce.

Electrical engineers and all others interested should take hold of this matter and settle it once for all. So long as it remains unsettled, so long will it keep haunting electricians like a nightmare. They all agree that something should be done to abolish the present system of rating and substitute something more definite, but one waits for another to act, and the result is there is lack of unanimity in action.

Mr. Grier's suggestions, however, will be fruitful in due time. They will awaken an interest in the matter, and it is hoped that all hands will pull together and accomplish this desired result.

USEFUL APPLICATIONS OF ELECTRICITY.—It would require a volume to describe the special uses to which electricity and electrical apparatus can be applied, but a perusal of our pages this week will give a fair idea of the ingenuity exercised in the domain of electricity and its application to useful purposes. For telephone work, the dry battery, which has many advantages over the ordinary fluid battery, is coming to the front. In the dental surgery and cautery line special attention has been given by electricians in the production of apparatus to facilitate the execution of the delicate work necessary in those professions. Railroading comes in for a generous share of attention, and we give a description of recently invented apparatus, designed with a view to lessening the dangers in railroad travel; and even the sporting public have not been forgotten, for they are provided with an apparatus which will record in visual characters, at any distant point, or points, the progress of a game of base ball, a horse race, yacht race, or any other sporting event. The particular illustrations above referred to, serve to show the wide range and diversity of application of inventive ingenuity, and in all electricity is the all-essential element. We publish many other illustrations which are equally interesting in their particular line, but they all go to show what a submissive and reliable servant electricity is to man.

ELECTRIC CARS IN STORMY WEATHER.—According to our eastern letter the operation of the electric roads in Boston was affected but little by the recent severe storms, and the fact may be taken as another strong argument in favor of electricity as motive power on street railroads. The late storms were of the most severe character, and telegraph, telephone and electric light conductors were in many places broken down by the weight of the accumulated sleet. The trolley wires of electric roads seem to have been exempt from damage, and, in Boston the cars contined to run pretty close to schedule time. This speaks well for the electric power for street railways, and no doubt the Bostonians appreciated their electric cars during the storm.

STORAGE BATTERY AND MOTOR FOR CAUTERY AND DENTAL SURGERY PURPOSES.

There is perhaps nothing in surgery to-day destined to occupy so high a position in the armamentarium of the surgeon as a thoroughly good and reliable storage battery.

Storage batteries have passed their experimental stage, and become regular articles of commerce, and their efficiency and durability largely depend on the care bestowed upon the forming of the plates, their manner of insulation and the general mechanical construction of the entire cell.

To produce a storage battery at once simple, easy of manipulation, and unfailing in its results has been the aim of Meyrowitz Brothers of 295 and 297 Fourth avenue, New York, and the result is their "M. B." storage battery, intended exclusively for electro-cautery, driving of small motors for nasal and dental surgery and the lighting of small incandescent lamps used for diagnostic illumination.

The cells of this battery are made of hard rubber, cylindrical in shape, and have an easily removed screw cover, which admits of ready inspection of the plates. Each cell contains eight storage plates, suspended from the cover, four positive and four negative, the terminals of which are carried above the cover to two binding posts, which are marked according to their polarity.

The storage plates radiate from the centre, and are separated in such a manner that "buckling" or contact between the plates and consequent "short circuiting" and exhausting of the current is made impossible.

The cell is closed by means of the screw cover. No leakage around the terminals can take place, the manner of insulation being such that the fluid cannot exude and corrode the connections, a fact which tends to prolong the life of a battery, and which those who have other storage batteries will appreciate. As the cover is heavy hard-rubber and the cells are securely placed in a substantial and highly finished antique oak case, with nickel-plated mountings, and a heavy, bolted handle, the battery can be easily carried about

The expense of charging is comparatively small, as the electric current can be applied from the common gravity batteries, which are cheap and can be maintained at an expense of one dollar per annum. Four primary cells will keep one storage cell fully charged.

One "M. B." storage cell is sufficiently powerful to heat all cautery knives and electrodes used in eye, ear, nose, throat and dental surgery, while two cells will heat heavier electrodes and the Ecrasseur Loop and run a ⅛ h.p. motor for two hours, or light a 2-candle-power lamp for eight hours. The power can be proportionately increased by using an additional number of storage cells.

A rheostat consisting of a coil of German silver wire, wound around a lava core, is placed in each battery to control the current, the amount of resistance being regulated by means of a lever. This rheostat permits the use of the lightest electrodes without fear of destroying them.

Our illustration (Fig. 1), shows a three-cell "M. B." storage battery cabinet with cautery and motor outfit, the lower half showing the primary cells, which are so arranged that they are constantly connected with the storage cells, charging them continuously and thus doing away with all further trouble in this regard. Figure 2 shows the "M. B." electric motor, especially designed for operations upon the nose and teeth. It is made in the shape of a highly finished nickel-plated sphere, 5 inches in diameter and weighs but 6¾ lbs. complete. It will be seen from the illustration, which shows the motor case both open and closed, that all its mechanism is perfectly protected and hidden from view. The motor presents a compact and elegant appearance and can be suspended from a bracket and swung in any position (as shown in Fig. 3) or placed upon a table as most convenient to the operator.

The whole shows simplicity, durability, power, economy and portability and should form part of every electro-cautery and surgical outfit.

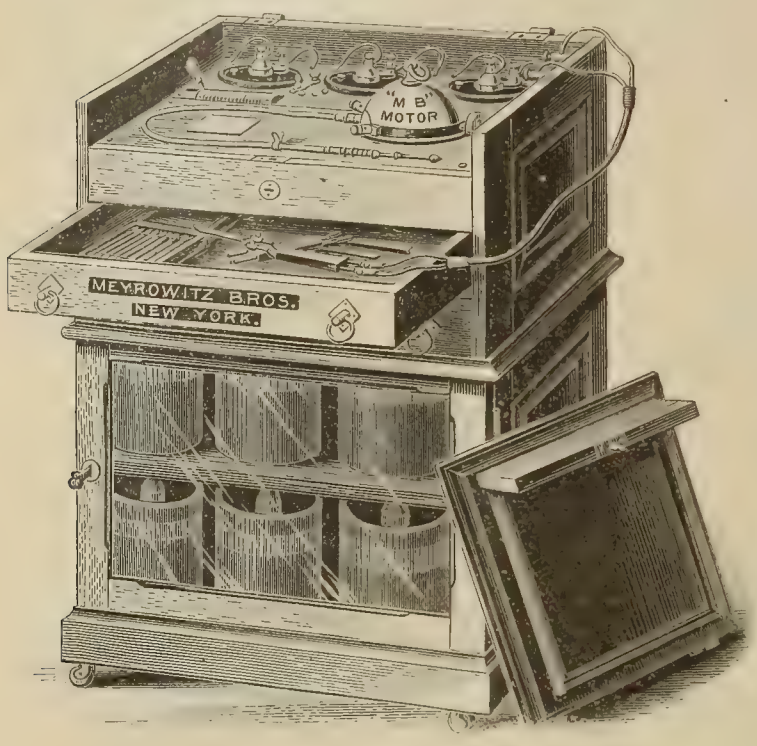


FIG. 1.—"M. B." STORAGE BATTERY CABINET.

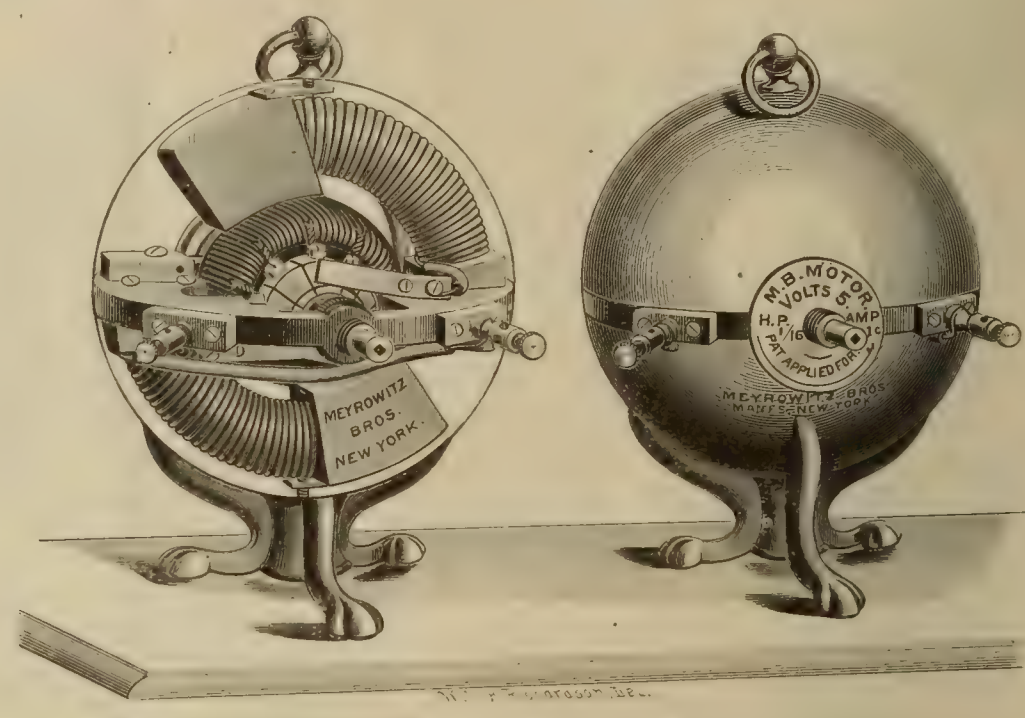


FIG. 2.—"M. B." ELECTRIC MOTOR.

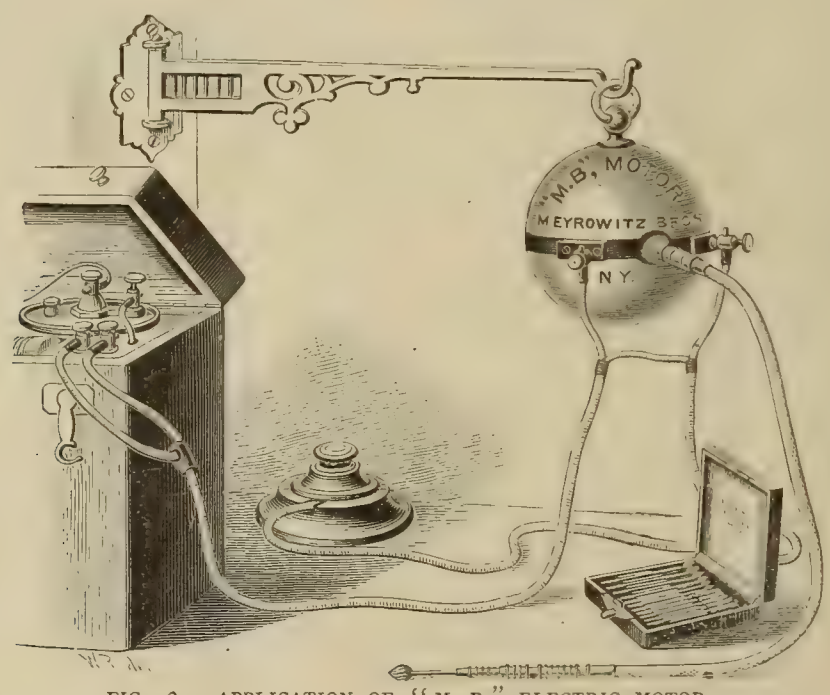


FIG. 3.—APPLICATION OF "M. B." ELECTRIC MOTOR.

ALUMINUM ALLOYS.

Quite recently experiments, says the *Engineer*, have been made at the department of aërial navigation for military purposes at Chalais, with light aluminum alloys, and have been attended with an encouraging measure of success. The aluminum used was obtained from the Société de l'Aluminum, and was very nearly pure. Copper in the form of ordinary conducting wire was used to alloy with it, the whole being rolled into sheets 1mm. in thickness. Strips having a width of 5 mm. were cut from these and tested, with the following results:

Composition.	Specific gravity. Calculated.	Specific gravity. Determined.	Tensile strength kilos. per sq. mm.	Tons per square inch.
	p. c.	p. c.		
Aluminum,	——	2.67	18.7	12.c
" 98, Copper, 2,	2.78	2.71	30.7	19.65
" 96, " 4,	2.90	2.77	31.1	19.9
" 94, " 6,	3.02	2.82	38.6	24.7
" 92, " 8,	3.14	2.86	35.5	22.7

These figures are sufficiently remarkable; the addition of only 2 per cent. of copper is seen to increase the tensile strength from 18.7 to 30.7 kilos. per square mm., while 6 per cent. more than doubles it.

LINES OF FORCE.—If a piece of hard steel is placed in any magnetic field, many of the adjacent lines of force are bent out of their previous shape, and converge into the steel.

SMALL ELECTRIC MOTOR FOR AMATEURS.*

BY GEO M. HOPKINS.

Every piece of electric work done by a student or amateur is of value, not only as an addition to his collection of apparatus, but as a means of acquiring a positive knowledge of electricity and of electrical apparatus. The annexed engraving shows a simple and easy constructed motor, which very fully illustrates the construction and operation of the Gramme motor, and is well adapted to various uses requiring only a small amount of power.

This motor was built by Mr. W. S. Bishop, of New Haven, Conn., after the general plans of the simple electric motor already illustrated and described some months since in these columns, but the construction here shown is more simple and more easily carried out. The perspective view here given is two-thirds the actual size. The detail views (Figs. 2 and 3), showing the armature in process of construction. are full size.

The field magnet is formed of a yoke of Norway iron $\frac{5}{16}$ inch thick, ½ inch wide and 2¼ inches long. In the yoke, near its ends and $1\frac{5}{16}$ inches apart, are drilled holes for receiving the quarter inch Norway iron cores of the magnet, which are driven into the yoke.

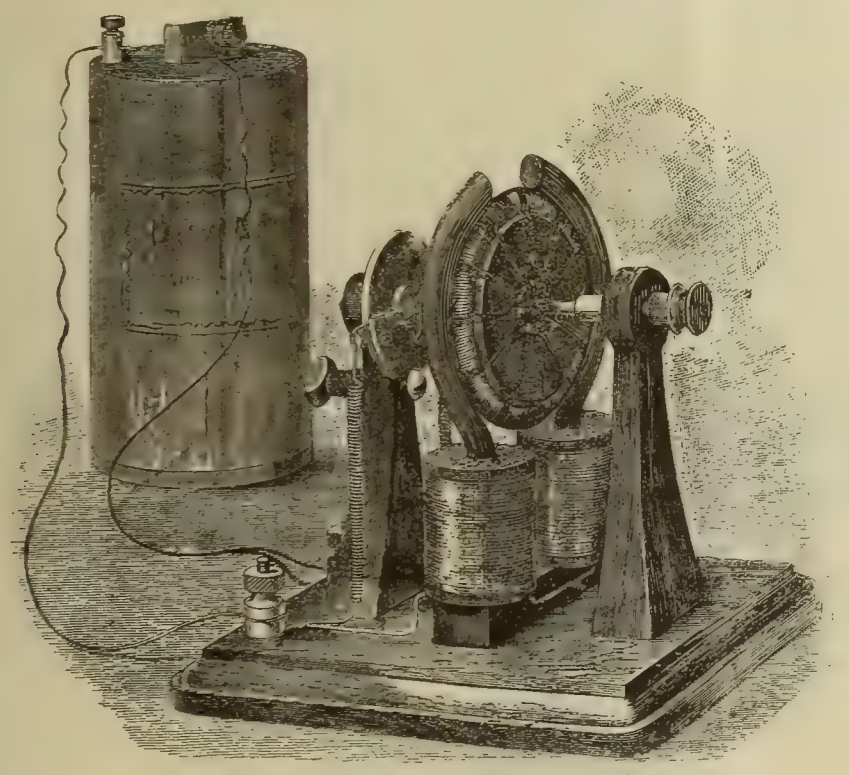


FIG 1.—ELECTRIC MOTOR.

The polar extremities of the field magnet are curved to form a circular opening $2\frac{1}{16}$ inches in diameter. The winding of the field magnet may be applied to the magnet cores, as shown in the engraving, or the wire may be wound upon spools fitted to the cores. The spools are 1 inch in diameter and 1⅛ inch long between the heads. Upon each spool is wound one ounce of double wound, cotton covered magnet wire. The yoke of the field magnet is fastened to the wooden base piece of the motor by screws passing upwardly through the base into threaded holes in the yoke.

The armature consists of a small Gramme ring mounted upon a wooden disc secured to the armature shaft. The armature core, *c*, is a ring formed of a piece of annealed iron wire, No. 13 B & S. gauge, having its ends beveled and drilled transversely to receive a pin, as shown in Fig. 2. A core of this kind, although theoretically not as efficient as a laminated core, answers every purpose in this very small motor, and greatly facilitates the construction of the armature. The core has an outside diameter of 1⅞ inches. The outside diameter of the armature is 2 inches, and the inside diameter 1½ inches. Upon the armature core are placed 12 coils, *b*, of silk-covered, single-wound magnet wire, No. 25 B. & S. gauge, separated by rings *d*, of soft iron wire No. 13, the rings forming polar extensions which add to the efficiency of the motor. The armature coils are formed in a lathe on a mandrel, separately, as shown in Fig. 3. This mandrel consists of a piece of No. 11 wire having two collars ⅜ of an inch apart, one of the collars being fixed and the other being removable. To allow for any contingency, it is advisable to make the distance between these collars a little less than that given, say $\frac{1}{32}$ inch less. Each coil contains 4 feet 4 inches of wire wound in five layers.

To facilitate the removal of the coil from the mandrel, the first layer is wound loosely. After winding, and before removing the coil from the mandrel, the wire is cemented with paraffine or wax melted on the coil with a warm iron. After twelve coils have been completed, they are strung upon the armature core, *c*, in alternation with the iron wire rings, *d*, and when the core is filled, its ends are brought together and secured by means of the pin, as shown.

The wooden hub of the armature is now fitted to the ring, but before the ring is secured on the hub, twelve equidistant holes are drilled transversely through the hub, near its center, and in each hole is inserted a piece of No. 12 copper wire one-half an inch long. The ends of the pieces of copper wire are allowed to project one-sixteenth of an inch beyond the sides of the hub. The ring is placed on the hub, and ends of the wire projecting from adjacent coils, *b*, are twisted together, and attached by means of solder to the copper wire pins extending through the hub and forming the commutator bars, the covering being removed from the extremities of the wire. It will thus be seen that to each commutator bar is connected the beginning of one coil and the end of the adjacent coil, so that by means of these connections the winding of the armature becomes continuous.

The posts in which the armature shaft is journaled are perforated near their upper ends with a hole of a size adapted to receive the armature shaft, and these holes are counter-bored from the inner surfaces of the posts, and a wire of the same diameter as the shaft is placed in the position of the armature shaft, and Babbit metal or type metal is poured into openings around the shaft, forming the journal boxes. A hole is bored in the top of each post before casting the metal to form an anchorage for the journal box, and after the casting, the anchorage is drilled through to the opening of the journal box, to form an oil hole for the armature shaft.

The journal box on the side of the commutator is made to project beyond the inner face of the post, to receive the disk which carries the commutator springs. This projection is made by clamping to the post a piece of wood having in it a hole corresponding with that in the post. After the journal box is cast, the extra piece of wood is removed, leaving a sleeve upon which to place the disk. This disk is an inch and a a half in diameter and $\frac{1}{16}$ of an inch thick.

To the inner face of the disk are clamped the commutator springs by means of small blocks as shown in the perspective view, these blocks being held in place by screws passing through the disk into threaded holes in the blocks. The commutator springs are curved outwardly and their ends are turned backward toward the disk, and their extremities rest upon the commutator bars, as shown in Fig. 1.

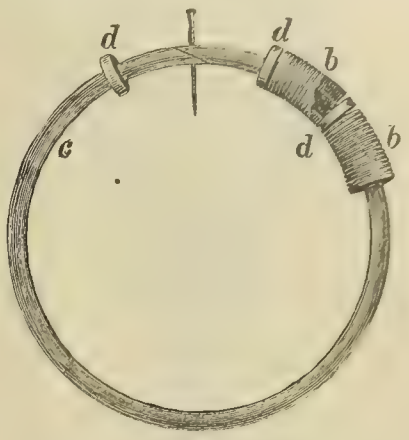


FIG. 2.—ARMATURE CORE.

The commutator disk and the clamping blocks are made of vulcanized fiber, which is strong and at the same time a good insulator. The commutator springs are hard rolled copper, and their inner ends are adjusted so as to lightly touch diametrically opposite commutator bars. The best adjustment for the commutator springs is found by moving the disk in one direction or the other. It will be found that the maximum effect is secured when the contact surfaces of the commutator springs are nearly in a vertical line.

The commutator disk is clamped in any desired position by an ordinary wood screw, which passes loosely through the post and is screwed into a wooden thumb nut bearing against the outer surface of the post. The terminals of the field magnet are connected directly with the binding post and also with the outer ends of the commutator springs as shown.

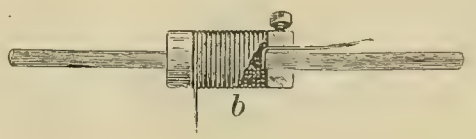


FIG. 3.—METHOD OF FORMING A COIL.

With one cell of dry battery the motor makes about 1,800 revolutions per minute, but it does not develop its maximum power until one or two cells are added in parallel. Any of the dry batteries will run it for short periods, but if it is required to run it continuously for any length of time, one or two cells of Bunsen or Fuller battery should be used.

The motor being shunt wound, is practically self-regulating. Its speed with any amount of battery powers does not much exceed 2,000 revolutions per minute.

Scientific American.

WASTE OF ENERGY.—In all machines which have moving parts, a certain percentage of the energy takes the form of heat, due to friction at the bearings and other surfaces which comes into contact.

LOSS OF MAGNETISM.—A magnet raised to a red-heat loses its magnetization entirely. This can easily be demonstrated by heating a magnetized sewing needle in a gas flame.

THE HALL ELECTRIC SEMAPHORE AND THE STEWART-HALL TRAIN-ORDER SIGNALS.

A number of prominent railroad officials recently made a trip over the Central Railroad of New Jersey to inspect the new Hall automatic electric semaphore signals and the Stewart-Hall system of train order signals as used on that road.

Among these gentlemen were Messrs. Hall and Young of the Hall Signal Company ; J. H. Ohlhausen, general superintendent ; W. H. Peddle, superintendent, and Robert Stewart, superintendent of telegraphs, of the Central Railroad of New Jersey ; Mr. Barton, general superintendent and Mr. Ford, chief engineer, of the

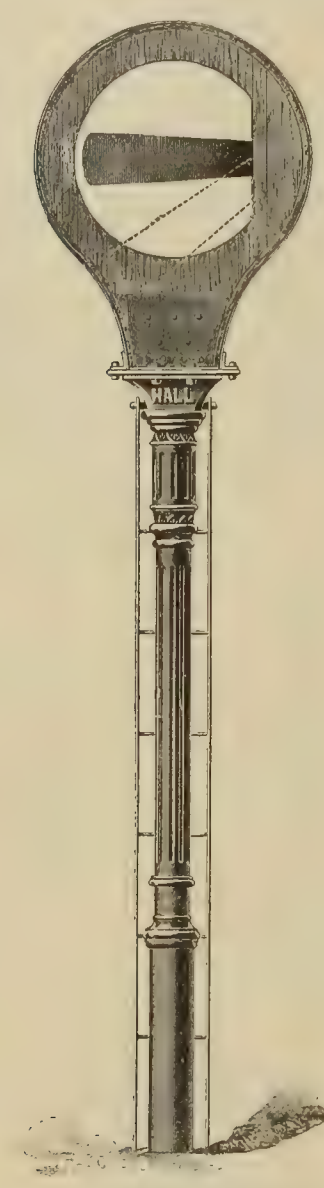


FIG. 1.—SEMAPHORE SIGNAL.

Long Island Railroad , Mr. H. B. Hammond, president of the Indianapolis, Decatur and Western ; Mr. Gannon, general superintendent of the Staten Island Rapid Transit ; Mr. Foley, superintendent of telegraph, and Mr. Brangs, electrician, of the Delaware, Lackawanna and Western; Mr. McCoy, superintendent, and Mr. Myers, superintendent of signals, of the New York Central and Hudson River Railroad ; Mr. Sperry, supervisor of signals, of the Pennsylvania Railway, and Winslow Stevens, superintendent of signals of the New York, New Haven and Hartford Railroad.

The party had a pleasant trip, partly contributed to by an elaborate collation served up by Mr. Wallace, the Jersey Central's caterer.

There was not one dissenting voice as to the successful working of the system, all being unanimously in favor of it.

For the benefit of our readers we will describe this block system as now used by a number of railroads.

Those who have had any experience with the rattle-trap affairs used a few years ago, consisting of a board on each side of the box, to be raised and lowered by means of ropes which were continually stretching, breaking or freezing so that the light could not be cut off or shown when needed most, will appreciate the decided improvement of these electric block signals.

The standard signal of the Hall Signal Company has always been of the disc form, as this form was considered to be the most conspicuous, but as there was a desire on the part of railway officials to obtain, in connection with the disc, a semaphore signal to conform to the standard adopted by many roads, the present combination of disc and semaphore—a front elevation view of which is shown in Fig. 1—was devised.

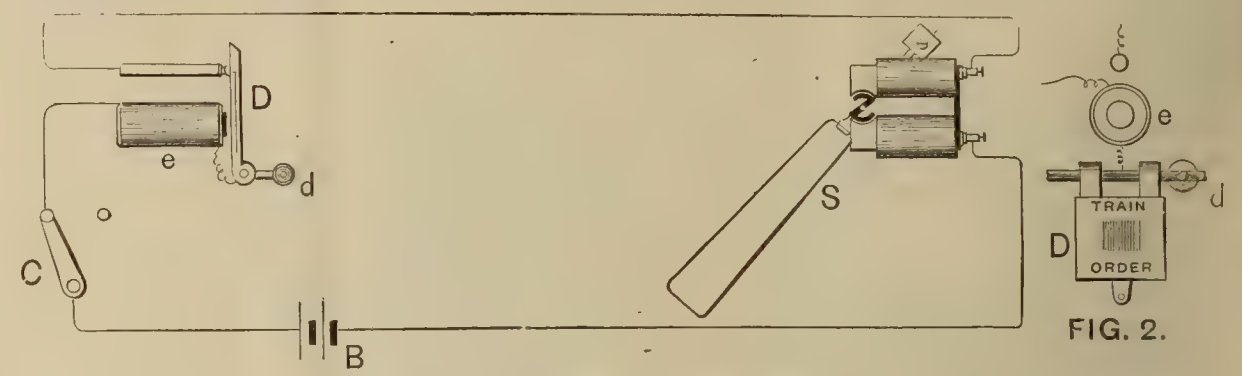


FIG. 2.

FIG. 2.—DIAGRAM OF CONNECTIONS.

There is a rotary movement employed to operate the semaphore blade, with a counter-weight heavier than the semaphore. Energizing an electro-magnet holds the blade in the safety position, but the breaking or weakening of the current causes the signal to rise to the danger position by gravity.

The construction of the case is such that the back glass is translucent, while the front glass is transparent, and the contrast of the dark blade against a white background is very great, producing a most distinctive signal ; while at night the signal is not one of color alone, but also of



FIG. 3.—INDICATOR BOX.

form, as both positions of the blade are plainly visible against the back glass, through which the light from a powerful reflecting lamp is thrown. This gives a signal of *color* and *position*, both by *day* and *night*, which is an immense advantage over an exposed semaphore.

By means of two wires, strung upon poles, a metallic circuit is maintained from one end of a block section to the other. The electro-magnet holding the signal at "safety" is kept closed by this circuit and any opening of it causes the signal to go to "danger." The circuit is opened by each train as it passes the signal at the entrance to the section and the signal at once shows opened which breaks the signal circuit at a point where it cannot be closed again, except by the action of a "clearing" track instrument placed 2,000 feet beyond the outgoing end of the section. The train on reaching the latter instrument closes the relay, thus closing the entire circuit, and restoring the signal to "safety." All the switches in a section have a circuit breaker so that they set the signal for that section at "danger," whenever they are moved off the main track, by opening the circuit.

In connection with this electric block system has been added a train-order signal to be used in those sections which include a telegraph station.

Station operators and agents have so many duties to perform, selling tickets, checking baggage and express, and receiving train orders for trains that stop but a minute, that much annoyance and many serious accidents have been occasioned by their forgetting to deliver train orders, and the object of this system is to prevent the giving of a clear signal before the delivery of the orders intended for a train.

The switches for setting the signals are placed on the operator's table. On receiving an order for a train from the dispatcher, the operator sets his signal against that train, by opening his hand switch (C in diagram, Fig. 2.) To clear his signal it is necessary for him, not only to restore his switch, but to rise from his chair and operate the push in the front of the indicator box, when he is at once reminded by the words "Train order" on the drop, that he has an order undelivered. An illustration of this indicator box is shown in Fig. 3.

This signal, the joint invention of Mr. Robert Stewart, superintendent of telegraph of the Central Railroad of New Jersey, and Mr. Wm. P. Hall, of the Hall Signal Company, may be used as simple station starting signals, the drop acting as an indication of the position of the signal, and will, we think, prove of great interest to a large number of roads, where the introduction of a more comprehensive system of signals is not warranted.

The entire system of block and train-order signals reduces the danger to the travelling public to a minimum, and should be adopted by every railroad in the country.

ELECTRIC RAILWAY NOTES.

As an evidence of the popularity of electricity as a motive power for street railways, it may be mentioned that the Port Huron and Gratiot Electric Street Railway does twice the business now that it did before electricity was adopted. Last year the road carried 400,000 passengers.

P ogress in the building of the electric railway between Ann Arbor and Ypsilanti, Mich., is progressing very favorably, and the work will be completed in a short time.

Loss in Transformation of Energy.—It is impossible to construct a machine for the conversion of energy without a certain amount of loss in the transformation, but in every case the chief aim of the engineer should be to make the loss as small as possible, or to make the machine as efficient as possible.

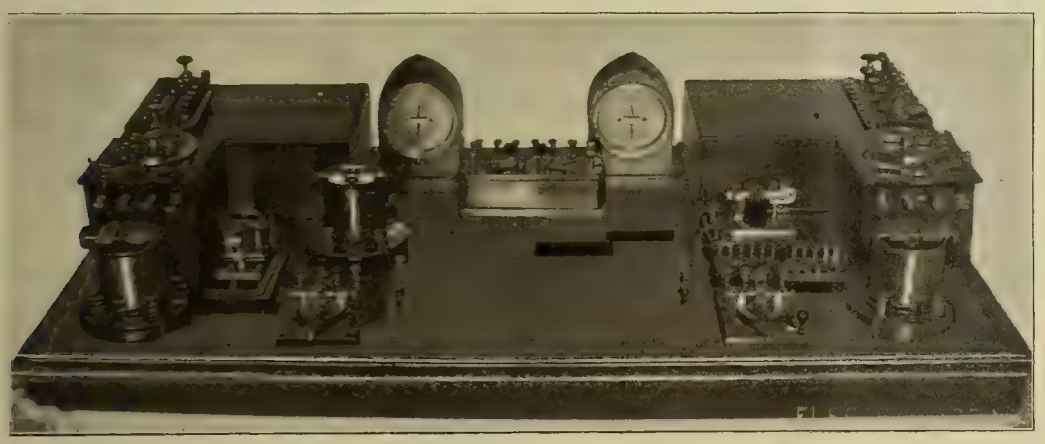
WHEATSTONE REPEATER.

One of the most important functions in the manipulation of the Western Union Telegraph Company's Wheatstone Automatic System, is that performed by the repeaters. This consists essentially of a combination of galvanometers, relays, condensers, etc. Taking these parts in the order given, it may not be uninteresting to particularize their functions. The galvanometer is used to detect the fluctuations of current that in practice exist, to more or less extent, on every telegraph circuit, and which become, apparently, more highly developed the higher the speed attained. These fluctuations are due to causes well known, such as leaks, earth currents, etc. The galvanometer is sufficiently sensitive to record a difference in the apparent duration of contact of the distant transmitter of very small amounts in the current.

The relay is the most important feature of the combination and has probably received more scientific handling and development than any similar piece of telegraph machinery extant. It is but a few years since that the repeating of signals at a speed of 80 or 100 words per minute was looked upon as a remarkable achievement, and with good reason. Large coils, cores yoked to permanent magnets, and armatures, were looked upon as a *sine qua non*. The interesting researches, however, into the theories of the so-called magnetic lag, extra currents, etc., by the British postal telegraph authorities, and which were conducted by Mr. W. H. Preece, produced phenomenal results. It was found that by joining the coils up in multiple and dividing the cores into two sections, etc., that is, with no yoke between them, a speed of 450 words and even higher was attainable. The play of the relay armature is very small, and these instruments will work well with very low currents. The condensers are direct reading and are specially made for the purpose, of the best materials and the highest possible insulation, and are made by Mr. Wm. Marshall. The insulation reaches some 250 megohms and higher. In conjunction with the relays there is what is known as a leak circuit. This is tapped through resistance coils on to the armature of the relay, and when the latter is in use a portion of the outgoing current is thus sent through a receiver. The latter is a very sensitive form of polarized relay, having clock-work to carry forward a strip of paper upon which the signals are made. It is obvious that, when the automatic signals are passing, some such an arrangement is necessary to watch their successful transmission to and fro. By the means of a suitable switch this receiver can be used on either side of the repeater. The system is always used as a duplex, and, therefore, the usual accessories of equating and retarding resistances are used. A key, having contacts back and front, is also used, as the battery is a double one, grounded in its centre. The combination is placed upon a specially prepared board, having its connections permanently fixed. The wiring of this board forms one of the most intricate, yet artistic arrangements of wire imaginable. It was customary to import the repeaters, but they are now built in the company's own repair shop, and have had many changes and improvements made to suit American methods. These changes have added most considerably to the usefulness of the apparatus.

It may not be out of place to mention that dynamo currents are successfully used on this system. Some few years ago extensive experiments were carried out, but as large coiled receivers were then used and considerable variation in the current was experienced its use was not as successful as is now the case. This is due to the fact that the dynamos are constructed in a much better manner than they formerly were, and the currents generated are not so fluctuating. Reasonably steady currents are essential to the successful working of the Wheatstone system. Besides the improvements in dynamo construction and in the methods of combination, subdivisions and utilization of dynamo currents the successful operation of the Wheatstone system, and the improvements in the receiver, have materially aided in the attainment of the general result.

The Wheatstone system in this country is under the general supervision of Mr. S. P. Freir, an English expert. When the system was first introduced in America the apparatus was quite unfitted for the conditions of service in America, and it required considerable ingenuity to Americanize the system, which was very successfully accomplished by Mr. Freir. This gentleman has produced many inventions during his work of adapting the Wheatstone system to American ideas and conditions, and entirely to his indefatigable energy is due the improved and successful Wheatstone system as we find it in operation in America to-day.



WHEATSTONE REPEATER.

Our illustration shows a set of Wheatstone repeaters, such as are used in this country. The galvanometers will be readily distinguished, and adjacent to each will be noticed a large square box. These boxes are the condensers, which are an essential part of the system. It is necessary for successful work by this system to use condensers of the very best make and accuracy. In looking around for such condensers those made by Mr. Wm. Marshall, of this city, were very naturally selected. Mr. Marshall's goods have a world-wide reputation for accuracy and excellence of workmanship. They are, moreover, very superior as to their insulating qualities. The principal users of condensers all acknowledge that Mr. Marshall's are the best obtainable in this country.

In referring again to the illustration, which is made directly from a photograph, it may be said that when the set is complete it includes two other instruments, which are placed in front of the galvanometers. These, however, were removed in order to obtain a better view of the galvanometers.

TRANSFORMATION OF ENERGY.—In every machine for the conversion of energy, there is always a certain amount of loss attending the conversion; in other words, less energy appears in the new than existed in the original form.

RESEARCHES ON SECONDARY BATTERIES.*

Some time ago F. Streintz, in conjunction with Aulinger, advanced the theory that in the secondary cell, the seat of the decrease of the electromotive force, is to be found in the hydrogen plate. This theory was propounded in the *Annalen der Physik und Chemie* (*vide* series 2, vol. xxvii., p. 178.)

Shortly after the announcement of this theory, F. Streintz succeeded in showing that the hydrogen plate *is* the seat of the decrease of electromotive force. This was proved by the results of some experiments on the charging and discharging of secondary cells, for during the discharge the potential of the positive plate remains practically constant, and of a value to which that of the negative plate gradually approximates.

In cells that contain only one positive plate associated with two negative plates each of the latter may be discharged, and the potential brought to that of the positive plate, while the latter remains practically unaltered. In fact, the durability of the positive plate compared with that of the negative plate is very great.

This work was described at length in the *Annalen der Physik und Chemie*, series 2, vol. xxxviii, p. 344.

Streintz has recently been pushing his investigation further in this direction, and in conjunction with G. Neumann, has succeeded in throwing more light upon the theory of the secondary cell.

As we have seen, Streintz has already demonstrated the electromotive behavior of the plates of a secondary cell on charging and discharging. The new investigation was undertaken with a view to fixing the chemical relations which take place at the same time.

For this purpose the difference of potential exhibited by various lead compounds with respect to an amalgamated plate has been investigated.

The compound to be examined was packed tightly into two strong glass cylinders, one being provided with a bright lead electrode, whilst the other was furnished with an electrode of platinum.

The zinc plate was immersed in dilute sulphuric acid, and the connection with the lead compound under examination was effected by means of a woolen thread moistened with the acid.

In order to study the variations in the potential, a sensitive quadrant electrometer was employed; the zinc plate was connected up with one pair of quadrants, and the lead or platinum electrode with the other pair.

The readings were taken till the same result was obtained with the lead electrode, as when the platinum electrode was connected with the electrometer. When this step was reached, it was then concluded that the connection was metallic. When it was otherwise, it was assumed to be electrolytic.

The lead compounds which were investigated in this way by Streintz and Neumann, were the following:

Lead sub-oxide or plumbus oxide	Pb_2O
Lead protoxide or plumbic.....	PbO
Red lead or minium.....	Pb_3O_4
Lead peroxide or pure oxide...	PbO_2
Lead hydroxide (1).....	$Pb(OH)_2$ (?)
" " (2).....	$PbO(OH)_2$ (?)
Lead sulphate.....	$PbSO_4$

In the above list the queries are used to indicate that authorities differ regarding the composition of the hydroxide or hydrate of lead.

Of all these substances, the only one that really showed metallic conduction was the peroxide of lead, and, in general, the difference of potential against zinc increased in the case of the oxides and hydroxides according to the quantity of oxygen in their composition.

The following conclusions are deduced from these and the previous investigations.

1. The phenomena in a secondary cell are sufficiently explained by the behavior of metallic

*London *Electrical Review*.

lead, its sulphate and its peroxide, together with the gaseous ions, hydrogen and oxygen.

2. When a secondary cell is discharged, the metallic surface of the negative plate is converted into sulphate of lead, which partly passes into peroxide of lead. On the other hand, the peroxide on the surface of the positive plate, is superficially converted into sulphate of lead.

3. When a secondary cell is charged, the sulphate of lead disappears from both negative and positive plates, and, finally the positive plate consists entirely of pure peroxide of lead, whilst the negative plate consists entirely of lead and absorbed hydrogen.

It may be noticed that the latter part of statement three was, in a measure, suggested by a previous observation of Streintz, namely, that lead possesses in a marked degree the power of occluding hydrogen, the occlusion being apparently similar in character to that observed in palladium. This was shown by the study of the effect of current density upon potential differences.

A full account of this research by Streintz and Neumann may be read in the *Annalen der Physik und Chemie*, series [2], vol. xli., p. 97. And as bearing upon the same subject, we may recommend our readers to study in this connection the researches of Frankland on the chemistry of storage batteries.

ELECTRO-MAGNETIC MECHANISMS.*

BY PROF. SILVANUS P. THOMPSON, D. SC., B. A.

The Principle of Reversibility.

Far as these analogies have been traced, they may be carried one stage further. The principle of reversibility which holds good of the steam cylinder, holds good of the electro-magnet also. In its usual function the cylinder and piston mechanism of the steam-engine serves to convert the latent energy of the steam under pressure into mechanical work; but the very same mechanism is capable of serving the inverse function of employing mechanical power to compress steam, air or any other gas. The

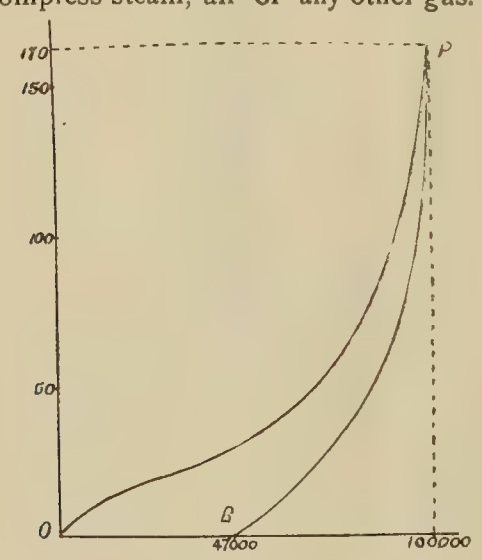


Fig 2.

pump is the inverse of the engine in its functions; its action is simply the action of the engine reversed. From the thermodynamic point of view the action is equally inverse. In the engine heat is converted into work, or in other words, entropy is let down from a high temperature to a low one, thereby furnishing energy to a mechanical system. Reversing the action, energy furnished by a mechanical system is employed to transfer entropy from a low temperature to a high one, and the apparatus becomes a machine for artificial refrigeration.

Turning to the electro-magnet, energy furnished by letting electricity pass from a high potential to a low one is employed, magnetically, to prodnce a mechanical motion and so to perform work. Reversing the action, energy furnished by a mechanical system is applied to an apparatus consisting of magnetic circuits and copper wire coils, which thereby becomes a machine for pumping up electricity from a low potential to a high one; in other words, it become a source of electric currents. The modern dynamo machine is simply an electric engine—a combination of iron cores and copper coils—capable of serving in either of two functions, as generator or as motor, each the inverse of the other.

*Continued from page 49.

Relation between Magnetizing Force and Magnetism.

It is time to return to the principle of the magnetic circuit, briefly enunciated above, and to re-state it in more precise terms. The number of magnetic lines that will be evoked in any given magnetic circuit is directly proportional to the calculation of the surrounding electric current, and inversely proportional to the magnetic reluctance of the iron and air-gaps of the magnetic circuit. It is usual to specify the calculation of current in *ampere turns*, meaning thereby the product of the amperes into the number of turns of wire in the coil. The reluctance of the magnetic circuit must usually be calculated in parts, to be added subsequently together, allowance being made for leakage of magnetic lines. The reluctance of each part is proportional directly to the length, inversely to its cross-section, and inversely also to its permeability.

All known substances possess permeability, none having yet been discovered that is impermeable to the flux of magnetic lines. The vast

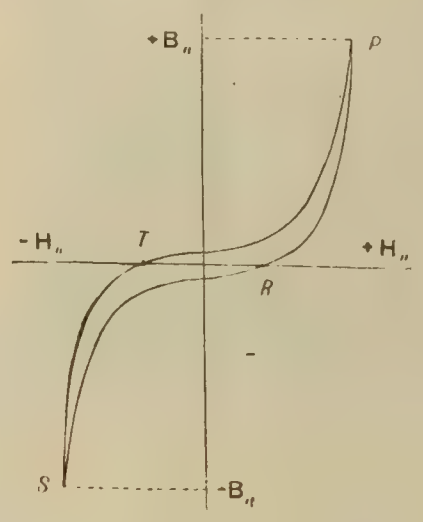


Fig. 3.

majority of media—including air, all gases, all liquids, all organic solids, all compound bodies, save three, all metals, save three—have a small and constant permeability, not differing sensibly from that of vacuum. The exceptions that have a relatively large and variable permeability are the three metals—iron (including steel), cobalt and nickel (possibly some chronium and cerium), together with some of their alloys, and the compounds, loadstone (triferric tetroxide), pyrrhotine (magnetic pyrites), and ferrosocobaltic oxide. Of these only iron need be here considered.

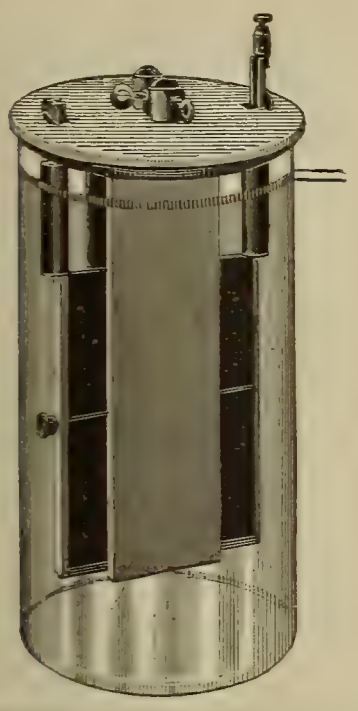
Magnetic Qualities of Iron.

Different specimens of iron differ widely in their permeability. Moreover, the permeability in any given specimen of iron varies with its degree of magnetic saturation; a sample that is already well magnetized. Approximately the permeability of a specimen is proportional to the difference between the actual magnetic flux through it, and the maximum flux that can be forced through it. A certain specimen of annealed wrought-iron for example, which became saturated to practical maximum when permeated with 18,000 lines per square centimetre, had at 17,000 lines per square centimetre a permeability of 161, and when only pushed to 16,000 lines per square centimetre, had a permeability of 320. The intensity of the magnetizing force at any point, usually denoted by the letter **H**, is often expressed by saying that it would produce **H** magnetic lines per square centimetre if acting on an air core. Now, if the space were occupied by a core of iron instead of air, there would be produced by the same magnetic force a larger flux of magnetic lines per square centimetre. This larger number expresses the degree of magnetization of the iron (also called the magnetic induction in the iron); it is denoted by the letter **B**. The ratio of **B** to **H** expresses the permeability of the material at that particular stage of magnetization. To ascertain the magnetic properties of any specimen, a series of observations must be made with various intensities of magnetic force. In any complete research a number of such series have to be made at different temperatures; as certain materials, notably the alloys of iron and nickel lately investigated by Dr. J. Hopkinson, change their magnetic properties much when heated. A series of such observations made by Dr. Hopkinson on a specimen of wrought-iron are represented by the curves in Fig. 2 Two liberties have been taken with this figure. In the first place, the numbers blotted out are the numbers of magnetic lines per square inch, instead of the usual numbers per square centimetre. In the second place, the magnetic forces are plotted vertically, and the resulting induced magnetizat on horizontally, the converse to the usual mode of plotting. The curve that starts from O represents the set of observations made with magnetic forces gradually increasing to about $H = 170$, when the resulting number of magnetic lines per square inch in the iron is about 100,000. It will be noticed that when the magnetizing force **H** approaches the value of 100 the curve becomes very steep, any further increase producing relatively little increase in the magnetization. The second curve represents the result of them decreasing the magnetizing force back to zero, when there remain behind a residual magnetization of no fewer than 47,000 lines per square inch. To remove these would require the application of a reversed (or negative) magnetic force of about $H'' = -13$.

Applying the principle of the indicator diagram to these curves, it will be seen that the area below the first of these curves, down to the zero line, and bounded on the right by the ordinate of the point P, represents the integral product of magnetic force into magnetization, and is consequently proportional to the work done (per cubic inch of the iron) in bringing about the magnetic state of things implied by the position on the diagram of point P. Similarly, the area under the descending curve represents the work restored in the demagnetizing of the specimen down to the state of things represented by the point R, when the magnetizing force has been removed. The narrow area enclosed between the curves represents the work not so restored, and for the expenditure of which the residual magnetism is all that there is to show. If the magnetizing forces are carried through a complete cycle of alternations from $+ H''$ to $- H''$ and back, the magnetization goes through a corresponding cycle, with the result that a definite closed area is completed between the curves in the diagram (Fig. 3). Were there no lagging in phase of the magnetization behind that of the magnetizing force, the ascending and descending curves would coincide instead of enclosing an area. Some specimens of magnetic material—particularly pure octahedral crystals of magnetic iron ore—show no such lag. They exhibit practically no residual magnetization. The phenomena of lag have been studied particularly by Professor Ewing and by Dr. John Hopkinson, to the former of whom we owe the term *hysteresis* to denote this lagging of effects behind the phase of their causes. When a specimen of iron is carried through such a complete cycle of magnetization, and brought back to the same magnetic condition as that from which it started, there is nothing to show in the way of residual magnetization; for in half the cycle work is spent in producing such a residuum, and in the other half work is also spent in destroying the residuum. In fact, the enclosed area represents the work lost by hysteresis. Its only effect is to heat the material; hysteresis being in magnetic problems as molecular friction in the problems of elasticity, the cause of work being wasted.

IMPROVEMENT IN EDISON-LALANDE BATTERIES.

The Edison Manufacturing Company have recently made some very considerable improvements in all their types of Edison-Lalande batteries by the addition of hollow-hard rubber insulators, which are placed on the sides of the copper frames, holding oxide plates, as shown in cut, thereby entirely preventing any short circuiting at the line of solution. By this means, the efficiency of the battery is very greatly increased, as the zincs are not attacked in the least



IMPROVED EDISON-LALANDE BATTERY.

at the water line. The Edison Manufacturing Company will forward these insulators, without charge, to fit any of the Edison-Lalande cel's in use or in stock, on application. In send ng for these insulators a list of the number of batteries and the types should also be forwarded. The type of each cell is stamped on the copper frame. In the K type of cell the company has also substituted a narrower frame, holding smaller and thinner oxide plates, which are exhausted at the end of first charge, together with the zincs and potash solution. This is considered a very great improvement, and they will be pleased to exchange any wide frames, new or otherwise, belonging to the old type K, for the new narrow frames. They will also exchange any supplies of unused oxide plates, old type K, for plates to fit above narrow frames.

SCORING GAMES AND RACES BY ELECTRICITY.

The great popular interest taken in base-ball games, horse racing, and other kindred sports, has stimulated inventors to produce a reliable method of making visual records of the progress of the game for the benefit of those interested, but located at points distant from the scene of action. The popular enthusiasm over base-ball is unquenchable, as is also the desire on the part of such enthusiasts to obtain the latest and reliable news from the grounds on which the game is being played.

Mr. Samuel D. Mott, of Passaic, N. J., is the patentee of a very efficient apparatus invented with the view of meeting this popular want, and he seems to have very successfully attained his object.

The following description and illustrations will give a very good idea of the operation of the apparatus. Fig. 1 represents the Electrical Sporting Indicator and Bulletin—as the device is called—and Fig. 2 shows the mechanism and circuit connections employed in its operation.

Mr. Mott's main purpose has been to devise an instrument of the class referred to so that any number of them may be connected with a single electric circuit operated from the grounds or track where the event is in progress, or at any point from which information as to the progress of the game or race may be sent. He employs an indicating device (Fig. 1), containing a certain number of pointers or hands, a certain number of cylinders or traveling bands, portions of which only are exposed through openings in the face of the indicator. The hands or cylinders are made independently movable and are properly designated by numbers or figures to correspondwith the contestants and with the several

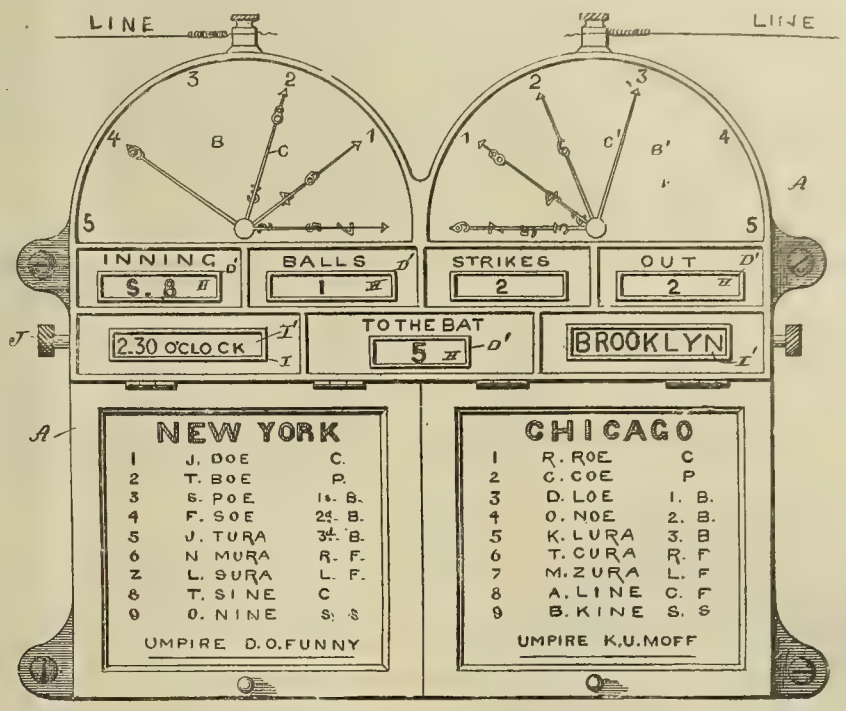


FIG. 1.—MOTT'S ELECTRICAL SPORTING INDICATOR.

parts or positions in the game or race, which is taking place. The operator may turn any one of the hands to any different point to indicate one fact, or may turn the cylinders to expose any given number of characters which will indicate the corresponding condition in the progress of the event.

The indicator, shown in Fig. 1, is designed to exhibit the progress of a game of base ball. The semi-circular dials (B. B′) are divided into given spaces numbered from 1 up, as may be desired. A number of pointers one for each contestant and properly designated, are arranged to be moved step by step over these dials. Each pointer is controlled in its movement independently of all the others by ratchet wheel D, (Fig. 2). If there be 9 contestants on a side, there will be 9 pointers C and a like number of pointers C′. The names and numbers of each contestant and the side to which he belongs is displayed on a card or space therefor provided at the lower part of the indicator and the several pointers will bear numbers, or marks to identify each one with its proper contestant. The cylinders H are independently movable by means of ratchets H′. Pawls E′. Armature Levers F′ and Electro Magnet G′, as shown in Fig. 2.

The operator on the grounds where the game is in progress has positive and negative keys K and K′, by means of which he may send at will direct or reverse current impulses over the line M. At each indicator, and forming part of the mechanism contained therein, are two electro magnets M′ M″, connected with the line either in series or in multiple arc. These magnets have polarized armatures. The magnet M″ is provided with a vibrating armature O carrying a pawl O″, that engages with a ratchet wheel P on a stud or shaft that carries a contact arm P′, which in its movement sweeps over and engages successively with a circular series of contact-plates P″.

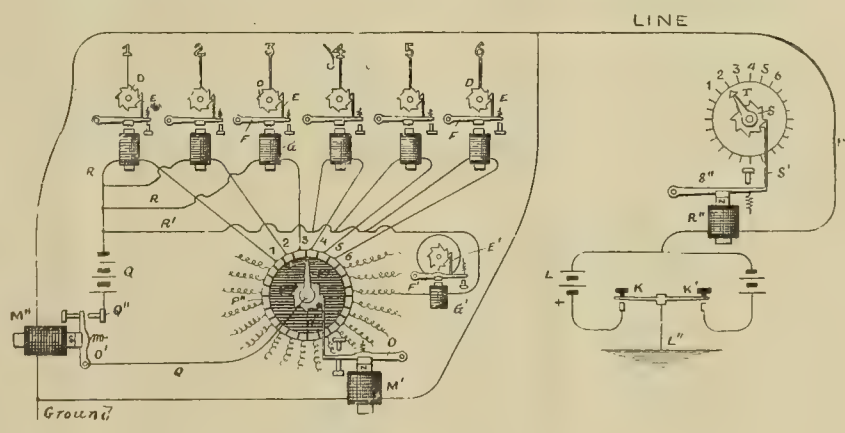


FIG. 2.—DIAGRAM OF CONNECTIONS.

Normally the armature O is attracted toward the magnet; but when the current impulse of given direction is sent over the line the attractive force of the magnet is neutralized and the armature recedes. This permits the pawl O″ to engage with the next succeeding tooth of the ratchet, and when the current is interrupted, the armature being again attracted, moves the ratchet and contact-arm P′ one space or step. In practice the number of ratchet-teeth will correspond with the insulated divisions or contacts P″. In this way the arm P′ may be shifted to any one of the contacts P″.

At the operator's instrument, the ratchet S carries a pointer that sweeps over a dial in which are divisions corresponding to the contact plates P″. Magnet R″ is similar to magnet M′, and ratchet S has the same number of teeth as ratchet P. Consequently the position of the pointer carried by the ratchet S should correspond with that of all the contact-arms P′.

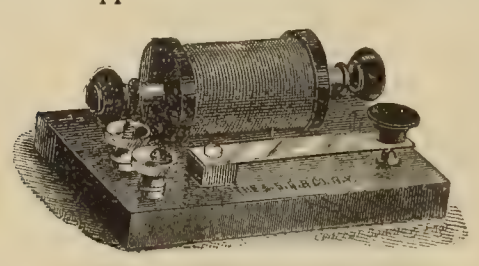
As the game proceeds the cylinders are turned step by step to exhibit the number of balls or strikes "called" and the other changes that take place in the game. When a contestant scores a run, the pointer bearing his number is moved to the figure 1, and when he scores more than one run his pointer is moved accordingly. The sum of the numbers indicated by the pointers on either

side shows the number of runs scored by that side, so that at a glance it may be seen from the indicator the exact stage and condition of the game in progress. For example, the indicator, Fig. 1, shows that a game is being played in Brooklyn between New York and Chicago; that play was called at 2 30 o'clock; that Chicago is playing the second half of the eighth inning; has made eight runs to ten for New York; that of these runs player No. 1 has made three, No. 6 two, and Nos. 2, 4, and 8 one each. It further shows that No. 5 is at the bat; that one ball has been called; that he has had two strikes, and that there are two "out." This will indicate the general purpose of the device.

In a modified form of instrument Mr. Mott will graphically indicate the progress of a horse race, the figures moving over the dial course uniformly with the contestants in the field. This instrument may be also used to show a boat race, foot race or a race of any kind.

THE FREY MAGNETO ELECTRIC BRAKE.

This is a convenient little contrivance for checking the swing of the needle or system of a fibre suspension galvanometer, by sending a slight induced current through the coils, the effect of which is to tend to swing the system in a direction opposite to that in which it is moving.



THE FREY MAGNETO ELECTRIC BRAKE.

The current being slight and capable of being nicely regulated, the deflection can be readily brought to zero. This instrument consists of a coil, the terminals of which are connected with the galvanometer through a contact key. A small bar magnet is pushed or pulled through the coil.

This apparatus is an invention of Mr. Charles P. Frey, and is being placed on the market by the E. S. Greeley & Company, of New York.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRIC AGE,
55 KILBY STREET, ROOM 61,
BOSTON, JANUARY 22, 1891.

Work will be pushed early in the spring on the plant of the Exeter (N. H.) Electric Light Company.

The plant of the Boston Heating Company has been sold to Mr. Hubbard Breed, of Salem, Mass., for $150,000.

Mayor Pease, of New Britain, Conn., has issued an order forbidding the New Britain Electric Light Co. to run their lights until further notice.

Mr. C. M. Goddard, electrical inspector of the New England Insurance Exchange, has been appointed secretary of that organization in place of Mr. O. P. Clark, resigned.

The Johnston Electric Train Signal Co., will move its headquarters to their factory in Woburn early in February. Mr. G. S. Russell, of Marlboro, has been elected assistant treasurer of the company.

When the Worcester and Shrewsbury R. R. is extended from its present terminus at Washington Square to Main St., early next spring, that portion of the line will be operated by electricity.

The annual meeting of the Essex Electric R. R. Co. was held on Monday at Salem, Mass., and the following directors were chosen: King Upton, J. H. Fallon, F. W. Stanley, W. F. M. Collins, J. M. Parsons, W. D. Dennis, F. E. Farnham.

The annual meeting of the Lewiston and Auburn Electric Light Co., of Maine, was held at the office of the company in Auburn. It was voted to issue preferred stock to stockholders of record, one share in every six. The business of the company has increased one-half the past nine months.

The severe rain and sleet storms of the past week, followed by the sudden falls of temperature and the consequent formation of ice upon electric wires, have caused considerable trouble throughout New England. Line and patrol men have been kept busy, night and day, and the resources and management of some of the companies were well tested. The energy and dispatch with which the breaks in all the circuits in and about Boston have been repaired, reflects very creditably upon the companies here. The West End road kept its trolley wires well cleared of ice during the worst of the storm, and ran their cars nearly up to schedule time.

The West End Street Railway Co. have applied to the railroad commissioners for permission to issue $4,500,000 additional stock. The estimated construction expenditures for which new stock is required, are as follows:

Central power station—to complete construction and equipment, ...	$1,200,000
East Cambridge power station, ...	650,000
To complete construction and equipment, ...	500,000
Line construction and equipment,	
Track construction and equipment at $7,500 per mile, (betterment in rails only.)	500,000
Electric car houses, ...	250,000
Electric cars (600 at $4,000.)	2,400,000
Total, ...	$5,500,000

W. H. M.

THE EXHIBITS AT THE ELECTRIC LIGHT CONVENTION IN PROVIDENCE.

General C. H. Barney, chairman of Committee on Exhibits at the convention of the National Electric Light Association to be held in Providence, February 17, 18 and 19, is sending out circulars to exhibitors, giving information concerning the display, etc.

A blank permit for space is forwarded to each intending exhibitor to be filled out and presented to the Superintendent of Installation, who may be found at the exhibition hall from and after 8 A.M., Monday, February 16, 1891.

This permit entitles the exhibitor to the space allotted him in accordance with his application, which space as indicated on a diagram which accompanies the circular.

The following "Notes to Exhibitors" are given:—

1. On account of the short time the exhibition will be open, it is deemed inadvisable to formulate any arbitrary rules for the government of exhibitors. The "golden rule," applied in conformity with the dictates of good fellowship and common sense, is deemed amply sufficient to prevent any exhibitor from encroaching upon the rights of his neighbors, or doing anything that will detract from the general appearance of the whole exhibition.

2. The exhibition will be held in Union Hall, Broad St., diagonally opposite from the hotel, which will be the headquarters of the Association, and only one block from the building in which the sessions of the Association will be held.

3. The installation of exhibits may commence on Monday, February 16th, and all goods *must* be removed from the hall by 12 M. on Saturday, February 21st.

4. The several electric circuits mentioned in circular from the committee, dated December 13th, 1890, will be brought into the hall, on the side indicated in diagram; but the conveying of same to different points in the hall as desired, will be at the expense of, and must be arranged for, by the exhibitors, individually.

5. The committee has arranged with the following parties who are thoroughly competent and responsible, to attend to such business in their respective lines, as may be intrusted to them by exhibitors, at reasonable rates. Exhibitors are requested to correspond with, and give their orders direct to these parties.

EXPRESS AND CARTAGE:—Isaac A. Sherman, 7 Custom House street, on receipt of express receipts or bills of lading, will transport goods to the hall, remove and store packing boxes, redelivering same on space, at close of exhibition, also, cart the goods back to the railroad depots, for re-shipment to exhibitors.

INSURANCE:—Henry R. Barker, 45 Westminster street, will attend to all insurance desired on goods while on exhibition.

CARPENTER WORK—John Battey, 82 Weybosset street, will attend to the erection of any counters, shelving, pavilions or railing desired.

SIGN PAINTING—Timothy Heffernan, 50 Westminster street, will attend to all signs, lettering or show cards that may be wished for.

ELECTRICAL WIRING—Either of the following parties in Providence, will attend promptly to such wiring or other electrical construction as may be needed by exhibitors.

Drake, Payson & Whittier, Washington and Eddy sts.

George H. Thurston & Co., 59 South Main st.

E. M. Carhart, 18 Custom House st.

Swarts & Gannett, Swarts Building.

Providence Construction Co., 20 Exchange Place.

J. F. Hedge, Jr., 146 Westminster st.

6. All goods shipped for exhibition should be plainly marked with the name of the exhibitor himself, for instance, "John Smith, Electrical Exhibition, Union Hall, Broad street, Providence, R. I."

7. The Chairman of the Committee will, upon application, cheerfully furnish any information not included above, or explain any point not fully understood.

The following are the names of applicants for space at the Providence electric light meeting received up to January 20th:

New York Insulated Wire Co., New York city, insulated wire and cables.

Phœnix Glass Co., New York city, electric glass ware, globes, etc.

Washburn & Moen Mfg. Co., Worcester, Mass. samples of wire.

Electric Engineering and Supply Co., Syracuse, N. Y., electric lighting and railway supplies.

Swartz & Gannett, Providence, R. I., electric appliances, accumulators, phonographs, etc.

The Eddy Electric Motor Co., Windsor, Conn., motors and dynamos.

Jewell Belting Co., Hartford, Conn., belting.

American Electrical Works, Providence, R. I., insulated wire.

Jenney Electric Motor Co., Indianapolis, Ind., motors and switches.

Interior Conduit and Insulation Co., New York city, interior and underground conduit.

James W. Queen & Co., Philadelphia, Pa., electrical instruments.

Drake, Payson & Whittier, Providence, R. I., electric models, motors and specialties.

The Okonite Co., New York city, insulated wire, etc.

The E S. Greeley & Co., New York city, electrical instruments and supplies.

Alexander, Barney & Chapin, New York city, general electric supplies.

H. T. Paiste, Philadelphia, Pa., switches, cut-outs, etc.

The Bryant Electric Co., Bridgeport, Conn., electric supplies.

Bernstein Electric Co., Boston, Mass., series lamps and instruments.

T. M. Foote Regulator Co., Boston, Mass., speed regulator.

The Holtzer-Cabot Electric Co., Boston, Mass., electric light appliances.

John Lynch, Washington, D. C., terra cotta conduits.

The C. McIntire Co., Newark, N. J., McIntire connectors, etc.

Eureka Tempered Cooper Company, North East, Pa., copper brushes, commutators, etc.

Standard Electric Supply Co., Boston, Mass., voltmeters and ammeters.

Narragansett Electric Lighting Co., Providence, R. I., display of incandescent lamps, etc.

The Johns-Pratt Co., Hartford, Conn., vulcabeston insulation.

Shultz Belting Co., St. Louis, Mo., belting.

The Walker Electric Co., New York city, ammeters, voltmeters, etc.

Chas. A. Schieren & Co., New York city, belting.

Sperry Electric Light Co., Chicago, Ill., arc lamps, etc.

Thomson-Houston Electric Co., Boston, Mass, recording watt meters.

G. G. Stillman, Boston, Mass., Spencer damper regulator.

THE OKONITE COMPANY.

The International Okonite Company (Limited), New York and London, has declared a dividend for the six months ended December 31st, 1890, on the capital stock of the company, at the rate of 8 per cent. on the preference, and 10 per cent. on the ordinary shares. As stated in our columns last July, this company is the consolidation of the Okonite Company of America, and Messrs. Shaw & Connelly of England, both prominent manufacturers of insulated wires and cables for electrical purposes. This liberal dividend shows an immense business done by the International Okonite Company during the first six months of its existence, and while much of this has undoubtedly been acquired in America, the business done abroad has been considerable.

The manufactory at Newton Heath, Manchester, is rapidly nearing completion, and the necessary machinery is nearly all ready for delivery. When this addition to the existing works comes to be fully developed, a noticeable increase in the English business is looked for. The company handle Okonite insulated wires and cables for aerials, underground and submarine electrical purposes, also Candee and Manson wires. These goods will be vigorously pushed abroad, where their popularity is nearly, if not quite as great, as in this country.

TRADE NOTES.

Mr. F. B. Aspinwall, the New York manager of the Wainwright Manufacturing Co., of Massachusetts, with headquarters in Boston, is distributing among his patrons and friends a neat canvas pocket wallet which should be found very useful for carrying letters, cards, etc. The Wainwright Manufacturing Co. are makers of the new Corrugated Feed Water Heaters and Surface Condensers; also corrugated tubing, expansion joints, Hartford Pump Regulators and steam specialties. Among the other classes of machinery which Mr. Aspinwall handles may be mentioned the monarch Sight Feed Lubricator, the Hoffman Automatic Damper Regulator, the Safety Cylinder Valve, the Monarch Cylinder Oil Pump and Lyman & Warren's Improved Steam Condensing Vacuum Exhaust Pipe Head. The special marine circular issued by his company, sets forth the merits of the Improved Park Double Tube Injector which is extensively used on steamboats. All the goods sold by Mr. Aspinwall are fully guaranteed to be just what they are represented to be, or no sale. Perfect satisfaction is guaranteed. Mr. Aspinwall is doing a very active and well merited business, and the excellence of the goods handled by him is unquestioned.

Mr. M. M. Moore, of 112 Liberty street, selling agent for the Smith & Vaile pump for boiler-feed, etc., has installed two large pumps of this class in the Newark Electric Light and Power Station, and one in the Rapid Transit Company's Station, Newark, N. J.

The C. McIntire Co., of 13 & 15 Franklin St., Newark, N. J., are doing a very satisfactory trade for this season of the year and are having large calls for their fuse terminals and for their special connectors and terminals. These goods have a large reputation for excellence and efficiency, and it is not surprising to hear of the great demand for them.

The enterprising firm of Stanley & Hall, 32 & 34 Frankfort St., have just issued a very elaborate and complete catalogue of electrical house furnishing and electrical supplies. It is profusely illustrated and is probably one of the most complete in its line ever issued. In it we find cuts and descriptions of many electrical novelties. The firm is an enterprising one as shown by their catalogue, and that their enterprise is appreciated, is evident from the fact of their large and increasing business.

The Ansonia Brass and Copper Company, 19-21 Cliff street, with their characteristic enterprise and good taste have gotten up and are issuing an extremely beautiful souvenir in the shape of an oblong book. The front cover is of celluloid, and the leaves contain elegant engravings showing the various mills and factories of the company. An engraving of their offices on Cliff street is given on the back of the cover. On the front cover, the title of the Company is beautifully engraved, and the whole thing is indeed a work of art.

The Edison Manufacturing Co., of Orange, N. J., has just issued an elegant and enlarged catalogue of Edison-Lalande batteries. It is noticed that great improvements have been been made in this battery, in all types of cells, and from all reports the changes have resulted in great increase of efficiency of the battery. The catalogue is profusely illustrated, and contains fac-similes of letters from different persons using the Edison-Lalande battery testifying to the excellence of the same. Much other valuable information concerning the battery is given in the catalogue.

FINANCIAL.

HELLO!! HELLO!!! CONNECT me with the public, please. Hello? Yes, this is Geo. B. Ellery. Say, I have inquired fully regarding your intended investment and am satisfied there is more and safer money for you in electric bonds and stocks than in your railways. I am talking of investment, not speculation or gambling—No, not through yet, central—you can choose between electric manufacturing companies, construction companies, light companies, railway companies by storage battery, trolley or rail system—No, *no*, don't cut me off yet, please—telegraph, telephone, electric or acoustic, talking —-- - - - - -- -- --- or PRINTING. You can invest in the patent, first mortgage bonds, preferred or common stock; judiciously invested you have less to contend with, and are not only safer, but your income, per cent. will be greater than is at all likely in any of the securities regularly quoted on the Stock Exchange,—not quite through yet central,—practically, all securities seek a market at the financial centres; every electric company within five hundred miles of New York should and will have bond and shareholders in New York, and their securities have a fixed value based on their present, but including their prospective, income from their franchise, contract or permit, owned by the parent, sub. or local companies. Think this over and if you want to invest a few hundred or thousand at bed rock prices let me know. —What—O, yes, anything of an electric nature, buy or sell—good bye.

The following letter from Mr. William Lidderdale, Governor of the Bank of England in reply to an address from Mr. H. Rokeby Price, the chairman, and a delegation from the London Stock Exchange, shows what a close contact bankruptcy had on capital and securities, representing it. "Mr. Rokeby Price, and gentlemen of the Stock Exchange:—I am sure my colleagues will appreciate as highly as I do, the honor you have done the Bank of England in presenting this address, and will value the favorable opinion of their action which has been expressed, an opinion the more to be appreciated as coming from a body peculiarly well able to judge of the magnitude of the crisis, and of the consequences that would have followed the suspension of Messrs. Baring Bros. & Co., with liabilities to the extent of £21,000,000. What these consequences might have been I hardly dare to think; what security would have been saleable? What bills could have been discounted, if so great a disaster had really come to pass? We have been enabled to escape the danger, and we may congratulate ourselves on the peace and quiet we are now enjoying, instead of the panic which would have followed the announcement of the failure of so great a firm, a panic which would have extended far and wide, and reached far beyond these shores. When you thank the Bank of England, it is very important to bear in mind the willing and cheerful assistance we have received from others. In the first place from Lord Rothschild, whose influence with the Bank of France was of such assistance to us in obtaining those means, without which we could not have rendered the aid we were enabled to give. Secondly, the help of Her Majesty's Government in the assurance of support if required, a support which it has happily not been necessary to claim. Equally valuable was the prompt assistance of those who subscribed to the guarantee fund, without which it would have been impossible even for the Bank of England to have undertaken so enormous a responsibility. So far as you refer to my personal exertions, I shall always remember with pride and satisfaction that, in the opinion of such a body as yours, in a moment of danger I was able to do my duty."

The converter shunted the current, the generator is being removed, all is on glass again, and the whole circuit undergoing repairs, which, let us hope, will be positive and permanent.

THE WESTINGHOUSE COMPANY'S AFFAIRS.

Mr. Paul D. Cravath, counsel in this city for the Westinghouse Electric Company, stated a few days ago, that he thought George Westinghouse would be out of his troubles in a few days. Mr. Westinghouse was in New York Monday, the 19th, and Mr. Cravath said that the electrician's friends were coming to the front very considerately to help him. Some of the creditors have signified their willingness to accept preferred stock instead of cash, and including what Mr. Westinghouse's friends in this city have taken, 20,000 shares have now been placed.

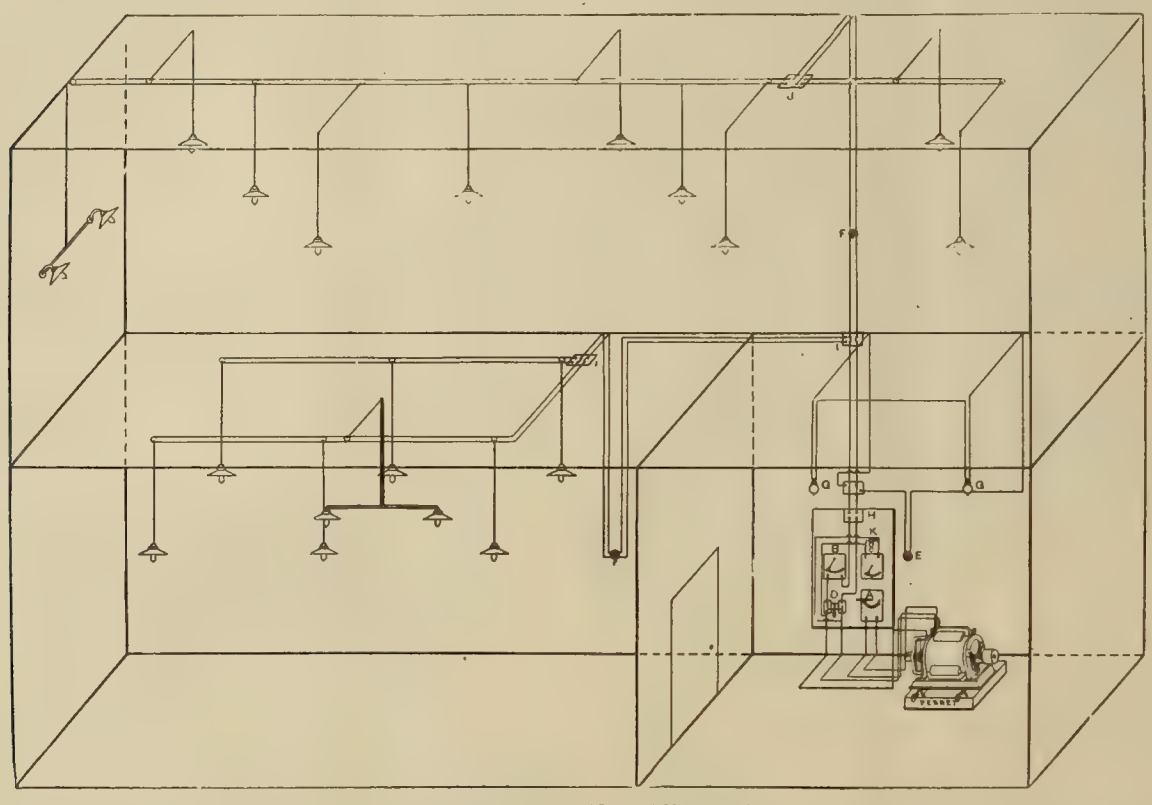
The proposition made in Pittsburg on the 17th inst., to the creditors was to accept preferred stock in place of cash, the signatures to be binding if 60,000 shares at $50 par, or $3,000,000 worth were disposed of.

Judge Lawrence vacated, on the 19th inst., an attachment for $1,899 obtained against the Westinghouse Electric and Manufacturing Company of Pennsylvania, by Robert D. Nuttell.

EXCITATION OF FIELD MAGNETS.—Primary batteries may be, and in fact were at one time, used to furnish the current for the purpose of exciting the field-magnets of an electric dynamo, but it is far more economical and advantageous to obtain this current by means of a small dynamo.

WIRING.

One of the most important points in installing an electric light plant is the wiring of the building in such a manner as to give the most tasteful effects and placing the lights where most needed with the most economical expenditure of wire. It is a simple matter when placed in the hands of experienced workmen, but many persons in placing small electric light plants in their houses, do this work themselves and go at it without any definite plans only to find out after it is finished that they have placed both the distributing apparatus and the lights in the most inconvenient places possible, and used twice as much wire as was necessary.



PLAN FOR WIRING A BUILDING.

The accompanying drawing shows very clearly the method of wiring a building and the connections with the gene ating and distributing apparatus.

Every part of the circuit should have wire of a diameter proportionate to the current it will have to carry, and all joints or splices should be electrically and mechanically perfect. All parts of it should be perfectly insulated, and care should be used to protect the insulation from abrasion where it passes through partitions or walls.

Those desiring to do their own wiring will find the drawing an aid in giving them a general idea how wiring is properly done.

Among the distributing appurtenances are a rheostat for adjusting the electrical pressure so as to produce proper brilliancy of the lamps, shown at A in the diagram ; a voltmeter C, to indicate the electrical pressure ; an ammeter B in the main circuit, to show the amount of current flowing to the lamps ; main switch D, and main cut-out H. These, with the pilot lamp K and the arc light switch E, if arc lights are used, as shown in the diagram, in connection with an incandescent plant, are placed as near the generator as is most convenient. The other apparatus shown are : I, branch cut-out ; F, branch switch, and J, a double branch cut-out. It will be seen that the lamps are placed in multiple.

UNIT FIELD OF FORCE.—A magnetic field of unit strength is one having one C. G. S. line of force per square centimeter, and if a conductor one centimeter in length is moved transversely through this field at a velocity of one centimeter per second, it will cut one line of force per second, and thereby develop one C. G. S. unit of electro-motor force.

INDESTRUCTIBILITY OF ENERGY.—Energy can never pass out of existence or be destroyed.

PROSPERITY OF THE EDISON GENERAL ELECTRIC COMPANY.

The annual election of the Edison General Electric Company was held January 19. Henry Villard was re-elected president; J. H. Herrick, vice-president; Samuel Insull, second vice-president; F. S. Hastings, treasurer, and A. Marcus, secretary. James B. Williams was elected a director in place of Joseph H. Decker, who declined to run.

The other directors elected were Carl Schurz, Thomas A. Edison, C. H. Coster, J. H. Herrick, Samuel Insull, Edward H. Johnson, A. Marcus, Francis S. Smithers, J. Hood Wright and Henry Villard.

The stockholders ratified the action of the directors in declaring a dividend on the stock held in trust by the Farmers' Loan and Trust Company, and voted to dissolve the trust.

It was also voted to increase the capital stock of the company from $12,000,000 to $15,000,000. A long report of the operations of the company for the year was presented and adopted. The profits were $2,782,457, and when the expenses were paid a surplus was left of $1,195,553. There was expended for the year $949,000 for new buildings, machinery and plants.

The quick assets amount to $3,619,063, while the entire liabilities, other than those of its stockholders, amount to $2,647,828. Adding to its quick assets $4,272,000, which represents amounts expended on contracts in course of completion, the working capital over and above liabilities appears to be $5,250,000.

The directors were elected by a vote of 105,358 out of a total of 118,613 shares. There was no opposition. The proposition to increase the capital stock was adopted by a similar vote. The company has 6,000 employes on its pay-roll, and the transactions for the year represented an aggregate of $10,000,000.

ELECTRIC LIGHT IN SAN DIEGO.

While enumerating some of the principal institutions of San Diego, Cal., the *San Diego Union* has this to say about the electric light system of the city :

"The incandescent system of electric lighting was introduced about two years ago by the Electric Rapid Transit Street Car Company, Geo. D. Copeland, president, and has become an assured success under his management, reducing the rates of commercial and domestic lighting beyond any which ever prevailed in this city. In fact the rates for gas and electric lights are now lower in San Diego than those prevailing in other towns on the Pacific coast where steam power is used, and should the project to use the water-power at the end of the flume materialize, still further reduction in rates may be expected.

The present Copeland plant consists of two Westinghouse alternating current incandescent dynamos of a capacity of 750 16-candle power lamps each, including exciters, switchboards and electrical instruments. The dynamos are run by steam power, and so complete are all the operations of the system that there has been no interruption in the regular business of light distribution during the past year. This plant was established at the close of the "boom" period, and many predicted that the effort to establish the business in the face of the opposition of the old established and wealthy gas company, and during a time of such financial depression as has prevailed during the past two years would be a failure. Under the economical management, however, of Mr. Copeland, the enterprise has become one of the permanent and successful institutions of the city."

THE SHAPLEIGH SELF-REGISTERING WIRE GAUGE.

We take pleasure in illustrating a self-registering wire gauge, invented and manufactured by Mr. M. S. Shapleigh, of 112 S. Fourth street, Philadelphia. A description is not necessary as our cut, which is the exact size of the gauge,



SHAPLEIGH WIRE GAUGE.

shows exactly what it is. As it is small enough to be carried in the pocket without inconvenience, there will be a large demand for it among those needing this useful article. It is guaranteed to be accurate in its record, and, as will be seen, the B. & S. wire gauge is used. This handy wire gauge is made of polished steel, and is provided with a hole so that it may be carried on a key ring.

WIRES DAMAGED BY STORM.

The storm of January 17th and 18th played general havoc with electric wires in this vicinity and along the coast States eastward. The rain and sleet froze to the wires as it fell, increasing the size of the conductors to huge proportions. The weight of the frozen rain was so great as to break the wires down. All classes of conductors suffered. In Boston the electric cars experienced great difficulty in keeping in operation on account of the inability to get a good contact between the trolley and wire through the ice. Telephone and telegraph wires were brought down in a chaotic mass and the electric light service was demoralized.

In Providence the telephone service was completely disorganized, as were also the telegraph and fire alarm services. The electric light station was shut down at 3 o'clock, A. M., January 18th, by order of the fire department, to prevent damage through the crossing of wires.

RETENTIVITY —In selecting material for permanent magnets, the principal thing to be considered is the retentivity, which should be as high as possible.

FOREIGN NOTES OF INTEREST.

A scheme is on foot to light Durham Cathedral by electricity, the motive power to be derived from the river Wear.

A committee have been sent on behalf of the State Railways of Saxony to examine the Zipernowsky system of electrical distribution as laid down by the Internationale Elektricitäts Gesellschaft of Vienna.

The Birmingham Electric Light and Power Company is rapidly progressing with the work of main-laying, and fair progress is being made at the generating station in Albert-street. Orders for over two thousand lights have already been received.

The total mileage run during 1890 by the accumulator cars on the Barking-road line, London, was approximately 80,000 car miles. According to schedule time the possible mileage was approximately 1 per cent. more than that actually run.

On December 17, 1890, the 15,000th telephonic apparatus was connected to the Berlin Exchange. The 10,000th telephone was installed April 18th, 1889. The number of subscribers has, therefore, increased 50 per cent. in under two years.

M. Paul Hoho and a M. Lagrange, an officer in the Engineers, have devised a system of electric welding which is essentially different, it is stated, to that of Elihu Thompson. The Hoho-Lagrange process will be worked in Belgium by the Julien Company.

The visible supply of copper in England and France and afloat thereto was 65,366 tons at the end of December, against 65,440 tons at the end of November. The present stock is about 33,500 tons less than it was a year ago. The deliveries in England and France during December were 11,881 tons, or about 650 tons more than in the preceding month. For the year they aggregated 145,641 tons against 118,652 tons in the previous twelve months, and 63,906 tons in 1888.

The authorities of the Port of Bordeaux have decided to lay down a telephone cable to enable vessels in the roadstead at Pavillac, 26 miles distant, to communicate with the port.

The Naples Council of Public Works has approved of a project for the construction and working by electricity of the tramways from Naples (Musco) to Capodimonte and Miano.

The little town of Vaison, in the department of Vaucluse, which has only some 3,000 inhabitants, is now lighted by electricity on the Ganz system, the generating plant being over a mile and a-half from the town. The pressure employed is 1,800 volts. In a few weeks time the little town of Monteux, in the same department will also be supplied with current on the alternate current transformer system. In each case a single alternator of about 30 h.p. is used

The Societe Francaise d'Accumulateurs have just made some seizures of Tudor and of Bett accumulators. With regard to the Gadot accumulators which were impounded some time ago, the experts' report is expected to be published immediately. As to M. Julien having recognized the Faure-Sellon-Volckmar patents and agreed to pay an indemnity to the Societe Francaise, he has acquired the right to manufacture lead and lead peroxide accumulator plates on payment of a royalty of 20 centimes per kilogramme.

The Golborne Colliery, in Lancashire, has recently been fitted with an interesting alternate current transformer plant, designed to light the colliery both underground and on the surface, also to supply current for 150 16 c.p. lamps at the residence of the colliery owner at Golborne Park, about 1½ miles away. The dynamo is a 25-kilowatt 2,000 volt Mordey alternator. At the colliery itself there is a 300-light "Hedgehog" transformer. For the private house there is a 150-light "Hedgehog" transformer, and a 50-light transformer for the lamps lighting the drive, which is about a quarter of a mile long. The long distance circuit is of $\frac{7}{19}$ insulated cable, and is mostly run overhead upon poles and suspension wires. In order to comply with the requests of local authorities, wherever the cable crosses a road, which it does in three places, it is laid underground in suitably protected iron pipes.

According to the *Bulletin des Teléphones*, the number of subscribers to the nine chief telephone exchanges in France was, at the end of November, as follows:—

Paris	9,200
Lyons	800
Marseilles	600
Bordeaux	500
Lille	450
Reims	400
Roubaix	350
Tourcoing	500
Nancy	176

Cannes, Saint Etienne, Nantes, Troyes, Saint-Quentin, have about 150, and then come some thirty towns with from 50 to 100 subscribers each.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the 53d meeting of the Institute, held at the house 12 West 31st street, the evening was devoted to the thorough discussion of Mr. Kennelly's paper on "Inductance and its Proposed Unit, the Henry," also the report of the committee appointed to consider the proper magnitude of the unit. The report of the committee was finally adopted, and is as follows:

REPORT OF THE COMMITTEE ON THE VALUE OF THE "HENRY."

At a meeting of the American Institute of Electrical Engineers, held September 16th, 1890, a committee, consisting of Dr. Wm. E. Guyer, Dr. Louis Bell, George M. Phelps, Edward A. Colby, and Francis B. Crocker, Chairman, was appointed to consider and report upon the best value for the "Henry"—the proposed practical unit of self-induction or inductance.

After careful consideration the committee has reached a conclusion and now recommends to the Institute the retention of the present value of the practical unit which is 10^9 absolute units of inductance, usually expressed as a length equal to one earth's quadrant or 1,000,000,000 centimeters.

The committee finds that this value is too high, in some cases, for convenience, as many practical measurements of inductance would have to be expressed in fractions of a henry. At the same time other practical values would often amount to a number of henrys, and sometimes to hundreds or even thousands of henrys. It is of course impossible to have a unit fit all cases, and in this instance it happens that the average practical inductances would approximate one henry in value. This may be considered fortunate. Small values may be conveniently expressed in millihenrys, analogous to milliamperes, etc.

The committee is of the opinion that even if the value of this unit (10^9 absolute units) had been much less convenient than it is, nevertheless it would probably be very unwise to change it, for the reason that it is derived from and related to the other practical units in the ratio of one to one, just as one ampere is equal to one volt divided by one ohm. To depart from this plan which has always been followed heretofore, would tend to destroy the harmony of the entire system of practical electrical units. The same fact made it necessary to define the farad as a capacity of one coulomb at one volt, although this makes its value so enormous that the micro farad is always used in practical work. It appears, therefore, to the committee that the value of the "henry" should certainly be fixed at 10^9 absolute units of inductance.

At the regular monthly meeting of Council held the same date, it was voted to change the date of the 54th meeting from February 17th to the 24th, in order to avoid conflicting dates with the convention of the National Electric Light Association, and also to afford members of the latter an opportunity of attending the Institute meeting upon their return from Providence.

Mr. A. H. Hardy Trott, of the Thomson-Houston Electric Company, Lynn, Mass., was elected a life member, and the following associate members were also elected:

F. C. Bates, Electrical Engineer, with Thomson-Houston Electric Co., Lynn, Mass.

William J. A. Bliss, Assistant in Practical Electricity, Johns Hopkins University, Baltimore, Md.

Edward Caldwell, Assistant Editor, *Electrical World*, 167 Times Building, New York City.

Charles F. Chandler, Professor of Chemistry, Columbia College, and Prof. of Chemistry and Physics, College of Physicians and Surgeons, N. Y. City.

Gustave J. Fischer, Engineer for Tramway Construction, Public Works Department, Sydney, N. S. W.

Samuel V. Hoffman, Post-graduate Student Johns Hopkins University, Baltimore, Md.

Arthur B. Levy, Assistant Engineer, Arc Light Dep't. Edison General Electric Co., 235 E. 50th street, N. Y. City.

Thos. R. Taltavall, Editor, ELECTRICAL AGE World Building, New York City.

NEW PUBLICATIONS.

We have received a copy of the first number of "*L'Electricien Revue Internationale de l'Electricité et de ses Applications* published in Paris, which represents the combination of "*L'Electricien*" and the "*Revue Internationale de l'Electricité et de ses Applications.*" The union of these two journals was effected recently, and the new journal will no doubt keep to the front in electrical matters on the continent. The first number is replete with original and interesting reading. The home office is 37 Rue Fondary, Paris, and M. Montpellier is editor-in-chief.

Discovery is the name of a new paper brought out in Liverpool, Eng., on the first of the year. It is to be devoted to invention, scientific discovery and the application of science to industrial purposes. It deals liberally with electrical matters.

ELECTRIC LIGHT NOTES.

During the sleet and snow storm January 17th, Hartford, Conn., was in darkness to a great extent. The weight of the ice on the electric wires was so great that some of them broke down and fell into the street, and as there was danger of the others being also leveled to the ground in a similar manner, the Mayor ordered the two electric light companies to shut off all the currents, and thus avoid danger. Gas and oil lamps were brought into use for the time being.

Leslie, Mich., is moving towards street lighting by electricity.

The city of East Tawas, Mich., is negotiating for an electric light plant for street lighting. It is the purpose of the town authorities to add the electric lighting to the water works plant, and to run it in connection therewith.

The Forest City Electric Light & Power Co., of Rockford, Ill., supplies light for about 6,000 incandescent lamps and 120 arc lamps. Besides this, the company furnishes power for a great many motors used in running various kinds of machinery throughout the place. The streets of Rockford, however, are not lighted by electricity. The company has a capital of $80,000, all paid in, and has two power houses.

AN INTERESTING ESTABLISHMENT.

E. T. Copeland & Co., dealers in steam engines and boilers for electrical light and power plants, will make a specialty of supplying engines and boilers for every line of duty. Salesrooms and offices are at 106 Liberty street. Mr. E. T. Copeland, the principal of this firm is well known to all electricians in this country as well as Canada and South American countries for his popularity gained through the introduction of the New York Safety Steam Power Company's electric light engines. Mr. Copeland's experience as a business man dates back 30 years, when he entered the department of steam power installations. He was most successful in this line of industry, and 12 years ago the New York Safety Steam Power Company, 30 Cortlandt St., New York, N. Y., secured him as their general manager. Up to that time the output of this company's engines, boilers, etc., was nominal; but through Mr. Copeland's energy and perseverance —for which he is noted—he increased the sales until he reached an average of over 500 engines per year; particularly electric light automatic high speed engines ranging from 25 horse-power up to 150. Mr. Copeland has made a specialty of fitting out steam yachts and launches for a number of years, and has met with well-merited success. He has secured the control of an entirely new engine ranging from 2 horse-power up to 50. These engines are made in various sizes, with automatic governors for electric lighting and power use. They are made in the most simple form, compact and strong throughout. The cylinders are of the vibratory type and on the most economical basis, allowing a direct acting piston rod without joints. These engines are made in such a compact form that any size desired can be placed on the floor, hung from the ceiling, or affixed to walls or upright columns, and in fact, placed in any desired position where the economy of space is an object. Mr. Copeland also controls an entirely new tubular boiler, of an improved type which has already gained a high reputation in the market. These boilers are so simple and compact that one of 70 h. p. can be placed in a space 5 x 5 x 5 ft. This firm has also secured a line of automatic electric light engines, of power ranging from 50 to 3,000 h. p. for any electrical application as well as mechanical. It is the intention of this firm to devote their main floor to offices for the representatives of different lines of manufactures. Their first floor and basement will be entirely devoted to the exhibition of plants. They invite manufacturers and others in the electrical and mechanical industries to come forward and investigate the advantages offered for the exhibition of specialties. They desire to exhibit the various applications of dynamos, motors, etc., or any application of mechanical power, and for this purpose are putting in a line of shafting to be run by a "Case" engine, the power to be developed by a Worthington boiler. The plans of Mr. Copeland's firm, when fully carried out will place them to the front in their particular line of business.

NEW YORK NOTES.

The Leclanche Battery Company have moved their factory and office to No. 117 East 131st street, where they have secured greatly increased space and facilities for manufacturing. The company will no doubt be better prepared to fill their orders without delay.

Mr. George C. Rand, of Lawrence, L. I., two years ago purchased 174 cells of storage battery to be used in lighting his house, stables, etc., but satisfactory results were not obtained. Having heard of the excellence of the batteries of the Accumulator Company, he called at their office, 44 Broadway, and ordered a battery of 60 accumulators of the 15 L type, to replace the 174 cells of the original battery, with which he had become dissatisfied. The accumulator cells have been in use over a month, and Mr. Rand is highly satisfied with them, and he claims that the 60 cells do more satisfactory work than the 174 original cells of the other make. He is very much pleased with his success with the accumulator cells, and does not hesitate to express his opinion of their efficiency.

Manhattan Electric Supply Co., 36 Cortlandt St., are meeting with a big sale of their early-risers outfit. Send for their new catalogue of electrical specialties and supplies.

Watch the Aluminum Brass & Bronze Co., 53 Chamber street, as they intend to astonish the buyers of the country as well as electricians, with one of the neatet novelties ever put on the market. This firm has introduced their silicon bronze wire into more than 100 electric railway plants for trolley wires.

Taylor Primary Battery Co., 39 Dey street, have been unable to keep up with the demand for their batteries within the past week. The writer in examining this battery recently was pleased to note a number of great improvements in the same, and it is no wonder that the firm have had such successful sales.

Mr. J. W. Godfrey, General Manager of the New York Insulated Wire Co., was in town the past week and reports the most brisk demand for their goods. An investigation of the reading columns of our paper will tell the story very faithfully of the numerous electric light and power plants using their products.

Mr. C. O. Baker, Jr., of 408 New Jersey Railroad avenue, Newark, N. J., the noted manufacturer of platinum for all electrical applications, particularly the incandescent lamp, was in town the past week and says that there is no foundation for the reports around town to the effect that there is supposed to be a substitute for platinum to be put on the market shortly.

The following gentlemen called at the Electric Exchange of Alexander, Barney and Chapin, 20 Cortlandt street, New York, during the past week: F. Z. Maguire, N. R. Tesla, C. G. Ferguson, Alex. Welsh, Charles Dutton, J. C. Perrez, J. W. Pease, D. J. Ludwig and Maybin W. Brown, New York; H. C. Carson, Akron, Ohio; T. H. Brady, New Britain, Conn.; M. E. Baird, Hartford, Conn.; Walter McIntire and A. J. DeCamp, Philadelphia, J. P. Powers, Troy, N.Y. and H. G. Martin, and C. F. Hutchinson, Boston.

The Ward Arc Lamp for alternating currents, which was only put on the market a week ago, is attracting unusual attention. The general questions among the trade are: How about the new Ward Arc Lamp for alternating currents? How does it operate? Is it a success? How simple is it? Does it really come up to your statements as reported in your last edition of the Electrical Age under New York notes? I must say that any one can verify my statements made in these notes by simply investigating for themselves the merits of this new arc lamp by a visit to the Electrical Construction & Supply Co., 18 Cortlandt St., New York.

Messrs. Tucker & Hall, Room 8, World Building, constructing electricians and contractors for electric light and power plants, including all the electrical apparatus for the same, steam plants, wiring, etc., are doing a first-class business. This young firm have already gained a high reputation for their excellent work and have every facility for carrying on such work in the best manner. They undertake the installation of either isolated or central station plants, and make a specialty of wiring for all systems of electric lighting, and also special wiring for household or office purposes. Mr. J. P. Hall has just completed the installation of 3,000 16 c.p. lamps and 5 United States dynamos in the new building of the New Jersey Central Railroad, Liberty, Washington and West streets. For this purpose 21 miles of White Core Grimshaw wire was used, and run in the well known interior tubing of the Interior Conduit and Insulation Company. Any wire in the building can be taken out and replaced as desired, and some runs are 150 feet in length. This firm are now engaged in installing a new plant in the Holland House, corner 5th Avenue and 30th street. This plant will include 3 United States dynamos of new special type, and 4,500 incandescent lamps of 16 c.p., each. Two of the dynamos have a capacity of 800 amperes and the third 600 amperes, and each machine has four upright field magnets. Grimshaw White Core wire is used in this installation.

Jerome Kidder Manufacturing Co., 820 Broadway, New York, are said to be the oldest manufacturers of electric medical batteries in this country. Dr. Jerome Kidder, the founder of this firm, in his day was one of the most popular physicians in this city and when he first introduced this line of goods, they met with popular favor and have kept that record up to to-day, as they are doing a very extensive business. They make batteries for every medical and therapeutical application. They will send a catalogue to any one desiring something in their line, whether they are physicians, surgeons, or heads of families, as well as individuals desiring electric medical treatment.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery Financial Editor, Electrical Age:

Anglo-American Electric M'f'g. Co.	$ 2.00
American Motor	5.00
American Telegraph and Cable	
Ball Electric Light	
Bell Telephone	204.00
Bentley Knight	
Brooklyn, Edison Electric Light	100.00
Brooklyn Citizens' Electric Light	12.00
Brooklyn Municipal Light	12.50
Brush Illuminating	70.00
Brush-Swan	20.00
Consolidated Electric Light	50.00
Daft	
Edison General	94.00
Edison Illuminating	95 00
East River Electric Light Company	80.00
Fort Wayne	10.00
Harlem Electric Light Co.	60.00
Julien	
Law Telephone	95.00
Mount Morris Electric Light	90.00
New York and New Jersey Telephone Co	96.00
North American Phonograph	25.00
Postal Telegraph	
River and Rail	15.00
Swan Incandescent	3 00
The Accumulator Co.	
Thomson-Houston Electric Co.	50.00
United States Electric Co.	40.00
United States Illuminating	70.00
Westinghouse Electric	
Anglo Am. Elec. Manuf. Co.	1.00
American Private Telephone. (Parent)	98.00
Cowles Elec. Smelting & Aluminium	
Edison Elec. 5s	99.00
Eureka Elec. (Loomis)	
Jamaica Gas & Elec. Light (N. Y.)	95.00
Mount Morris. 6s (N. Y.)	95.00
New England Telegraph & Telephone	51.00
New York and New Jersey Tel. & Tel. 5s	par
Rockaway Park Elec. Light	80.00
Saratoga Gas & Elec. Light 6s	86.00
United Elec. Traction Co.	2.50
Westinghouse Elec. Pref.	50.00

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate but will be found very near the mark.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRIC AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., Jan. 23, 1891.

The Electric Merchandise Company will soon have out a new and handsome catalogue which will be of value to the street railway trade.

The Elmer A. Sperry Company, 205 Canal street, are having their manufacturing facilities tested with orders for supplies. A large lot of porcelain cut-outs was a noticeable feature of the present week's output.

Mr. George Mills, an electrical engineer connected with the Sperry Electric Company, has just returned from the East, where he started a number of plants for that company, at Buchanan, Virginia, New York City and elsewhere.

The Washburn & Moen Company have secured an option on a tract of land at Waukegan, Ill., with the object of locating a factory to take care of their western business. Several other sites are being inspected, one being in the vicinity of Hammond, Ind. The company already owns a tract a few miles south of South Chicago. It is not likely that anything definite will be done before spring.

Explosions of gas in three manholes last Saturday killed a woman and injured several persons besides blowing out several plate-glass windows. Naturally the cause was at once laid to the charge of the electric service, but subsequent developments seem to point to the careless use of a candle by workmen in a neighboring basement as the occasion of the explosion. The finding of the coroner's jury and the discussion of the subject locally will probably lead to some method of ventilating the manholes in the near future to prevent repetitions of a like character.

The Belding Motor and Manufacturing Company have just met with a misfortune in the destruction by fire of their new factory at Waubansia and Howard avenues. The explosion of a lamp in the Expanded Metal Company's building started the fire, which spread to the Belding Company's building and completely gutted the same, leaving the walls but little damaged. The insurance on the building $30,000 will cover the loss. The boilers, engines and most of the new machinery were saved. The company expected to move into this factory, which was just completed, within a few days, and will work night and day to rebuild the structure. They expect to be able to move in in about thirty days. The factory is said to have been one of the finest in the city, thoroughly equipped in every detail, and will give employment to 500 men. It was provided with improved fire apparatus, which lack of water rendered unavailable. The old factory at 128 Clinton street is still running and all orders will be filled promptly from it.

A press despatch from Cleveland, O., under date of January 21, is as follows: The Cowles Electric Smelting and Aluminum Company held their annual meeting here to-day. A half ton of pure aluminum manufactured at their works in Lockport, N. Y., was displayed to the shareholders. Under the new process employed by this company pure aluminum is now sold at retail at $1.25 a pound. With the improvements now in progress it is expected to bring the price down to figures that solve the question of producing cheap aluminum.

NEW COMPANIES.—Peoria and Mount Hawley Street Railway Company, at Peoria, Ill., capital stock $250,000; incorporators, Delos S. Brown, William M. Lyons, George N. Brown.

Chicago Incandescent Light Company, capital stock $15,000; to manufacture electrical supplies; incorporators, C. S. Olmsted, E. S. Osgood, H. R. Husted.

Fulton & East Clinton Street Railway Company, at Fulton, Ill.; capital stock $20,000; to construct and maintain a street railway between Fulton, Ill., and Clinton, Ia., and furnish light and power; incorporators, Thomas A. Hardin, George S. Sardam, Clarence Green.

Princeton Electric Light & Power Company, Princeton, Ill.; capital stock, $15,000; to furnish electric light and power and to construct an electric motor line; incorporators H. H. Ferris, David Knight, J. A. Stean, D. B. Loverin, D. E. Munger, H. H. Preestly.

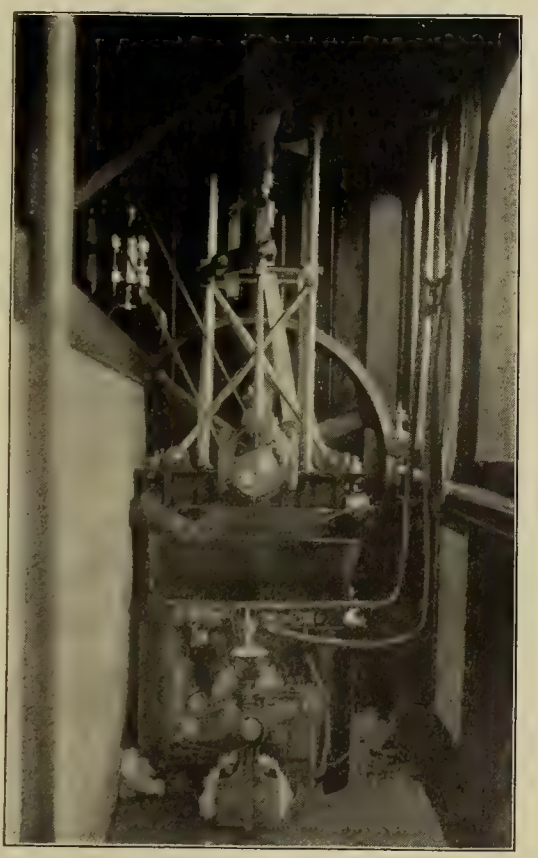
North American Electric Company, Chicaog; capital stock $1,000,000; to manufacture motors, car trucks, and electrical appliances; incorporators, J. H. Donnelly, F. J. Lally, and Myron H. Beach.

Chicago Electric Protective Company; capital stock $100,000; to deal in electrical supplies and operate fire and police alarm and patrols; incorporators, Mark Simons, W. M. Lawley, Frank S. Weigley. F.M.I.

ELECTRIC LIGHT PLANT ON THE STEAM YACHT "AZTEC."

No steam vessel of any pretensions is considered complete these days unless she has an electric light installation on board. Most all passenger steamers, on oceans, lakes and rivers are equipped with this electrical convenience, and these plants seem to give very satisfactory results. The success of electric lighting on ocean steamers led to its adoption on sound, lake and river steamers in this country, and it is not surprising to learn that pleasure yachts propelled by steam are now being fitted out with electric light plants.

Whether the plant is on a great ocean steamer or on a diminutive yacht economy of space is a very important consideration. The engine, dynamo, and all accessories must necessarily be as compact as possible and occupy a minimum amount of space.



DYNAMO PLANT ON YACHT "AZTEC."

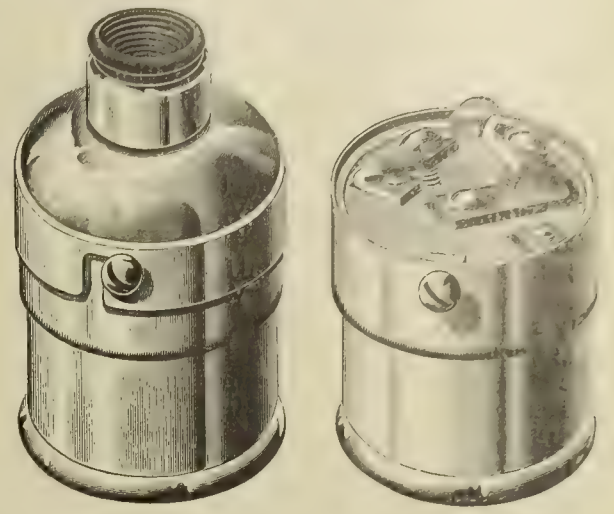
An interesting plant of this character is that installed in the steam yacht "Aztec."

As will be seen by reference to the accompanying illustration, which is reproduced from a photograph, the steam engine is placed above the dynamo, and the steam power is transmitted to the dynamo armature by the Evans friction system. The dynamo is a 100-light Loomis machine, and supplies current for 100 sixteen candle power Loomis lamps, and one Huntington search light.

The whole plant is compact and well designed. It takes up remarkably small space, and was installed by the Eureka Electric Co., of 18 Broadway.

KEYLESS LAMP SOCKET.

The accompanying illustration [illegible] keyless socket, the "ELECTIT" [illegible] being brought out by the Star [illegible] Philadelphia.



KEYLESS LAMP SOCKET.

This socket is made to fit any lamp and contains nothing in its make-up but porcelain and brass. It is easily wired and considered very neat in appearance.

This enterprising firm continue to add new things every few weeks and already have quite a complete line of electric lighting supplies, such as 5 Amp. and 10 Amp. S. P. Switches, 25 Amp. D. P. Switches, key and keyless-sockets, insulating joints, gas attachments, ceiling cut-outs, and branch and main cut-outs, etc.

PHILADELPHIA NOTES.

The Star Electrix Company, of 1320 Wallace street, corner Broad, will soon bring out some very ingenious sockets, cut-outs, and switches, and they expect to surprise the electrical trade in a few days with some lately perfected devices in this line. As those having need of these necessary parts of electric light and power plants are familiar with the way this firm improve things we think that they will be the parties surprised by the way their new devices will be bought up.

The Citizen's Street Railway of Norristown, Montgomery County, Penn., seventeen miles north of Phladelphia, has been purchased by a syndicate represented by Mr. C. R. Eberle, the general manager of the United Electric Equipment Company, who will thoroughly equip the same with electrical power in the near future.

Partrick and Carter Company of Philadelphia are now settled in their new quarters at 125 South Second street, and 131 Gothic street, and everything is moving along smoothly. They are very busy and all orders are now being filled with the promptness for which this house is noted, the delays caused by moving, etc., having been overcome. Their 1891 catalogue is now in the printer's hands, and will come from the press early in February. Copies will be mailed upon application, and those in the trade will receive discount sheets if they send their business card as evidence that they are entitled to such discounts.

The Empire China Works, 144 and 156 Green street, Greenpoint, Brooklyn, E. D., N. Y., are manufacturers of all kinds of porcelain electrical supplies for electrical light, electric power, electric railway inside and outside work. They also manufacture every line of insulators for electrical applications and make to order from special designs any porcelain insulator required and of any size. Standard goods always in stock.

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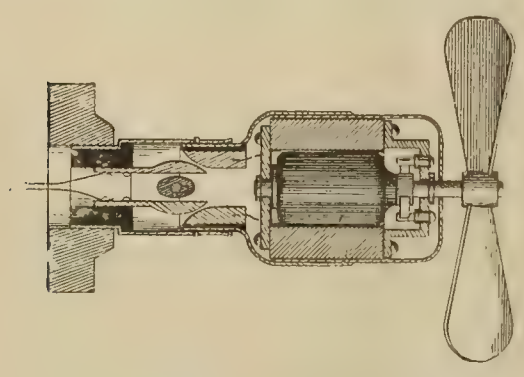
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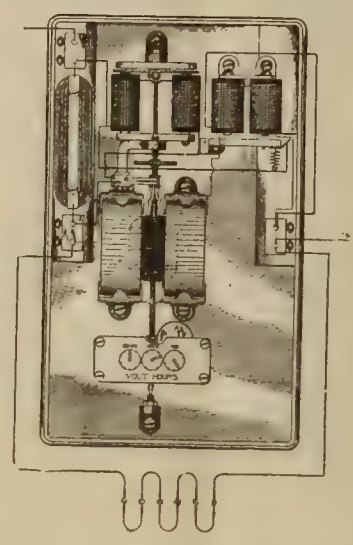
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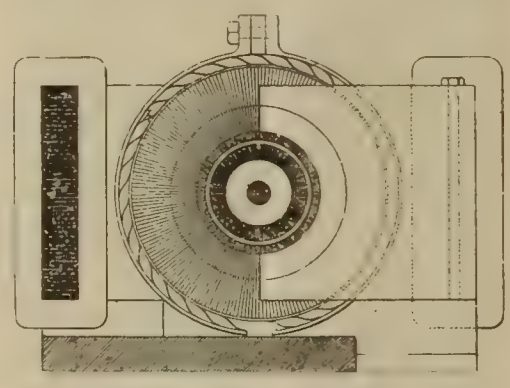
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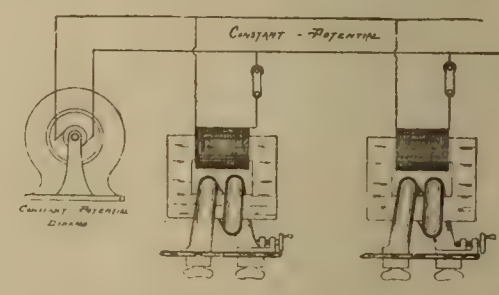
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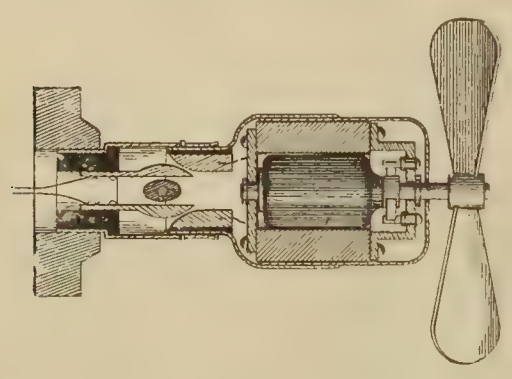
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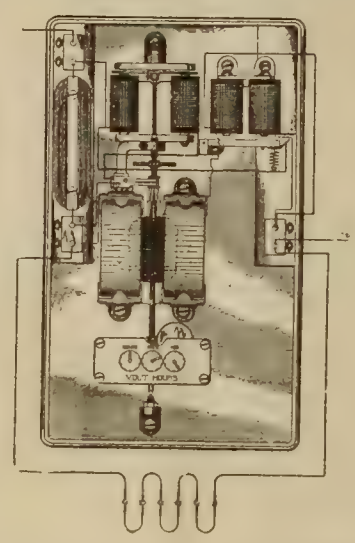
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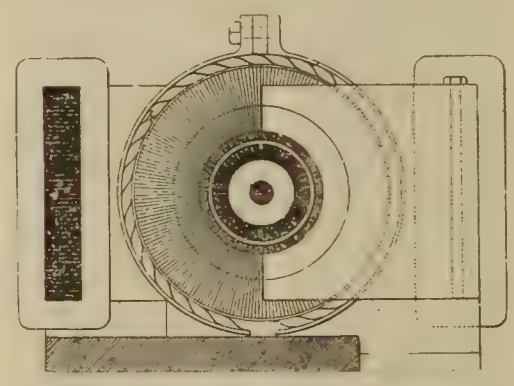
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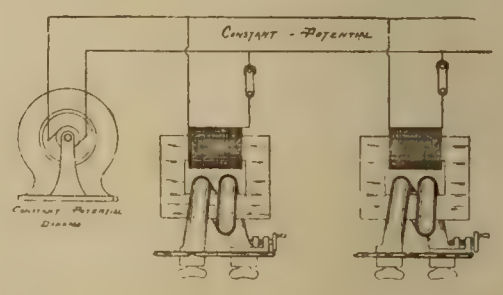
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VOL. IX—No. 6. NEW YORK, FEBRUARY 7 1891. PRICE 10 CENTS

Telegraph Instruments
AND SUPPLIES.

STEEL LEVER KEYS.
(SOLID TRUNNION).



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Over 73,000 now in use.

THE ONLY PERFECT KEY.

J. H. Bunnell's Patent, Feb. 15th, 1881.

A Beautiful and Perfect Key suitable for use on fine desks, or wherever a Legless Key is Preferable. PRICE, carefully boxed and sent, prepaid by mail, to any part of the United States, $2.25.

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IMITATION IS THE SINCEREST PRAISE.

After many futile attempts to break down the well deserved prestige of the Bunnell Steel Lever Key, of which about 75,000 are in use in the United States, our envious competitors do not manage to resort even to deliberately copying its appearance and presenting their productions as "improvements."

We are much gratified to be able to point out to telegraphers the plain fact, beyond dispute, that every key maker in this country today for which excellence is claimed and widely advertised, is simply more or less a copy in general appearance or parts (but not merits) of the original "Bunnell Steel Lever Key." With it commenting further upon the shocked table lack of principle and pitiful lack of originality, which these efforts at immitation indicate, we have only to say that the finest experts in New York and other cities prefer the Bunnell Key above all others for great speeding, and that in the late tournament, the immitation Bunnell Keys were used in several important cases where the sender in the haste and excitement of the moment mistook the immitation for the genuine, so closely was the appearance copied, and that the finest work was done on the genuine Bunnell Key. We shall continue to lead all others as we are unable for the operator's most perfect work, and we shall expect as matter of course that the imitators will follow somewhere at our rear as closely as they can.

J. H. Bunnell & Co., 76 Cortlandt St., N.Y.

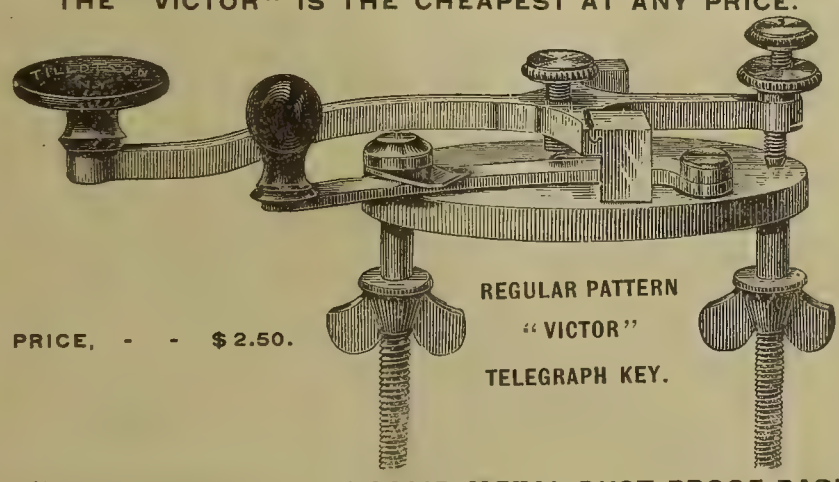
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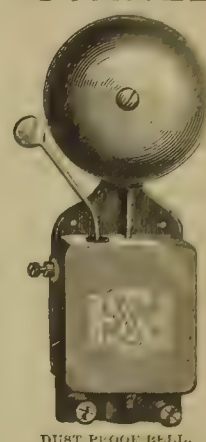
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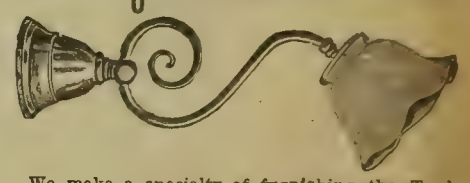
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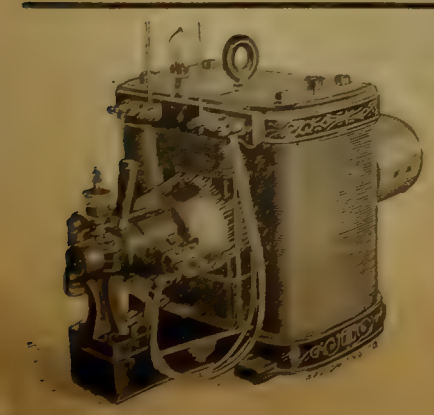
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See page xix for IMPORTANT INFORMATION.

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SEE PAGE XIV. C. S. VAN NUIS, 74 CortlandtSt. New York.

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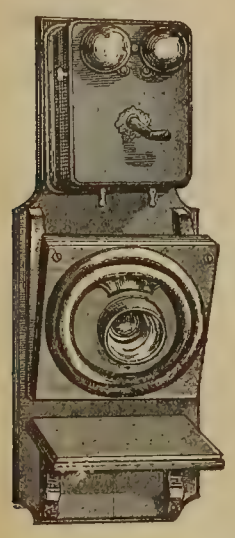
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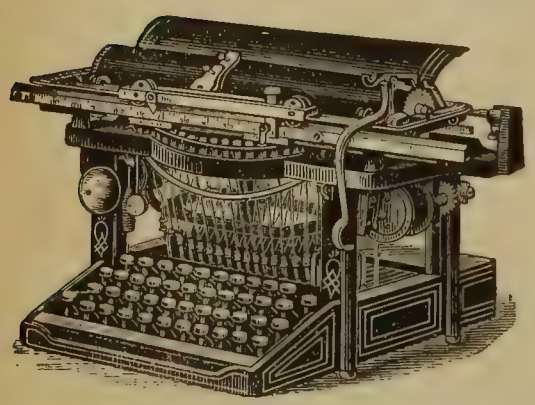
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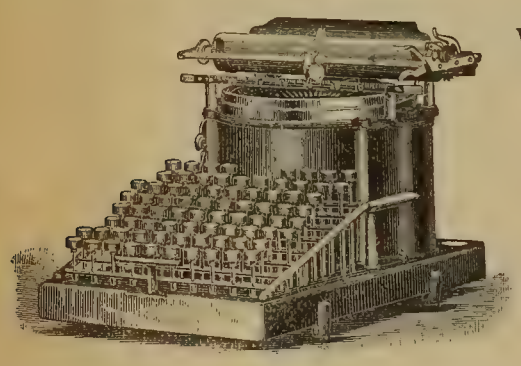
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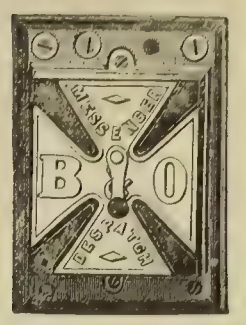
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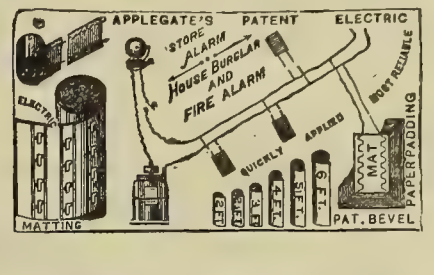
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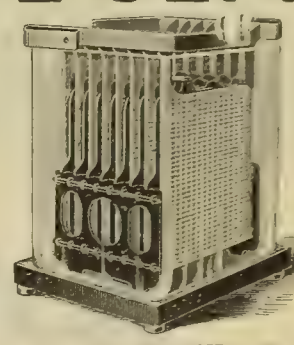
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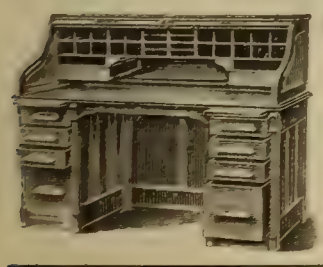
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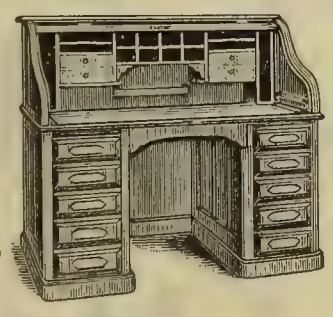
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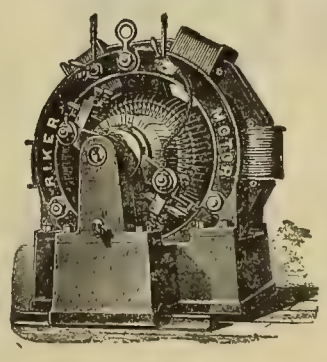
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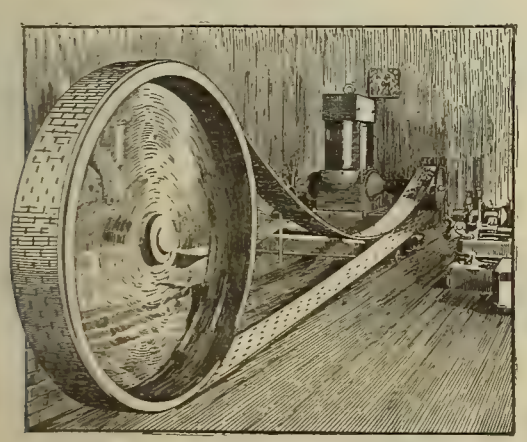
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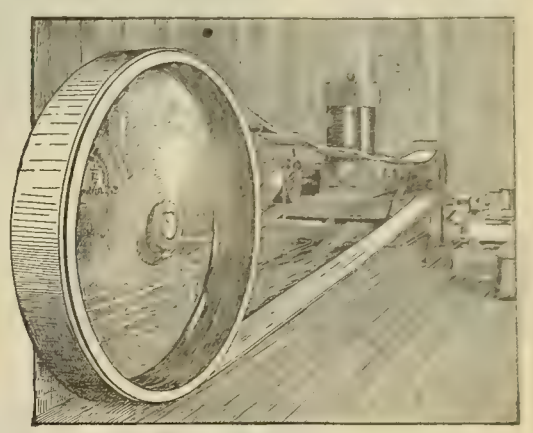
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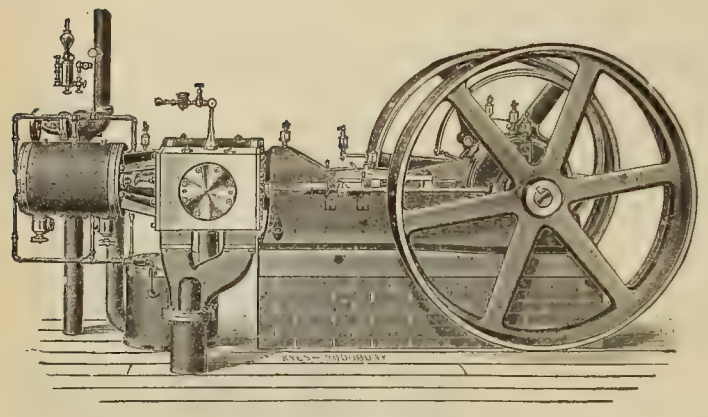
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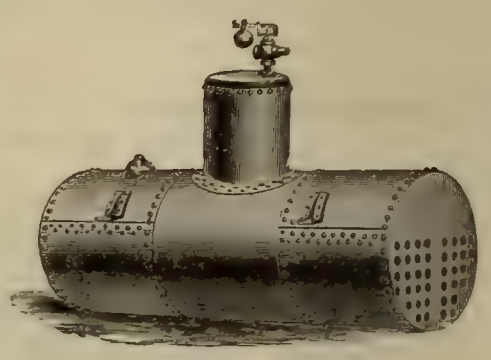
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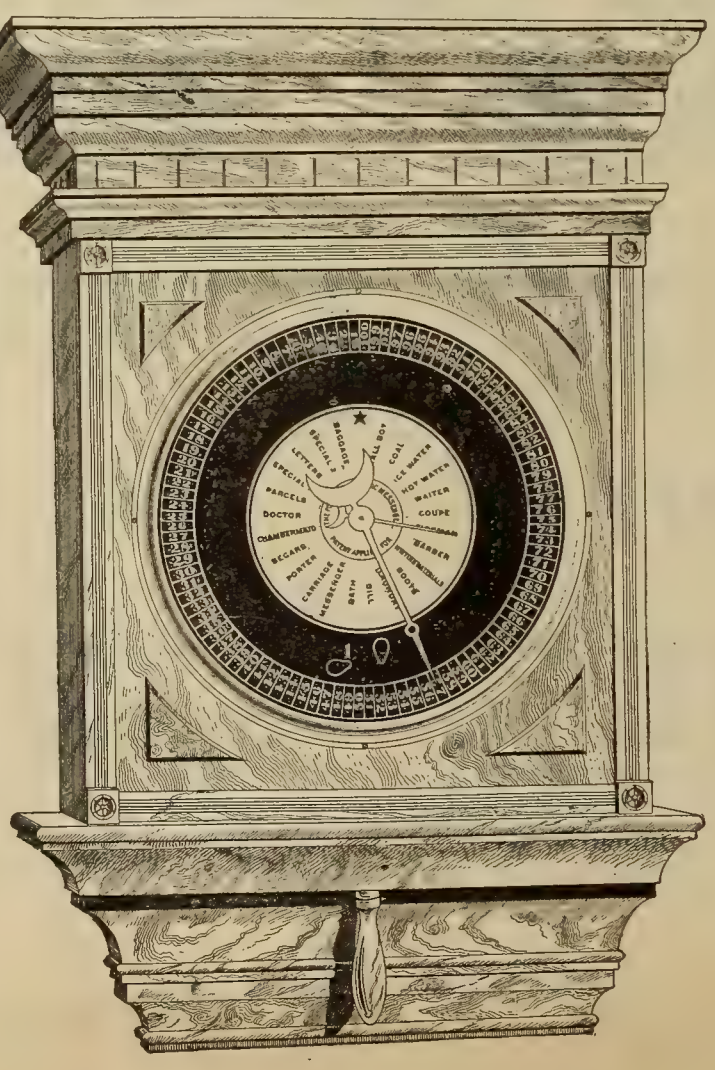
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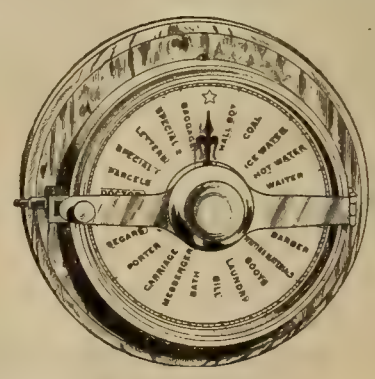
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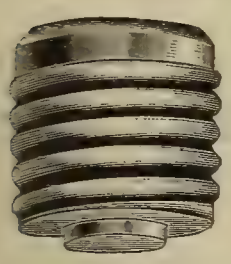
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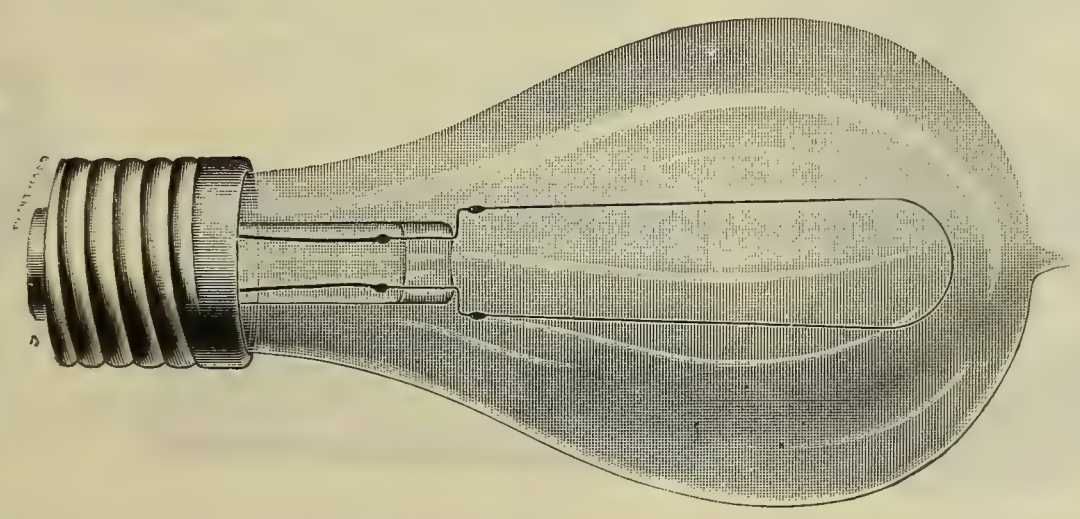
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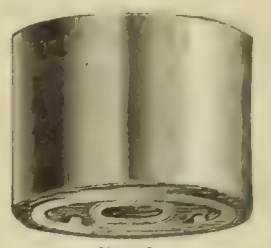
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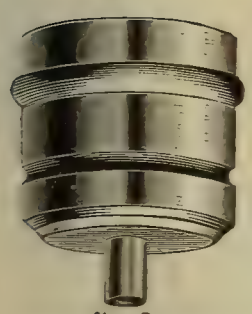
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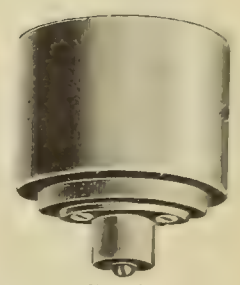


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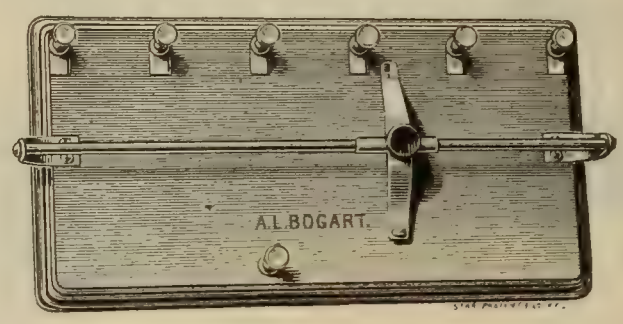
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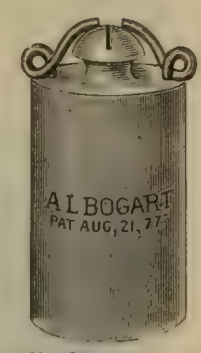
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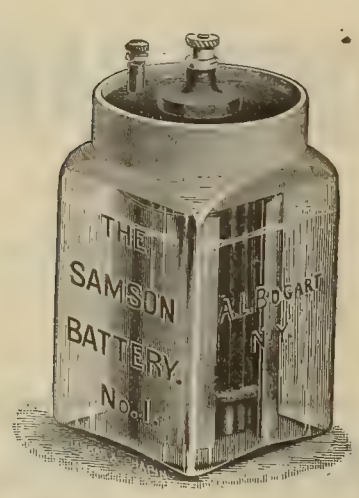
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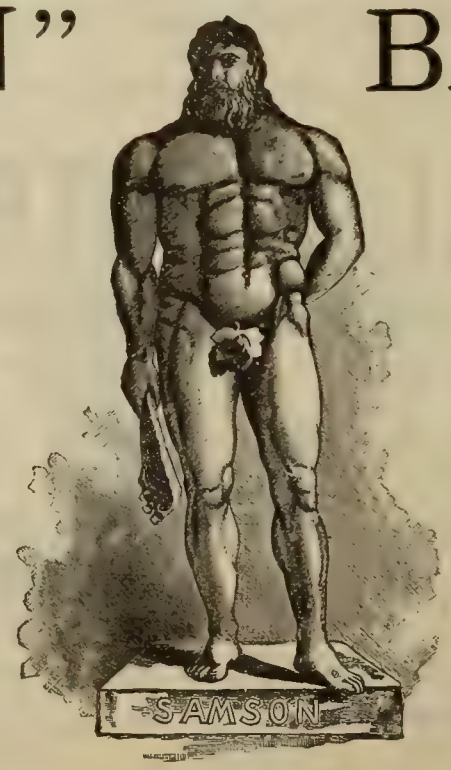
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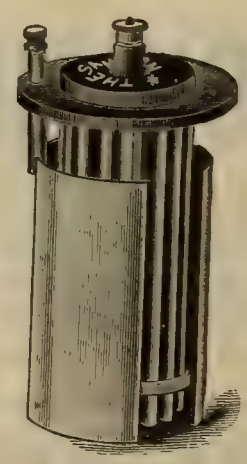
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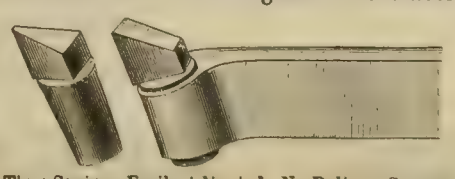
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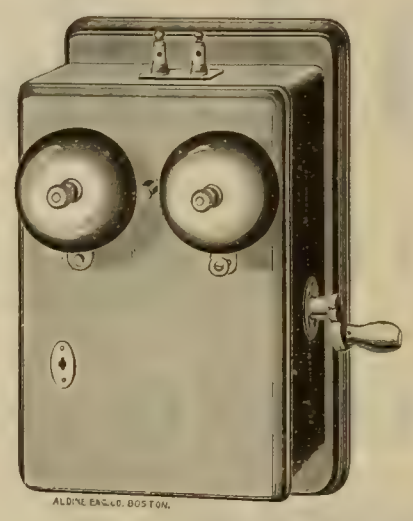
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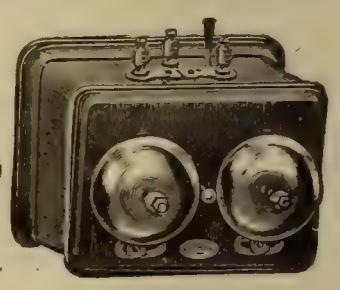
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NEW YORK, FEBRUARY 7, 1891.

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A DECIDED IMPROVEMENT.

The ELECTRICAL AGE will henceforth be of the size of the present issue. We have enlarged the paper for several good reasons, and we think the change will be much appreciated.

The electrical field is a rapidly expanding one, and in order to adequately chronicle all that is going on in this direction, an abundance of space is necessary. We have decided to provide the additional space by increasing the size of the pages, rather than increasing their number. The new size is a very convenient one in every way, permitting of a more artistic and pleasing display of illustrations, and affords our advertisers more room for show. They will certainly appreciate the change. This electrical age is a progressive one, and so is the journal of that name. We propose to keep to the front, and give our friends the best of everything in our line. The ELECTRICAL AGE seeks to merit the good opinion and admiration of its friends.

MOLECULAR TELEPHONES.—Our illustrated article on this subject, which will be found on another page, will be read with interest. The molecular telephone described certainly has the merit of being a practically successful apparatus. Indeed it possesses a power and range of action that are remarkable. A faint whisper is rendered audible on this telephone, and the ordinary tone of voice at the opposite end is reproduced with sufficient loudness and clearness to fill a large room so that it can be distinctly heard.

Mr. Shaver, the inventor of this telephone, is of the opinion that its action is due to a movement or disturbance of the molecules of the matter composing the resonator, which he uses, and which consists of a hemispherical metallic cup. The sound vibration at the transmitting end are transferred through the connecting wire mechanically and upon reaching the opposite resonator are spread out over the entire surface of the same, reducing an amplification of the transmitted sound.

THE RECENT STORM.

The damage to overhead electric wires in the Eastern States, particularly about New York City, on the night of January 25th was unprecedented. Even the great blizzard of March 12, 1888, did not accomplish such complete ruin as did this last storm. Along some of the railroads running out of Jersey City miles of telegraph poles are in all stages of ruin. In some cases the cross arms and poles have parted company, and in many others the poles look as though they had been out on a spree and had not recovered from the effects of it. Many more poles are laid flat on the ground, while others are broken off short. If a cyclone had attempted to destroy these lines it could not have accomplished any greater ruin than did the heavy snow of January 25th.

The long distance telephone lines which were regarded by many people as invincible when the elements were at war, on this occasion succumbed to superior force, and the magnificent lines in many places went down in the general wreck. It will be remembered that these lines withstood the great storm of March, 1888, and it was thought that that test was about as great as any that could possible occur; but our winter storms are very uncertain things, and little reliance can be placed on them. They may start out in a mild way but are liable to become furious before finishing their career.

The local telephone service suffered severely, as also did the fire alarm service, and the old method of watching for fires from high structures was temporarily put into practice. Fortunately, no serious fires occurred during the time the fire alarm service was crippled,

Electric light overhead wires suffered too, not so much directly as indirectly, by becoming crossed with broken wires of other classes. The currents were shut off more as a precautionary measure, as there was no way of ascertaining what harm might result if they had been turned on as usual.

In view of the great wreck of electric circuits, electricians generally will naturally ask themselves if it is not possible to construct electric lines in such a way that they will not be totally wrecked every time a winter storm rages. It would be well to give this subject some thought. It is an important one, and no doubt the electric companies would be glad to adopt some method that would avoid the enormous expense they are put to on occasions of this sort. The business public, too, would hail with delight any improvement that would render the electric service of all classes independent of the climatic eccentricities, so that it could be depended upon at all times and in all kinds of weather.

NOT SO BAD AFTER ALL.—Electric currents are charged with a multitude of evils and sins these days, principally by certain newspapers who sometimes excite the minds of their readers with ridiculous stories about the dangers of electricity. People are beginning to find out, however, that electricity is not as black as it is painted. The papers referred to are now beginning to realize that they are no longer in tune with the public on that point, and they, too, are beginning to look upon electricity in a reasonable light. They are looking at it now with one eye; after a bit they will use both eyes. As an indication of the change in the attitude of these papers toward electricity it may be mentioned that some Boston paper, as our Boston correspondent puts it, have so far departed from their usual custom as to devote no more space to an account of a woman receiving a slight shock from an overcharged telephone wire in Cambridge recently, than they did to the killing of 150 men by a mine explosion in Pennsylvania or the suffocation of three persons in East Boston recently by illuminating gas. Electricity has a hard road to travel in some directions, and often encounters enemies, but, to use a slang but expressive phrase, "it will get there just the same."

THE BELL TELEPHONE PATENTS.

The following interesting letter has been received from Mr. C. J. Kintner, the well known electrical expert and patent solicitor, of 45 Broadway, which explains itself.

NEW YORK, Jan. 28, 1891.

EDITOR ELECTRICAL AGE: In an editorial on page 55 of the last issue of your journal you discussed the question as to whether or not the Bell Telephone Patents have not expired in this country. I beg to advise you that you are laboring under a misapprehension as to the meaning of the law. Section 4887, Revised Statutes of the United States, is as follows:

"No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented, or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention which has been *previously granted* in a *foreign country* shall be so limited as to expire at the same time with the foreign patent; or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years."

From this you will observe that an American patent is limited by the term of a foreign patent *previously* granted only, and that if a foreign patent is granted subsequent to an American patent it has no effect upon the term of the latter.

You will note that Bell's English patent was granted on the 9th of December, 1876, his American patent having been granted on the 7th of March, 1876, or 9 months previous to the date of the granting of the English patent.

Until quite recently it has been held that an American patent will expire with a prior foreign patent granted for a shorter term, and for any of the lawful reasons of forfeiture in the country where the foreign patent was granted, such for instance, as the forfeiture of the foreign patent by reason of the non-payment of annuities, failure to work, etc., etc.

Recent Supreme Court decisions, however, have distinctly held that the length of the term of the foreign patent previously granted shall govern, and that there shall be no shortening of the American term for any other reason whatever.

You will understand, therefore, that Bell's American patent, No. 174,465, granted March 7th, 1876, for the broad method of Telephony, will not expire until March 7th, 1892.

I beg to remain, very truly, yours,
CHAS. J. KINTNER.

ELECTRICITY AND MICROBES.—The extermination of microbes is a comparatively recent application of electricity. Some experiments have lately been made by two European physicists with a view to the determination of the real effect of electricity on certain mobile bacteria. The first researches in this direction take us back to 1875, when Mr. Schiel observed that under the influence of the electric current the bacteria ceased to move. It was subsequently determined, however, by other investigators that immobile microbes are not necessarily dead. It still remains an open question as to what the real effect of electricity is on microbes. As far as the investigations have been carried, however, there seems to be good reason to hope that something of value may be developed through these researches.

LEAKAGE.—As there is a certain amount of "leakage" with every electro-magnet, of whatever design, only a portion of the lines generated by the ampere-turns pass through the armature.

THE UNIVERSAL ARC LAMP FOR INCANDESCENT CIRCUITS.

The antipathy in some cities against high potential arc light circuits has caused restrictions to be placed upon the running of over-head wires for such circuits, but, as incandescent currents are generally distributed and available in nearly ever city, attention has been turned to the placing of arc lights on these incandescent wires.

The nature of the incandescent circuit is such at the lamp mechanism must protect it from a



FIG. 1.

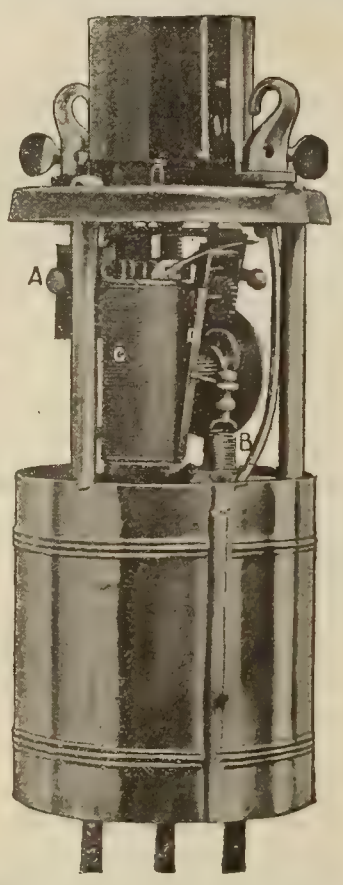


FIG. 2.

dead short circuit such as would be the case if the carbons were permitted to touch each other for any length of time.

The lamp should also be so constructed that it can be readily used with currents of considerable range of pressure, giving a light which is both steady and noiseless.

These necessary features have been worked out in an arc lamp made by the Univeral Arc LampCompany of 49 West 22d street, New York.

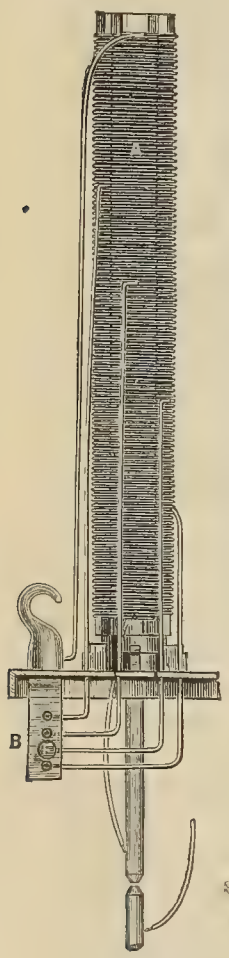


FIG. 3.

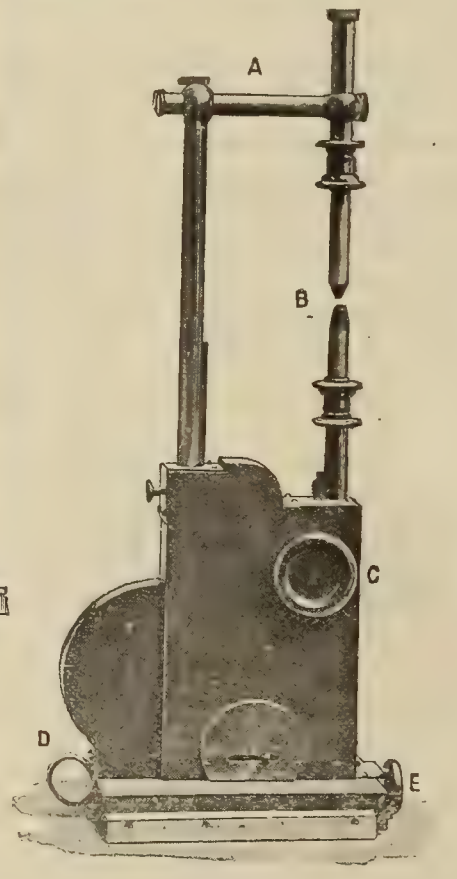


FIG. 5.

The lamp complete, as shown in Fig. 1, has its mechanism enclosed within a case, the bottom of which is made of slate.

The mechanism shown in Fig. 2, consists of a regulating magnet C, wound to nearly 500 ohms resistance and allowing but .03 ampere of current to pass. As this magnet is placed in shunt to the arc its strength is dependent upon the arc's resistance as regulated by its length.

As the length of the arc increases with continued burning, the increased strength of the magnet C attracts the armature D, which finally trips a pawl and ratchet that allows the carbon to feed until it has again resumed the proper length of the arc. When the carbon is completely burned the shunt magnets are automatically cut out by being released from the end of the carbon rod. Altogether there are three paths for the current from the terminal to the carbon rod, so that under no conditions can sparking occur at the contacts in the mechanism.

To enable the use of the lamp on circuits varying in potential from 100 to 120 volts resistance A,

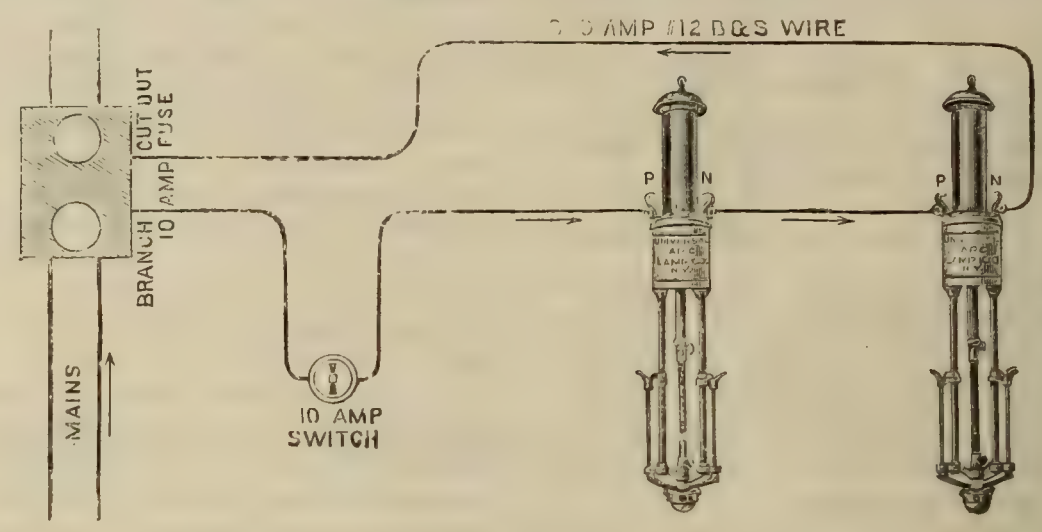


FIG. 4.

wound in sections and connected to a block of insulating material B, as shown in fig. 3, is placed within the hood of the lamp. By inserting the screw, F, ranges of resistance can be placed in the circuit adapting the lamp to the potential of the current used.

Another interesting feature is the convenient means by which the globe can be removed for trimming. The globe is supported on a circular base carried by two rods provided with clamps at their upper ends which firmly grip the side rods of the lamp. A slight pressure with the thumb upon

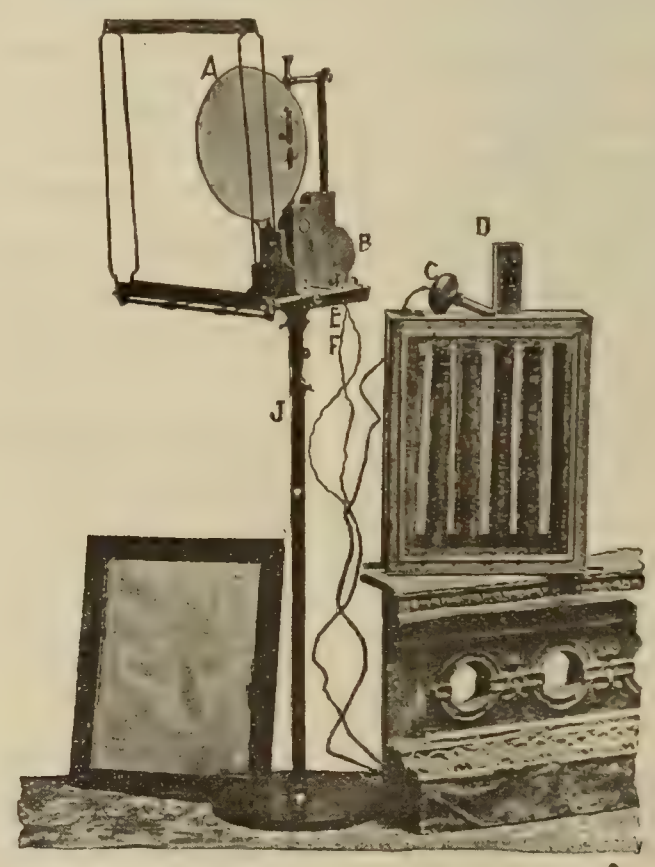


FIG. 6.

these clamps releases them, allowing the globe to be slid down free of the carbons.

The lamps are designed to run two in series to avoid the use of dead resistances and the consequent waste where one lamp alone is used.

Figure 4 is a diagram of connections.

These lamps are well ventilated, simple in construction, economical, using only from eight to nine amperes of current, and require no external or lamp resistance.

The light is steady and noiseless.

The same company have also designed an arc lamp that can be used wherever a constant direct current exists, to take the place of the calcium lights in theatres. As the attachments are made at the regular stage pocket, there are no cylinders or hose to encumber the stage.

The intensity can be varied from 100 to 10,000 candle-power, and, as the electromotive force used is but forty-five volts, it is absolutely safe to handle.

Figure 5 shows the lamp with its carbon holder and feeding adjustments and Fig 6 the lamp, reflectors, stand and all the connections.

The light may be quickly turned in any direction or the lamp elevated to any required height, burning equally well in any position.

Besides doing the work of the calcium light this lamp may be used in producing many novel and striking effects, such as the natural rainbow, illuminated fountain, morning clouds, thunder-clouds, chain-lightning, and numerous others. The wide range of use to which this lamp may be placed will soon cause it to replace the calcium light for stage effects in theatres.

EDUCATIONAL.

In the University of Pennsylvania a department of electrical engineering is successfully carried on. Study begins in senior year with a discussion of the various properties of electricity and electrical measurements. The course treats of the measurements of currents, the construction, calibration and uses of galvanometers, measurement of differences of potentials, quantity, resistance, etc., including study of the dynamo in its theory and practice. The electrical laboratory covers the uses of all electrical and magnetic test instruments, and the apparatus in this department is being rapidly increased. Clayton W. Pike, B. S., is the instructor of the electrical engineering department.

TELEGRAPH CURRENTS.

The following figures with regard to the duration of currents used in telegraphy, are given in *Zeitschrift für Elektrotechnik:* In ordinary Morse working the average duration of the signalling current may be taken at .125 second; with the Hughes apparatus currents lasting only from .04 to.05 second are emitted, while with the Meyer multiplex apparatus currents having a duration of as little as .007 second, with the Delany multiplex of .002 second are sent to line. The lowest figure is, however, reached by the Wheatstone automatic, which when transmitting at the rate of 600 words a minute, sends out 33,600 currents per minute, or 560 per second, each having, therefore, a duration of .0018 second.

AS OTHERS SEE US.

The *Street Railway Gazette* for January says: THE ELECTRIC AGE, Electric Age Pub. Co., New York, for January, comes from the *World* Building, New York, greeting the New Year from a model building in a model dress, with model purposes and aims.

STRENGTH OF A CONVEX POLE.—A bar electromagnet with a convex pole holds on tighter to a flat-ended armature than one with a flat pole does.

ELECTROMAGNETS.—Electromagnets with long limbs are practically no better than those with short limbs for sticking on to masses of iron.

THE WALKER ELECTRIC METER.

There has been a great and growing demand for some meter that would at all times and in all cases register the amount of current used by consumers.

Some electrical instrument or meter that will correctly and properly measure and record the amount of current passing through it for an extended period of time is absolutely necessary.

The quantity of current is measured in amperes and the instruments used are called ampere meters or ammeters. These instruments not only register the ampere current in a circuit at any given time but record continuously over more or less extended periods; the length of time depending on the mechanism of the meter.

Various methods have been devised by inventors to cause the needle or indicating part of the ammeter to record its action by means of a syphon pen or pencil, but these have proven absolute failures. The syphon would clog up and fail to operate, or the pencil would stick; in neither case could they be made to work satisfactorily, besides, the friction and labor the ampere meter needle had to overcome and perform consume energy.

The accuracy of a current meter must depend on the sensitiveness of the indicating portion of the device. It must respond to minute variations in the current strength, and must also move through equal intervals over its scale for equal quantities of current, irrespective of the number of lamps in the circuit.

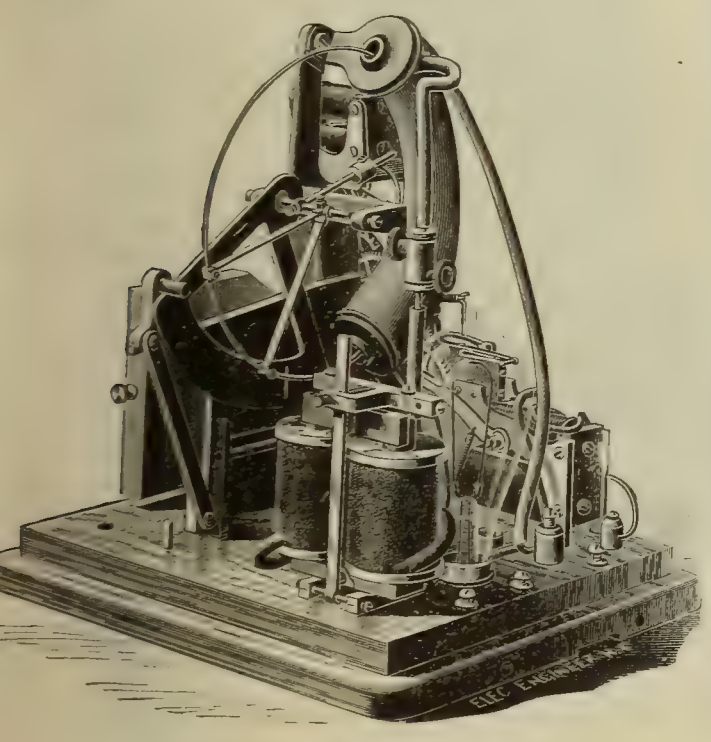


FIG. 1.—WALKER ELECTRIC METER.

So long as the needle or indicator is obliged to overcome friction, such as making an ink line, as is commonly done in instruments of this class, the meter cannot be absolutely reliable.

This fault has been entirely overcome by Mr. Geo. W. Walker, of the Walker Electric Company 50 Broadway, New York. He uses for the purpose of registering the current simply a beam of light, to all intents photographing the current as used. This being the case, there cannot possibly be any friction, and absolute exactness is assured.

The Walker-meter practically acts as a camera, continuously photographing the current strength as used.

The manner in which this is accomplished will be readily understood by reference to the accompanying engraving.

Fig. 1, as will be seen, consists, in the first place, of an ammeter coil, consisting of a solenoid in which an iron wire in the shape of a nearly complete circle is placed as a core. To the same shaft to which the circle or core is attached there is also fixed a light aluminum sector, provided with a fine vertical slot, and immediately behind this sector is a box which encloses a roll of sensitized photographic paper.

A screen placed between the sector and the box has a horizontal slot, before which the sensitized roll is made to pass by a small clock movement which is wound automatically by the small electro-magnet shown in the figure. This magnet receives its current from the lamp in the meter. The vertical slit in the sector is so arranged as to come immediately in front of the horizontal slit in the screen, so that in whatever position it may be, it will allow a ray of light to pass from the lamp on to the sensitized roll.

Perforations in the screen representing the calibration of the instrument cause continuous lines to be printed on the sensitized paper.

The clock movement remains stationary and the lamp goes out when no current is on the circuit, but both start up immediately upon the lighting of even one lamp. This clock movement, at intervals of one hour, also turns a shutter and allows the light of a lamp to pass through a slot in the screen, so as to impress upon the sensitized paper the vertical lines shown in fig. 2, and which indicate hours of service.

The entire amount of current consumed is measured, the record being in the shape of a monthly diagram showing in a detailed manner exactly how much current has been consumed. The record is made permanent by the usual method of photographic "fixing" and can be used for future reference; or, in case of any question as to the correctness of the monthly bill, will be convincing of its proof.

Climatic changes do not affect the meter. It will operate equally as well in a damp, cold cellar as in a warm room.

The loss in operating this meter is confined to the energy necessary to burn one lamp in the meter which, at the candle-power used, takes one-sixteenth of an ampere. This is the maximum loss, whether one or a thousand lamps are being measured. Other meters have a ratio of loss of from five per cent. upwards, and every electrician knows that there is a wide difference between five per cent. on one lamp and five per cent. on one thousand lamps.

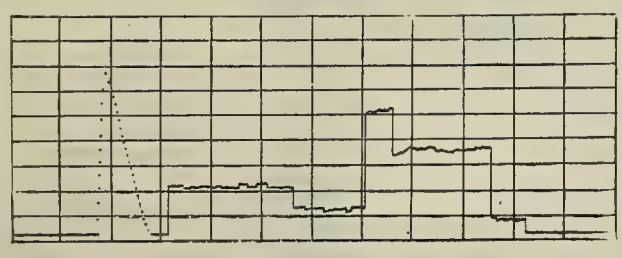


FIG. 2.—RECORD CARD.

THE CHEMISTRY OF ELECTROLYSIS.*

In electrical decomposition, we find that certain elements always appear at a certain pole of the battery, or at a certain electrode, as Michael Faraday called it. He gave the term "ions" or travelers, to the elements, and the term "electrodes" to the terminals or what were formerly called "poles" of the generator. He called the terminal by which the current entered, the "anode;" the one by which it passed out, the "cathode." At the cathode, metals always appear, at the anode, the non-metals always appear. Hydrogen gas, which is considered by all chemists as a metal, also appears at the cathode. Sir Humphry Davy startled the world by an experiment which I shall try to repeat. I have here a solution of the common sulphate of soda; in this, I have nothing but water; and in the third, nothing but water. They are simply tinted by a little tincture of litmus, which has the peculiar property of being changed by the action of an acid to a red, and by the action of an alkali to a blue. Now, having turned on the electric current, you will notice that those at the end are beginning to change in tint, while the center one does not change. The interesting fact in this experiment is that the central substance is not changed. The acid appears in the third, having passed from the first, through the center one, without showing any effect in the latter. Under the action of the current, then, the acid passing in one direction, and the alkali in the other, there is no effect on the one intervening, so far as the acid properties are concerned; in other words, the effect is masked. That experiment created quite a sensation when first exhibited by Sir Humphry Davy. The explanation is, however, that there must be a series of particles of the same nature from one end to the other; otherwise chemical decomposition is impossible.

There is no doubt that these pieces of asbestos which you see running across these carry quite a little of the sulphate of soda into the second cup and a little over into the third, and we must have a complete series of molecules or particles of sulphate of soda from one side to the other, otherwise we could not produce any action whatever. That, then, is the principle of the action of the current, the electro-transfer of elements. And these elements always travel in opposite directions with reference to each other, and always in the same direction with reference to the direction of the current, the metal and hydrogen always appearing at the cathode; the non-metal, or acid, always appearing at the anode.

Michael Faraday investigated perhaps more thoroughly than any other experimenter the action of the electric current in chemical decomposition; and in fact most of the experiments that we have, standard experiments, are really due to him. He established two laws of electro-chemical action. First, that of definite electro-chemical action. In other words, he proved beyond a question that a current of a certain strength will always produce a certain amount of decomposition—no more, no less—in a given time.

A certain amount of hydrogen can be set free by a current of a certain strength in one minute; a certain amount of oxygen can be set free, a certain amount of metal can be deposited—so much, and no more.

Moreover, he showed secondly, that if you pass a current consecutively through three or four or more solutions, each element is deposited only in direct proportion to its combining or atomic weight. But elements which represent two atoms of hydrogen are not deposited in their full combining weight, but just one-half their combining weight. For instance, for every one grain of hydrogen that is liberated in decomposition, only eight grains of oxygen are liberated, about 32 grains of copper, and about 35½ grains of chlorine gas; sulphur, if liberated, is liberated also only one-half its combining weight, it being again an element which represents two atoms of hydrogen.

To recapitulate, the elements of the chemistry of electrolysis are:

1st. That under all circumstances, each element appears at a certain one of the electrodes—the metals and hydrogen at the cathode, the non-metals, acids, etc., at the anode.

2d. The elements travel through the intervening space between the electrodes in opposite directions, and do not leave any record of their presence *as elements* in that transfer: the electro-transfer of the elements is imperceptible in the body of the liquid, as you have seen from this experiment of Sir H. Davy.

3d. We have a definite electro-chemical action from a current of a definite strength in a given time.

4th. We have electro-chemical equivalents.

5th. It requires a certain minimum electro-motive force to produce decomposition.

SPARKING.—When a coil which is carrying the whole of the current generated in one-half of the armature is short-circuited by the brush, the electro-magnetic inertia of the coil, due to its self-induction, prevents the instantaneous cessation of the current; and that even if the coil is commutated at the moment when its plane is exactly at right angles to the field and therefore in itself inactive, yet there will be a considerable spark caused by what we may term the self-induction current in the coil.

CURRENT STRENGTH.—The ultimate strength of the current is limited not only by the saturation of the field-magnets, but also by the amount of power at our disposal to drive the armature around.

*Abstract of lecture by Wm. H. Dopp, before the Buffalo Electrical Society, January 19, 1891.

AN INTERESTING ELECTRICAL POWER PLANT.

Wm. Schwarzwaelder & Co., manufacturers of desks and office fixtures, at 37 and 39 Fulton street, New York, have a 10 h.p. Perret electric motor located in their basement which is running a pump, used for raising water to a tank on the roof; a fan for ventilating and keeping the cellar dry; a buzz saw for cutting lumber for making packing boxes; a passenger elevator and a freight elevator (the latter of which is not shown in the cut.)

The motor is equipped with the Perret self-feeding carbon brushes and self-oiling bearings, and is run at a speed of 600 revolutions by a 110 volt current from the Edison Pearl street station.

Mr. Schwarzwaelder says the motor has been in operation four months, giving entire satisfaction. It has required very little attention, the bearings being oiled but once a week, with no attention, so far, required by the brushes. It runs without sparking and the commutator is as smooth now as when first put in.

Both the freight and passenger elevators are of Frisbie's make.

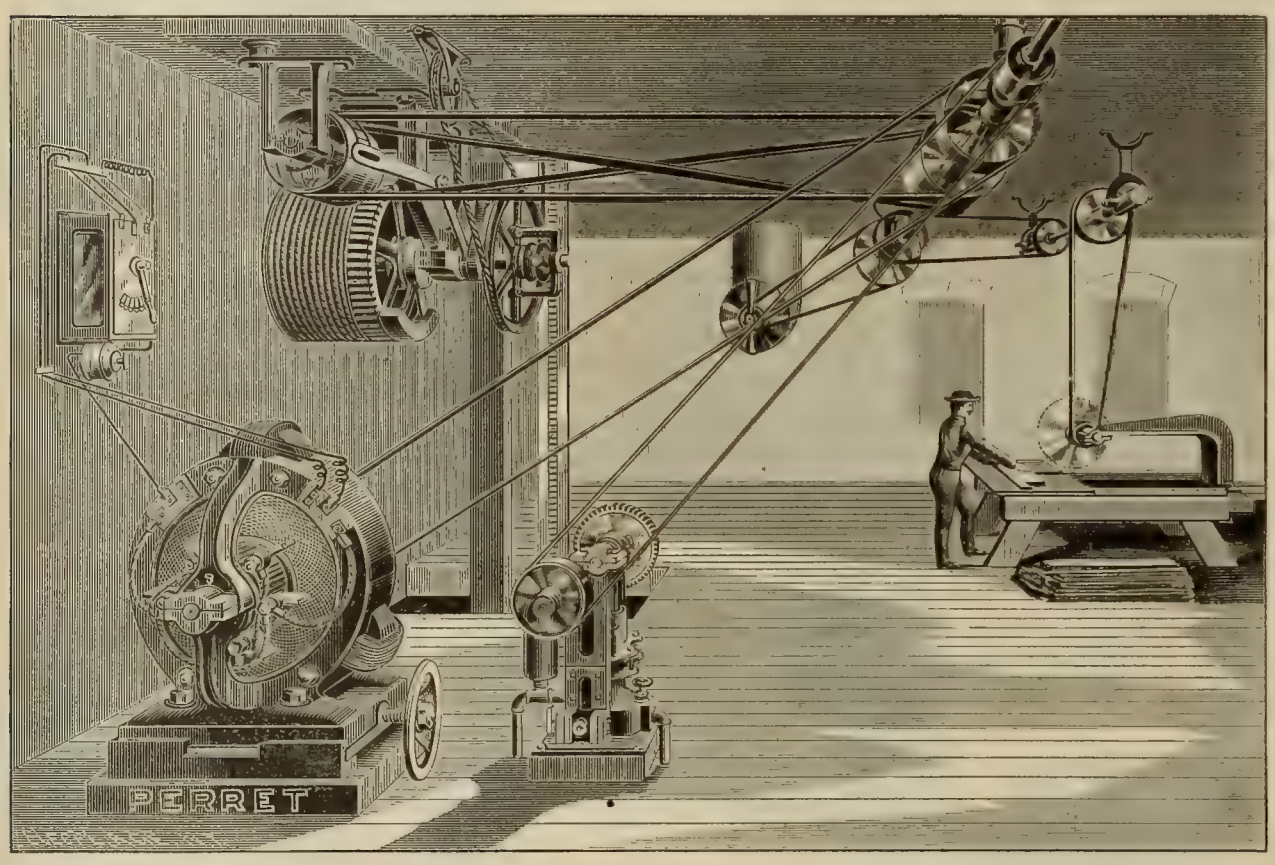
In our illustration the entire mechanism is clearly shown, and what strikes the observer most forcibly is the fact that such a comparatively small machine can supply sufficient power to do all the work that is required in this case.

The fact that an electric motor of a given power occupies much less space than any other class of machine of equal power, is one of the valuable features of electric motors. Room is valuable to business men, and the economy of room in using an electric motor, be it ever so small, is a great consideration.

The Perret motors can justly claim a large share of the credit of possessing this valuable feature to a large degree. This, in addition to their general mechanical and electrical efficiency, is sufficient explanation for the great demand existing for these motors.

The mechanical and electrical construction of these machines is as perfect as it is possible to attain. Every detail has been worked out scientifically, and they represent in every particular the highest development of electrical and mechanical science.

The Elektron Company may well be proud of the prominent place they occupy in the revolution now in progress in the use of mechanical power, and that the Perret motors are all that they are claimed to be is evident from the fact that they are found so frequently supplying power for all classes of work, and the demand for them is a healthy and constantly increasing one.



ELECTRICAL POWER PLANT.

WAVE MOTION.—The eye only responds to waves of $\frac{1}{70000}$ to $\frac{1}{37000}$ of an inch in length, while the length of the waves emitted by an alternating current system is 600 miles. The waves that affect the eye most occur at the inconceivable rate of at least 400 millions of millions per second, while less than 300 waves per second are emitted by an alternating current system.

AN IMPROVED PROCESS FOR THE PRODUCTION OF COPPER.

Copper is a material of such supreme importance to the electrician that any advance in its method of manufacture must be of direct interest to him. Mr. Percy C. Gilchrist has recently communicated to the London section of the Society of Chemical Industry the results he has obtained by applying what is known as the "basic process" to copper refining.

In the production of steel by the original Bessemer process, only pig iron free from all but a very small amount of phosphorus could be used, owing to the facts that phosporus has a most deleterious influence on the finished metal, and that it was not eliminated in the natural course of events. By the substitution of a "basic lining" (*i. e.*, one composed of material such as magnesia) for the "acid lining," composed of siliceous matter, such as sand or ganister, it was found possible to remove the phosphorus owing to its tendency to become oxidized to phosphoric acid and combine with the basic material. It, therefore, seemed probable that the same device would be applicable in the case of copper for the removal of arsenic—the electrician's *bête noire*. The high price of copper of good conductivity mainly depends on the cost of the elimination of those impurities which are, perhaps, more objectionable for electrical purposes than for any other.

Mr. Gilchrist's experiments have taken practical shape, and at least one big copper company is using furnaces with basic linings. Speaking generally, the value of the process lies rather in the elimination of arsenic more readily and at a cheaper rate (less copper passing into the slag and having to be reworked) than in any extraordinary perfection in the refined product. Its adoption should, therefore, lead to a reduction in the price of copper of good, but not abnormally good, conductivity, rather than to the attainment of any remarkably low resistance. Since it has become common practice to specify 98 per cent. conductivity, and such a conductivity being easily attained, manufacturers would do well to try and reduce the cost rather than to attempt to produce an article of greater purity but at a higher price.

THE ACTION OF ELECTRICITY ON MICROBES.

Electricity appears to be a determined enemy to microbes. The first researches concerning the action of electricity on microbes were carried out by M. Schiel, and go back to 1875. Observing that under the influence of the electric current certain mobile bacteria ceased to move, the author therefrom concluded that the electricity had killed them; but it is now known that immobile microbes are not dead microbes. Thus MM. Cohn and Benno-Mendelsohn again took up these researches, bringing thereto this corrective, that the microbes were not considered as dead only so far as their sowing was sterile. The experimental process employed by these gentlemen specially consisted in passing through a U-tube containing the nutritive solution the current from a few elements of a Marié-Davy pile. The nutritive solution had been sown previously, and when it became thick it was concluded that the current had remained without action.

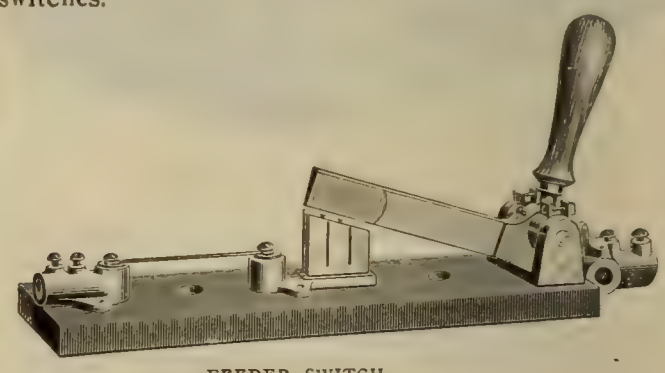
In thus conducting their experiments, MM. Cohn and Benno-Mendelsohn saw that the effect of a weak momentary current was always *nil*. With a longer and a more intensive action, for instance, with the current from two powerful elements for twenty-four hours, the liquid near the positive pole remained intact, but the bacteria were not killed. It seemed even that this was the liquid which had become sterile, for it did not let a new sowing which had been introduced multiply, and, in reality, it had become strongly acid. With a current from three elements for twenty-four hours, there were at one and the same time observed at the two poles the death of the bacteria and the sterility of the liquid traversed by the current. But as it produced a profound chemical change in the cultivation, it was not possible to draw any conclusion relative to the direct action of electricity on the microbes. The experimenters, in order to avoid these decompositions produced by the current, then tried induction currents, but without obtaining appreciable results. With cultivations on potatoes, the chemical changes also occurred. The recent experiments of MM. Apostoli and Laquerrière, whose experimental preparations were not sufficiently described, but who appear also to have used a U-tube, have not advanced the question.

THE H. E. FEEDER SWITCH.

It is a well known fact that switches for carrying the heavy current of an electric light plant cost so much money that few are able to buy them.

To combine a switch which would break quickly, and one that would carry a very heavy current with the lowest possible resistance and at the same time be so cheap that every electrical engineer can afford to buy it, are the main points in a neat switch designed by the Hunt Engineering Company of 238 Washington street, Brooklyn.

They achieve these results by an arrangement which is peculiar in itself, namely, at the point where the armature or movable part of the switch is situated, they have placed a double set of scraping contact brushes. The result is that it is not necessary to place two sets of the usual vertical brushes which are found on ordinary switches.



FEEDER SWITCH.

They also found it very convenient to use a set of double lugs, the holes of which are at right angles with each other; there being three altogether.

These switches are made up of tempered copper and cast brass, the resistance of both of these metals being about as near to soft copper as it is possible to get.

The switches are well proportioned as will be seen from our cut, and positively will not heat in carrying the current which they are rated for. All switches are made up in either single or double pole, mounted upon slate and present a generally good appearance.

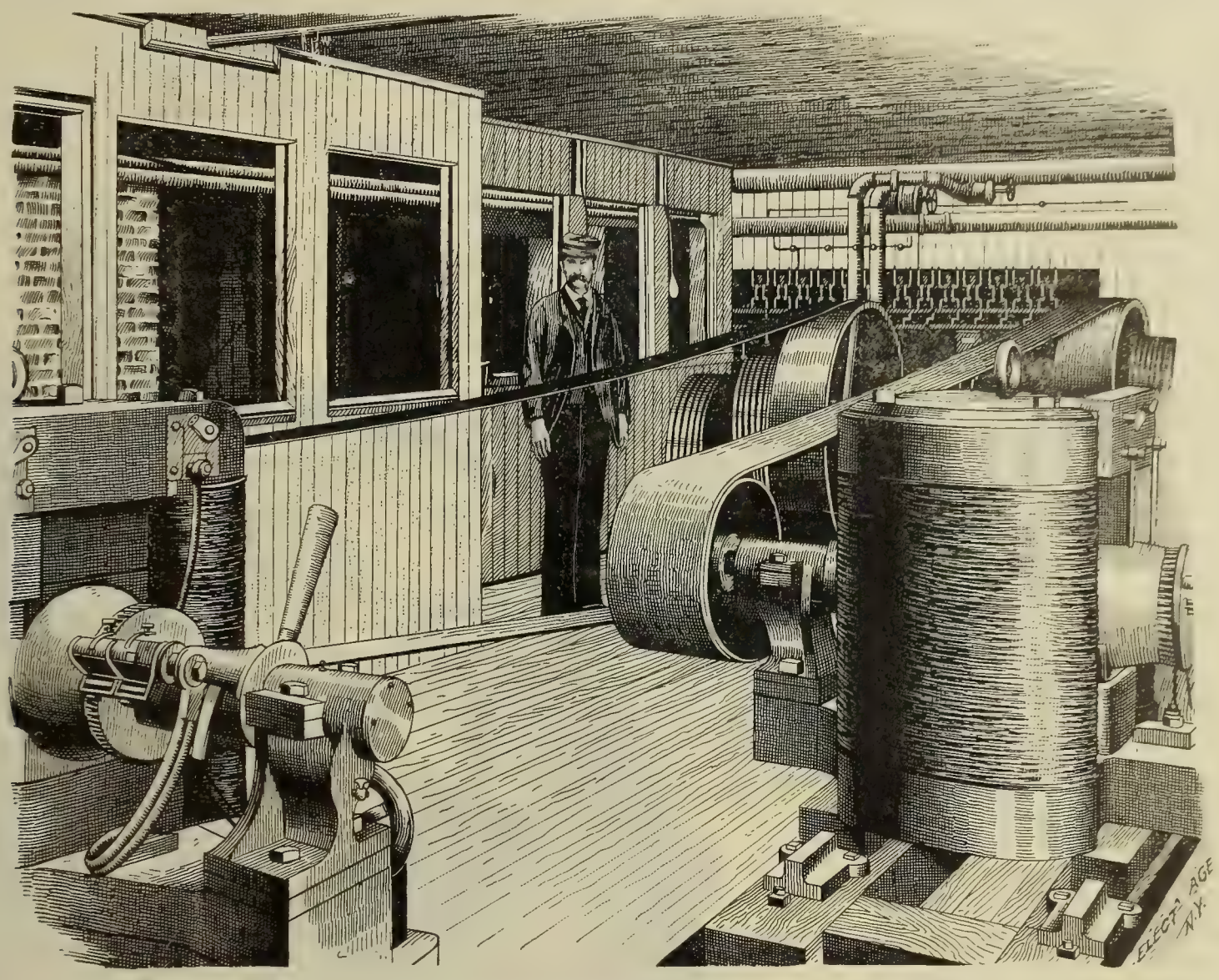
Several of them can be connected together through the medium of a circular bus bar, or each switch may be connected separately to its respective wire.

There is no other switch upon the market that will carry the same amount of current with equal safety, and at the same time be sold at as low a price. This switch is said to be an entirely efficient one, and this characteristic may be readily noted by reference to our illustration.

HEAT WASTE.—To increase the current of a conductor without increasing the heat waste, it is necessary to increase the area of the conductor.

A NEW LOOMIS ISOLATED PLANT.

The elegant granite building of the Manhattan Company and the Merchants' Banking Company, 40 and 42 Wall street, New York, has recently been rewired throughout and an isolated electric light plant on the Loomis system was installed by the Eureka Electric Company, 18 Broadway. The plant consists of two Eureka dynamos of the latest design, each having a capacity of 400 incandescent lights. They are worked singly or in multiple, as desired, by the proper switch arrangements. Each dynamo is provided with two adjusting screws on its base for the purpose of increasing or decreasing the belt tension.



LOOMIS' ISOLATED PLANT AT THE MANHATTAN BANK BUILDING.

One admirable feature of the mechanical part of the dynamo is the armature shaft bearings. The portion of the shafts enclosed in the bearings have on them parallel grooves, and below the shaft there is a reservoir of oil. On the shaft above the oil reservoir works an endless chain which is long enough to dip into the oil, and as it revolves with the shaft it carries with it a continuous supply of the lubricant, which is distributed over the surface of the bearings by the grooves in the shaft. By this method the bearings are kept continually oiled. There is no danger from running dry or undue development of heat by friction.

The two machines work with remarkable smoothness, and there is exceedingly little sparking at the commutators. The fact that these are entirely new machines, the absence of sparking speaks well for this particular make.

The speed of the armatures is 1,200 revolutions per minute, and the voltage of each machine, which is compound wound, is 110. The switchboard, which is shown in the illustration, is of black marble, and is provided with the terminals of 15 circuits. At each end of the switchboard is located an ampere meter, manufactured by the Eureka Electric Company, each with a range of from 0 to 300 amperes. In the center of the board are placed the volt meters and a Loomis automatic ground detector. The volt meters are also of the Eureka Company's make.

The switch is well constructed and the materials of the most substantial character. It is, withal, very simple in its arrangement, as may be judged by our illustration.

The building was re-wired for 1000 lights, and the greater part of the wire was laid in moldings, the work having been done quite recently, and after the building had been completed.

The installation of this plant was begun about two months ago, and it has been in operation about two weeks.

The electric light for this building had been previously taken from the street mains before its own plant was put in, and considering the difficulties naturally attending the installation of an electric plant in a building already settled, the work in this instance has been done in the most complete and satisfactory manner.

Between 40,000 and 50,000 feet of Grimshaw White Core Wire was required in the wiring of this building, and the wiring was done by the Eureka Electric Company themselves.

The steam plant consists of two 60 H. P. Beck Engines each running at a speed of 320 revolutions a minute. Each engine has a brick foundation isolated and independent of the building itself, thus obviating all of the ill-effects of vibration.

The Beck Engine is well-known in the electrical trade as a superior machine for driving dynamos. It is made by the Taylor M'f'g. Co., of Chambersburg, Pa., and gives the best of satisfaction where ever used. The engine bearings are provided with self-feeding oil cups made by W. P. Phillips, Boston, Mass., and each of the cylinders and valves of the engines are lubricated by the "Spray Feed" lubricator made by the Lunkenheimer Brass Company of Cincinnati, O.

The belts used in this plant are of leather, and were made and put in by the New York Leather Belting Company.

The engine plant was installed by Cooke & Co., of 22 Cortlandt, street, under the charge of H. H. Hungerford, mechanical engineer, and the dynamo plant was put in under the supervision of Mr. John H. Romme, Electrician of the Eureka Electric Co., who was assisted by Mr. R. A. Davidson of the same company. The engineer in charge of the plant is Mr. Edwin Goss.

NEW ELECTRIC LIGHT PLANT IN JAMAICA, L. I.

On the first of the year the village of Jamaica, Long Island, was for the first time [illegible] successfully illuminated by electricity and the citizens are delighted with the new light. The transformer, and incandescent lighting system of the National Electric Manufacturing Company of [illegible] is used. The street lamps are of 32 candle power and about 300 feet apart. There are now in service 125 lamps but ultimately 300 will be used. The plant consists of a dynamo of 1000 lights capacity, a 100 horse power engine and a 125 horse power boiler, with the other necessary equipments. The plant is operated by the Jamaica Gas Lighting Company which has been illuminating the streets of the town for nearly 40 years, and the introduction of the new light was attended with much enthusiasm on the part of the citizens. Everybody is well pleased with the light and have a good word to say for the system, which, as is well known, is an excellent and efficient one.

THE EDCO STORAGE BATTERY SYSTEM OF STREET CAR PROPULSION.

We are informed by Mr. D. H. Bates, Vice President and General Manager of the Accumulator Company, that the negotiations which have been pending for 60 days between his company and the Eckington and Soldiers' Home Railway Company of the District of Columbia, have resulted in the execution of a satisfactory contract for the equipment of the new G street branch of that road with six storage battery cars.

The Eckington and Soldiers' Home Railway Company was one of the first street car roads in the United States to adopt electricity as a means of propelling its cars, and the Thomson-Houston System of trolley wires installed several years ago upon that road, extending from 7th street and New York avenue in Washington, D. C., to Eckington and the Soldiers Home in the northeastern part of the city, has been one of the most widely known and successful in the country. Congress, however, will not permit the railway company to erect any more

trolley poles, particularly in the heart of the City, and, besides, while the existing trolley system on the Eckington road has so far given good results, generally, its inherent defects are serious, chiefly in the frequent and violent changes of load upon the engine and dynamo plant, which cause such strains upon the machinery, as to point to its inevitable destruction at an early date, and meantime lead to a rapidly increasing percentage of expense for repairs and maintenance, saying nothing of the loss of revenue and popularity, sure to result from breakdowns. It became necessary, therefore, for the Eckington Company to look around for another system for its extension, or branch from New York avenue and 5th street, via the Pension Office and 6th street to 15th street, opposite the Treasury Department, including a proposed extension to the Capitol.

Col. George Truesdell, the President of the Eckington and Soldiers' Home Railway Company, has been for several months examining into various systems of electrical propulsion, and finally concluded upon the Edco system as one fully meeting all the requirements of his company, in the premises.

The Edco system is the invention of Mr. W. W. Griscom, the President of the Electro Dynamic Company of Philadelphia, the initials of which title serve to form the word "Edco." The Accumulator Company some time ago made a close working arrangement with the Electro Dynamic Company in order to avail itself of the best possible system for motive power and lighting, the Electro Dynamic Company having proved to the satisfaction of the officers and experts of the Accumulator Company that its work, both in construction and design, was without exception the best in this country or Europe.

The cars for the Eckington and Soldiers' Home Road are being manufactured by the J. G. Brill Company of Philadelphia, and will be upholstered and finished in handsome style, lighted by electricity, equipped with the Edco system of motors and gearing, the gearing running in oil with dust tight covers for motors, and with a sufficient number of "23 M" type accumulators, made by the Accumulator Company to accomplish an average speed of 8 miles an hour, and a maximum speed, when desired, of 15 miles an hour.

The Brill Company has promised the cars for the last of March, and they will be equipped and installed in running order within about 80 days thereafter. The factory of the Electro Dynamic Company is being run three nights a week, in order to keep up with its orders for Dynamos, Motors, Gearing, switches, etc., etc.

The six storage battery cars which the Accumulator Company is under contract to deliver to the Dubuque Street Railway Company, are rapidly approaching completion, and will be delivered and installed some time next month.

NEW TEST INSTRUMENTS.

Many electrical plants are operated without the aid of suitable testing appliances on account of their great expense, and to meet this want the Central Electric Company of Chicago are placing upon the market a new voltmeter and ammeter, which are claimed to be as accurate as the most expensive instruments in use, and, at the same time, sold for about one-third of the price.

The cut shows the form of these instruments, which are beautifully finished and are supplied in handsome hard-wood boxes. The instruments combine the qualities of convenience, accuracy and durability with simplicity. They are made on correct scientific principles, have been severely tested by scientific experts, and pronounced strictly accurate and thoroughly reliable. No permanent magnets are employed, and only the softest chemically purified and annealed iron is used in the electro-magnets.

By an arrangement of the coil and iron, residual magnetism is reduced to a minimum, thus securing the greatest possible accuracy. The springs are of the best steel, and aged, insuring permanency and reliability and requiring no recalibration.

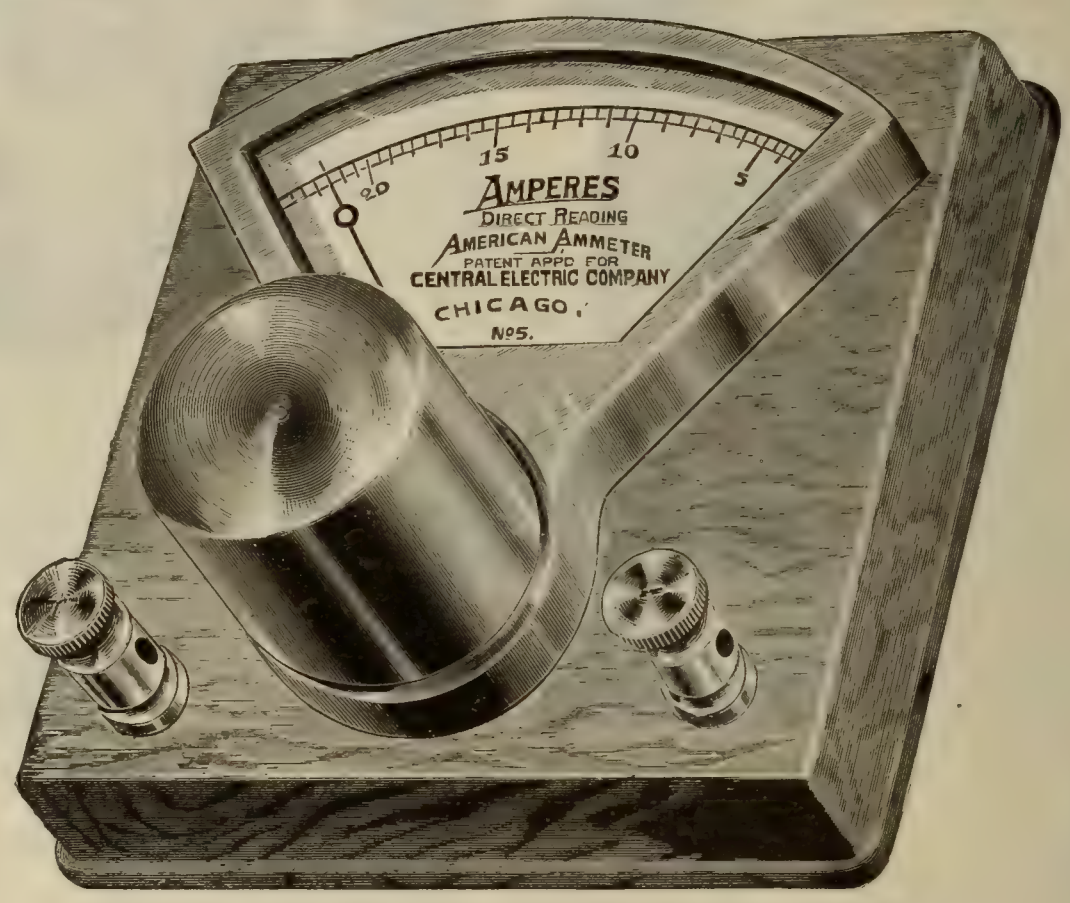
The pointer is pivoted on polished steel needles, is very sensitive, and when set for any point will positively stop at the same point when at rest.

The voltmeter is exactly similar in appearance to the ammeter, and the instruments would seem to be very desirable adjuncts to any electrical installation. Patents have been applied for on these instruments, which the Central Electric Company control.

ELECTRICAL ENGINEERING AT CORNELL UNIVERSITY.

Among the theses subjects of the senior class are the following:

J. F. Booraem—"The Brush Transformer."
P. K. Browd—"Electrolysis in Bleaching," etc.
H. A. Benedict—"Electrical Distribution of Energy."
F. Barton—"Test of Edison Dynamos."
E. H. Brown—"Electric Currents in Alloys.
S. G. Barnes—"Electricity in Mining."
G. R. Chamberlain—"Electric Motor."
L. P. Clephane—"A New Phonograph."
F. B. Carey—"Test of Electric Motor."
H. C. Cushing—"Electric Insulating materials."
R. E. Danforth—"Synchronous Motors."
C. L. Etheridge—"The Brush Transformer."



CENTRAL ELECTRIC COMPANY'S AMPERE METER.

L. W. Emerick—"Comparison of Edison Shunt and Compound Wound Dynamos."
A. C. Field—"Automobile Torpedoes."
E. Fitts—"Electrical Resistance of Alloys."
E. E. Fisher—"Design of Light and Power Station."
H. R. Graves—"Aluminum Modulus of Elasticity."
J. L. Hall—"Test of Electric Railway Plant."
H. J. Hotchkiss—"Aluminum Alloys."
S. E. Hitt—"Brush Current Transformer."
S. W. Hayes—"Railway Signal."
E. C. Haggett—"Modulus of Aluminum."
H. L. Kuehmsted—"Alternating Motor."
J. E. Kress—"Aluminum Alloys."
L. Levy—"Storage Battery Traction."
J. C. McMynn—"Alternate Current Arc and Lamps."
W. N. McComb—"Electricity *vs.* Steam-power.
L. A. Osborne—"Electric Light and Power Plants."
S. G. Pollard and F. C. Perkins.—"Electric Train Lighting."
F. Raymond, 3d—"Edison-Eickemeyer Motor."
H. B. Smith—Electricity and Aerial Navigation."
F. J. Tone—"Design of an Electric Locomotive."
C. M. White—"Brush Dynamo."
R. C. Williams—"Design of Electric Plant."
E. M. Wood—"Synchronous Motors."
H. M. Willson—"Electricity in Mining.

The officers of the "Cornell Electrical Association" for the present term are:

Frank C. Perkins, president; E. M. Wood, vice-president; L. W. Emerick, secretary.

At the last meeting the name of the organization was changed from the "Senior Electrical Association" to "Cornell Electrical Association" and Juniors were made eligible for membership.

It has been arranged to have representatives of the leading electrical firms address the association upon the systems they represent.

Mosscrop '87 has recently been engaged in the establishment of a new electric railway at Amsterdam, N. Y. This road has some of the heaviest gradients yet attempted, a number varying from 400 to 600 feet to the mile.

E. A. Wilhelm, '90, is at present in charge of the electric station at Willard Asylum, Ovid, N. Y.

INDUSTRIAL NOTES.

The Rochester Machine Tool Works, Rochester, N. Y., manufacturers of the celebrated Acme Safety Automatic Engines, have opened an office at 40 John street, New York, where they will keep an extensive stock of these engines on hand. Acme engines are made in sizes of one, two, three and four horse-power and they are adaptable to all classes of work including electric lighting. The Acme Engines are arranged for either natural gas or kerosene oil fire as ordered and no extra insurance is required on account of the oil fire. Messrs. W. B. Brook & Co. are the New York agents, at 40 John street.

The Page Belting Company is inviting its friends to view their stock of belting, lace leather, cut lacings, etc., between 8 A.M. and 6 P.M. on any week day after February 1st, 1891, at their New York store, 16 Dey street. At this store Mr. George A. Pierce, Manager, will keep the largest assortment and most complete stock of these goods in the city. The company are dealers and manufacturers of all the staple grades of leather belting, such as Raw Hide, Hercules, Tanned Lacing and Metallic Tipped Cut Lacings and special belting for electrical purposes, and have a first-class and well equipped belt shop in connection with the store. They employ skilled workmen to splice new belts, repair old belts or equip new plants at short notice.

LINES OF FORCE.—Whenever any of the lines of force forming part of two separately generated magnetic fields traverse a common space, there is a decided action between the two sets of lines, the tendency being to so alter their paths that as many lines as possible shall coincide in direction.

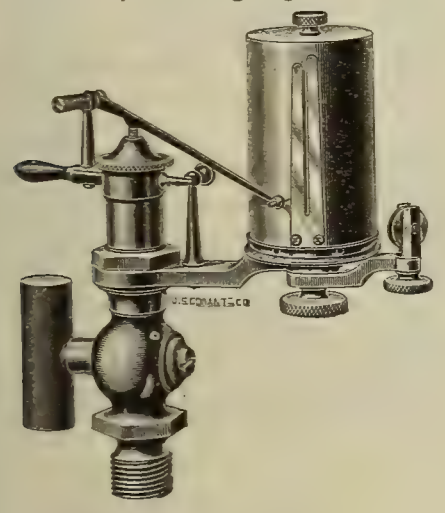
AN IMPROVED ARC INDICATOR.

The indicator illustrated below is extremely delicate in quickly answering changes of steam pressure, producing a smooth expansion line, without oscillation, and even indicates the very slight fall of pressure due to condensation at the junction of compression and admission lines.

It is well known that so long as the height due to the pressure is reached it matters not whether the path be straight or curved, providing the pencil path is always the same.

The arc motion is much the simpler as it requires only a single straight arm lever supported from a central bearing, with no possible chance for any bind to appear from the pressure put on the pencil arm while taking the diagram. A pressure indicator with a parallel motion requires so many minute joints and so much delicate workmanship as to make them too expensive for general adoption.

Our illustration shows an arc indicator constructed on scientific principles and in the simplest manner possible, with a view of placing on the market a reliable instrument in every particular, and at a price so low as to come within the reach of every working engineer.



IMPROVED ARC INDICATOR.

This indicator has been upon the market for two years, improvements being made from time to time, until now it has reached a high degree of perfection and will record the action of steam in the cylinder of an engine up to the highest speed more accurately than any other indicator.

A card taken with the indicator shows the admission line to be curved, but by drawing the arc line beside it, when on the drum, by raising the pencil arm with the finger, the engineer has the card as if squared, and, with this arc, can note all the points he desires more readily. For instance, whether the admission line is parallel with the arc or not, it will indicate if the valve is late or early, and the point where compression commences is noted by the distance from the arc line.

The theoretical expansion line is laid out by striking arcs with the dividers instead of drawing straight lines with a straight edge and square.

The area of the card from which the power is measured is not affected by the arc motion as all horizontal distances are, just the same as in a straight line card, depending for its area only upon the length of base and altitude.

The drum, which has a bearing at both ends, is made as light as possible. The drum spring is ground, concaving on the side to avoid all frictional resistance in the drum. The groove for the cord is so arranged that there is but one turn of the cord on the drum, preventing the distortion caused when the cord runs double. The tension of the spring can be changed for any speed without in any way affecting the number of the spring.

Scales, cords, leads, cards, etc., with a treatise containing complete directions for attaching and using the instrument, are furnished with the indicator.

Hine and Robertson, 45 Cortlandt street, New York, are sales agents for this improved indicator, and they will give any desired particulars.

ACCUMULATORS.—The plates of accumulators form an electrical connection inside the cell only through the electrolyte, and outside by joining one set of plates to the other through a conductor, which may be very complex; such, for example, as a long length of wire, with one or more lamps in its course. In this condition the circuit is said to be closed; and unless the cell be exhausted, a current flows. When the outside conductor is broken no current passes and the circuit is open.

DRY BATTERY FOR TELEPHONE WORK.

With the inconvenience and bad tempers caused by the fluid from the common gravity cells ruining carpets, floors and clothing, and their non-portability came the invention of the dry-cell, which, although not absolutely *dry*, can be placed in any position without any danger of its contents being upset. This permits the use of a dry battery where a fluid battery would be impractical.

Among the best known of these cells is the Crosby dry battery which is neat, clean, effective, simple, compact and portable. It has an electromotive force of 1.55 volts and a current of from 1 to 15 amperes. It is made in all shapes and sizes.

It can be used for gas lighting, electric bells, annunciators and medical use. In fact for open circuit work of all kinds it has no equal.

One of the latest applications of these dry cells is to telephone work. Our illustration shows a battery of three Crosby dry cells used in connection with a long distance telephone. They are, of course, as equally applicable to the ordinary local telephone, and are far preferable for general telephone work to any of the fluid cells. These cells have proved signally successful in this class of work, and it is likely they will be more generally adopted in this direction.



CROSBY DRY CELLS IN TELEPHONE WORK.

The battery is sold semi charged, requiring only a small quantity of pure water to fully charge it. It does not work until wanted, and recuperates quicker and oftener than any other cell.

DEVELOPMENT OF HEAT IN CONDUCTORS.

If a current of electricity is urged through a solid conductor, heat is developed, and the amount of heat so developed is proportional to the total energy expended in the conductor. This energy is proportional to the product of two factors, viz.: the strength of the current C, and the difference of potential E between the extremities of the conductor, necessary to maintain that strength—or the heat H developed is proportional to E C; but by Ohm's law $E = C R$, therefore $EC = C^2R$.

It is manifest from these simple formulæ, that the heat developed varies directly as the resistance, and directly as the square of the current strength. It may also be said to vary directly as the potential difference. If we have two equal and uniform conductors, A and B, and maintain a potential difference at the ends of one of them, A, twice that of the other, B, the heating effect will be quadrupled; for with equal resistance the current strength will also be doubled, and in fact, energy is being expended four times as fast in A as compared with the rate of expenditure in B. If, however, while both conductors are of the same length and sectional area, the specific resistance of B is twice that of A, and the same potential difference is maintained in both of them, the resistance of B being twice that of A, will have the strength of the current flowing through B. Hence if in A, $H = C$ or $C^2 R$, then in B, $H = \frac{1}{2} C R$ or $2 R (\frac{1}{2})^2 = \frac{1}{2} C^2 R$. In this case twice as much heat is developed and twice as much energy is expended in A as compared with B. Again, if the current in B is made equal to that in A, by doubling the potential difference in the former then in A, $H = R C$ or $C^2 R$, and in B, $H = 2 R C$ or $2 C^2 R$, so that doubling the resistance and keeping the current strength constant, doubles the heat developed and causes twice the amount of energy to be expended. One great lesson is here enforced, viz.: that the amount of energy obtained in the form of heat can only equal and never by any possible means, exceed the amount of electrical energy expended or absorbed in the conversion.

THE PHOTOGRAPHIC ACTION OF ELECTRO-MAGNETIC WAVES.—In the *Wiener Berichte* of October 9, 1890, Franz von Dobrzynski says: I have for several months been engaged in investigating the photographic action of electro-magnetic waves. The electro-magnetic waves were obtained by the method of Hertz. They acted on dry bromide of silver and gelatine "Nys" plates procured from Geissler in Bonn. The plane of the plates either included the axis of the vibrator, or was at right angles to it. The exposure was three hours. No sensitization of the plates was made. The development and fixation took place in the ordinary manner by ferric oxalate and hyposulphite. The action was visible after development and fixation by the appearance of alternating bright and dark bands across the direction of vibration of the waves, or by the appearance of dark bands in the direction of the vibration. Both kinds of bands could occasionally be observed together. In many experiments the plates were covered with tinfoil. Portions of the coating of the tinfoil were cut away. The tinfoil did not prevent the formation of bands. This points to the fact that the chemical action which here comes into play is not a primary one. The cross bands suggested stationary vibrations. They might be due to reflexion from the sides of the wooden box, by which the plates were protected from the influence of extraneous rays; but they might also owe their origin to reflexion from the side of the room. The only experiment which could be made with a reflecting metal ball was not in disagreement with this view; the cross bands were now more distinct and regular. If this view is correct, it may be concluded that waves of from 0.6 to 20 centim. are effective.

LIGHT AND ELECTRICITY.—We can take the condenser or a Leyden jar and store up electricity in any quantity, and keep it there for a considerable time, and then discharge it at will. We cannot do so with light or magnetism, and yet we know that all of these are one and the same thing with only a difference of degree.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
55 KILBY STREET, ROOM 61,
BOSTON, January 30, 1891.

Derby and Chester, N. H., are moving for an electric railway.

Lieut. W. M. Wood, of the U. S. Navy, the inventor of the electrically welded shell, will be actively connected with the company.

Incandescent lights are being introduced into the Gilford hosiery mill at Laconia, N. H., now occupied by Coburn and Leavitt.

The manufacturer of a storage battery for street cars is negotiating for the old works of the Brayton Petroleum Engine Company at East Bridgewater, Mass.

The selectmen of Spencer, Mass., have granted a decree of location to the Worcester, Leicester and Spencer Street Railway. The stockholders of the road have met and accepted the location.

The new engine for the electric light station at Windsor Locks, Conn., has been set in position, and the company will soon be ready to meet any emergency that may come on account of the water failing.

It is rumored that a syndicate of Salem and Lynn capitalists, who are largely interested in the Lynn and Boston road, are negotiating for the purchase of the Naumkeag Street railway, so as to get a through line to Boston.

It is estimated that it will take two years for the Thomson-Houston Company to finish the 17 400 H.P. generators for which their contract with the West End road calls. Special machinery for their construction is being put into the new Lynn factory as fast as possible.

At a special meeting of the stockholders of the American Bell Telephone Company, held in Boston, January 7, a resolution was passed increasing the capital stock of the company from $12,500,000 to $15,000,000 and the number of shares from 125,000 to 150,000, each of the par value of $100.

A woman received a slight shock from an overcharged telephone wire in Cambridge recently and the daily press of this city so far departed from their usual custom as to devote no more space to this occurrence than they did to the killing of 150 men by a gas explosion in Pennsylvania, or the death of three people from suffocation from illuminating gas caused by a leaky gas pipe in East Boston.

The first grand ball of the Massachusetts Electrical Engineers and Mechanics' Association was held at Odd Fellows' Hall, last evening, and, notwithstanding the rain, there was a crowded attendance. The hall was very cleverly decorated with red, white and blue incandescent lights. Festoons of these ran from the four corners of the hall to the centre of the ceiling and a large sign of "Welcome," together with the monogram of the association, blazed out above Page's orchestra on the platform at one end. The affair was both an artistic and social success.

The experiments and tests which have for 18 months been in progress in the line of shell welding by the U. S. government have now resulted so favorably and in something of such a practical nature that the government has entered into an arrangement with the Thomson Electric Welding Company to furnish a large quantity of their supplies, with a surety of a very large business in the future. It is the intention of the Welding Company to form a special company for the sole object of making these shells. Plans are already prepared for a new factory on Federal street, West Lynn, which will be ready for occupancy within 60 days.

The wires of Boston and vicinity have, from all accounts, escaped with as little damage from Sunday's storm as those of any portion of the country. There was practically no damage to the lighting or railroad systems,, the whole loss falling on the telegraph and telephone companies and these it is stated suffered considerably in some places. The fire alarm system of Boston was pretty well used up and the police alarm out of running order for a day or two. Most all breaks have been either temporarily or permanently repaired at this writing, however, and division superintendents and linemen are earnestly hoping the enemy will not renew hostilities.

W. H. M., Jr.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., Jan 23, 1891.

The city authorities of Urbana, Ill., have been restrained by the courts from interfering with the street railway company of that city in making the necessary changes for operating its cars by electricity.

An appropriate frontispiece of a circular issued by Mr. George Cutter setting forth the advantages of his combination shades, is a picture of a toad very contentedly sitting beneath a toad-stool and soliloquizing, "Nothing like a good shade."

Since the Central Electric Company decided to go into the Railroad Supply business, they have been looking thoroughly into the subject and announce that they will shortly be upon the market with some Railroad Specialties, entirely their own. These will be announced aad illustrated in due time.

The Citizens Street Railway of Elkhart, Ind., has recently changed hands, Mr. Jackson of the Detroit Electrical Works, being one of the leading stock holders in the new company which will be known as the Elkhart Electric and Railway Company. The line which is now seven miles long will be extended.

We have been favored with a view of a sample of the new Volt-Meter and Ammeter, illustrated elsewhere in this issue, the patents for which have been passed into control of the Central Electric Company. The instrument is certainly of a fine appearance, and should meet a ready sale among persons who desire a reliable and, at the same time, a moderate priced instrument of this class.

The Standard Oil Filter Company, of 205 Canal street, this city, report a very satisfactory demand for their filters, the well-known Ellis Oil Filter. The confidence of this company in their filter is such that they send them on thirty days trial to responsible parties. Mr. C. E. Gregory, of this company, expects to have some of their filters on exhibition at the Electric Light Convention at Providence.

Wm. Baragwanath & Son, of this city, report recent shipments of their well-known feed water heaters for use in electric plants in Seattle and Tacoma, Washington, of 300 and 400 horse power, respectively, also 600 horse power to Denver, and the same to Streator, Illinois. This firm have done a very large business during the past year, over one hundred thousand horse power capacity in heaters having been placed.

Mr. Wm. H. McKinlock, President of the Central Electric Company, met with quite a painful accident a few days ago, which confined him to his room for several days. In running for a train he stumbled and was thrown headlong into the street; but, fortunately, escaped anything more than a sprained ankle. We are happy to be able to say that Mr. McKinlock has so far recovered as to resume his duties, though he still "favors" that ankle.

Mr. E. L. Brown, proprietor of the Elmwood Paper Mills, Elmwood, Ill., is fitting out his mills with a complete electric light plant consisting of one 30-light Western arc dynamo; one 500-light National alternating current incandescent dynamo and one Phœnix, Dick and Church engine of 125 h. p., with a Phœnix boiler 66 x 16 inches. A fine brick and iron building 20 by 60 feet was erected especially for this installation which will be as perfect in all its details as it can be made.

The Rookery Building, Chicago, is rapidly becoming the electrical centre of the city, there being now some fifteen or twenty companies or their representatives located there. The door of No. 331 is particularly favored, electrically, bearing the names of four electrical enterprises, as follows: Thos. G. Grier, consulting electrician of the National Engineering Bureau; G. A. Edward Kohler, western representative of the Eddy Electric Manufacturing Company; National Electric Manufacturing Company, Geo. S. Searing, representative; and C. F. Dunderdale, electric railways, lights and power plants.

NEW ELECTRIC INCORPORATIONS.—The Day Electric Construction Company, Chicago; capital stock, $1,000,000; for the manufacture of electric motors, dynamos, and other machinery; incorporators, Edwin F. Getchell, LeRoy D. Thoman, Norman L. Ross. The Morrisonville Electric Light Company, Morrisonville, Ill.; capital stock, $4,000; to furnish electric lights; incorporators, H. C. Bohn, J. W. Campbell, E. D. Green, A. E. Gowin. The Mercantile Telegraph Company, Chicago; capital stock, $100,000; to transmit intelligence to a distance by means of electricity and magnetism, to construct telegraph lines between the respective states and territories of the United States, and to engage in a general telegraph business; incorporators, Julius Schweizer, George Einstein, Henry H. Kennedy.

F. M. I.

THE STANDARD UNDERGROUND CABLE COMPANY.

The Annual Meeting of the Standard Underground Cable Company was held at the Company's office in the Westinghouse Building, Pittsburgh, Pa., January 27th. It was well attended by the stockholders, there being nearly 9000 shares of stock represented.

Mr. George Westinghouse, Jr., was elected President, and the following gentlemen were elected as Directors, namely: George Westinghouse, Jr., Mark W. Watson, John H. Dalzell, Robert Pitcairn, Joseph W. Marsh, James H. Willock and H. S. Sweitzer.

The annual report of the Board of Directors was exceedingly gratifying to the stockholders. It showed that the company's business for the year 1890 amounted to $917,946.62, representing an increase of 50 per cent. over the business done in the year 1889; the net earnings for the year 1890 were $204,913.78, or a little over 20 per cent. on the entire capital stock; two dividends aggregating $30,000 were paid during the year, leaving the net addition to surplus account $174,913.78. The Company's net surplus on December 31st, 1890, was $315,735.85.

The raw materials used by the Company during the year were as follows: 342,549 pounds of cotton and jute yarn, 1,625,209 pounds of copper, 1,853,538 pounds of lead.

During the year 1890 the company added 84 new customers to its already large list, and its business covers a wide range of territory, as is graphically illustrated by the large map of the United States shown in the company's office, nearly every state and territory of which is dotted with circles or crosses indicating the cities in which the company's underground cable or overhead wire, respectively, are in use: and the markings on Johnson's Commercial Chart of the World shows that the company's business is not limited to the United States, but extends to Mexico, South America, Europe, Africa, Asia, China end Japan.

The new Board of Directors met a few days later for the purpose of electing officers.

LECTURES, ETC.

Mr. Robert S. Dobbie, of the Edison General Electric Company, will deliver an illustrated lecture on "Arc Lighting" before the Department of Electricity of the Brooklyn Institute. The meeting will be held in the lecture room of the Y. M. C. A. building on Fulton street, Feb. 6th.

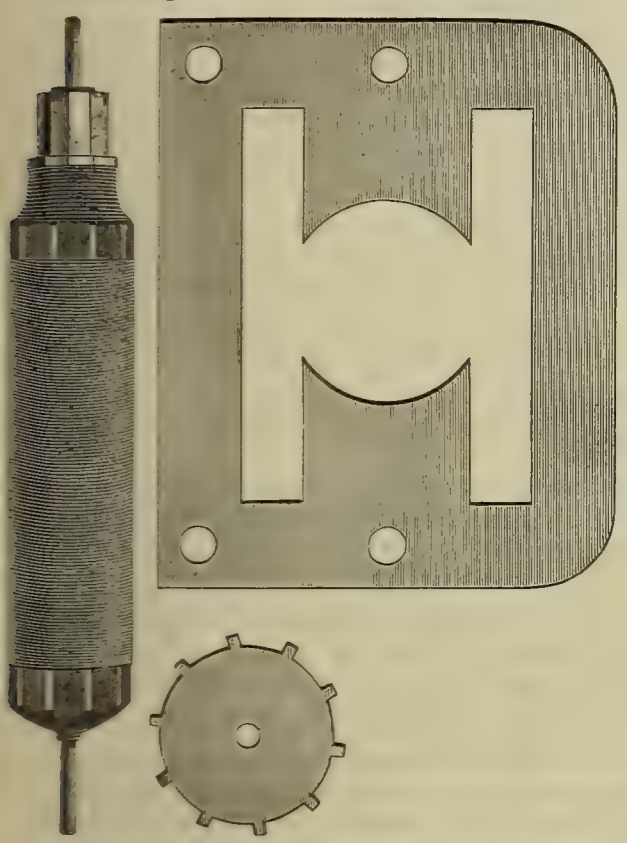
ROUND DISCS NOT ATTRACTED.—If a thin round disc of iron is laid upon the flat round end of an electromagnet (the pole end being slightly larger than the disc), the disk is not attracted and will not stick on, even if laid down quite centrally.

SMALL HIGH CLASS MOTORS.

In the early history of electric light and motor construction, small motors and dynamos did not receive the attention that was given to those larger and then more important sizes ; in consequence, a great number of very inefficient small motors have been put on the market.

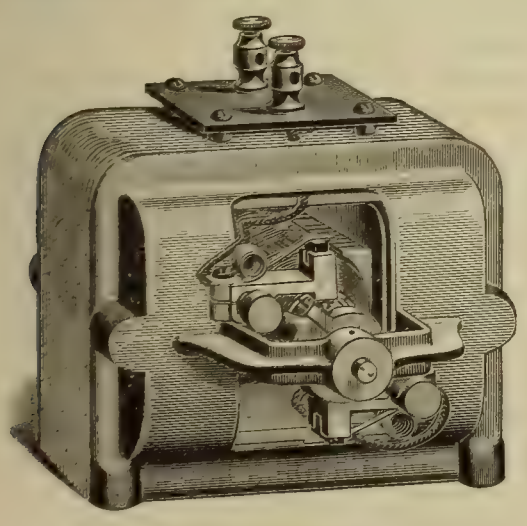
It requires greater care and more profound knowledge of the science of electric engineering to design and construct a highly efficient motor or dynamo, say one ⅛ h.p., than is necessary to design and construct one of 10 h.p. or larger.

The latest candidate for popular favor in this direction, is the result of the effort of Mr. Foree Bain, of Chicago. The motor dynamos are manufactured and placed on the market by the Bain Electric Manufacturing Co., 47 and 49 South Jefferson street, Chicago.



BAIN'S MOTOR-DYNAMOS.—ARMATURE, AND FIELD AND ARMATURE LAMINATIONS.

In detail the field magnets and armature cores are stamped of the best soft sheet iron ; the sheets of the field magnets, in which there are no joints, are then varnished and held together by a stud in each side ; this stud also passes through a cast iron guard on either end. The guard answers as a means for making the motor "iron clad," and it also carries the two bearings.



BAIN'S MOTOR-DYNAMO.

The shaft is made of the best Stubbs steel ground, true on centres. The armature core is of the Siemen's type, with Paccinotti projections, and the winding is Bain's modification of Froelich. The commutator is large and solidly made, and the brushes are made of a patented material resembling carbon. The advantages claimed for this little motor are : 1st. It is an efficient motor or dynamo, and may be used as either. 2d. The field magnets are laminated ; there are no joints in the field magnets ; there is a double magnetic path, and the armature runs "end on." 3d. The field coils are placed as near to the armature as possible; all the lines of force of the field coils are concentrated in core; there are no radiating magnetic lines of force, and the machine is "iron clad." 4th. Best mechanical construction ; the bearings do not require oil or grease, or lubricant of any kind ; machine is self contained, no nuts, bolts, or screws to become loosened. 5th. Highest possible efficiency and lowest speed consistent therewith ; acme of durability and simplicity.

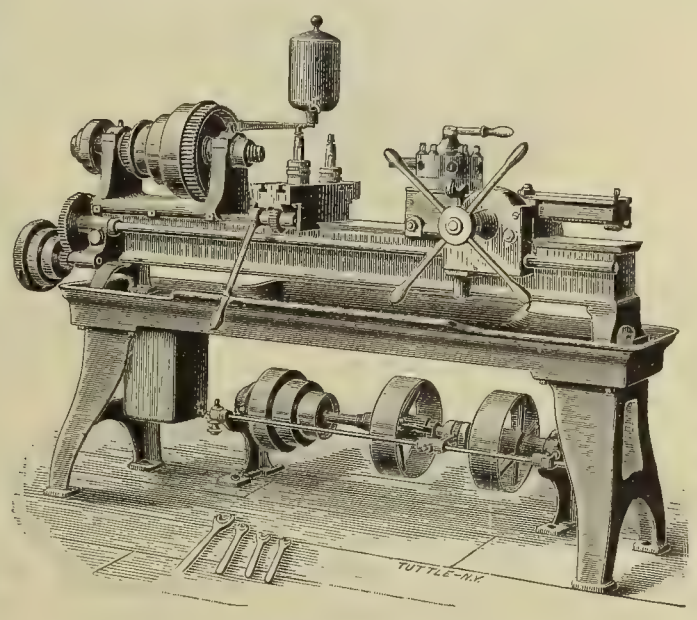
Machines of this type are carried in stock from one $\frac{1}{12}$ h.p. to 1 h.p., and they are wound for battery work from two volts to 25 volts; also wound for 110-volt circuits and constant currents for 6½ and 10 amperes.

IMPROVED SCREW MACHINE AND TURRET LATHE.

The Screw Machine and Turret Lathe, herewith illustrated, are manufactured by The Garvin Machine Co., New York.

They comprise their latest designs in this class of lathes, of which they manufacture a very complete line.

The screw machine is known as their No. 3 size, and is 14 in. swing, 4½ ft. bed. It is arranged with power feed and automatic stop. The feed rod and

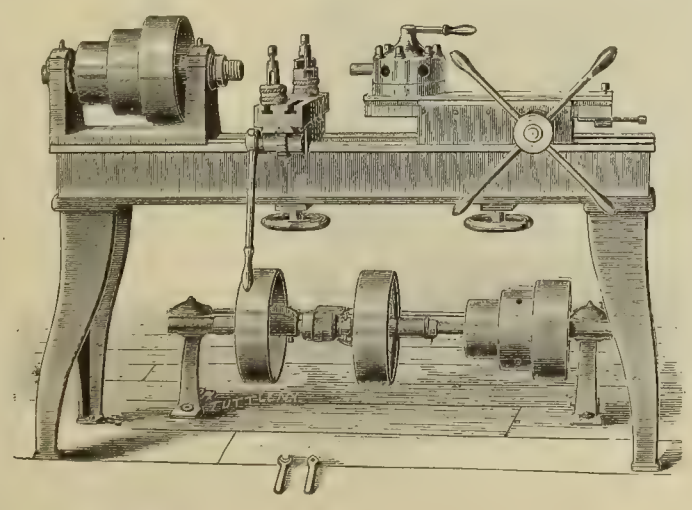


GARVIN'S SCREW MACHINE.

connections are placed on the front of the lathe for convenience in handling. The feed is tripped by means of an adjustable dog, carried on top of the turret slide.

The spindle runs in composition boxes and has a 1½ in. hole its entire length. The outer end of the spindle is threaded for chucks, or is made with automatic spring chucks and wire feed.

The wire spring chucks used are of new pattern, which have no end motion when gripping stock.



GARVIN'S TURRET LATHE.

The turret is 8 in. diameter, with eight 1¼ in. holes for tools and has a movement of 12 ins. The cross slide is made with rack or screw feed, and with stop for each tool.

The head is made as shown, with back gears, or with plain cone, or back gears and friction clutch. The friction cluch head admits of changing instantly from fast to slow speeds, or stopping, as desired. This is particularly valuable when using large dies or when different parts of the work vary largely in diameter.

This machine is also made with extra large spindle, when desired, which gives a 2⅛ in. hole in spindle or 1½ in. hole with wire feed and spring chuck. The pan for chips is especially large and has a slide extension where chips accumulate, with oil pot at end, where it is not likely to become clogged. Countershaft has self-oiling cones with friction pulleys, 14 in. diameter 4 in. face.

Weight of machine, complete, 1,600 lbs.

The Turret Lathe, here shown, is designed for all classes of work where oil is not required. It is made with the same heads, spindles and turret as the No. 3 Screw Machine, and with plain chuck, spring chuck or wire feed.

It is also made with draw-in chuck operated by hand wheel at back of spindle. It is 16 in. swing, and the bed is of open pattern with V's.

The cross slide and turret block are clamped with hand wheel shown. Countershaft has friction pulleys, 14 in. diameter, 4 in. face.

Weight of machine, complete, 1,400 lbs.

TO PROSECUTE INFRINGERS.

Several suits have been brought in various parts of the country during the last few years, for infringements of patents on Electric Fixtures and Combination Gas and Electric Fixtures. During the pendency of such suits some of the manufacturers of these goods were working under licenses granted by the owners and licensors of the following patents :

No. 259,235, granted June 6, 1882. No. 266,549, granted October 24, 1882. No. 266,550, granted October 24, 1882. No. 272,169, granted February 13, 1883. No. 278,465, granted May 29, 1883. No. 294,697, granted March 4, 1884. No. 307,879, granted November 11, 1884.

A number of the contesting manufacturers, in view of the heavy expenses entailed in defending these suits, and the uncertainty as to the final decision, after careful investigation, came to the conclusion to accept the conditions under which Mr. Maitland, who had meanwhile become the owner of the above named controlling patents relating to Electric Fixtures and Combination Electric and Gas Fixtures, would grant them licenses under his patents.

W. C. Vosburgh Mfg. Co., Limited, Brooklyn, N. Y.

Cleveland Gas Fixture Mfg. Co., Cleveland, Ohio.

Joseph Donaldson, New York, N. Y.

Iden & Co., New York, N. Y.

Charles Royle, Brooklyn, N. Y.

L. Plaut & Co., New York, N. Y.

J. B. McCoy & Co., New York, N. Y.

The Mitchell-Vance Co., New York, N. Y.

G. W. Shaw & Co., Philadelphia, Pa.

F. McLewee & Son, New York, N. Y.

DeKosenko & Hetherington Mfg. Co., Philadelphia, Pa.

E. P. Gleason Mfg. Co., New York, N. Y.

Thos. Day & Co., Limited, San Francisco, Cal.

Alfred Kochn, New York, N. Y.

Archer & Pancoast Mfg. Co., New York, N. Y.

Thackara Mfg. Co., Philadelphia, Pa.

Cassidy & Son Mfg. Co., New York, N. Y.

Central Gas & Electric Fixture Co., New York, N. Y. (successors to Oxley, Giddings & Enos).

Yeaton & Harris Mfg. Co., Philadelphia, Pa.

New York Gas Fixture Co., New York, N. Y.

J. L. Gaumer, Philadelphia, Pa.

German-American Mfg. Co., New York, N. Y.

Bergmann Gas & Electric Fixture Co., New York, N. Y.

Bradley & Hubbard Mfg. Co., Meriden, Conn., and New York, N. Y.

Chicago Gas & Electric Fixture Mfg. Co., Chicago, Ill.

Mr. Maitland has decided to bring suits against any parties infringing on his patents by manufacturing, purchasing or using, and has retained as his counsel, Messrs. Phillips, Phelps and Hovey, of New York City, to prosecute such suits at once.

ELECTRIC CIGAR LIGHTER.

Of the many hundred applications of electricity to the needs of man during the past few years, not one has been more successful, and not one has won its way so surely to public commendation as the electric cigar lighter. An invention to be surely successful, and to be universally adopted, must have apparent advantages over the apparatus which it is intended to replace.



FIG. 1.—CIGAR LIGHTER.

The Crosby Electric Company, of 89 South 5th avenue, New York City, are making an electric cigar lighter that possesses the merit of being a work of art as well as being useful. This lighter perfectly supplants all the known methods of making a light for the smoker, does away with the care of a dirty oil lamp, of keeping the match box full, of polishing up the gas globes, and the



FIG. 2.—CIGAR LIGHTER.

paying for gas, the one-hundredth part of which is not actually used.

Alcohol is used with the lighter, and the light is made by simply touching the alcohol brush to some part of the bronze figure, which gives off a spark when touched by the brush and thus ignites the alcohol.

A small battery is used, and as there is no strain upon the same only during the short space when the brush is in contact with the figure, the battery will last indefinitely, and when renewals are needed—in from six months to several years—they are easily and quickly made at a very slight cost, less than one-third, in fact, than any dealer spends on matches during the same time.

The figure is of bronze and is as finely finished as any bronze displayed and for sale by jewelers or dealers in bric-a-brac. It is not so large but that it can be placed on the shelf already used for oil lamp or gas, and as it is clean, practical and beautiful, will surely displace matches, oil and gas.

It is unique, durable, beautiful and economical, and cigar dealers who intend to keep themselves in touch with the public by showing their patrons that they are on the alert for anything that will add to their comfort should procure this attractive novelty, as it will save them both unnecessary labor and expense.

Our illustrations show two designs of these electric cigar lighters. In the style represented in Fig. 1, the circuit is completed by touching with the alcohol torch the staff held in the hand of the figure. In Fig. 2, the ignition of the alcohol torch is effected by touching simultaneously the metal torch and the staff held elevated above the heads of the two figures.

THE PRACTICAL APPLICATION OF ACCUMULATORS.

BY E. V. BAILLARD.

The storage battery or accumulator invented by G. Plantè, in 1860, and reduced to a practical shape by C. A. Faure, 1880, and subsequently improved and modified by Sellon, Volkmar and others, is one of the members, and I may say most important members, of that wonderful array of modern productions which have contributed to making electricity so useful and so faithful a servant to man.

The storage battery of to-day is, however, but little understood, and I have found even among professional electricians very erroneous impressions existing regarding their uses and practical applications.

The general impression is that the accumulators can do anything and everything. They are frequently expected to do work which nothing else can do, and although in many cases they do it and do it well, when they fail to do it they are condemned.

The old idea that "bottled" electricity could be purchased at a store from which unlimited lights and power could be obtained is dying out, but occasionally crops up and shows that it is not quite dead yet. The old methods of installing which, as for dynamos, was that any plan and anything was good enough is also dying out, but there are still many who fondly imagine that accumulators can be installed with all local conditions and requirements totally ignored, that no attention whatever will be required by them, and that with a few hours charging at indefinite intervals and rates almost any amount of service can be obtained therefrom. On the other hand, the impression that accumulators require an expensive installation with numerous and costly switches, that they require constant attention, frequent repairs, and that even at that are unreliable and inefficient is equally false and absurd.

An accumulator plant to be successful must first of all be judiciously planned out to fit existing conditions and meet the local requirements, then properly installed, and left in the hands of [not a skilled electrician as some may believe] but of any honest and conscientious man of ordinary intelligence. Very little of his time will be required; all the labor required being the addition of water as fast as it evaporates, an occasional inspection and cleaning of the cells; in fact no more attention than is required by a dynamo, but as the effects on a dynamo of continued neglect of the commutator brushes, oil cups, etc., will result in a peck of trouble, so with accumulators, if all the above conditions are complied with, the great bugbear, buckling and sulphate, etc., will be unknown quantities, and the service efficient and satisfactory.

The uses of accumulators are so various that it is impossible to enumerate more than a few of them. In the household where a few cells are used to light from a Christmas tree to a ball room, to drive from a fan or sewing machine to a water pump in the physicians and dentist's practice, where if he desires to make use of the latest wonderful discoveries, methods and appliances the storage battery is indispensable; the electric plater is enabled in a day to accomplish 24 hours' work daily instead of 10 in the workshop; the artisan or inventor is supplied with a source of energy which he can depend on, control and alter at his pleasure, in the laboratory; the operator is supplied with a source of constant energy entirely free of magnetic influences or vibrations due to fast running machinery.

At sea we see the accumulators used for signalling, range finding, propelling and exploding torpedoes, driving launches, lighting pleasure yachts, etc.

In the telegraph and telephone, the accumulators are widely used; for phonographs, the photographic dark room, magic lanterns, etc., the accumulators supply the current when it would be entirely out of the question to use dynamos.

From these we pass regular electric light installations from the small plant at a country residence to the larger installation in hotels, office buildings, theatres or central stations, reaching up to 1,000 lights capacity, used also for motors, elevators, ventilating fans, printing press, and what not.

In the streets we see the cars driven by that wonderful energy through the aid of accumulators; in the mines it is used not only to draw the coal out of the mines but drill and cut it.

That all this is not a prophecy and not drawn from purely theoretical deduction as to what can be done will no doubt be news to many, but it is nevertheless true, and perhaps the usefulness of the storage battery can best and more conclusively be shown, not by saying what it can do, but what it has done and is now doing; with this end in view I propose to describe a few of the most characteristic installations now in operation.

NEW CATALOGUES.

Mr. James H. Mason, of 118 and 120 Park Avenue, Brooklyn, N. Y., the inventor and manufacturer of the famous Mason primary battery, has quite recently issued a catalogue which shows that his business is greatly expanding. It will be remembered that Mr. Mason received a medal from the American Institute on his primary battery, the first medal ever given for primary batteries.

Mr. Mason is now handling electrical goods of every description, including bells, alarm clocks, electric magic lanterns, electric motors for small power, induction coils, push buttons, annunciators, etc., etc. The catalogue contains much other valuable information.

Mr. Mason has made extensive alterations in his factory within the past few months, involving two remodellings and an increase of 3,025 square feet of space. He has also been very successful in installing small electric-light and power plants to be run by his primary batteries, which, from the slight attention required, have given good satisfaction.

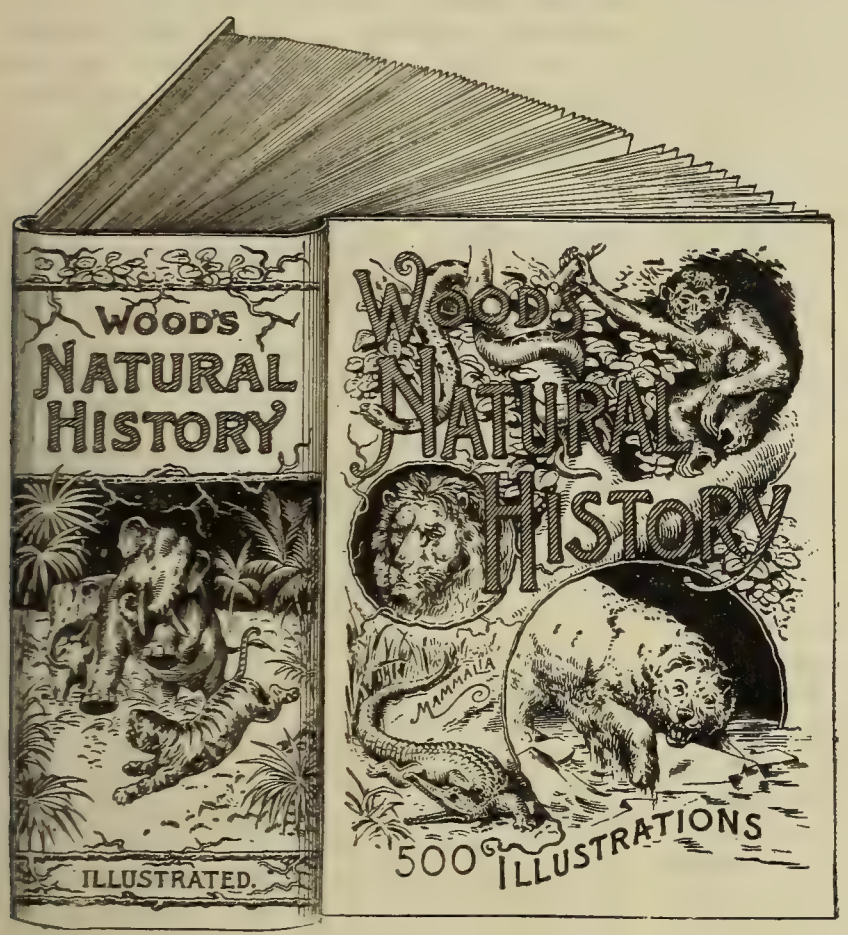
AMPERE TURNS.—The composition of the "ampere turns"—that is, the proportion of current strength to the number of convolutions—will depend largely upon the manner in which the exciting current is obtained; for it is sometimes necessary to have considerable resistance in the coils, and then the number of convolutions may be made great and the current correspondingly weak; while in other cases a high resistance is inadmissible, when only a few turns can be employed, and the necessary magneto-motive force must then be obtained by the aid of a heavy current.

RESIDUAL MAGNETISM.—If the field magnets are once strongly magnetized by a current passing in the direction in which it is desired the currents shall afterwards be generated, the cores will rarely lose all traces of magnetism especially if of cast-iron.

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Descriptiption of Design.

The Words, "WOODS' NATURAL HISTORY," on the side are executed in gold, including the Lion's head, the Boa-constrictor and Polar Bear being in solid silver, with the balance of design stamped in jet black ink on a background of dark cloth, relieved by finished red edges. The words on back appear in black on a background (4x 2¾ inches) of solid gold. Size, 10x7½ inches; 3½ inches thick; weight, over 6 pounds.

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A WEEKLY ILLUSTRATED ELECTRICAL JOURNAL.

NEW YORK NOTES.

Ajax switches carry big currents, but Mr. C. S. Van Nuis, 74 Cortlandt St., will permit any one desiring switches in his line to carry one or more away with them by simply leaving their order, or the price of the goods with him.

New York Safety Steam Power Co., 30 Cortlandt street, manufacturers of high speed electric light engines in horizontal and upright types, are continuing to do a successful business in the electrical industry. This firm furnishes complete steam plants, including boilers, engines and other necessities from two horse-power up to 150.

Eugene Munsell & Co., 218 Water street, New York, are said to be the largest importers and exporters of mica for electrical use. They furnish mica of any size and width, cut to order in any shape required. They are already furnishing large quantities of these goods to the leading dynamo and motor companies of this country.

Himmer & Anderson, 20 Vesey Street, New York, manufacturers of dry batteries and electrical novelties, are meeting with universal success by large sales of their electric cigar lighter. These electric cigar lighters are being sold in large quantities. Their dry battery, shown the writer, stood up for some time at 1⅛ volts and 14 amperes on the meters.

Stanley & Hall, manufacturers of electrical house furnishings, are as busy as ever putting out their noted dust proof bells. During a call there the past week they demonstrated their usual improvements, as they are bringing out several new novelties which I know will meet with big success among the buyers of the country, so I advise the trade to keep their eye on this firm.

Chapin & Thompson, 602 West 22d Street, manufacturing electricians, engineers and contractors for manufacturing electrical specialties as well as dynamos, motors, etc., have sold out to J. Jones & Son. They invite inventors and others to investigate their facilities for designing and manufacturing experimental and model machinery.

The Empire China Works, 144 and 156 Green street, Greenpoint, Brooklyn, E. D., N. Y., are manufacturers of all kinds of porcelain electrical supplies for electric light, electric power, electric railway inside and outside work. They also manufacture every line of insulators for electrical applications and make to order from special designs any porcelain insulator required and of any size. Standard goods always in stock.

William Ryle & Sons, 54 Howard street, New York city, are manufacturers of silk floss and threads of any desired diameter and quality for insulating wires; also all kinds of braiding silks. This firm has been furnishing the wire manufactories for a number of years with this line of goods, and invite all those not using their goods to give them an opportunity to test the quality of their silk.

P. C. Ackerman, the popular representative and manager of the New York office, 10 Cortlandt street, New York, of the American Electrical Works, Providence, R. I., manufacturers of patent finish electric light wires, magnetic office and annunciator wire: also rubber covered wire and lead incased wire, telephone and incandescent cords, is meeting with his usual success.

A visit to the C. and C. Electric Motor Company, 402 and 404 Greenwich street, New York, found them in their usual busy and active state, not having time to devote a few moments to the writer. He was invited to investigate the stock himself. They have enlarged their quarters and have added drafting and drawing departments on the main floor, and many other improvements have been made throughout their extensive factories. It is a well-known fact that their machinery for winding and other machine work is all run by their own motors from one central station in the building. To attempt to describe the advantages of the use of electric motors for running machinery would take the balance of our valuable space, but we can say that the application of motors in this way makes a saving in the neighborhood of 50 per cent. in the transmission of power. They have already fitted out numerous factories in a similar manner in this country and are now engaged in this work in a neighboring city. They are as busy as ever sending out their usual quota of motors from ⅛ up to 25 horse-power.

Brush Electric Company, Cleveland, Ohio, the well known manufacturers of the Brush Arc and Incandescent System of Electric Lighting, held their meeting Jan 21st. The following officers were elected:

A. Barton, of Boston, President.
Mr. Bartlett, of Boston, First Vice-President.
C. A. Coffin, of Boston, Second Vice-President.
J. Potter, Cleveland, O., Treasurer.
S. M. Hamill, Cleveland, O., Secretary.
Mr. Charles S. Pease, formerly of the Westinghouse Co., Gen'l Manager.
Mr. Charles F. Brush, General Electrician.
Mr. Gustav Pfannkuchi, Electrician for the Alternating System.
S. H. Short, Electrician for the Electric Railway System.

Hine & Robertson, 45 Cortlandt St., Engineers' Specialties.—Mr. J. L. Robertson of this firm sometime since secured the control and has successfully continued the business of engineers specialties. The firm became popular through the introduction of the Eureka Packing and Kellam's Damper Regulator, which specialties are in use among the leading electric light and power stations of the country. Their Eureka Packing, round rubber core, which is noted for its application to piston boxes, readily conforms to the shape of the box and prevents leaking and steaming. The firm makes a separator for extracting water from steam, which delivers dry steam to engines and avoids hammering and the danger of the forcing of cylinder heads. They make a simplified arc indicator for testing the power of electric light engines. They also have many other specialties which our readers should examine.

The Walker Electric Co., 50 Broadway, City, have taken another office for the use of Manager George W. Walker, and enlarged their different departments, including receiving and salesrooms, test rooms, etc. The company reports a very active demand for the Walker Electric ammeters and voltmeters, which are giving much satisfaction wherever used.

Messrs. J. Jones & Son, 602 and 604 W. 22d st., are notifying the trade by circular that they have bought out the plant of the late firm of Chapin & Thompson, at the above named address, where it is their intention to carry on a general manufacturing electrical business. Their connections with the late firm of Pearce & Jones, of this city, Mr. Jones, Sr., in the management (spreading over a long term of years) of that concern's manufactory, and Mr. Jones, Jr., in the business position thereof, have given them a knowledge and experience second to none in their line. It is their intention to make use of this for their customers' benefit, and to give all whom they come in contact with, the best of work, at a fair price. They have been appointed by the Berlin Demagnetized Co. its sole manufacturers and selling agents, and they will be pleased to supply to the trade the now well known and popular Watch Demagnetizer. They cordially invite their friends to give them a call, 602 and 604 W. 22d street.

Messrs. E. D. & J. L. Moore, who were first known to the writer in 1883, under the name of Moore Bros., at 23 Dey street, and now at 106 and 108 Liberty street, where they have been located for a number of years. They are both young men, but old in electrical experience, as they have been connected with electrical construction work long before the writer first knew them, which was eight years ago. Their name is popular among all the electricians, manufacturers, and a large circle of financial and commercial men in this section. Since their advent at their present address they have inaugurated a manufacturing department and have met with excellent success. They are turning out household specialties, particularly electric bells in wood and iron boxes, also skeleton in wood and iron. These they have been making a specialty of for a number of years. Large quantities of their goods are now sold over the counters of the leading supply houses of the country. They were, some time ago, offered a large sum of money by a gentleman who desired to associate himself with them, incorporate a company, and build up the business. The incorporation was recently effected on this basis and now the business is carried on under the name of the "Moore Electrical Manufacturing Company." The new company will continue at the present location and manufacture for the trade.

Nassau Electric Company are manufacturers of electrical specialties, with exhibition and salesrooms 19 Park Place, New York. This firm has been introducing some of the latest and best specialties ever put on this market, in electric alarm thermometers, electric bell outfits and capsule batteries. Their capsule batteries are three inches long and 5–8 of an inch in diameter, and will give electro-motive force of 1 7–8 volts, and a current of 2.20 amperes. These specialties have met with marvellous success from their many convenient applications. Their bell outfit is made with a battery and push button, combined so that the whole of it will lie in the palm of your hand. Connected therewith is a flexible cord conductor furnished in any desirable length. This outfit can be carried around conveniently for use in any application desirable. The electrc alarm thermometers contain a battery and bell, and can be set to ring at any degree of temperature. It is very useful for schools, colleges, halls, manufactories of all kinds, and mills where they desire a regular temperature. The capsule batteries of the size quoted above, can be carried in the vest pocket. They are sold separately if desired. The writer witnessed an exhibition of several new specialties in which they utilized these capsule batteries, one of which was a case about three inches square, and about one inch in depth, on top of which was a one candle-power lamp, and all in such portable shape that it could be carried in the pocket, and gave quite an illumination, guaranteed for 30 hours' continuous use. He was also shown a new medical outfit containing two cells of this capsule battery, and an induction coil of the smallest diameter and length that the writer ever saw in a medical battery. The writer tested the strength of the two cells of batteries and was unable to take the full strength of the current, and was requested to try one single cell with this small induction coil and was unable even to take the strength from the one cell. They are also bringing out a number of other useful specialties which they will put on the market very shortly. They have also an entirely new vibrator, and a new regulator for altering the strength of a current. W. T. H.

FINANCIAL.

LOCAL ELECTRIC BONDS AND STOCKS.

When you comprehend there is scarcely a town in the United States of five thousand population without a local electric company, and to install each plant requires bonds and stock which must be placed for cash to purchase, construct and maintain, until self-sustaining and dividend paying, one need not be a prophet to realize the great number and investing value of this particular class of securities. The bonds, of course, are always based on a valuable solid franchise or municipal contract including the real and personal estate. The majority of the stocks pay a larger percentage than the bonds, beside increasing in value with the growth of population and retirement of the bonds. The local investors instead of placing their money in Wall street where it is subject to the action of promotors, pools and speculators, beyond their pos-

sible knowledge, should for many reasons put it in their local improvements. There is nothing that will so much enhance the local value as a satisfactory electric plant. It brings security to the citizens, is the greatest enemy of crime and will aid in every way in increasing their town to a city with all its extra comforts. The instances where good dividends are not earned are as scarce as angels' visits. Invest in your local electric securities, actively assist in the management, subscribe for and carefully read the ELECTRICAL AGE to enable you to keep pace with all improvements and your remaining days will pass as smooth as a thousand volt current short circuiting back to its generator.

A fair proportion of the January interest is being invested in electric enterprises as collected. A larger amount would be if the securities were more easily obtainable by the general public. There has been no defalcation among the bonds, coupons being paid as fast as presented. The year 1891 will see a great many new and increasing dividends on stocks, and hundreds of thousands of new shares will be created. The first act of a public electric company after completion and acceptance of its plant should be to secure a public quotation of its securities. The New York Stock Exchange boasts one such which, as Christopher Columbus once remarked, "beats nothing." It is a good beginning, but a law would not be out of place compelling all New York Electric Companies to list their shares on the New York Stock Exchange, with a clause permitting companies of other States to do likewise. For the single member the market is steady and strong.

FINANCIAL.

It is not apparent that the great pecuniary loss caused by the snow storm of Jan'y 25 and 26, has resulted in any marked depreciation in the value of the shares. Of course the Western Union Co. was the greatest sufferer with the telephone companies a close second; but while the latter's market value as subsidiary companies affects all electric securities, the former is a peg on which no true Yankee will hang a guess as a basis of value for his other holdings. The electric light companies—be it understood this financial column discusses all electric bonds and shares which have or desire a market in New York—generally have a reserve fund for just such emergencies. Their values therefore have not been materially affected. To the electric railway companies it is eqnal to a collision, misplaced switch or broken rail, the repair gang making all secure again in a few hours. The construction and supply companies benefit nearly to the extent of the others' loss, meanwhile as will be seen by all readers of the ELECTRICAL AGE under the proper headings, electric enterprises are advancing rapidly in all directions in numbers and efficiency.

To American electric light and power companies who are losing their profits in the economy of water power over steam, only to find that both will be required this is encouraging. In the Bombay presidency, 12,000 Hindoos, all trained men, are building the greatest piece of solid masonry seen in modern times. They are under the guidance of Mr. T. Craigie Glover, who during thirty years of strenuous labor in carrying out works, has trained 500,000 men to become stone-masons, carpenters, etc. The work in hand at present is a huge dam. The structure is two miles long, 118 feet high and 103 feet wide at the base, the expanse of water confined will be eight miles square. The first cost is considerable but the long years of dividends may justify it. There is none of the stock as yet for sale in this market.

The past week has been fairly active in securities, prices have ruled strong with the exception of Bell Telephone, no doubt the agitation for a reduction in monthly charges all over the country coupled with the question of the possible expiration of the United States patent in December last is having some effect.

The following companies have declared dividends:—Edison Illuminating, one per cent. (quarterly); Edison General Electric, two per cent. (quarterly); International Okonite Co., semi-annual, eight per cent. on preferred and ten per cent. on ordinary shares. January coupons on bonds, are being cashed on all as far as heard from.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery Financial Editor, ELECTRIC AGE:

Anglo-American Electric M'f'g Co	$1.00
American Motor	5.00
American Telegraph and Cable	
Averil Underground Conduit Co	3.00
Ball Electric Light	
Bell Telephone	185.00
Bentley Knight	
Brooklyn Edison Electric Light	100.00
Brooklyn Citizens' Electric Light	125.00
Brooklyn Municipal Light	130.00
Brush Illuminating	70.00
Brush Swan	20.00
Boston Electric Co	105.00
Consolidated Electric Light	50.00
Daft	
Edison General	94.00
Edison Illuminating	95.00
East River Electric Light Co	80.00
Fort Wayne	10.00
Harlem Electric Light Co	60.00
Hacketstown Electric Light Co., shares	105.00
Julien	
Law Telephone	95.00
Mount Morris Electric Light	90.00
New York and New Jersey Telephone Co	96.00
North American Phonograph	25.00
National Construction Co	50.00
Postal Telegraph	
River and Rail	15.00
Richmond Light and Power Co	
Swan Incandescent	3.00
The Accumulator Co	
Thomson-Houston Electric Co	50.00
United States Electric Co	40.00
United States Illuminating	70.00
Westinghouse Electric	
West End Electric Co. (Boston)	22.00
American Private Telephone (Parent)	90.00
Cowles Elec. Smelting and Aluminium	
Edison Elec. 5s	99.00
Jamaica Gas and Elec. Light (N. Y.)	90.00
Mount Morris 6s. (N. Y)	95.00
New England Telegraph and Telephone	51.00
New York and New Jersey Tel. and Tel 5s	par.
Rockaway Park Elec. Light	85.00
Saratoga Gas and Elec Light 6s	86.00
United Elec. Traction Co	2.50
Westinghouse Elec. Pref	50.00

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate but will be found very near the mark.

PHILADELPHIA NOTES.

We learn that Mr. David Brooks, a well-known electrician of Philadelphia, has written a letter to the City Council in which he proposes to lay an electrical conduit by his well-known system at cost for the city, providing the city will use it and encourage its use by others. He will allow the city to use it in this way free of charge. Mr. Brooks claims that a three-inch pipe carrying 500 conductors, can be laid at a cost of $16.00 per mile.

J. Elliott Shaw & Co. have been making many improvements since moving into their new store and factory, No. 632 Arch street. They have just completed the finest sample show board of Electric Bells in this city which is so arranged that customers can test the quality of over 50 styles of bells with gongs measuring from 2½ to 18 inches in diameter. Their Norway Iron Frame Electric Bells command a ready sale, but no more so than their double Armature Heavy Stroke Bell used in factories, railroad stations, etc. In proof of their claim made for these bells we were shown some flattering testamonials just received from their customers, of which they are justly proud. The outlook for the coming summer is bright, and with their present facilities hope to meet the demand of the public for reliable goods at a moderate cost.

In his annual report, Mr. David Walker, chief of the Electrical Bureau of this city, states that the police and fire alarm service is thorough in all its workings and the electrical department takes front rank, when compared with other first-class cities. Chief Walker in his report states that he prefers the conduit system of running wires to the old method.

The new location of the Partrick & Carter Co., of this city, was a happy selection, and if their business continues to increase in the next three months as it has since they moved, a more eligible site will have to be considered. To THE ELECTRICAL AGE is due much of the success of this enterprising and wide-awake firm.

When the telegraph, telephone and electric light systems all over the eastern section of the United States were disarranged by the storm of January 25, Philadelphia's underground electric system worked to perfection, no trouble being experienced. Of 967 miles of electric wire in the city, 903 miles are strung on poles, 64 miles are laid in underground conduits in the most improved and perfect manner. Of the 903 miles, 9 miles are electric light wires and 12 miles are police, fire and city department telegraph and telephone wires. While the overhead electric lights were out all over the city, those that were fed from the underground conduits burned during all the storm and after it as brightly as ever. Underground fire alarms and telephones worked as if there had been no storm, while the overhead systems were in a chaotic state. After the practical object lesson made by her underground lines, Philadelphia is inclined to force all electric wires underground without any delay.

The Hale & Kilburn Manufacturing Company have just issued a new and complete catalogue of their numerous manufactures in the way of patented railway specialties, containing 48 pages, with numerous elegant half-tone illustrations. It is probably the most complete book of the kind that has yet been issued. We note, among other things, that over 35,000 of their Automatic Tilting seats have already been sold. They have just placed upon the market an entirely new thing in the way of a reversible seat for use on electric and cable cars. It is a marvel of comfort and compactness, and ought to revolutionize street car seating. It has already been adopted by several electric lines, and bids fair to become the most popular seat of the future. The company's immense works are full of orders for these goods.

The destruction of telephone wires in this city by the recent storms is being rapidly righted. The General Manager of the Bell Telephone Company has been giving his personal attention in supervising the necessary repairs, and by the end of this week the business public will once more resume their accustomed "Hello."

TRADE NOTES.

At a recent meeting of the Kansas City Electrical Works, Kansas City, Mo., the capital stock of the company was increased from $10,000 to $25,000. This company is doing a very large business in the electrical line. They manufacture electric apparatus of every description, and do repairing, rewinding and general work upon dynamos and motors of every make. The company is the southwestern agents for the Mather dynamos and motors, and it is their purpose to equip a shop with improved machinery for the handling of dynamos, electric car motors and other heavy work. They are also sole agents of the United States for Messrs. Gilbert & Woodring's patent "Strand Alarm Indicator," which is used with considerable success in Kansas City on the Metropolitan cable railway.

Messrs. Cooke & Co., of 22 Cortlandt street, have recently put in a 150 H. P. Beck Engine in the power station of the Watervliet Turnpike Railway Company, Albany, N. Y. This makes the entire power of this station 550 H. P. The recent improvements also include boilers with the aggregate capacity of 250 H. P.

RESISTANCE TO LINES OF FORCE.—The spaces between the pole-pieces of the field-magnet and the core of the armature offer considerable magnetic resistence, which may roughly be taken as nearly proportional to the distance between the iron surfaces, the permeability of the copper wire and its insulation being about the same as that of air.

EFFECT OF HEAT ON VOLTMETERS.—A current, in passing through the coils of a voltmeter, heats the wire, and increases its resistance, and consequently a given distance of potential will send a weaker current through the coils after they are heated than before.

EFFICIENCY.—The efficiency of a dynamo is judged by the ratio of the energy re-appearing as electric currents to the total amount given mechanicalty to the machine.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS.

ISSUED JANUARY 27TH, 1891.

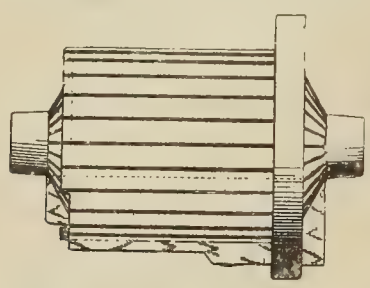
445,176. Electric Arc Lamp. Joel A. Hayes, Carson City, Nev. Filed Apr. 23, 1890.

445,207. Electro Magnetic Motor. Nikola Tesla, New York, N. Y., assignor to the Tesla Electric Company, same place. Filed May 20, 1889.

445,217. Thermal Cut Out. Albert Barrett, Kansas City, Mo. Filed Dec. 5, 1890.

445,220. Coin Controlled Electric Coil. Edward J. Colby. Chicago, Ill. Filed Oct. 17, 1889.

445,234. Electric Cable. John C. Reilly, Brooklyn, N. Y. Filed May 20, 1890.



NO. 445,319.—COMMUTATOR PATTERN.

445,253. Electric Cut Out. John S. Potter, Newton, Mass. Filed Aug. 16, 1890.

445,295. Electric Bell. John F. Wollensak, Chicago, Ill. Filed Sept. 29, 1890.

445,306. Circuit Controller and Alarm. Charles M. Woolcott and Albert E. Wilmot, New York, N. Y., assignors to Thomas W. Robertson and Charles E. Ongley, both of the same place. Filed Oct. 16, 1890.

445,308. Motor truck for cars. John A. Brill, Philadelphia, Pa. Filed Oct. 3, 1890.

445,310. Electric Switch. George Cutter and Charles G. Armstrong, Chicago, Ill. Filed July 31, 1890.

445,319. Commutator pattern. Philip F. Lenhart, Brooklyn, N. Y., assignor of seven-eighths to Atkins Stover, same place. Filed June 17, 1890.

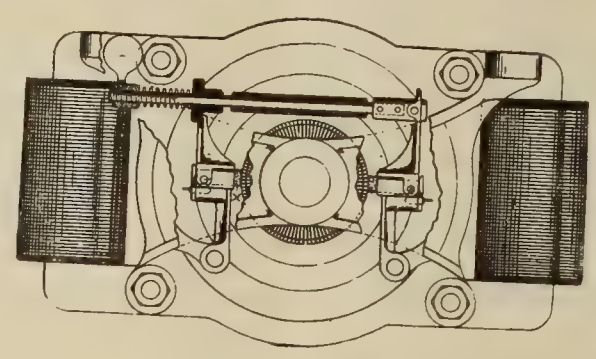
445,341. Electric Guest Call. Alexander Striemer, Sleepy Eye, Minn. Filed July 29, 1890.

445,363. Electric Cut Out. Sigmund Bergmann, New York, N. Y. Filed Feb. 17, 1890.

445,364. Key for Electric Cut Outs. Sigmund Bergmann, New York, N. Y. Filed May 5, 1890.

445,365. Electric Cable Connector. Sigmund Bergmann, New York, N. Y. Filed July 24, 1890.

445,374. Manufacture of Carbon Filaments. William M. B. Keen and William F. Haarmann, New York, N. Y., assignors of one-fourth to Egbert Le Fevre, same place. Filed June 19, 1890.



NO, 445,499.—ELECTRIC MOTOR:

445,409. Turn Out for Electric Railways. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Filed June 29, 1887.

445,422. Secondary Battery. Charles F. Brush, Cleveland, Ohio, assignor to the Brush Electric Company, same place. Filed June 9, 1881.

445,425. Galvanic Battery. Walter A. Crowdus, Memphis, Tennessee, assignor to Jo. W. Allison, trustee, same place. Filed Oct 7, 1890.

445,440. Telescopic Joint. Edward C. Davis and Thomas Baldwin, London, England. Filed Aug. 2, 1890. Patented in England.

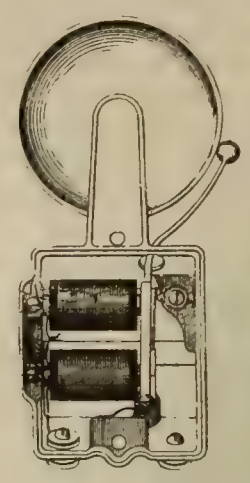
445,442. Telegraphy. John Doggett, Plain City, Ohio. Filed July 28, 1890.

445,448. Regulator for dynamo-electric Machines. John H. Holmes, Newcastle-on-Tyne, England. Filed May 14, 1890. Patented in England and France.

445,475. Telephone. Eloy Noriega, Mexico, Mexico. Filed Oct. 2, 1890.

445,479. Electric connection for track-wiring Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Oct. 10, 1890.

445,499. Electric motor. William M. Dresskell, Brainard, Minn. Filed June 9, 1890.



445,341.—ELECTRIC GUEST BELL.

445,515. Conductor-switch for Electric Railways. Frank J. Sprague and Johan F. S. Branth, New York, N. Y. Filed Sept 27, 1888.

445,521. Commutator-Brush holder for Electric Motors. George H. Condict, Philadelphia, Pa.. assignor to the Electric Car Company of America, of Pennsylvania. Filed Apr. 18, 1890.

NEVER FAILED.

ST. PAUL, MINN., December 3d, 1890.

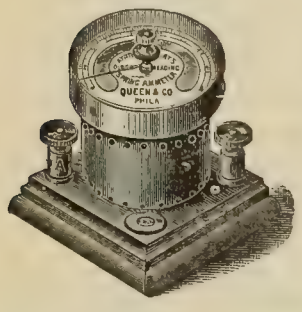
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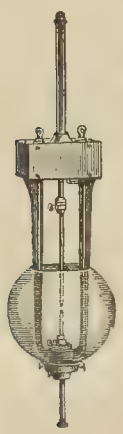
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Seventy Ampere hours for Six Cents.

See advertisement, page xviii

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We will print notices under this heading ***Free until March 1st.***

WANTED.—A position by an electrical engineer to take charge and supervise the equipment of street electric railways, or any description of light and power work. Address ELECTRICAL, care of this office, ELECTRIC AGE.

AN ELECTRICAL ENGINEER of 10 years' experience, competent to take charge of any class of work, desires a position with a good concern at a fair salary. Storage battery or construction work preferred. Address, PERMANENT, care of this office.

DRAUGHTSMAN.—Mechanical Draughtsman wants a position in the electrical line, or as assistant to an electrician well posted in electrical work especially central station work and plans. Address: W. HAMILTON, care ELECTRIC AGE, N. Y.

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Important Electrical Notice.

The Electrical Commissioners of the District of Columbia, invite communications from firms interested in electric cables, conduits, subways, etc. Also upon the subject of municipal electric lighting, electric transmission of power, etc. Communications received until March 1st, 1891. Personal interviews cannot be granted at present.

Address ELECTRICAL COMMISSION, Room 30, District Building, Washington, D. C.

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Engine Lathes.—42 in x 12 ft.; 32 in. x 12 ft; 29 in x 15 ft.; 24 in x 28 in x 20 ft.; 1 each 24 x 10 ft. 12 ft. and 16 ft.; 1 each 17 in. x 6 and 8 ft; 1 each 16 in. x 6, 8 and 10 ft; 1 each 14 in x 6 and 8 ft; 6 12 in x 5 ft.; 2 each 11 in. x 4 and 5 ft.; 2 each 10 in. x 4 ft. power or foot power; 1 16 in x 6 ft., 15 in x 6 ft., 14 in. x 5 ft. Fox Monitor Lathes; 1 15 in. x 6 ft. Square Arbor Fox Lathe; 1 each 15 in. x 6 ft. and 14 in x 5 ft. Turret Lathe; 1 Engine Lathe, 14 in. x 6 ft. Topper.

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1 " 32 in. x 32 in x 10 ft. 42 in. x 36 in. x 12 ft.
1 " 36 in. x 28 in. x 10 ft.
1 " 60 in x 66 in. x 24 ft. with 1 head.
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1 Friction Shaper, each 15 in. 20 in. 30 in. stroke.
1 Crank Shaper, each 12 in. 15 in. 20 in. adj. stroke.
1 each Nos. 1, 2, 3 and 4 Wire Feed Screw Machines
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1 each 2, 3, 4 and 6 Spindle Gang Drills.
3 Crank Planers. 6 Lincoln Pat. No. 2 Millers.
1 each Nos. 51, 52 and 53 Ferracute Presses.
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2 No. 2½ in. Fowler Press. 10 foot and Power Presses.
1 No. 1 Bliss Foot Presses.
1 Boiler Plate Shear, 33 in. throat.
12 Punching and Shearing Machines, assorted.
1 Bolt. Cutter each ¼ in. to 1 in. and ½ in. to 2 in.
1 36 in. Gear Cutter.
1 each 48 in., 60 in. and 72 in. Radial Drill.
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1 48 in. Gear Cuter.
1 Sellers Jib Crane 50 tons.
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1 16 ft. Boring an Turning Mill.
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1 36 in. Upright Drill.
1 20 in. stroke Fitchburgh T. H. Shaper.

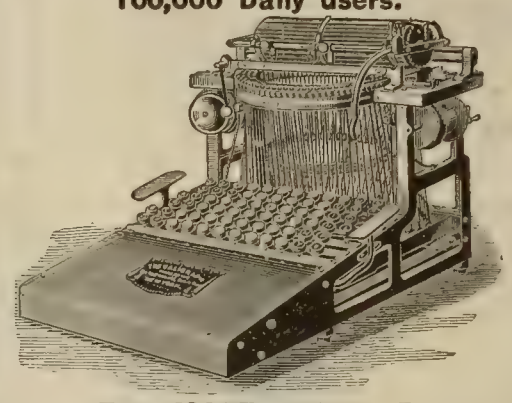
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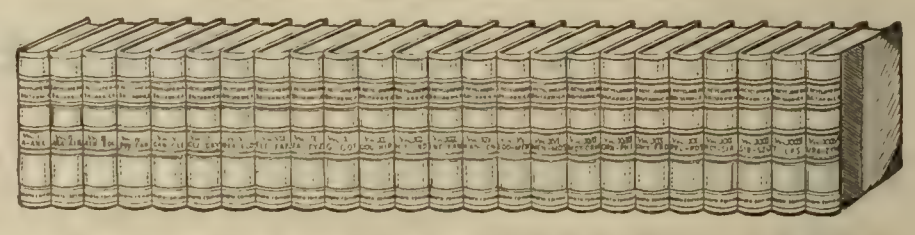
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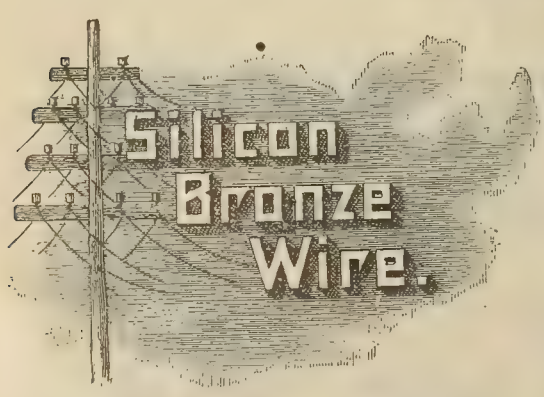
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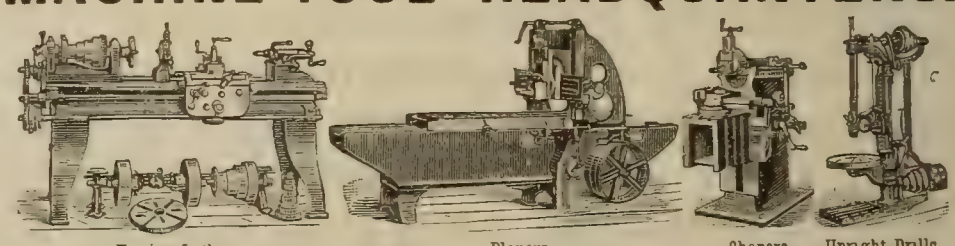
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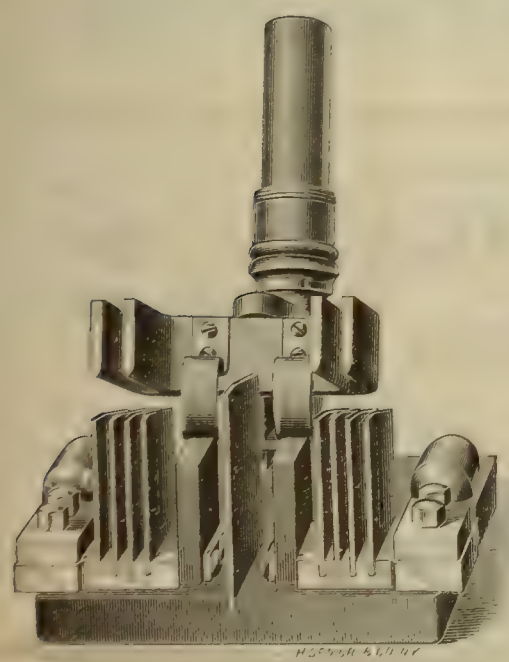
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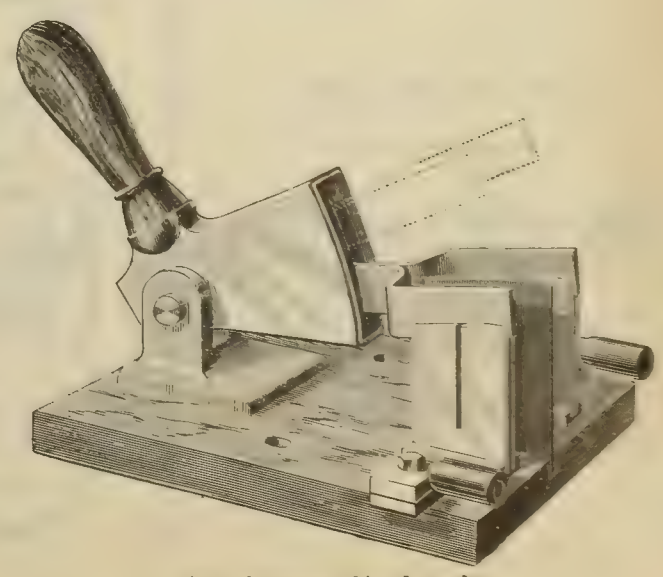
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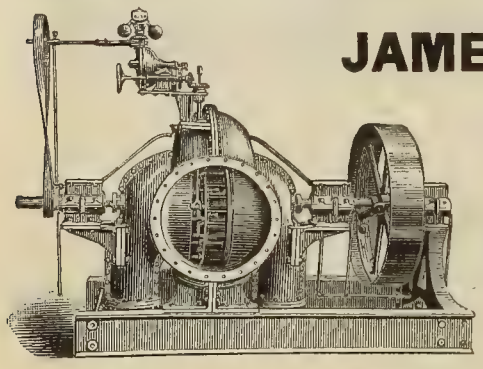
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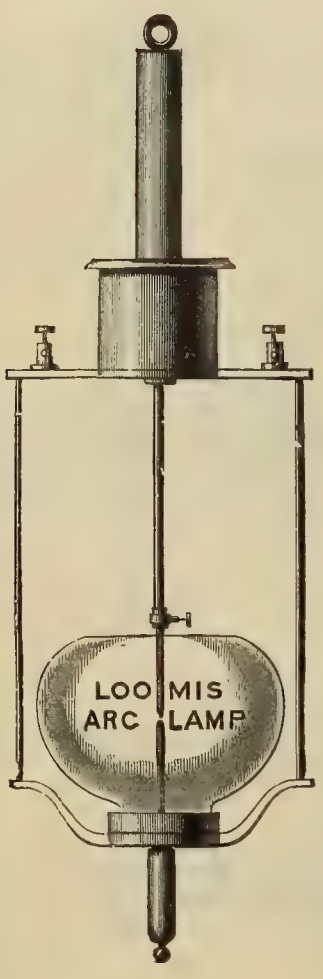
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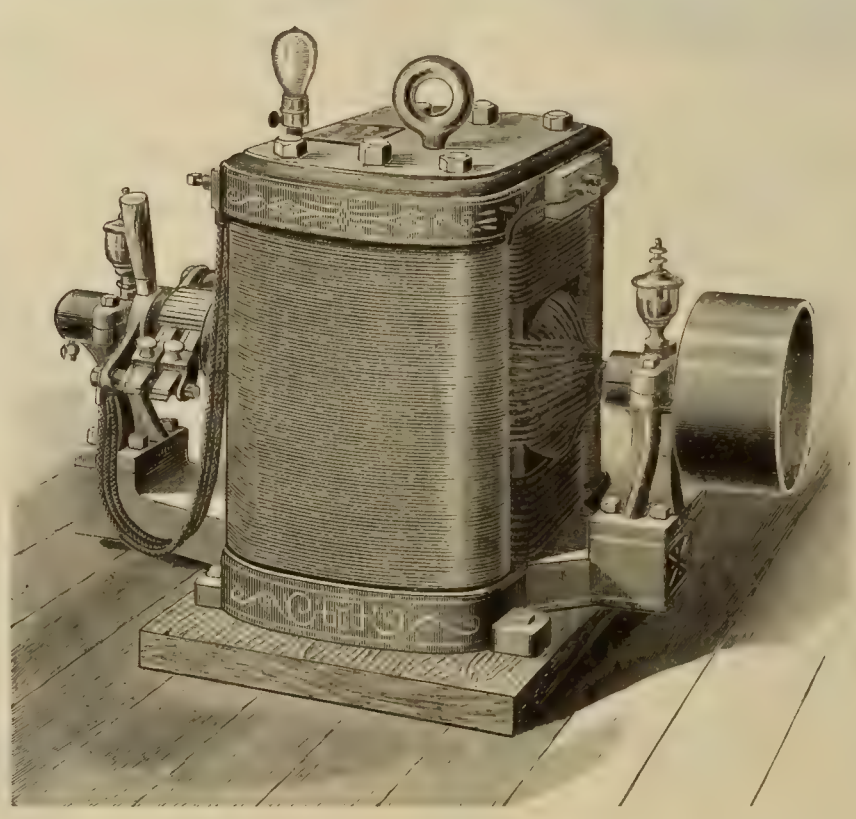
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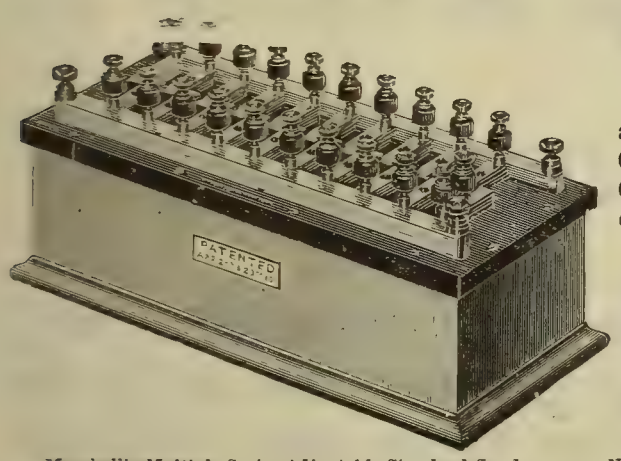
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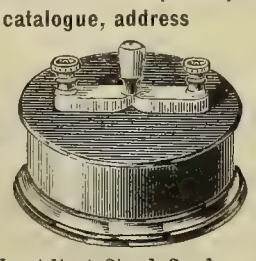
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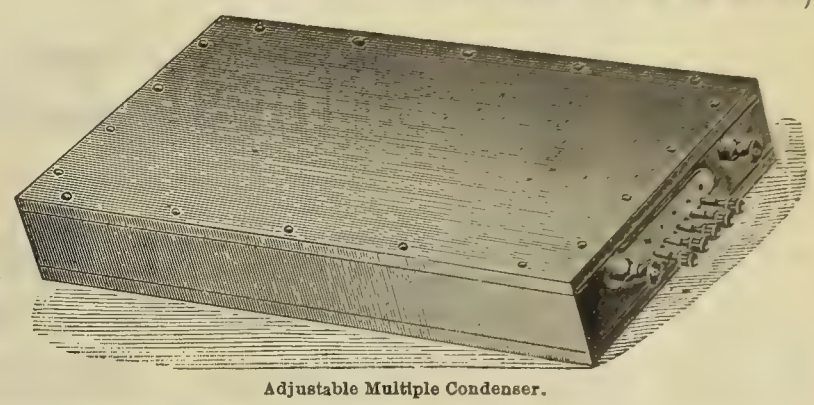
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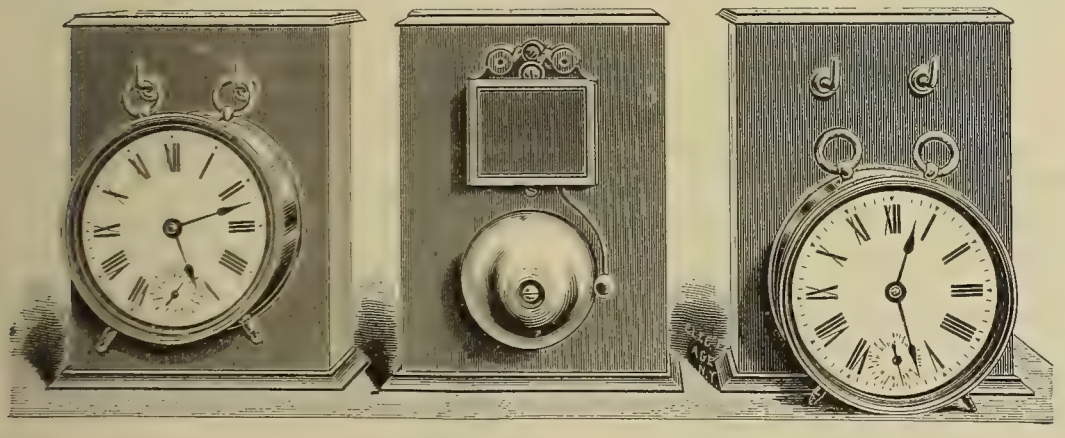

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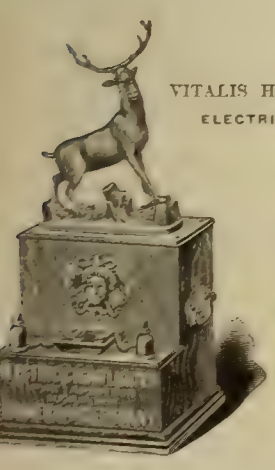


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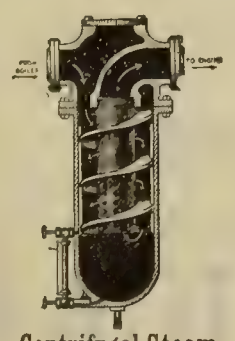
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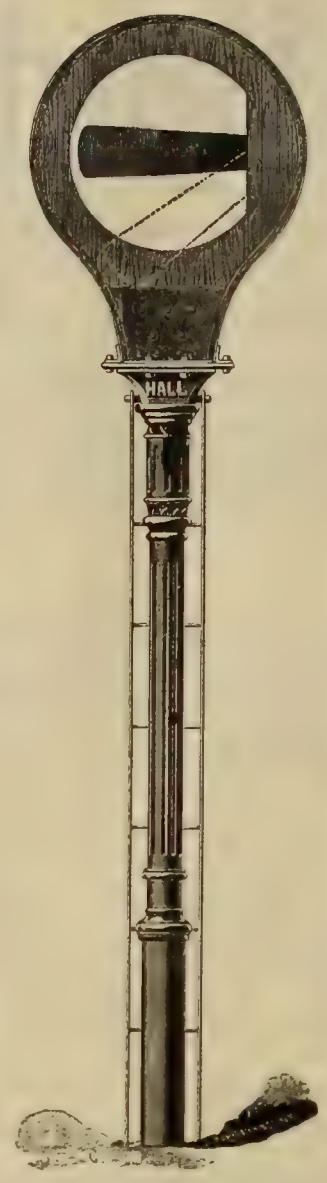
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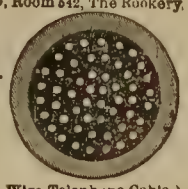
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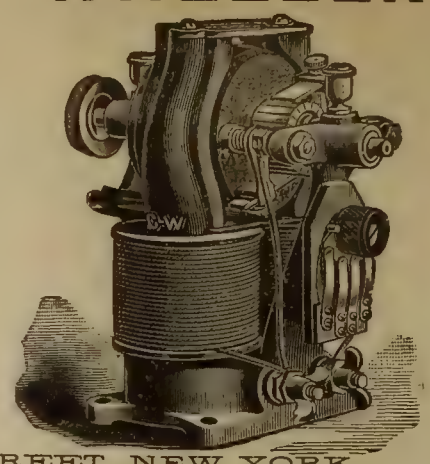
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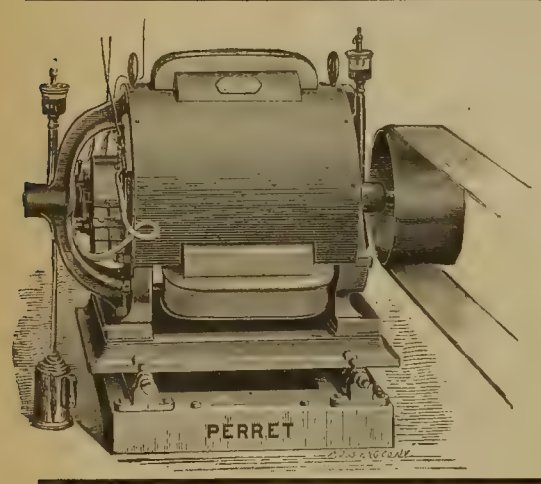
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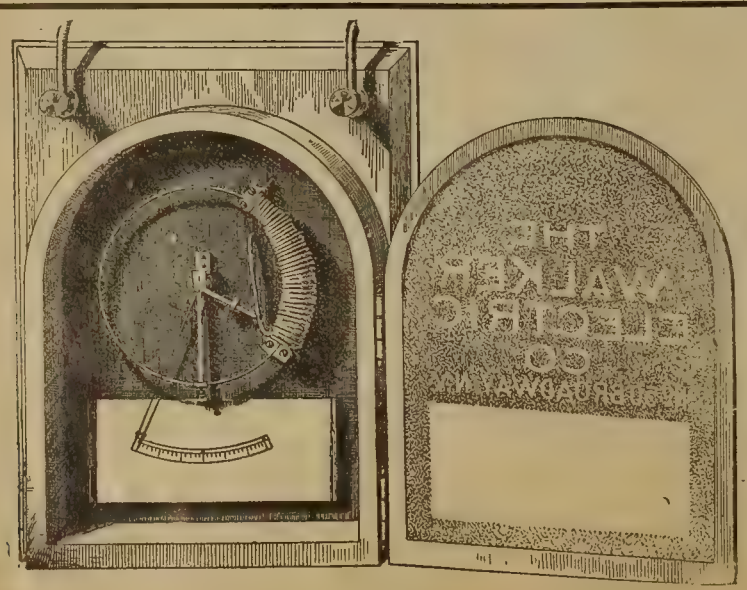
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SHALL IT BE MONTREAL?

On another page we publish a communication which will be of interest to the members of the National Electric Light Association.

At the Cape May convention of that Association last August, Mr. A. J. Corriveau, of Montreal, suggested that the summer meeting of 1891 be held in that city, and in the communication referred to Mr. Corriveau renews the suggestion.

It strikes us that it would be a wise thing to hold the next summer convention in the Canadian metropolis, and we are not aware that there is anything in the Association's constitution prohibiting such a course. The Association, it is true, is a national one, not international, but the people on both sides of the border line are so near alike in every respect, except in their political organization, that to hold a meeting across the boundary line, as is proposed, would, we think, be no flagrant violation of any law or rule It is not customary for such bodies to go out of our own country to hold meetings, but here is a case where mutual advantage to electrical people in both countries would certainly result.

The Canadian people are really anxious and ready to go more extensively into the electrical field, and naturally look to us on this side of the line for encouragement and help.

To dwell on the benefits that would result on both sides in the event of holding a convention in Montreal would require a volume; they are obvious; and aside from the business advantages, the Americans would meet with a most hearty welcome. No doubt Montreal would, as Mr. Corriveau states, be glad to have the privilege of entertaining the association. Our Canadian friends are celebrated for their hospitality and heartiness, and they certainly would give the members of the Electric Light Association a rousing reception.

We commend Mr. Corriveau's letter to the thoughtful consideration of the members and particularly to the committee having in charge the matter of selecting a place of meeting for the next convention after the one held at Providence.

THE TROLLEY SYSTEM IN THE ANNEXED DISTRICT.

It is really amusing to witness the efforts now being made by a few alleged property owners to prevent the introduction of the trolley system on the Harlem Bridge, Morrisania and Fordham Railway, which is located in the annexed district north of the Harlem river. These persons base their objection mainly on the assertion that they gave their consent to change the motive power on that road from horse to cable, and not to electricity. They now seek to enjoin the road from the use of the trolley system, charging that the company obtained the consent of the property owners under misrepresentation.

There must necessarily be some one to object to every step taken toward improvement, whether it be in public affairs or private, and this case is no exception. A handful of injured citizens seek to overrule the desire of a majority of property owners concerned, to have an electric road in their locality, and are inventing all sorts of absurd objections against the proposed system. These disgruntled persons are encouraged, too, by certain daily papers whose columns teem with learned discourses on the trolley system—the most diabolical and dangerous invention of the age, according to their argument. If people would accept as unadulterated truth the statements made by these journals that the trolley system is dangerous and a nuisance, then the enterprising railroad in question would have little chance of carrying to a successful issue its designs. But fortunately the people have a great deal more brains and common sense than these papers credit them with, and they will look into the matter themselves and learn for themselves whether or not the trolley system is the black fiend it is represented to be by these newspapers.

When Mayor Grant went to Boston he saw for himself what merit there was in the trolley system, and when he returned home he did not hesitate to acknowledge that it was a successful one and free from many of the objections usually urged against it by its enemies. He was so convinced that it was just the thing needed in the sparsely settled districts north of the Harlem river, that he gave his consent without any hesitation to the building of an electric road in that section. The necessary consent was also obtained from the Board of Electrical Control, but notwithstanding all this a few chronic kickers are now trying to prevent the consummation of this most desirable object by working through the courts, with a daily paper or two at their back to sustain their cause.

In one of these learned dissertations on electric railways practical electrical engineers may learn some things they never knew before. For instance, it is asserted that "the cars themselves [meaning electric cars] are dangerous in streets that are at all crowded." Just why electric cars are any more dangerous than any other cars is not stated. To go into details would weaken the cause, hence these papers discreetly refrain from giving any reason why electric cars are any more dangerous than others.

Another fact that is set up as an argument against the proposed system, and one which electrical people ought to know, is that electric cars are subject to vexatious delays "on account of something getting out of order, or the tracks or wires being obstructed by snow or ice."

It is a well-known fact that the power to overcome obstacles of the class just mentioned exist in a greater degree in the electric system than any other method of car propulsion. There is less delay to electric cars in stormy weather than there is to horse or cable cars, and the truth of this has been time and again demonstrated.

The State Railroad Commission is now in this city hearing the arguments of the objecting property holders against the proposed use of the trolley system, but the advocates thereof certainly have the best of the fight. The opponents have, by their intense effort to magnify the enormity of the crime of operating an electric railway, hopelessly injured the cause.

APPOINTED CHIEF OF THE DEPARTMENT OF ELECTRICITY.—We understand that Mr. James P. Barrett, the city electrician, Chicago, has received the appointment of Chief of the Department of Electricity of the World's Fair. THE ELECTRICAL AGE congratulates that gentleman on the distinction conferred upon him, and the electrical fraternity at large on the good fortune at having their interests at the World's Fair in the hands of so worthy a person as Mr. Barrett. He was quite the unanimous choice among electrical people for this important position.

OF INTEREST TO ARCHITECTS.—We print on another page some specifications with reference to the use of interior tubing for electric light wires, which will be of great interest to architects in general. The article is authentic, and if the specifications are faithfully carried out the utmost satisfaction will be obtained in the use of the interior tubing referred to. Architects and builders need instructions of this sort, and we are sure the publication of them in the electrical press will result in great advantage to all concerned.

THE RAPID TRANSIT PROBLEM IN NEW YORK.

A person once, in referring to a peculiar feature of a western city, described it as "all length with no width." This, to some extent, describes the principal geographical feature of New York city. There is considerable width to the town, but it is very long, and the result is great distances have to be traversed by many of the citizens in going to and fro between homes and business places. The question of rapid transit in the city is, therefore, a peculiarly important one. The existing elevated roads are inadequate to transfer the thousands of people with anything like reasonable speed and comfort during the rush hours. Some new system is needed, and the question of rapid transit is one of the leading ones of the day in New York at the present time.

All sorts of plans and systems are advocated and discussed, and it is interesting to note, though not surprising, that electricity as the motive power is the popular favorite.

Interviews are printed every day with distinguished electricians, and they all agree on electricity as the only power that can be successfully used. The sentiment is quite unanimous in favor of an underground road running along the length of Manhattan Island. The success of the underground road recently opened in London is referred to as a solution of the problem with which New York is now brought face to face.

Prof. Moses G. Farmer has expressed his views on the subject, and he says some exceedingly interesting things, which will give electric railway managers in general something to talk about.

The professor says by all means build the road underground. "Build it large enough to accommodate many tracks;" he continues. "Build it so as to accommodate the trolley system for the present, but build it large enough for the storage battery system in the twentieth century, when the storage battery will be so reduced in weight that it will have to call in the aid of electricity to produce sufficient adhesion to be able to move empty cars on slippery rails. Build it large enough to accommodate many copper cables, which shall bring into the city from afar hundreds of thousands of horse-power and lay one horse-power down upon the mechanic's bench at the low sum of 16 cents for the whole eight

hours of his day's work. Build it for the twentieth century when Fourteenth street will be farther down town than Canal street was uptown in 1840 at the time of my first visit to New York, when the old United States tavern was in its prime and the aspiring Astor House was just budding into usefulness.

"Build it that when the narrow streets shall have given way to broad, magnificent avenues, with eight, ten and twelve stories of fire-proof buildings, it shall be the rule and not the exception. Build this tunnel and railroad so that its bonds and securities shall be more sought after by investors than any municipal or government bond is inquired for now. Build it so that ladies who leave Boston by the elevated railroad at 9 o'clock A. M. to do their shopping may get through in season to return home and dress for dinner. Build it so that the mechanic and shop girl can come into town from twenty or thirty miles out of town, can reach their place of labor in season to do a full day's work and get home in season for supper and not be tired either, but rather feel refreshed after their homeward ride.

"Build it in the belief that in the twentieth century sheet copper will be sold profitably for 9 cents per pound; copper wire sold profitably at 25 cents per pound; sheet iron and sheet steel at prices so fabulously low that a merchant of the nineteenth century would sigh for the changes that come over the spirit of his dreams.

"Build it in the belief that the New Yorker of 2050 will be able to take his supper in New York and his next breakfast in San Francisco.

"Yes, by all means, let it be a magnificent tunnel; let its cars be propelled by electricity alone. Discard cables entirely; dispense with steam, except at the outlying power stations; have its cars and stations brilliantly lighted by incandescent lamps, gorgeous in their effulgence. Build it so that it shall be the poor man's solace and comfort, giving him prospect of a good night's rest with his family.

"Build it so that thirty miles per hour shall be feasible and absolutely safe.

"Build it expecting the population of New York to outrun the present population of London, and not need to have the 'darkest spot' in it. Build it. Build it now.

"Only forty-four years ago I built an electric locomotive and propelled it by forty-eight cups of Gryve battery, and carried passengers on a little track laid down in the Town Hall of Dover, N. H., probably the first passengers carried by electricity 'on a rail' in this country, and now I see the electric railway running every twenty minutes from Dover to Great Falls, N. H., the spot of my early prophecy. I am pretty sanguine in what I predict.

"No longer ago than 1852 I purchased some magnesium wire for the purpose of taking a photograph by its aid, and I paid at the rate of $3,000,000 per ton for it. I can now purchase it for less than $5 per pound. Again, in 1856 I was paying from $40 to $50 per pound for aluminum, with which to prepare alloys: I made some experiments in extracting it from Gay Head clay, and as the result of those experiments I then predicted that aluminum would yet be sold profitably for 65 cents per pound, and it can be purchased at this time for a little more; and I further predict that it will yet be sold at less than 25 cents per pound and profitably, too."

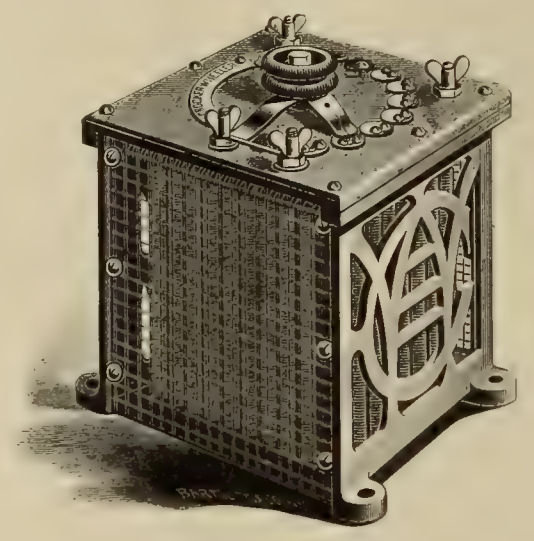
In conclusion Prof. Farmer declares that the New York people are welcome to his predictions if they are worth anything. While they are of great interest to the citizens they are especially so to the electrician.

The Berliner Mashinenban Actien-Gesellschaft has just completed an installation consisting of 3,000 glow lamps and 80 arcs at the Spandau Small Arms Factory. A 29 h.p. electric motor is also used to drive boring machines, lathes, etc.

A Zürich Company is endeavoring to obtain a concession from the authorities of Aargau for building a canal on the left bank of the Reuss. The power obtained is to be used for industrial purposes.

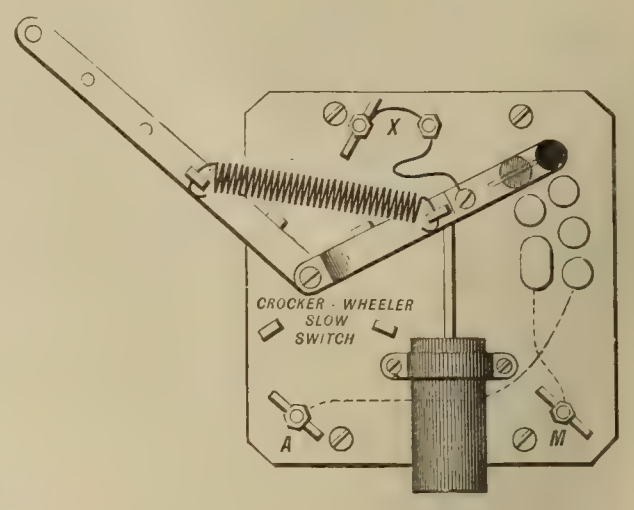
SPEED REGULATORS FOR MOTORS.

The new rheostat or speed regulator for motors, lately brought out by Crocker-Wheeler Motor Company, of New York, strikes one with its compactness, solidity, durability and the ease with which it can be operated. As our cuts show it consists of an iron frame, with bottom and top of slate, enclosing a number of coils of wire. On the top is a semi-circular strip of brass, with a resistance disc at its end, so arranged that one arm of the lever in revolving comes in contact with the disc before the opposite arm touches the armature discs on the opposite side, thus cutting in the field automatically with the resistance before putting the armature in the circuit. The field is cut on and off gradually; there is also place for the fuse connection on the top of the box.



CROCKER-WHEELER SPEED REGULATOR.

This company has also recently brought out an automatic slow switch and reversing switch. All are simple in design and more efficient than the usual run of this class of instruments. The general make-up is the same as that of the rheostat; in fact, the only difference is the arrangement of the switch on the top.



CROCKER-WHEELER SLOW SWITCH,

The lever of the slow switch is divided near the centre by a swivel joint and works with a spring. It is attached to the piston of a dash-pot containing oil, and when the lever is released its opposite end is retarded by the oil, and moves slowly over the resistance discs.

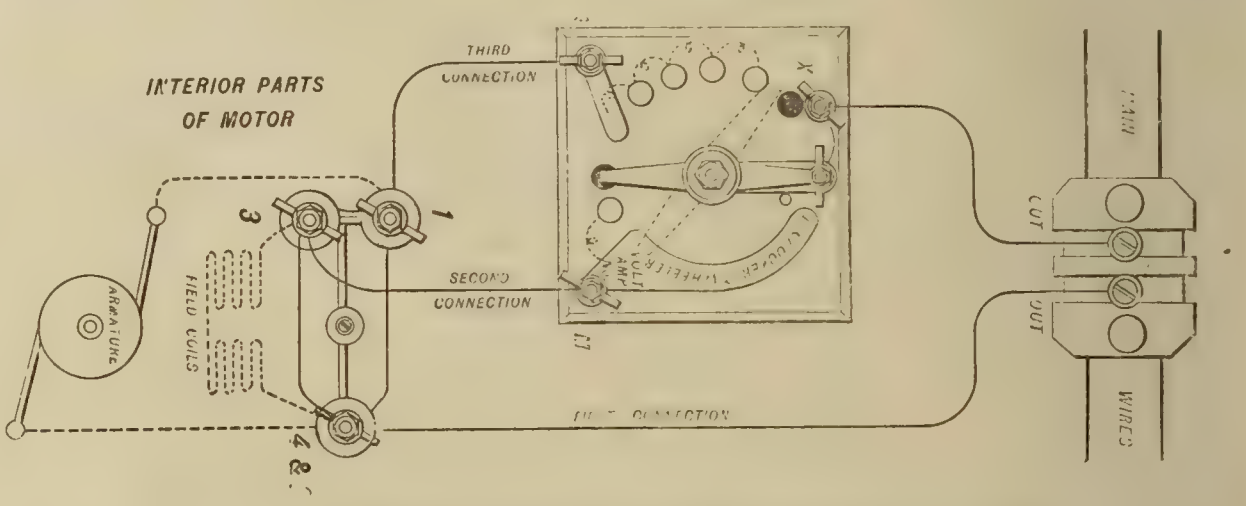


DIAGRAM OF CONNECTIONS OF CROCKER-WHEELER SPEED REGULATOR FOR MOTORS.

In the reversing switch the end of the double lever remains at rest in the centre on insulated discs, but when turned either to the right or left passes over the series of resistance discs, which allows the current to be turned on gradually. This instrument is a reversing switch, speed regulator and rheostat combined, and may be used for any one or all three purposes.

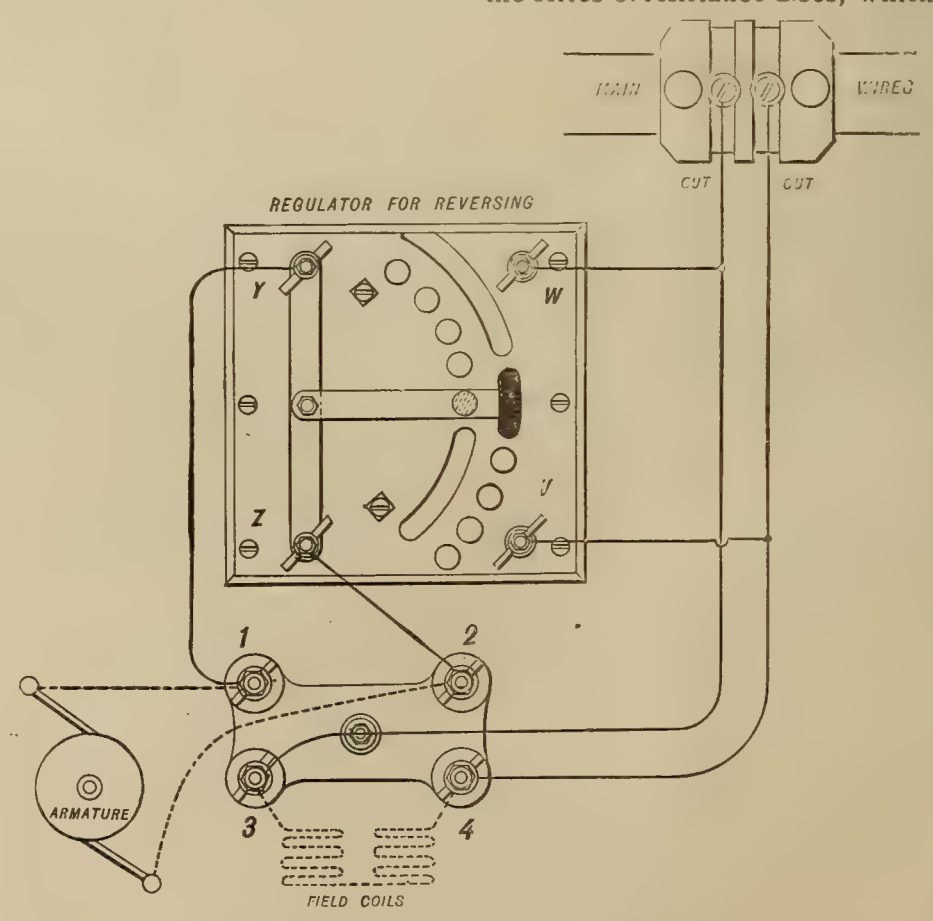
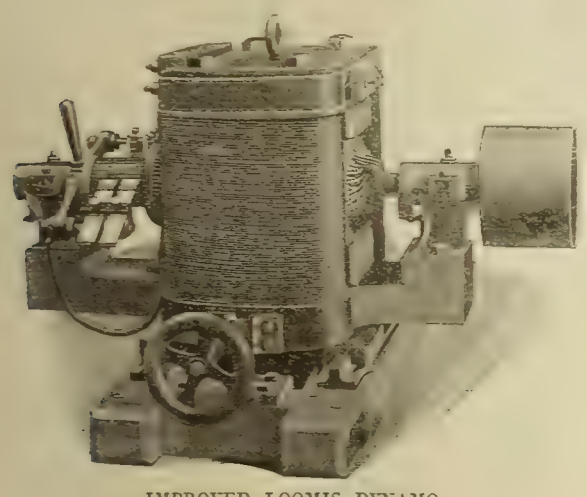


DIAGRAM OF CONNECTIONS FOR REVERSIBLE MOTORS.

The wire used in the coil is of sufficient size to carry the full current without danger of burning out, so the switch can be left in the circuit, and the speed regulator or rheostat be used without danger.

IMPROVED LOOMIS DYNAMO.

The Eureka Electric Company, 18 Broadway, have recently made some important improvements in their Loomis dynamo. In most all machines oil cups are used to lubricate the bearings, but in the improved Loomis dynamo these have been dispensed with. The bearings in the new machine are now made with greater surface and are self oiled. The larger bearing surface reduces the heating to a minimum. Another valuable improvement added to this dynamo is new adjusting screws, to move the dynamo one way or the other, so as to vary the belt tension as circumstances require. This particular feature of the dynamo is meeting with good results and is thoroughly appreciated by all concerned. We give herewith an illustration of the dynamo, showing the absence of the oil cups usually found on machines of this class. The large bearings will also be at once noticed:



IMPROVED LOOMIS DYNAMO.

The oiling of the shaft bearings is accomplished by an endless chain which revolves with the shaft and dips into the reservoir of oil located underneath the bearings. The chain picks up the oil from the reservoir and carries it up to the shaft bearings. It is then distributed to all parts of the bearing surface by means of parallel grooves cut on the shaft.

The Loomis system of electric lighting has a well-merited reputation for efficiency. The system complete includes voltmeters, amperemeters, ground detectors, switches, cut outs and other safety appliances.

SPECIAL TRAIN TO THE PROVIDENCE CONVENTION.

Gen. C. H. Barney, chairman of the Committee on Transportation of the National Electric Light Association, makes the following announcement with reference to transportation to Providence on the occasion of the annual meeting there of the Association, February 17, 18 and 19:

The Committee on Transportation announce that to accommodate delegates going from and through New York to the ensuing meeting of this Association at Providence, R. I., they have arranged for a train of parlor buffet cars to leave the Grand Central Depot on Monday, February 16: at 1 P. M., arriving in Providence at 6.15 P. M.

Applications for seats must be made to the undersigned, previous to 6 P. M. on Friday, 13th inst., accompanied by a remittance of $1.00 for each seat desired. This is imperative, as the necessary cars will be ordered in on Saturday. Seats will be allotted in the order in which applications are received.

Delegates from points West and South of New York, desiring to take this train, should purchase their through tickets, via "Shore Line Route" from New York.

For the convenience of New York delegates desiring tickets on the certificate plan, and to avoid a rush at the station, a representative of the Railroad Company will be at the Electric Club, 17 East 22nd street, New York City, on Saturday, 14th, inst, at 2 P. M., to deliver tickets and issue certificates.

Single (train) fare from New York to Providence - - - - - - - -	$5 00
Return fare if certificate is obtained -	1 67
Making the Round trip - - -	**$6 67**

Extra charge for seats in parlor car, $1.00.

For further information, address,

C. H. BARNEY, *Chairman of Committee.*
20 Cortlandt Street, N. Y. City.

ELECTRO-THERAPEUTIC-GYNÆCOLOGICAL CABINET.

Although the application of electricity to the curing of disease has been strongly advocated since Franklin thought that atmospheric electricity could be used for this purpose, physicians generally let it alone, either being sceptical as to its utility in this direction or having no time to devote to its study.

During the past fifty or sixty years a few master minds of both America and Europe have demonstrated the stimulating influences of light currents of electricity on animal tissues; and, with the discoveries in the physiological domain of the co-relation or interaction of all portions of the body with each other and that the limb that has muscles to pull it in one direction cannot return by the use of the same set of muscles, but only by another set exactly contrary in its action; or, in other words, that all our functions are balanced by the tendency of our different parts to work in opposite directions and only forming a complete and perfect whole by the proper proportions of these balanced forces; physicians have combined the two, using the subtle currents to build up and strengthen the parts too weak to perform their proper functions.

It is seldom at the present time that a physician or surgeon is found without an electrical cabinet of some kind in his office and with the rapidly increasing knowledge of this remedy for the suffering of mankind a compact Electro-Therapeutic-Gynaecological Cabinet is sought for by all physicians, surgeons and dentists.

The cabinet manufactured by Otto Fleming, manufacturing electrician, of Philadelphia, Pa., illustrated in figures 1 and 2, is one which has a number of

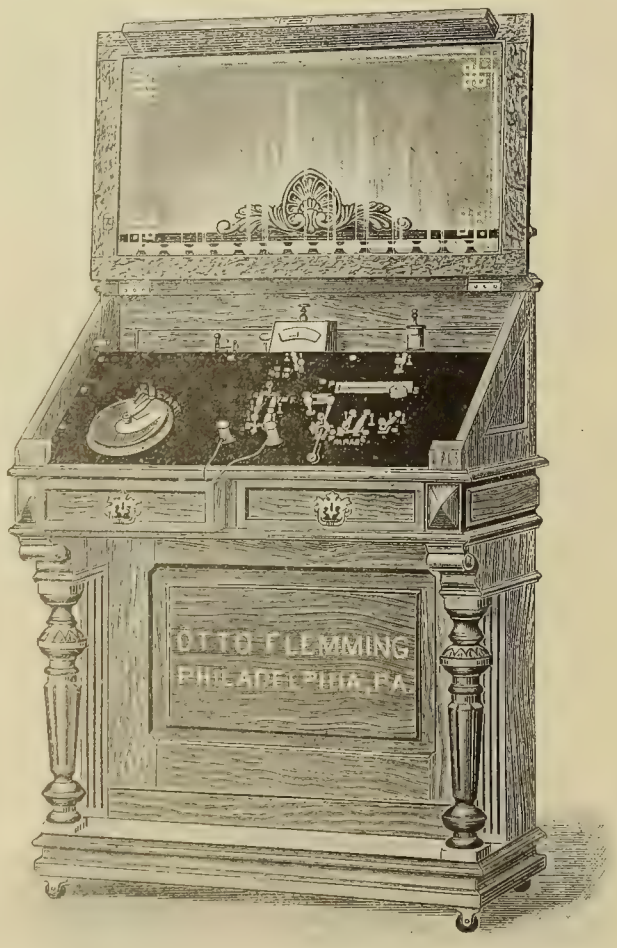


FIG. 1.—ELECTRO-THERAPEUTIC GYNÆCOLOGICAL CABINET.

features distinct from all others. As will be seen in Figure 1, which shows the front of the case opened, displaying the different instruments, it is arranged to afford the greatest ease and rapidity of operation, the whole cabinet being very compact, and an ornament to any office. Figure 2 shows the rear of the case opened to show the battery of semi-dry Crosby cells, which is shipped with the cabinet ready for use.

The Dubois-Reymond Induction Coil used in this cabinet is mounted underneath the platform, with its graduated scale, index, the head of the controlling screw, the slow interrupter and the rapid vibrating spring in plain view above. To vary the current at will a "Massey" Current Controller is used, to rapidly increase or decrease the resistance of the circuit from a fraction of a milliampere to the full strength of the battery without shock. It consists of a porcelain plate provided with a semi-circular conducting area of graphite, broadening and deepening up to the terminal, which is the graphite plate with a metallic surface, which is in direct contact with the battery without any material resistance. When the crank is placed on the porcelain, the circuit is



FIG. 2.—REAR VIEW OF CABINET.

broken; moving it slightly forward it soon touches the sickle point and the graphite mark permits the least amount of current to pass through, since the current must pass over the whole area of graphite. By turning the crank slowly and steadily onward there is a gradual increase of current without shock, until finally the metallic surface is reached when the whole power of the battery is turned on. The reverse action turns the current off. If the motion is made slowly the increase and decrease is exceedingly gradual and the needle point of the "Flemming" milli-ampere meter, which is used with this cabinet, points constantly to the exact current strength of the moment without oscillation. By the use of this current controller a more economical wear of the cells results, as all cells are worked alike. It may be used with a small or large number of voltaic cells or in connection with an incandescent light circuit for medical galvanic work, but cannot be used for actual cautery.

A liquid rheostat is used when exceedingly weak faradic currents are required. It is to be filled with water by unscrewing its top cap, and its central rod regulated so that the current may be made to pass through a greater or less volume of water, thereby increasing or diminishing its resistance at will, rendering even strong faradic currents of a smoother and more pleasant sensation.

There is also used the "De Watteville" Current Combiner and Commutator for the simultaneous administration of galvanic and faradic currents when both of these currents are useful. The commutator or pole changer has an index always pointing to the negative pole, in whatever position the switch may be placed, whether used for simple or combined currents.

This is one of the most complete electro-medical cabinets on the market, and they are constructed in the most finished and workmanship-like manner, as may be judged by reference to our illustrations.

MAGNETIC FIELD.—If we thread a wire which is carrying a current through a piece of cardboard, and sprinkle iron filings on the cardboard, they will arrange themselves in concentric circles round the wire.

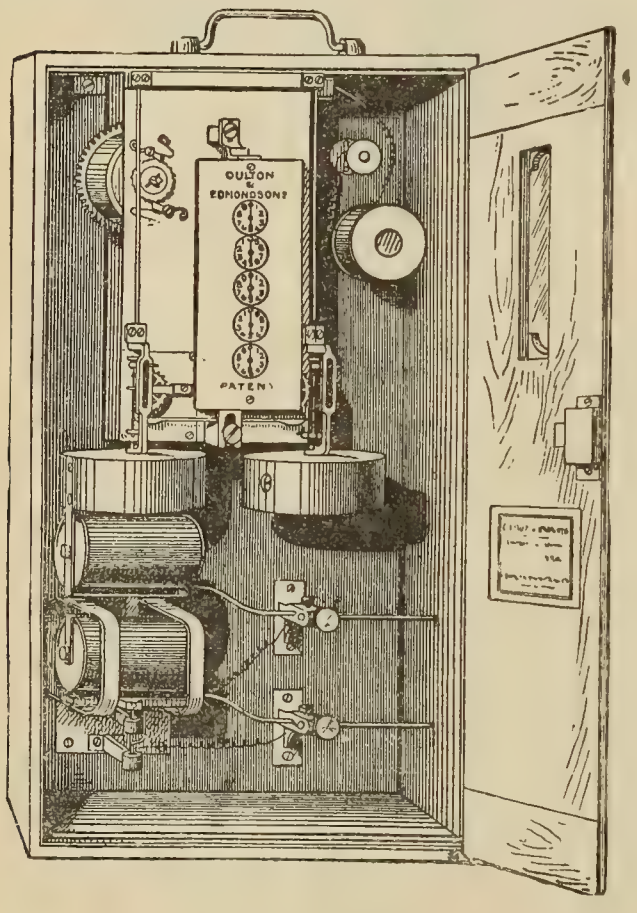
THE OULTON-EDMONDSON ELECTRICITY METER.

The following description and illustration of the Oulton-Edmondson electricity meter are taken from the London *Electrical Review*, and will be of interest to American electricians :

This Watt-meter, for either continuous or alternating currents, consists of a set of clock-work, having two "torsion balances," which keep identical time, except when current is being consumed. When a current passes through the main conductor it quickens the speed of one of the balances, and the difference of speed (registered on the dials in B. T. units) is a measure of the current consumed. A difference of 10 beats per hour = 1 B. T. unit, and the measurement is proportional to the current throughout the whole range for which each instrument is constructed.

The clock-work is of first-class quality, with "high-numbered" pinions. Both balances are driven by one main spring, the force of which is equally divided between them by a novel "differential gear," and their synchronism is consequently all but perfect.

The electrical arrangements consist of two "compound wound" solenoids, astatically attached to one of the balances, and swinging, the one above and the other within, the coils of the main conductor, and influenced by the current to be measured.



ELECTRICITY METER.

The principal winding of the swinging solenoids consists of fine wire, connected with a fixed resistance coil (by which the instrument is calibrated), and coupled across the supply terminals. In a 100 ampere meter these high resistance or volt coils consume about .007 ampere on a current of 100 volts. By themselves, however, they would not give proportional readings. For in pendulums and chronometric balances the force required to produce the vibrations is proportional to the square of the number of vibrations in a given time. If, therefore, a = the normal number of vibrations, and b = the number to be added by the current, the force required to produce a will be a^2, and to produce $a+b$ will be $a^2+2ab+b^2$; the difference $(2ab+b^2)$ being the force to be exerted by the current under measurement. With the volt coils alone, the force actually exerted would be in the ratio $2ab+b$ only. Upon each volt coil, therefore, there is wound a "correcting coil," carrying a very small proportion of the current passing into consumption. If correctly calibrated, this small current brings the ratio up to $2ab+b^2$. This correction is mathematically perfect and makes the readings absolutely proportional throughout any range.

In meters in which the influence of the current on a vibrating pendulum or chronometric balance is the basis of measurement, the element of friction is entirely dealt with by the force of the clock, which supplies power exactly in proportion to the speed of vibration. The current under measurement has, therefore no friction to overcome. Hence such meters register the smallest as accurately as larger currents.

The right hand balance weighs about 4 lbs. It contains two "timing screws" which are really small weights, and when screwed inwards will *quicken*, and when outwards will *slacken* the speed of the balance. The number of vibrations is about 15 per minute. The balance spring instead of being coiled as in a watch, is quite straight, and forms the means of suspending the balance, which thus vibrates practically without friction. This spring acts by "torsion," a principle familiar to all who have seen "the 400 day clock."

The left hand balance and its solenoids are of about the same weights as the above, so as to vibrate in the same period of time.

Although driven by the same main spring, the two balances are free to move independently. The current for the volt and correcting coils is conveyed from the + terminal to a mercury cup placed concentrically with the left hand balance, into which a wire upon and concentric with the balance projects. After traversing the volt coil it is conveyed up the "torsion spring," and through the fixed resistance coil to a terminal near the top of the case and thence to the — main. The current traversing the "correcting" coils returns through the upper mercury cup to the — terminal of the instrument. This current is very small, as for 1 ampere on a 100 volt circuit it has to furnish a magnetic force equal to only $\frac{1}{1800}$th of that furnished by the volt coils. As, however, the turns in the correcting coils are much fewer than those in the volt coils, the actual current in the former may be (for 1 ampere) somewhat greater than in the latter, and it increases in proportion to the current consumed.

On the left hand side of the block the torsion spring carrying balance is seen opposite T; the two balances (on one of which is seen the timing screw) opposite B; swinging solenoids, S; main conductors in the form of straps at M, and m, m, —, and +, mercury cups. On the right of figure, opposite T, is the terminal for high resistance circuit; R, fixed resistance coil, and — + main terminals.

The denominator of the fraction $\frac{1}{1800}$, is the $2\,a\,b$ of the difference $2\,a\,b+b^2$ mentioned above, when the balances normally vibrate 900 per hour.

The following is a summary of the advantages claimed for the Oulton-Edmondson meters :

1. Their synchronism is much more accurate than has been attained in previous meters acting on the same principle.

2. They will go for three months without rewinding, even when worked up to their full capacity.

3. They will measure any current however small.

4. They give proportional readings over a longer range than any other mechanical meter extant.

5. The electrical energy consumed is less than in any other existing Watt-meter.

6. The dials register the consumption in plain Board of Trade units.

7. There are no "make and break" contacts.

PLATINOID WIRE.—Platinoid wire possesses so many advantages that its properties ought not to pass unnoticed, because of the high resistance it has. German silver wire has been used on account of its high resistance, but this property in platinoid is almost double. This alloy does not oxidize in air, and its resistance for various temperatures is fairly equal. The wire is also very strong and its cost no greater than that of German silver. Therefore. it is evident that, for any definite resistance, far less platinoid wire is required than if German silver were used. The word platinoid would seem to imply that platinum is present in its construction, but it is not the case. There is a small amount of tungsten in the alloy. Its melting temperature is high, which renders it very suitable for use in resistance frames.

SCORING GAMES AND RACES AT A DISTANCE BY ELECTRICITY.

In our issue of January 31st we gave an illustrated description of an invention of Mr. Samuel D. Mott, of Passaic, N. J., for the purpose of recording games, races and similar events at any point distant from the scene of action. We give herewith a description of a modification of the same invention, by means of which new electro-mechanical results are attained, novel and interesting from the electrician's standpoint; also diagrams showing a striking application of it to practical and commercial uses. Fig. 1 shows a concurrent representation of anything in the nature of a race. The transmitting part of the apparatus is shown at A. It consists of a positive and negative key, operator's index and battery. In the line, at the receiver is the neutral relay n and a polarized relay n', one giving the uniform step by step motion to the hands of the cylinder or disk controlled by ratchets r r' actuated by magnet m m', etc., and the other selecting a magnet in the instrument to show—in the case of a horse race—the number of the race as at a, to start the horse and at the same time tap a gong as shown at b, to show the winners in colors

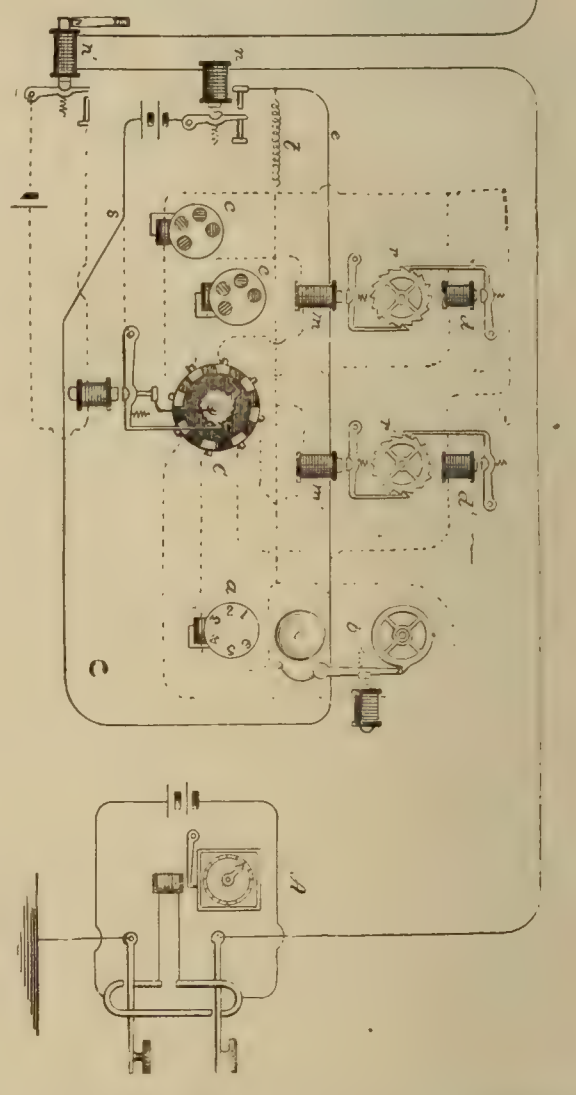


FIG. 1.—SCORING GAMES BY ELECTRICITY.—DIAGRAM OF CONNECTIONS.

marked on the bristol board disks as at c, or acting to accelerate by magnets d d', or to retard by means of the neutralizing coil on m m' in any contest selected by the operator at A through the medium of the selector C and polar magnet n'.

This diagram for convenience shows only two contestants with their respective magnets, but it will be readily understood that more may be added to the circuit, and that they may be in series, as shown, or in parallel. The resistance t is to proportion the neutralizing current to the same strength as the energizing current in any one magnet. In other words it will equal the sum of the resistances of all actuating magnets, less one. This equals the magnetizing and demagnetizing current from the battery neutralizing its effect on m, for instance, when a current is split at s. There is no need of synchronism as ordinarily understood ; the fact that the contestants all come together and stop on the scratch after each event insures identity of action in all instruments for all practical purposes.

Fig. 2 is an ornamental dial, showing the relative positions of the horses in a race from start to finish. A bulletin card 5, supplied with the day's entries,

will play any race when connected by wire with the track or course. The horses' names are printed in colors to correspond with the dummies on the dial, on which may also appear any information such as sweepstakes, handicaps, the purses, ages, best records, names of jockeys, etc. The dummies are also colored, so that in each race their identification is complete

The horses come in in the proper order, stopping on the scratch ready for the next race.

The dial is now exhibiting a race taking place at Monmouth Park, Wednesday, August 20, 1890. The winner of the first race was Atlas; 2d, Chaos; 3d, Louise; 4th, Castaway; 5th, Lotion. The sixth is just ending, with Wahoo winner and Eclipse second.

It will be apparent that the dummy horses may be replaced by colored arrow-heads, or even letters or figures.

The advantages of this system from an economic standpoint, and quite apart from its popular and attractive aspect, is the fact that no receiving operator is necessary, the dials receiving and publishing the event at one and the same time, one operator taking the place of one hundred and one when a game or race is being reported from the grounds to one hundred different localities. In comparison with the stock "tickers," it is very much cheaper to manufacture, simpler in mechanism, and by no means as liable to derangement or error in working.



FIG. 2.—SCORING GAMES BY ELECTRICITY.—DIAL.

It can be worked over single line circuits to greater distances than any "ticker," and it does not require the attention necessary for that instrument, such as winding, supplying with tape, etc.

An important point in connection with this invention is the capability of the signals being relayed or repeated over long lines. Operated from New York to Chicago instruments used at Cleveland or Pittsburg, or other intermediate points, could be actuated by relays interpolated in the line. The signals are wholly unintelligible if the line is tapped.

AN IMPROVED STORAGE BATTERY.

The electrical apparatus that probably receives at the present time greater attention from investigators than any other, is the storage battery, or accumulator.

As is well known, the storage battery is capable of great improvement in several important respects. For instance, the great weight of the plates is a serious objection, and much effort is being put forth to remove this fault without impairing the general efficiency of the cell.

The tendency to buckling of the plates is another difficulty to contend with, to obviate which great care in handling and maintenance is neeessary, Buckling may be prevented by careful watching and handling, but to be of real practical value a storage battery should rexuire no more than ordinary care.

Domestic lighting, practical and economical, is something we all want and hope to see some day, and many people look to the storage battery for the solution of the problem. For this class of work, however, such a battery should be so constructed as to render it as easy to take care of and keep in running order as to perform any other ordinary household duty.

The greatest field, however, for the storage batteries is not in household use only. There are innumerable uses to which they can be applied, many examples of which we see every day. Street cars are propelled by their energy; electric motors derive their power therefrom, and electric lights are successfully maintained. Yet, for all this, the average storage battery is not the reliable thing we wish it were.

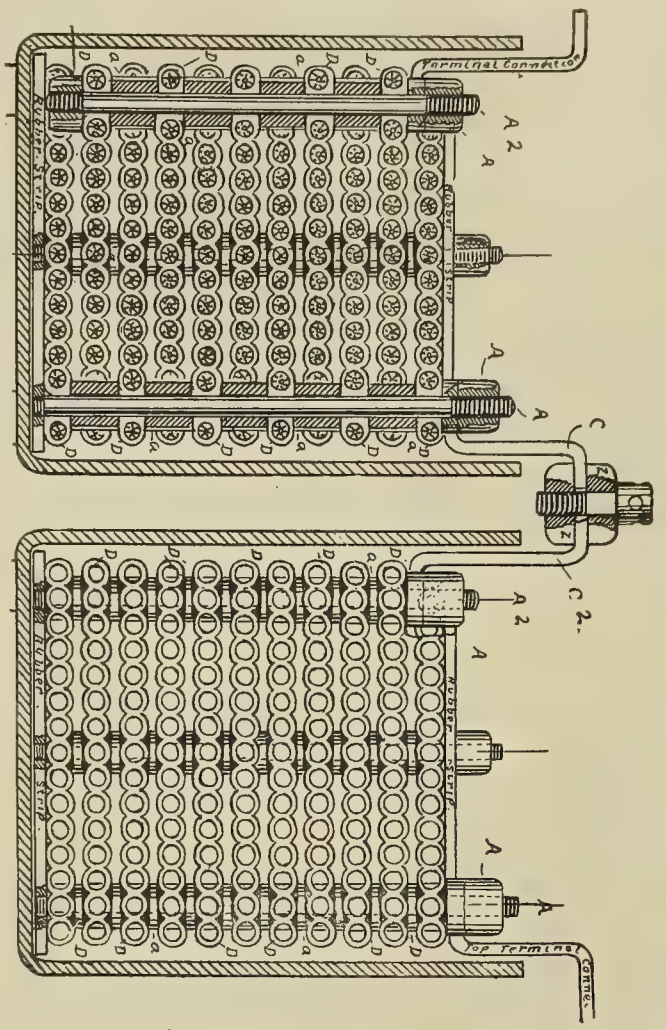


FIG. 1.—ERNST'S STORAGE BATTERY.—SECTIONAL VIEW.

The efforts of inventors, therefore, is in the direction of improving the storage battery so that it will be durable, reliable and efficient, and can be depended upon.

Experiments are being carried on quietly by many electricians with these objects as their aim. Some, of course, are successful in varying degrees and some are otherwise.

Our attention has recently been called to an improved storage battery plate that seems to overcome many of the ills that storage batteries in general are heirs to.

These plates are the invention of Victor H. Ernst, of 705 Summit avenue, Jersey City, N. J., and in their construction many unique features are noticed.

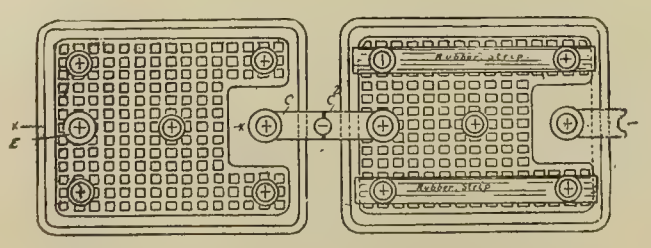


FIG. 2.—PLAN OF ERNST'S STORAGE BATTERY.

The accompanying illustrations give a good idea of the construction of the housing. The most important feature, however, is difficult of illustration. It consists of a cord of asbestos, which is run transversely through the plates of the cell zig-zag fashion.

This asbestos cord performs a most important function. It is run through the housing before the active material is incorporated into or with the housing. By means of the natural capillary attraction of the asbestos cord, the electrolyte has forced action through the active materials, giving a circulation which prevents heating. When the active material begins to expand it does so inwardly since the "housing" is many times more rigid than the former. By this inward expansion the asbestos cord is compressed, and in this manner the action on the plate is equalized, and the buckling of plates is thus prevented.

The asbestos cord acts as a yielding cushion to the active materials held in the plate, whereby all cracking or jarring loose, or disruption of the active material is avoided in car and vehicle work.

The electrolyte is caused to circulate throughout every particle of the active material by means of the asbestos cord, and this interoscillating action is one of the many features of the plate construction.

Cells constructed on this new principle have been subjected to the most severe tests and rough usage for fifteen months without the least detrimental effect.

Another very important feature of this cell is that no soldering or lead-burning is necessary in assembling the cells, and connecting them up for use—a very practical clamp is used instead, which most effectively establishes a connection between the terminals.

In addition to the valuable features above described there are many others which the Ernst storage cell possesses to an eminent degree. These may be enumerated as follows:

1.—No buckling, bulging or twisting of plates.

2.—No falling out or loosening of the active material.

3.—No heating of the cell under action in the electrolyte.

4.—No heating when the cell is removed from the electrolyte even when the plate is fully charged.

5.—No sulphating when the plate is removed from the electrolyte.

6.—All mutilation of the plate and its connections is avoided by means of a removable and separable terminal.

7. Absolute knock-down features so the plates can be separated quickly, after curing, then packed in compact form for transportation.

8. The plates are readily removed, replaced or repaired.

9. A complete circulation of the electrolyte throughout the active materials, whereby the inner particles are also brought into action. This is one of the most important features of the plate. Owing to this, the plates last much longer and keep in much better condition than has been possible heretofore.

10. A feature permitting the ready enlargement of a cell by the addition of a desired number of plates.

11. The cell may be discharged rapidly without causing the least damage to the active materials or plates.

12. Excessive current when charging will not in the least cause buckling or dislodgement of the active materials.

13. The only cell extant to-day without solder or lead-burning, doweling or riveting.

Mr. Ernst's inventions are controlled by the Ernst Electrical Storage Battery Company, of Atlantic City, N. J. The president of the company is Mr. Thomas Grimwood, whose office is at 115 Broadway, New York.

MAGNETIC POLE.—The strength of a magnet pole can be estimated by measuring the force with which it attracts or repels another pole, the force being equal to the product of the two polar strengths; or, if M represents the strength of one pole, and M′ the strength of the other, similarly magnetized, the force of their repulsion will be $M \times M'$.

WIRING.—All wires and cables should be so laid that a small distance intervenes between them. The circuit should always be complete, in order that the current may be everywhere carried by insulated wires. Hence measures must be taken not only against the possibility of short circuit, but also against damp, which causes leakage and injures, first the insulation, and then the wires.

INVITATION TO HOLD THE NEXT N. E. L. A. MEETING IN MONTREAL.

We have received an interesting communication from Mr. Albert J. Corriveau, president and manager of the Canadian Electrical Construction Manufacturing and Supply Company, Montreal, Canada, in which he renews his suggestion made at the Cape May convention last August, that the next summer meeting of the National Electric Light Association be held in Montreal.

Mr. Corriveau says :

As there now remains but a few more days before the opening of the winter convention of the National Electric Light Association of the United States, held this year at Providence, R. I., I think the time most opportune to renew the suggestion I had the honor to make while attending a convention of the Association during the past summer at Cape May, N. J., viz. that the next summer meeting of this electrical fraternity be held in Montreal, Canada. To more fully impress this idea, then so flatteringly received, on the members of the association, I seek permission to use the columns of your Journal, as I feel no better medium exists to reach the members, widely separated as they are throughout every State in the Union, than by means of the papers particularly deted to electrical pursuits.

To do this thoroughly, in view of the vast benefits to be derived by such a gathering in Montreal to the electrical interests of the Dominion, I may perhaps have to trespass too much on your valuable space. I remember, however, that your principal object is the dissemination of the knowledge of the semi-unknown force of electricity, and think the points I wish to cover in carrying out my idea, as I think the benefit to Canada and the profitable pleasure of such a visit of the members to Montreal will prove of interest to the general reader.

First, then to be considered are the benefits to be derived by Canada in general and Montreal in particular by the holding of the convention here. It is well known that every member of the association is one who, if not himself an electrician, has the advancement of the science and all things thereto pertaining at heart.

Canada,—and this I can say from personal knowledge,—is as yet to a certain extent a *terra incognita* to the several branches of electricity and the various uses to which this subtle power is put in the United States. True, many, perhaps nearly all of the cities of any importance in the Dominion are lighted by its brilliant rays ; but it is equally true that I found during my many visits to the most important towns and villages outside of the cities that there are hundreds of the former in the dark, so to speak, but ripe for the reception of this great conqueror of the nineteenth century.

A few of the cities have adopted a system of electrical street railways—now in course of construction—for trial, but I believe that its use for the transmission of power from central stations, for manufacturing and other purposes, has not even been attempted. Certainly the science on this side of "line forty-five" is as yet in its infancy. Here, then, is a wide field for the National Association. In this "virgin soil" a world of good can be done by holding one of its meetings in our midst, by showing the strength of its organization, by showing its influence, and by the power it can wield by letting Canadians hear the learned discussions on the many highly interesting and widely practical papers read at these semi-annual reunions on all things pertaining to electricity.

Canadians are naturally a slow people in grasping at a project which they do not thoroughly understand, unless assured by personal experience of its absolute success; but once this is instilled into their minds it will be found that they are blessed with as much push and energy as the most energetic people the world over.

How better, then, can they be taught to enter into and utilize the full usefulness of this grand power, that science has placed at their disposal, than by seeing and listening to the men of brains ; the men of wealth ; the men of influence, that are bande together in this great brotherhood, "The National Electric Light Association of the United States."

Through my several years' experience in connection with the electrical business almost in every part of Canada, I can probably gauge the feelings of the general public on these matters as well, if not better, than most any other person, and therefore I know the vast majority are in favor of electrical advancement. I know further that all that is requisite for the formation of a Canadian Association on similar lines which would give rise to electrical experiments throughout the Dominion is but a boom, such as the coming of our anticipated visitors would be. In using the word anticipated, I do so advisedly, for since my return from Cape May I have been indefatigable in telling our people of the distinguished guests—individually and collectively jolly good fellows, notwithstanding their scientific worth—whom we might expect next summer. All classes, including the most influential men of our population, have received the information with every expression of delight. An official civic reception even would be probable, which, if given, would equal if not excel that tendered the visiting steel and iron men last year. One thing is certain, however, that should these electrical magnates, with their lady friends come, as all hope, nothing in Montreal will be too good for them, and they may rest assured of receiving a true Canadian welcome.

So far I have spoken of the benefits to accrue to Canada by the holding of the Convention in Montreal. I will now say a few words as to why it would be advisable to do so.

First. Montreal is within easy reach of every point in the eastern, western and northern States. If by rail, there are a dozen different routes centering here with their connections, the principal of which are the Grand Trunk with its Chicago and Western connection ; the Canadian Pacific, with its St. Paul and Minneapolis branch ; also in the East with Boston Air Line ; the Central Vermont, connecting with the Boston and Maine Central and New York Central, and the Delaware and Hudson connecting with the New York Central. Special reduced rates over these several routes no doubt could and would be arranged for the members of the Association. All the lines named run through parts of Canada, where the scenery is of great and varied beauty. If by water, via the St. Lawrence route, on which ply the palatial boats of the Richelieu and Ontario Navigation Company, and by which the greater part of the trip could be accomplished, the visitors would enjoy the novelty of a semi-ocean voyage by the turbid waters of the rapids and could return by the more rapid railways."

Mr. Corriveau then describes at length the beauties of the trip down the St. Lawrence, and among the Thousand Islands, and continues :

"The trip down the St. Lawrence will give the members of the association some idea of the magnificent and almost totally unused water power of Canada. It will offer them food for reflection, and no doubt a worthy subject for subsequent discussion as to how best this power could be utilized as a motive for electric lighting and other purposes to which electricity can be put. At present there is a somewhat, as yet, chimerical scheme afoot here to obtain the rights of the Lachine Rapids so as to utilize the current as motive power for many different purposes. The members of the association can visit the scene easily from Montreal and decide how far the scheme is feasible.

Isle Aux Huron, a small island directly at the foot of the Lachine Rapids has been divided by nature into two parts and through the channel thus made runs a current of tremendous velocity. This island has been purchased by a strong syndicate, who propose to obtain an almost unlimited power, not alone by the facilities offered by the island. but by damming the north channel and thus obtaining the enormous energy of the rapids. This it is proposed to transmit by electricity to Montreal four miles distant, for use there and the surrounding districts. The only difficulty to carrying out the scheme is our annual spring and fall inundations, which by the backing up of the water at the foot of the rapids, would materially affect this power. Able engineers are now at work trying to solve this difficulty and strong hopes are entertained that it will soon be overcome ; in fact, many experts favor a plan of flood prevention, which I have proposed myself and had under government consideration, and which the said experts claim would, by carrying off the surplus water of the ice jammed river, answer every purpose.

As to accommodations, the members of the association need have no cause to fear. Our hotels are among the finest in America, and the palatial Windsor and favorite St. Lawrence Hall have obtained a world-wide reputation.

There are many large halls—particularly that attached to the Windsor Hotel—any of which would be suitable for the business meetings of the convention, while there are equally as commodious buildings suitable for the electrical exhibitions that are always held at these meetings of the Association. On the occasion which I hope will come, Canadian inventors and manufacturers in this line can exhibit side by side with those of the United States.

I think that above I have given sufficient reasons why it will be in the interests of the association to hold their next summer convention in this city, but before closing I will point out a few more attractions within easy reach of Montreal that could be easily taken in by the members during their sojourn on Canadian soil."

Mr. Corriveau then ntions meseveral places of interest that could be visited, and closes his letter with the following words :

"Surely I have written enough to show that the Association, so soon to be in conclave, should fix on Montreal as their next place of meeting ; and why ?

"Because I only voice the sentiment of Montreal's people when I say that it should be so.

"In writing as I have I did not wish to dwell too much on my country's merits; simply to impress on these gentlemen—these Knights of Electrical Science, with ladies fair—the pleasures as well as scientific profit to be gained by holding the annual summer convention of 1891 of the National Electric Light Association of the United States in this city.

"A word in closing, Mr. Editor, to the gentlemen of the Association: come one and all, and I can assure you once more a hearty welcome from the citizens of Canada and of Canada's metropolis."

Making Incandescent Lamps.—Although it is, evidently, a comparatively simple matter to obtain the degree of exhaustion necessary for incandescent lamps, there are several causes for a deterioration manifesting itself in the vacuum after the finished lamp has been laid aside for a time, such as the occlusion of gases by the carbon and platinum, and by the cement employed to connect them together, and the very thin film of air which is liable to adhere to the inner surface of the bulb. In order to expel these gases, the filament is raised to incandescence during the later stages in the process of exhaustion, or the heat is applied externally. The lamp having been sufficiently exhausted, the small glass tube connecting the bulb to the exhaust tube is fused, drawn out to a thread, and the lamp sealed off. The lamp is then tested for efficiency, that is to say, the amount of light emitted for a given electrical power. A lamp may be said to have a very good efficiency if it yields one candle-power in return for 3.5 watts, so that an average 16 candle-power lamp should absorb 56 watts.

Number of Lights.—Many suppose that a dynamo sold to light fifty lamps cannot be used for more : this is not so, for ten times this number might be added in some cases ; but the wire on the armature would become so hot that destruction of the insulation would occur, and possibly fusion of the wire. The meaning of a fifty lamp machine is simply that the wire in the armature is only large enough to carry a current for fifty 16 c. p. lamps, so that attention is necessary to observe that this limit be not exceeded by any accident or stupidity, such as putting fifty lamps on the circuit which may require a larger current than fifty 16 c. p. lamps.

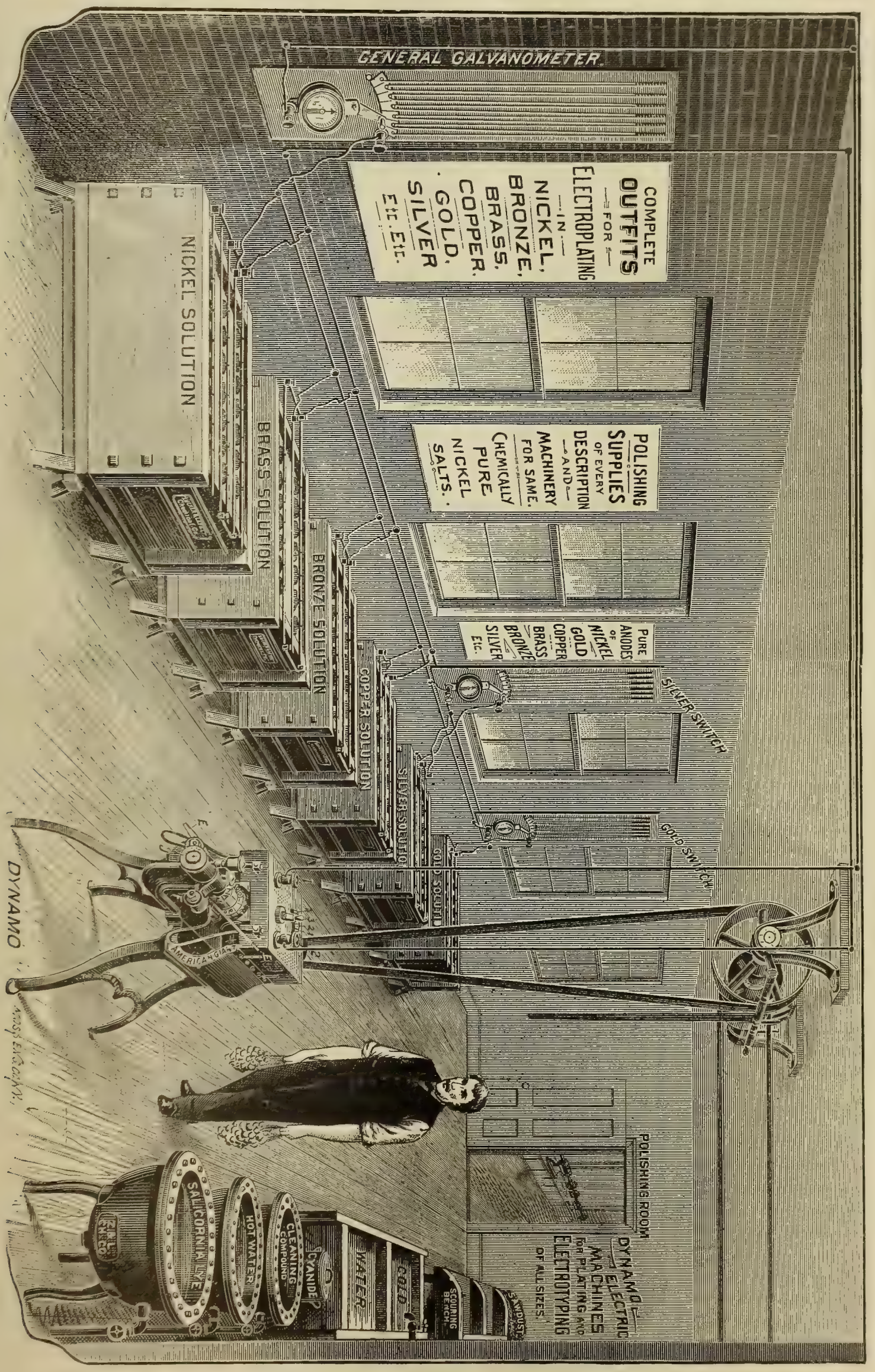
ELECTRO-PLATING.

The art of electro-plating has in late years made great strides in its development. It has grown from a small beginning with almost the same rapidity as did the electric light from Sir Humphry Davy's simple discovery.

any electrically conducting surface with a metal by the aid of the electric current. As used in practice articles of baser metals are covered with silver, nickel or copper, or with any other metal, such as gold or platinum.

The process of electro-plating is an extremely interesting one, and is, in general, carried on as follows: The object to be plated is connected with the negative terminal of a battery or dynamo and placed in a solution of the metal with which it is to be plated, opposite a plate of that metal connected with the positive terminal of the battery or dynamo. By the action of the current the metal held in solution is deposited upon the articles to be plated.

The success of electro-plating depends, to a very large extent, upon the electric current. Formerly primary batteries were used for the purpose of plating, but in recent years dynamos have been adapted to this work with perfect success. The work is accomplished with the dynamo with greater rapidity and more economically than is possible with a battery.



ELECTRO-PLATING PLANT.

In 1801 Wollaston observed that a piece of silver connected with a more positive metal became coated with copper when put into a solution of copper. This is the first record of electro-plating. From this humble beginning the art has developed into a science, an example of the highest development of which is given in the accompanying illustration.

Electro-plating consists essentially of covering

Electro-plating dynamos are especially wound for this class of work and have few armature coils. One of the most successful of this class of machines is the one which is shown in our illustration, namely, the American Giant, made by the Zuckers and Levett Chemical Company, 40 Murray street, New York.

The current for the electro-plating is supplied by

an American Giant Dynamo Machine, which is shown in the foreground of the illustration.

The American Giant Dynamo has the reputation of being one of the best machines ever made for this class of work. Standing on a frame-work as it does, it is very portable. and altogether is a very compact machine.

One current is used to precipitate the metals in the various vats. In our illustration nickle, brass, bronze, copper, silver and gold are all deposited by the current derived from the one circuit. as shown. The connections are very clearly illustrated in the cut, and it does not require any explanation to understand the *modus operandi.*

The galvanometer shown at the left of the cut indicates at all times the strength of the current in the circuit. On the right are shown other accessories required in the finishing of the plated goods.

The Zucker & Levett Chemical Company are said to be the leading manufacturers in their line in the world, having for many years made it a study whereby a manufacturer can facilitate the production of his wares with the best and most economical results. The leading manufacturers are now using this company's pure refined nickel anodes and salts to obtain a deposit of nickel almost as white as silver. These goods are conceded among manufacturers to be the best made.

The advantages of using these anodes are many, among others being the pure white deposit. They do not crumble, in some instances wearing down to the thinness of a knife blade.

The company also manufacture the various chemicals, etc., used in the art of plating and polishing, as well as all the machinery necessary for the complete equipment of an electro-plating plant.

THE BELL TELEPHONE PATENTS.

We have received the following letter from Mr. F. W. Jones, Electrician and Assistant General Manager of the Postal Telegraph-Cable Company. This letter, in conjunction with that of Mr. Kintner, in our last issue, and our article on the subject, published in our issue of January 31, make extremely interesting reading:

EDITOR ELECTRICAL AGE:

It does not appear that you were in error in announcing the expiration of Bell's U. S. Telephone Patent No. 186,787, of January 30th, 1877, filed January 15th, 1877. The patent is identical with Bell's English patent of December 9th, 1876, which expired last December. Mr. C. J. Kintner has stated the law clearly enough in your February 7th number, but has evidently applied it to the wrong patent.

Assuming that Bell's patent of March 7th, 1876, dominates his patent of January 30th, 1877, this, if true, would not controvert your assertion that the latter had expired by limitation of law. This, then, leaves secured by patent whatever is contained in the 1876 patent. Of course, you are well aware of the great telephone law suits in England, particularly the one in High Court of Sessions before Lord McLaren, of Edinburgh. In this case Sir William Thomson, Sir Joseph Bramwell, and others all testified, and the court decided that neither Bell's U. S. patent, No. 174,465, of March, 1876, nor any of his patents, lectures, or publications, in this or any other country, nor his exhibit at the Centennial Exposition of 1876, had disclosed a telephone, or had in any way anticipated his English patent of December 9th, 1876, for the magneto telephone.

For Mr. Kintner or any one else to decide off-hand to the contrary, should at least receive the tribute due to courage.

F. W. JONES.

ELECTRIC RAILROADS.

A dispatch from St. Louis, Mo., dated January 25th, says that a company was recently formed there, under the name of "The Adams' Electric Company," for the purpose of prosecuting the claims of Dr. Wellington Adams, of that city, against persons and companies operating various electric motors in various cities. The stock of the new company will be $5,000,000.

The stock of the parent company only reaches the modest amount of $25,000 in 250 shares of $100 par value each, of which fifty shares are still held in the treasury of the company. The sale will be made on this basis to the Adams Electric Railway Company which is capitalized for $5,000,000 in 200,000 shares of $25 par value each. Of the new company's capitalization 20,000 shares will be made treasury stock, which may be sold at the option of the company, and the remainder will be pooled so that none of it can get on the market. The pooling of the stock is done, it is said, to prevent the possibility of outside parties obtaining a controlling interest in the company, which might possibly be done by some of the electric railway systems against whom the Adams Company proposes to bring suit.

The brief upon which the first suit will be brought is being prepared by the company's lawyers, and it will be very voluminous, as it will give a full detailed history of patents issued on all appliances for electrical railways with full transcripts of the records of the Patent Office at Washington, said to support Dr. Adams' claim for priority as the patentee of the electric motor truck which is used by every electric street railway system now in successful operation.

The brief will also contain descriptions and illustrations of every model for such electric railway patents now in the Patent Office, and will in fact be an exhaustive exhibit of electrical railway patents for the past ten or twelve years.

ELECTION OF OFFICERS.

The Board of Directors of the Standard Underground Cable Company, elected at the annual meeting of the company on January 27th, met on February 2d in the company's office, Westinghouse Building, Pittsburgh, and organized by electing Joseph W. Marsh as vice-president and general manager; Frank A. Rinehart as secretary and treasurer, and Oscar R. Ebel as auditor.

An executive committee was also elected, consisting of John H. Dalzell, Mark W. Watson and Robert Pitcairn, the president or vice-president being *ex-officio* members.

The many friends of Mr. Joseph W. Marsh will be glad to learn of his election to this important office. His long and efficient service justly entitle him to the honors and benefits of his new position, and it is safe to say that the Standard Underground Company will prosper more than ever under the wise direction of its new chief executive.

THE CROCKER-WHEELER ELECTRIC MOTOR COMPANY.

At the annual meeting of this company, held at their office, No. 430 West 14th street, on January 7th, 1891, the following officers and directors were elected for the ensuing year: S. S. Wheeler, President; F. B. Crocker, Vice-President; H. H. Crocker, Treasurer; and R. H. Peterson, A. F. Higgins, William B. Baldwin, A. K. Sloan, David Crocker, Directors.

The annual sworn statement showed a full paid capital of one hundred thousand dollars ($100,000), while the total indebtedness was less than nine thousand dollars ($9,000), and consisting only of the ordinary open monthly accounts. The statement showed that the business of the company had about doubled in each quarter year.

WIRE JOINTS.—One of the most important details in connection with the running of electrical conductors is that of jointing. The chief features which should pertain to a well-made joint are that, the electrical continuity should be fully maintained; that its mechanical strength should be at least equal to that of the conductor itself; that no free ends should be left on the finished joint; that it should be durable both electrically and mechanically; that it should be as compact as possible, and that with a covered wire the insulating coating should be made continuous and as uniform as possible.

SPECIFICATIONS FOR WIRING FOR ELECTRIC LIGHT EMPLOYING THE CONDUIT SYSTEM OF THE INTERIOR CONDUIT AND INSULATION COMPANY.

Inasmuch as the interior conduits of the Interior Conduit and Insulation Company are being largely used for purposes for which they are not designed, that company has carefully compiled the following specifications for the purpose of enabling architects, builders and owners to intelligently comprehend the many advantages enjoyed by their system.

SYSTEM.

The building to be thoroughly equipped from the source of supply to each outlet with the insulating conduits of the Interior Conduit and Insulation Co. in such manner as to provide continuous channels or race-ways for the wires. The continuity of each tube employed for this purpose shall be such as would be required if it were to be used for conveying water or gas.

Strict compliance with this requirement will be demanded, since one of the chief advantages of the system herein specified is to exclude water and gas from the wires, and therefore afford adequate protection against their deleterious effects.

ACCESSIBILITY.

To the end that each and every wire may be at all times accessible for inspection, repairs or renewal, the location, sectional division, joining, intermediate and terminal elbowing, the placing of switches, cut-outs and junction boxes, and the final emergence of the tube beyond the finished surface at the fixture outlet, must be done in strict compliance with the rules and regulations herein contained.

APPLIANCES.

In order to secure safety, durability and convenience and to give a finished character to the work, all appliances employed shall be such as are designed especially for use in conjunction with this system.

SUBDIVISION OF RISERS.

The building must be divided into a number of sections, and each section provided with an independent group of risers, thus avoiding the multiplication of elbows, intersection boxes and long runs of the taps or branches.

Every conductor in each group of risers must be provided with an independent tube.

BRANCHES.

For all branches the Standard Twin Conductor of the Interior Conduit and Insulation Company, requiring but one tube, must be employed. The current limit of the branches must be that fixed by the Fire Underwriters' rules.

SIZE OF TUBES.

All tubes must be of sufficient size to allow the wires to be readily drawn in, withdrawn and reinserted at will.

A quarter (¼) inch tube will be permitted only where space is extremely limited, as under a thin plaster finish.

CLIPS.

Tubes, whether concealed or on the surface, must be held in place by metal "clips"; the use of staples for such purpose will not be allowed where it can be avoided.

JOINTS.

The tubes must be cut squarely and then reamed out smoothly and the ends joined in the manner and by the use of the corrugated coupling designed for that purpose.

ELBOW LIMITATIONS.

Where more than four elbows are unavoidable an intersection box must be inserted to relieve both the wires and the tubes of strain when the wires are being drawn in.

OUTLETS.

All tubes must emerge at outlets in terminal boxes, thus leaving the outlets so protected as not to be injured by the plasterers.

FIXTURE SUPPORTS.

Where no gas pipe or other support for the fixtures exists, the special form of terminal box designed to furnish such support must be employed, and must be substantially fixed to a suitable foundation in the ceiling or walls.

JUNCTION BOXES.

Main circuit junction boxes must be placed on each floor in each section; from these junction boxes all branches in that section must ramify.

CUT-OUTS.

Standard non-combustible cut-outs must be used within the junction boxes, and each branch wire leading from the same must be protected by a safety fuse.

FLOOR WORK.

To guard against mechanical injury and the destructive action of cement, all floor conduits must be made of double tube, one telescoped within the other and both the outer and inner tubes joined in the usual manner. The outer tube must, in the case of contact with cement, be alkali proof. As a further protection, all floor tubes must be covered during construction with a light board.

WIRES.

For mains a conductor having an insulation known as "fire and weatherproof," and for branches the standard twin conductor of the Interior Conduit and Insulation Co. must be used.

ANNUNCIATOR WIRING.

All the annunciator or bell wires must be placed within conduits and such of the foregoing rules and regulations as are applicable to rendering them accessible and affording suitable protection shall be followed.

INSERTING WIRES.

After the conduiting is completed powdered soapstone must be blown into the tubes in order to facilitate the drawing in of the wires.

INSPECTION AND ACCEPTANCE.

As a guarantee that the wiring will be properly done, it is required that the contractors, in event of their being unfamiliar with the system, communicate with the Interior Conduit and Insulation Company of New York, or their authorized representatives, and obtain the requisite instruction. The right is reserved to subject the work of the contractor to the inspection and approval of the Interior Conduit and Insulation Company as a condition of acceptance and final payment.

TRADE NOTES.

Messrs. James Schawel and Company, importers and melters of platinum, No. 29 John street, handle pure platinum in sheet and wire of any guage. Special sizes are furnished on short notice. The firm also make a specialty of incandescent lamp wire of all sizes and of superior finish. The metal is guaranteed to be pure. Orders are promptly and carefully executed, and platinum scrap is taken in exchange for new metal, or purchase.

The Lava electric insulators manufactured by the D. M. Steward Mfg. Co., of Chattanooga, Tenn., are meeting with well merited success. They are adaptable to all electrical purposes, and can be made in any shape desired. The company claim for their Lava insulators adaptibility to a wide range of uses and situations, exterior and interior. They are water, fire and acid proof, and extremely hard, and it is said they are superior to all other insulators, which claim the company substantiates by excellent testimonials.

Messrs. Holmes, Booth & Haydens, 25 Park place, have received a letter from Mr. Charles E. Scott, Treasurer of the Bristol Electric Light and Power Company of Bristol, Pa., under date of January 29th, from which the following extract is taken: "All our K. K. lines withstood the storm of Saturday night. In two instances telephone wires rested across the mains without short circuiting us, and a number of such wires depended from our lines to the ground, without showing any ground at the station. In fact, we have never had a break or ground on your wire, and hope that we never may." The "K.K." line wire and other wires made by this company are justly celebrated for superior qualities, and the above complimentary notice is evidence of the great strength of the "K. K." wire. Mr. Thomas L. Scovill is the New York agent for the company, which has its factories at Waterbury, Conn.

NEW YORK NOTES.

The Garvin Machine Co., corner of Laight and Canal streets, manufacture lathes and all kinds of machinery and tools needed by the manufacturers of all classes of electrical instruments. It is the headquarters for machine tools, and everything necessary in that line can be found at this place.

The value of mica as an insulator for electrical machines is well known. Mr. A. O. Schoonmaker, No. 158 William street, is a large dealer in these goods, and has a large trade among electrical manufacturers. The mica sold by Mr. Schoonmaker is of the very best quality, and gives great satisfaction to all who use it.

The Ajax switches manufactured by C. S. Van Nuis, No. 74 Cortlandt Street, are rapidly finding their way into the electric light stations and power plants all over the country. The special features of these switches are their great carrying and breaking capacity. They are, moreover, simple in construction, cheap and practically indestructible. They are made with a capacity as high as 800 amperes, and perform the work for which they are designed with the utmost satisfaction.

In our issue of January 17th last, under the head of New York Notes, it was stated that Mr. J. W. Godfrey, General Manager of the New York Insulated Wire Company, 649–651 Broadway, had received as a Christmas present from the Southwestern Supply Company, of St. Louis, Mo., an elk's head with large antlers. Mr. Gilman, of the Great Western Electric Supply Company, Chicago, Ills., was the gentleman who presented Mr. Godfrey with this beautiful gift, and not the company above referred to.

The John Stephenson Company, limited, builders of tram-cars, No. 47 East 27th street, are very busy these days in their effort to keep up with the orders for their celebrated street cars. Their superior facilities for the construction of tramway cars enables them to turn out vehicles of the highest class. Their cars are met with on all the principal street roads in the country, and they seem to be particularly sought after for electric railway use. Promoters of electric railway enterprises would do well to look into the company's facilities and goods when looking about for new equipment.

The Porter Electric Messengers, manufactured by the National Electrical Manufacturing Company, Nos. 14 and 16 Vesey street, are meeting with a large and well deserved sale. The system can be introduced into any hotel now equipped with ordinary gravity or needle annunciators and ordinary push-buttons; no additional wires are required. Guests, by means of this system, are enabled to indicate on the annunciator what they desire. There are calls for ice-water, hot water, messenger, carriage, barber, etc., etc., and, by the use of this valuable apparatus, much time is saved both to guests and hotel employés.

Wallace & Sons, No. 29 Chambers street, the well-known manufacturers of soft and hard drawn electrical copper wire for electric lighting, telegraph and telephone use, are turning out large quantities of goods of these classes. They call special attention to their hard drawn copper trolley wire for electric railways, which is giving excellent satisfaction on many roads. They also make a specialty of copper track bonds, with iron or copper rivets, and have ample facilities to fill all orders with despatch. Their copper wires are manufactured from selected Lake Superior refined copper and is of uniform gauge, high conductivity and great tensile strength.

The desks made by William Schwarzwalder & Co., Nos. 37 and 39 Fulton street, corner of Pearl, are the most convenient that can be found anywhere. In the office of THE ELECTRICAL AGE three of them are now in use and are giving great satisfaction. It is surprising how much room there is in these desks, and how conveniently the space is subdivided for different purposes. The firm manufacture bank and office fixtures of all kinds, and have a large establishment at the address given. In our last issue we illustrated the electric power plant at their place, which is evidence that the concern is a very enterprising one.

W. D. McQuestin, the well known electrical engineer and expert, is completing one of the most important electric street railway stations in the country. Mr. McQuestin's knowledge on the subject of power stations is acknowledged to be of a superior nature which is verified by the fact that the most important power stations in this country have been constructed under his supervision. The present station which he is completing, is for the Aurora Street Railway Company of Aurora, Ill. The power house is constructed entirely of stone and faces the Fox River. It is understood the ultimate capacity of this station will be 2,500 horse-power.

Messrs. Charles A. Schieren & Company, No. 47 Ferry street, New York, manufacturers of the celebrated perforated electric driving belts, are doing a good trade in these goods. These belts run smoothly and noiselessly, and there is none of that wavy, noisy, flapping motion usually seen where ordinary belts are used. The perforating in their belts allow the air to escape from between the belt and the pulleys, and that is the secret of the steadiness and noiselessness of the belt while in motion. The firm, we understand, very generously give their permission to parties using ordinary belts to perforate them if they so desire. Anyone using these perforations without a written permit from this firm, however, are liable to be prosecuted.

Pierce & Thomas, 42 Cortlandt street, engineers and contractors of electric light, power and railway steam plants, have the agency for the McIntosh & Seymour single and compound engines, which are particularly adapted to electric light and power applications, and they have been adopted by the largest electric light and railway companies in the country on account of their strength, durability, efficiency, etc. This firm also control the best water tube and return tubular boilers, as well as all the requisites for a complete plant. They have every facility for drawing up specifications, designing plans and supervising and installing complete steam plants. Among the plants for which they have recently closed contracts is the Electric Consolidated Street Railroad Company of Columbus, Ohio, for which concern they will put in four 175 h.p. water tube boilers and two 250 h.p. McIntosh & Seymour compound railway condensing engines, condensers, feed pumps, heaters and everything necessary to make the plant complete. W.T.H.

ARC CARBONS.—The resistance of prepared compressed carbon varies with the different makers, the resistance of one specimen amounting to 2,430 times that of a similar piece of pure copper, or nearly 4,000 microhms per cubic centimetre. The specific resistance of the comparatively impure and more crystalline gas-retort carbon has been shown to be about 17 times as great as that of the prepared material. The actual resistance of the prepared carbons ordinarily used for arc lamps is about 0.15 ohm per foot. In order to reduce this they are frequently coated with a very thin layer of copper deposited electrolytically. But great care must be taken that the metallic deposit is very thin, otherwise it will melt for some distance up the rod, and there will be a danger of fused globules falling off on to the glass globe and fracturing it. It may also be in sufficient quantity to decidedly tinge the flame of the arc with the characteristic green hue of burning copper.

MAGNET POLE.—The force acting upon a magnet pole is found by multiplying the strength of the pole by the strength or intensity of the field in which it is placed.

FINANCIAL.

Hello! Give me the public, please. Hello? Yes, all right; this is Ellery, ELECTRICAL AGE. O, yes, your bonds are all right; I will have some safe shares for you in a few days, but think we must go a little further from New York. I didn't catch that. O! Construction Company's shares. Yes, they are a good investment; you may have to pay above par for them, but I rate them ahead of 6 per cent. bonds. Electric Supply Company's? Certainly. There are several in which you can invest a few thousand safely. Good bye.

Postmaster General Wanamaker says: "The postal telegraph must come." It has been tried many years in foreign post-offices and pays in every instance. From a financial stand-point telegraphy has been a monopoly in the United States for a long time. It is no longer open to public competition, the hour is here when the government should condemn and purchase the existing corporations with all their machinery requisite, give a year's notice and on the first day of the following postal new year begin a business of its own including every presidential post-office in the land, claiming everything on wire, taking all patents as they fall in, and purchasing all new discoveries which seem desirable. A new 3.65 bond will be eagerly absorbed and the public benefitted accordingly.

As a result of the expiration of the master telephone patent in England, the National Telephone Co., Limited, held a meeting on Jan'y 22, in London. The President Mr. F. R. Leyland informed the shareholders of their loss, and explained the accounts up to Oct. 31, being the first six months of the current year, showing a net profit of £108,170. 19s. 11d. which with £11,113. 9s. 7d. brought forward leaves £119,284. 9s. 6d. to their credit on Oct 31, 1890, equal to about 8½ per cent. on the capital of £2,464,000. On Jany 1, 1891, having lost the first "key" patent, although the second "key" patent does not expire until July, 1891, a reduction has been made in all large cities, except London, from £15 to £10, which is expected to increase business; to handle that requires more capital for construction, &c. The articles of association permit the directors to issue debentures to the extent of one-half the capital stock, and they intend after mature deliberation to issue under the powers given them, perpetual debenture stock, from £300,000 to £350,000. This will be largely dealt in on the Stock Exchange, and therefore far preferable to a small issue for which there is neither sale nor power of purchase. So far as known there was as yet only one new company started, (in Manchester) and they had great difficulty in getting their capital £40,000 subscribed. Working expenses for the past six months amounted to 40 per cent. of the gross receipts.

Not later than 1893 no doubt a similar meeting will be held in this country, and it is just as well for promoters to prepare now, secure your capital and your territory, decide on particular kind of telephonic appliance and corporate name you will adopt, and through the advertising columns of THE ELECTRICAL AGE let the public know how much financial interest they can have and on what terms. It is the quickest, cheapest, fairest way to raise the money; publicity will create a market for your securities. The current is being turned on; get aboard or get left. Some of us will live to see the Government own all electric conductors of this nature; get there before you short circuit.

The market continues strong and shows more activity. Among the late dividends are the Thomson-Houston with their first of $1.00 per share on common stock. Asbury Park L. and P. 3 per cent. semi-annual.

LINES OF FORCE AND E. M. F.—It is only during the time that the lines of force of a field are being cut by a conductor that an E. M. F. is induced in that conductor; therefore in order to obtain a continuous current, or a very rapid succession of currents, it is evident that either the conductor or the field must be kept continually in motion.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Motor Co			5.00
American Private Telephone (Parent)	50,000	100.00	98.00
American Telegraph and Cable			
Anglo-American Electric M'f'g Co			1.00
Averell Insulating Conduit	3,000,000	100.00	5.00
Asbury Park, L. & P	50,000	10.00	
Ball Electric Light	2,000,000	100.00	
Bell Telephone			185.00
Bentley Knight			
Brooklyn Edison Electric Light	1,500,000	100.00	100.00
Brooklyn Citizens' Electric Light	500,000	10.00	*120
Brooklyn Municipal Light	500,000	10.00	*125
Brush Illuminating	1,000,000	100 00	70.00
Brush Swan of New England	2,000,000	100.00	25.00
Brush Swan, (Ithaca)	50,000	10.00	
Bay Shore, Elec. Light (L. I.)	8,000	50.00	
Consolidated Electric Light			50.00
Cowles Elec. Smelting & Aluminium.			
Daft	1,000,000	50,000	
Edison Elec. 5s			*99
Edison General			94.00
Edison Illuminating	4,500,000	100.00	95.00
East River Electric Light Co	1,000,000	100.00	80.00
Edison Elec. Light (N. J.)	1,600,000	100.00	
Excelsior (N. J.)	500,000	100.00	
Fort Wayne Elec. Light Co	4,000,000	25.00	10.00
Hackettstown (N. J.)	25,000	20.00	25.00
Hudson Electric Light (N. J.)	100,000	100.00	
Harlem Electric Light Co	250,000	100.00	60.00
Interior Conduit			2.00
Jamaica Gas and Elec. Light (N. Y.).			95.00
Julien			
Law Telephone			
Long Branch Electric Light	50,000	100.00	
Mount Morris 6s. (N. Y)			*95
Mount Morris Electric Light			90.00
Morristown, L. H. & P	50,000	100.00	
N. E. Telegraph and Telephone			51.00
N. Y. and N. J. Tel. and Tel 6s			*par.
N. Y. and N. J. Telephone Stock.		100.00	96.00
North American Phonograph			20.00
Newark, L. & P	150,000	100.00	
Newark, Elec. Light (Schuyler)	100,000	100.00	
North New York, Lighting	150,000	100.00	
Postal Telegraph			
Passaic, Electric Light	15,000	100.00	
Paterson, Electric Light	100,000	100.00	
Peoples, Elec. Light, (Trenton)	100,000	100.00.	
Plainfield, Electric Light	100,000	100.00	
Port Richmond, (S. I.)	100,000	100.00	
River and Rail Electric Co			
Rockaway Beach Elec. Light	50,000	100.00	80.00
Richmond L. H. & P. (S. I.)	150,000	100.00	
Saratoga Gas and Elec Light 6s			*86
Swan Incandescent	800,000	100.00	2.00
Thomson-Houston Electric Co			50.00
United Elec. Traction Co			2.50
United States Electric Co			40.00
United States Illuminating	1,000,000	100.00	70.00
United E. L. & P	5,000,000	100.00	
Westinghouse Electric Co	5,000,000	50.00	25.00
Westinghouse Elec. Co. Pref			50.00
West End, L. (Boston)			21.00
Yonkers, L. & P	50,000	100.00	

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate, but will be found very near the mark.

* Per cent.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
55 KILBY STREET, ROOM 61,
BOSTON, February 6, 1891.

The local wiring and construction companies report February business larger than usual.

The Holtzen-Cabot Electric Company have declared a dividend of four dollars per share, payable Feb. 15.

Col. Burnham, of the Electric Gas Lighting Company, will shortly leave on a business and pleasure trip through the West.

The Hatherly Street Railway Co. have petitioned the selectmen of Abington for a new location, which will give them a direct line between Rockland and Brockton.

The Concord, N. H., Gas and Electric Light Co., has just placed contracts for two large boilers, a 225 horse-power Reynolds-Corliss engine, four new gas purifiers and a building 60 by 38 feet.

Mr. G. W. Wilson, electrical inspector of the Boston Fire Underwriters' Union, has recently been on a trip to Manchester, Nashua and Concord, N. H., doing inspection work for the New Hampshire Board of Fire Underwriters.

Municipal lighting continues to be a subject of debate. The town of Peabody, at a recent special meeting voted to petition the legislature for authority to establish a town and commercial electri- plant. A committee of five was appointed to proc cure counsel and urge the passage of the act.

The adjourned hearing before the railroad commissioners, on the petition of the West End Street Railway Company, for authority to increase the capital stock $4,500,000, which was to have been held Feb. 3, has been postponed to April 20, at the request of the corporation's counsel.

Two new corporations have been organized at Portland, Maine, the Builders' Insulating Tube Co., capital stock $100,000, for the manufacture of insulating devices and the Telecene Company, capital stock $15,000,000, $1,500 paid in, for the purpose of manufacturing electrical instruments.

The Somerville Electric Light Co., elected the following officers at their recent annual meeting: Clerk, H. C. Buck; Treasurer, F. S. Pearson; Directors, W. S. Hooper, J. H. Fletcher, David Cummings, F. S. Pearson, H. M. Moore, R. E. Nickerson, L. E. Merry, G. B. Neal, E. L. Churchill. It was voted to declare a semi-annual dividend of 3 per cent.

The winders of the Thomson-Houston Electric Company, of Lynn, Mass., will give a grand concert and ball on Easter Monday night, March 30th, in that city. Owing to the completeness of the arrangements and to the minute attention paid to every particular and detail, it is expected that nothing in Lynn will surpass it, as no time, labor, or money will be spared to bring it to that ideal.

The Worcester and Millbury Street Railway Company has been formed at Worcester, Mass., with a capital of $150,000, for the purpose of building a line of road from Lincoln square to Millbury, a distance of eight miles. The promoters of the company are some of them connected with the Worcester, Leicester and Spencer road, but the corporations are to be separate. The directors are: G. S. Happin, Hon. Samuel Winslow and ex-Alderman T. M. Rogers, of Worcester; E. D. Morse and Hon. L. L. Whitney, of Millbury; T. T. Robinson, of Dedham, and W. B. Ferguson, of Boston.

Mayor Matthews, Police Commissioner Osborne and the pole rights of the New England Printing Telegraph Company have been the subjects of much discussion during the past week. The last official act of the retired Board of Aldermen was to grant the Printing Telegraph Company valuable pole locations on Tremont street, and the Mayor now charges Commissioner Osborne with being interested in the company and having used the influence of his position in the company's behalf. Gen. Osborne being a State officer, the Mayor has petitioned the Governor and Council for an investigation, and they have taken the matter under consideration. Commissioner Osborne denies the charges and also petitions the Governor for an investigation. The Printing Telegraph Company has not as yet been heard from, but irrespective of its connection the affair promises interesting developments. W. H. M., Jr.

NEW PUBLICATIONS.

LECTURES ON THE ELECTRO-MAGNET, by Prof. Sylvanus P. Thompson. The W. J. Johnston Co., Limited, New York. 273 illustrations; pp. 287. Price, $1.

In February, 1890, Prof. Thompson delivered four lectures on the Electro-magnet before the Society of Arts, London, several abstracts of which were published in the ELECTRICAL AGE during the latter part of last year. These lectures were widely read, and are of extreme value.

This volume is reprinted with the direct sanction of the author, and is the only authorized American edition. It should be in the possession of every electrician and student.

This and every other book on electrical subjects can be obtained of the ELECTRIC AGE PUBLISHING Co., World Building, New York.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION have just issued a very handsome little pamphlet replete with information concerning the Association and its next meeting in Providence, on the 17th, 18th and 19th instants. It contains a great deal of interesting matter outside of the Association's affairs, including a historical description of Providence.

PERMANENT MAGNET.—A piece of iron or steel which acquires and retains the power of acting as a solenoid, is called a permanent magnet, or simply a magnet, and its extremities are also called poles.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., Feb. 6, 1891.

Mr. Sam'l Insull, of the Edison General Electric Company, paid Chicago a visit this week in a business way.

The Bain Electric Manufacturing Company have this week moved into their new factory at 47 and 49 Jefferson street. Mr. Foree Bain, president and engineer of the company, has for some years conducted his business of electrical engineer and manufacturer at 84 Market street, and the new company and enlarged quarters are the outgrowth of his work there.

The meeting of the National Electric Light Association is being talked about considerably and it is likely Chicago will send a large delegation. The hope is also expressed that the association will come to Chicago for its next meeting. Such a plan would, perhaps, be advantageous to the electrical interests in view of the World's Columbian Exposition, as the work of the Exposition will be well under way by that time, and no means should be spared to keep electricity in the foreground.

The record which George Cutter has made by selling the Bryant switches in the West is well known to our readers, and he is still having a steady call for them. As General Western Agent for the Bryant goods he had also found a ready sale for the new Bryant sockets. The factory has been hard pressed to catch up with its orders for the keyless, key and wall sockets, and still the demand for them is growing. Thousands of them have already been sold in the West and many thousands will be sold on their merits this spring.

The following electrical corporations were formed this week: The Marquette Heating and Lighting Company, La Salle, Ill., capital stock $4,500; to furnish heat and light; incorporators, W. E. Berkenbeurl, J. E. Malone, N. Strauss, W. A. Locke, G. A. Wilson. The Electrical Mineral Ore Reducing and Mine Discovering Company, Chicago, Ill.; capital stock, $100,000; for dealing in patents and machinery for discovering and developing mines; incorporators Theodore M. Moe, Martin J. Pendleton, Fred. H. Brown. Universal Motor Company, East St. Louis, Ill., capital stock $20,000,000: for the manufacture of motors and machinery; incorporators, Jerman Kehl, Alex. S. Mann, John Tremlett.

F. M. I.

PHILADELPHIA NOTES.

The largest private electric light plant in Philadelphia is at Wanamaker's great store. There are 550 incandescent and 472 arc lamps in the building.

The new photometer made by Queen & Co., 924 Chestnut street, is meeting with a satisfactory sale, and the excellence and accuracy of the instrument is attested to by all users. In the next issue of the ELECTRICAL AGE will appear a description and illustration of this apparatus.

The firm of Vallee Bros. & Company, situated at 17 North Sixth street, Philadelphia, is fast becoming one of the prominent supply houses in the electrical business in eastern Pennsylvania. There has long been a necessity for a complete electric light supply house in Philadelphia, and the above firm are now bending their energies in this direction with every indication of success. The firm has been in the electrical contracting business for ten years, but have given up this branch entirely and are now making a specialty of lighting supplies. They are special agents for the Bryant sockets, the N. E. switch and are negotiating with a number of prominent manufacturers for the sale of their goods. The Economic incandescent lamp is also a specialty and the large sales made of them during the past month are very strong recommendations of the quality of the lamp, showing that a cheap article is not always popular. The members of the firm, Mr. Garrett A. Vallee, Geo. W. Vallee and H. C. Roberts, are all energetic young men and practical electricians, so that any new things in the lighting line are always sought by them. Electric light men and others interested in electrical pursuits will always find them ready to give the latest in their line the best attention It is needless to say that their aim is to suit purchasers with the best goods on the markets.

H. G. G.

REDUCED RATES TO PROVIDENCE.

The convention of the National Electric-Light Association, which is to be held in Providence, R. I., from February 17th to 19th inclusive, will no doubt attract a large number of persons engaged in the electrical pursuits and those interested in electricity, generally.

On account of this convention the Reading Railroad has arranged to place on sale at its principal stations and ticket offices, tickets to Providence, which will be sold at full rate going, but which will be accompanied by a Trunk Line certificate which will enable the holder to purchase in Providence a return ticket at one-third of the regular fare. In purchasing tickets, care should be taken to notify the agent that it is on account of the Electric Light Convention; otherwise the Trunk Line certificate will not accompany the ticket, and full regular fare would be demanded for the return passage.

Tickets will be on sale from February 14th to 18th inclusive, and the rate from Philadelphia for tickets going will be $6.80 via New York and the all rail route, and $4.75 via New York and the Sound Line Steamers.

The route to New York is via, what was formerly known as the Bound Brook Route, but now a portion of the famous and popular "Royal Blue Line"; justly celebrated for the magnificence and splendor of its equipment and the speediness and prompitude of its train service.

A NEW STREET RAILWAY JOURNAL.

The *Street Railway Review* is the name of a new paper published in Chicago, and devoted to the interests of street railway business in all its branches. It is an excellent paper in appearance, and starts out on its career full of hope. Mr. H. H. Windsor is editor, and F. L. Kenfield Business Manager, and the office of the journal is in the Caxton Building, 334 Dearborn street, Chicago.

INSULATING UNDERGROUND ELECTRIC CONDUCTORS.

At present there is a tendency towards false economy in the matter of insulation of underground wires. A thin covering of the insulating material placed over the conductor, and when new and absolutely perfect the insulation may test higher than is actually essential in practice. But the slightest indentation or abrasion of the covering, such as may easily happen, and does happen, in handling during the process of laying, even if it does not quite expose the copper, leaves such a weak spot that the development of a "fault" there, becomes only a question of time. The insulating covering, of whatever material, should be of reasonable thickness, not so much for the purpose of obtaining an extremely high initial insulation-resistance, as to ensure its maintenance at a fairly good value. Gutta-percha must be used with caution. If not exposed to light and air it is practically imperishable, and it may therefore be used with advantage under conditions which are at all similar to those obtaining in the case of a submarine telegraph cable; but it quickly cracks and perishes if employed in a dry, airy situation. In such cases india-rubber would be preferable; but for underground work pure and simple there is very little to choose between these two substances. With rubber, the copper requires to be tinned in order to protect it against the sulphur which rubber insulation usually contains. Gutta-percha, however, softens at a lower temperature than does india-rubber, and hence is more likely to allow the conductor to become decentralized when heated by the current.

These materials are the best available for insulating purposes, but they are expensive and a large number of substitutes have been introduced. Some of them are fibrous in their constitution, and are impregnated with an insulating oil. Their specific resistances are lower than those of gutta percha or rubber, but this is not a serious drawback provided the coating is sufficiently thick. They are not as a rule impervious to moisture, and require therefore a water-proof covering.

In some instances the temperature at which the compound softens is very high, where the tendency to decentralization is reduced.

ANSWERS TO INQUIRIES.

W. F. P., Richmond, Va. We cannot learn that any such article as magnetic paper is manufactured. Sprinkling with iron filings is the nearest approach to what you want that we know of.

VACUUMS.—Mr. W. Crookes says he has obtained a vacuum of one hundredth of a millionth of an atmosphere, which is equivalent to one-tenth of an inch at the top of a barometer tube 200 miles in height. That would appear to be an almost perfect vacuum: but such is the smallness of the molecules of matter, that, were a small tube containing a centimeter of air exhausted to that extent, there would still be left in it ten billion molecules.

RESISTANCE.—The effect of increasing the size or sectional area of a conductor is to increase its conductivity and, consequently, to diminish its resistance in exactly the same way that increasing the diameter of a pipe increases the amount of gas or water that can be passed through it. The resistance of a conductor varies inversely as its sectional area.

CONDUCTIVITY.—If two equal wires lie side by side, and the current is allowed to flow through them, the conducting power of the double wire will be twice that of either wire taken separately, in precisely the same way that a water or gas-pipe two square inches in section will transmit twice as much as a similar pipe only one square inch in section.

MEASUREMENT.—The amount of attraction or repulsion exhibited by solenoids furnished with their iron cores may be used as a means of measuring current strength, but the arrangement is not a convenient one, owing chiefly to the difficulty in obtaining perfect freedom of motion, the liability of variation in the current strength, and the varying

POWER DEVELOPED.—The electrical power which is being developed in any circuit can be found by simply multiplying together the electrometive force in volts and the current strength in amperes in that circuit, the result being the number of watts of power developed therein, or $w = e\,c$, w being the number of watts.

CURRENT STRENGTH.—By current strength is meant the rate of flow of electricity, and it is measured by the quantity of electricity passing any point in a circuit, during a given time.

ELECTRICITY A CURE FOR NARCOTIC POISON.

296 WATER ST., Dec. 8th, 1890.

JEROME KIDDER MFG. CO.,
820 Broadway, New York.

SIRS: Your catalogue received. Thanks.

I have used your Faradic battery since 1875 and can ascribe several recoveries from narcotic poison to its use.

Yours.
H. P. WENZEL, M. D."

EXTRAORDINARY OFFER.

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PHOTO-ELECTRICITY.

Prof. G. M. Minchin read a short paper before the Physical Society, London, January 16th, entitled "Experiments in Photo-Electricity." As the subject is one of great interest we give the paper as published in a London contemporary:

The author's investigations in Photo-electricity were begun in the year 1877, the object then in view being to endeavor to obtain a solution of the problem of photography at a distance for which he had suggested the name of telephotography.

The author's earliest experiments were made with cells containing strips of silver, as electrodes, coated with collodion or gelatine emulsions of various salts of silver, and also eosine, fluorescine, and some aniline dyes, and immersed in dilute solutions of different salts of sodium, potassium, and barium, and even distilled water, the process being, of course, carried out in darkness. One of the electrodes was completely screened from light, while the other could be illuminated at pleasure. Prior to exposure the electrodes were connected through a Thomson reflecting galvanometer, and the current due to inequality in the plates allowed to subside before exposing to light. On exposing the unscreened electrode to light, a current was set up, the screened electrode being positive in some cases and negative in others, this being determined by the salts employed in constructing the cell. The more highly refrangible rays of the spectrum were found in most of the cells to give the greatest effect, but one in which an emulsion of sulphide of silver and a dilute solution of potassium sulphate was employed was most sensitive to the green rays. When an emulsion of silver bromide and a dilute solution of potassium bromide were used, the effect of passing a current through it from a bichromate cell was found to be a blackening of the immersed portion of the silver electrode connected with the carbon pole, and the immersed portion of the other electrode, though not visibly affected by the current, was turned black by means of the ordinary pyrogallic acid developing solution. Similar results were obtained when a photoelectric cell was employed in place of the bichromate cell.

Some extremely interesting results, however, were obtained with electrodes of ordinary commercial tinfoil, unprepared in any way, immersed either in ordinary tap water or in distilled water. The exposed electrode always became initially positive, but after an interval of time, ranging from a few minutes to some hours, the current was reversed in direction and of greater strength than before, and continued for many days if the exposure to light was maintained. When the surface of the tinfoil was chemically cleaned the cells became completely insensitive to light, showing that the photo-electric effects must be due to the presence of a film of some kind on the surface of the foil.

After a long series of experiments, in which an electrometer was used instead of a galvanometer, the author discovered that a sensitive surface which at once became negative on exposure to light could be obtained by coating the tinfoil with sulphide of tin, and the liquid which gave the greatest sensitiveness was methyl alcohol, prepared from oil of wintergreen. The author then described a method at which he had arrived, after a laborious series of experiments, for producing a sensitive surface, which will become positive on exposure to light. The residual effect after exposure to light takes a considerable time to disappear, but it can be rapidly got rid of by connecting the sensitive electrode with the copper, and the insensitive electrode with the zinc of a Daniell's cell. The volts developed were found to be approximately proportional to the square root of the intensity of the incident light.

One of the most curious effects observed with these cells is that after standing for some time they frequently become insensitive, and the cell can be restored to its full original sensitiveness by a slight tap to its support, or to the table on which it stands. When in the sensitive state a similar tap renders the cells insensitive, and this series of alternating sensitiveness and insensitiveness can be continued indefinitely. Cells in the insensitive state may also be made sensitive by electric sparking in their neighborhood.

The deflection on exposure to light was much smaller when the sensitive plate was in connection with the zinc pole of the Daniell than when connected with the copper pole, and the author, in consequence of this, suggests as a possible explanation of the effect of light on the cells, that it may reduce the amount of oxygen on the films, for when the sensitive plate was connected with the copper of the Daniell the amount of oxygen on it would be increased, while it would be diminished when the sensitive electrode was connected with the zinc.

The author then referred to the so-called "selenium cells," which should more properly be termed "selenium conductors," or "selenium resistances." He stated that last year he first endeavored to construct selenium cells, properly so-called, viz., cells in which an E.M.F. was set up by the action of light. The best effects were produced by means of aluminium electrodes, one of which was coated on one side with selenium and gradually heated until the brown color had been attained. When, however, the aluminium plates were immersed in alcohol they became covered with a gelatinous deposit which made it necessary to find some other liquid, and after many trials *acetone* was found to give the best results. These cells differ from any of the photo-electric cells previously constructed by the author in their great sensitiveness to the light from all parts of the spectrum, the maximum effect being produced in the yellow bordering on the green.

The author, in conclusion, called attention to three problems, towards the solution of which these photo-electric cells might contribute. The first was the construction of a really scientific photometer, for purposes of comparison at any rate. Each light would be spread out into a spectrum, and the intensities of the different portions compared by means of the cells, the intensities of the different portions being proportional to the squares of the observed volts. The principle of Newton's chromatic circle could then be applied to determine the resultant intensity of the light. The second problem was the photographing of objects at a distance, and it was one which there appeared to be no prospect of solving at present, in spite of the startling stories appearing from time to time in the newspapers. The third problem was the direct transformation of radiant solar energy into useful work.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS.

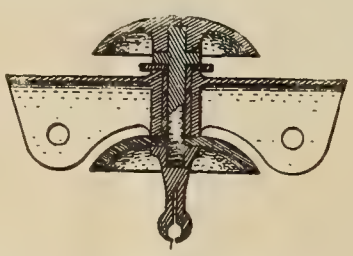
ISSUED FEBRUARY 3D, 1891.

445,538. Electric Signaling Device. Samuel J. Burrell and William H. Markland, Brooklyn, assignors to Charles F. Burrell, New York, N. Y. Filed June 4, 1890.

445,542. Secondary Battery. Henry T. Cheswright, Carcassonne, France. Filed April 14, 1890.

445,545. Non-Interference Signal Box. Moses G. Crane, Newton, Mass. Filed Nov. 22, 1889.

445,546. Electric Arc Lamp. James W. Easton, New York, N. Y., assignor to P. Minturn Smith, Plainfield, N. J., and William D. Perry, Brooklyn, N. Y. Filed Feb. 19, 1890.



NO. 445,594.—ELECTRIC CONDUCTOR SUPPORT.

445,549. Mast Arm for Electric Lights. George Fitch, Sharpsburg, Pa. Filed July 3, 1890.

445,583. Rolling Stock for Tramways or Railways. Charles Zipernowsky, Buda-Pesth, Austria-Hungary. Filed Sept. 22, 1890.

445,593. Motor. Nelson E. Austin, Danbury, Conn. Filed Nov. 4, 1889.

445,594. Electric Conductor Support. Charles Foster and William H. Bevis, Cincinnati, Ohio. Filed July 30, 1890.

445,623. Electric Motor. Francis J. Patten, New York, N. Y., assignor, by mesne assignments, to the Patten Alternating Motor Company of New Jersey. Filed Oct. 6, 1890.

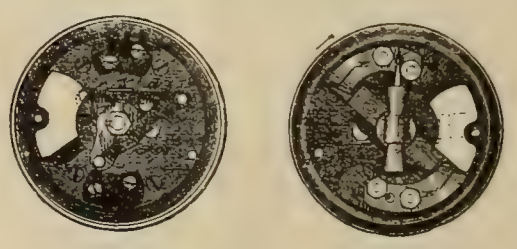
445,624. Electric Motor. Francis J. Patten, New York, N. Y., assignor, by mesne assignments, to the Patten Alternating Motor Company of New Jersey. Filed Oct. 18, 1890.

445,634. Contact Device for Electric Railways. Edward M. Bentley, New York, N. Y. Filed Sept. 20, 1888.

445,636. Electrical Medical Apparatus. Josephus C. Chambers, Detroit, Mich. Filed April 21, 1890.

445,648. Apparatus for Electric Branding. William Cannell, Hartford, Conn. Filed April 8, 1890.

445,653. Electric Semaphore. Frederick Stitzel and Charles Weinedel, Louisville, Ky., assignors to the American Semaphore Co., same place. Filed Dec. 21, 1889.



NO. 445,752.—ELECTRIC SWITCH.

445,654. Regulator for Electrically-Propelled Vehicles. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Oct. 17, 1890.

445,674. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Filed Jan. 14, 1889.

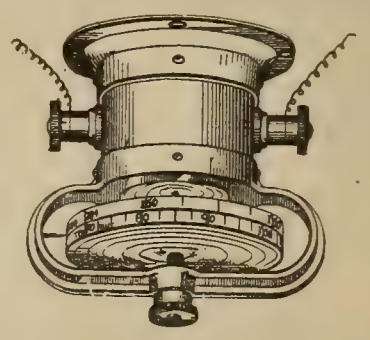
445,686. Cut-out for Incandescent Lamps. Turner D. Bottome, New York, assignor to John B. Tibbits, Hoosick, N. Y., Filed July 25, 1889.

445,687. A symmmetrical Electrical Resistance. Turner D. Bottome, Hoosick, N. Y. Filed Jan 28, 1890.

445,688. Incandescent Electric Lamp. Turner D. Bottome, Hoosick, N. Y. Filed Nov. 8, 1890.

445,715. Autographic Telegraph. Harry Etheridge, Pittsburg, Pa., assignor to the Writing Telegraph Company, New York, N. Y. Filed March 7, 1890.

445,716. Automatic Switch for Autographic Telegraphs. Harry Etheridge, Pittsburg, Pa,, assignor to the Writing Telegraph Company, New



NO. 445,931.—ELECTRIC FIRE INDICATOR.

York, N. Y. Filed Oct. 29, 1888. Renewed July 12, 1890.

445,721. Telephone Box or Cabinet. Benjamin A. Stevens, Toledo, Ohio. Filed May 26, 1890.

445,724. Electric Arc Lamp. Otis C. White, Worcester, Mass. Filed Nov. 7, 1889.

445,727. Electric Gas Lighting Apparatus. Henry H. Cutler, Newton, Mass. Filed May 6, 1890.

445,728. Electric Gas Lighter. Henry H. Cutler, Newton, Mass. Filed Mar. 15, 1890.

445,741. Electric Motor Switch. Franklin A. Weller, Boston, Mass., assignor to William S. Hadaway, Jr., trustee, same place. Filed Feb. 1, 1890.

445,751. Electric Wire Connector. John W. Hoffman, Pullman, assignor to the Pullman's Palace Car Company, Chicago, Ill. Filed Aug. 22, 1889.

445,752. Electric Switch. John W. Hoffman, Chicago, Ill., assignor to the Pullman's Palace Car Company, same place. Filed Feb. 4, 1890.

445,770. Method of Electric Soldering and Cementing Cans. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation same place. Filed Sept 27, 1890.

445,771. Apparatus for Soldering and Cementing Cans by Electricity. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey corporation, same place. Filed Sept. 27, 1890.

445,773. Electrical Station-Indicator. Edwin S. Ely, Chicago, Ills, assignor of one-half to John H. S. Quick, same place. Filed May 28, 1890.

445,790. Insulator. Henry D. Winton, Wellesley. Mass. Filed July 23, 1890.

445,795. Successive Non-Interference Signal-Box. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed Nov. 22, 89.

445,796. Electric Visual Indicator. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed March 7, 1890.

445,797. Repeater. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed April 12, 1890.

445,798. Successive Non-Interference Signal-Box. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed May 16, 1890.

445,800. Successive Non-Interference Signal Box. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed May 31, 1890.

445,799. Non-Interference Signal Box. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed May 29, 1890.

445,801. Successive Non-Iuterference Signal Box. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed Nov. 10. 1890.

445,802. Successive Non-Interference Signal Box. Frederick W. Cole, Newton, Mass, assignor of one-half to Moses G. Crane, same place. Filed Oct. 10, 1889. Renewed Jan. 5, 1891.

445,822. Electric Cut-out. George A. Scott, New York, N. Y., assignor to Sigmund Bergmann, same place. Filed Aug. 13, 1890.

445,841. Coupling for the Trolley Wires of Electric Railways. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Oct. 29, 1889.

445,872. Electrode for Secondary Batteries. Sidney H. Barrett, Springfield, Mass., assignor to the Barrett Storage Battery Company, same place. Filed

445,903. Reel for Raising and Lowering Electric Lamps. John T. Roberts, Fort Scott, Kans. Filed July 26, 1890.

445,906. Dynamo-Electric Machine. Carl J. Schwarze, Brooklyn, N. Y. Filed Oct. 2, 1890.

445,907. Starting Device for Electric Motors. Edward P. Sharp, Boston, Mass. Filed Mar. 18, 1890.

445,908. Trolley-Wire Holder. Edward P. Sharp, Boston, Mass. Filed Sept. 25, 1890.

445,931. Electric Fire-Indicator. Thomas R. Douse, London, England. Filed Nov. 1, 1890.

445,952. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed Sept. 23, 1886. Divided and this application filed Sept. 4, 1890.

445,954. Electric Car-Lighting. Linwood F. Jordan, Somerville, Mass., assignor, by mesne assignments, to the B. G. Electrical Supply Company, Portland, Me. Filed Nov. 16, 1889.

445,957. Electric Switch. George R. Lean, Boston, Mass., assignor to the Bernstein Electric Co., Portland, Me. Filed March 24, 1890.

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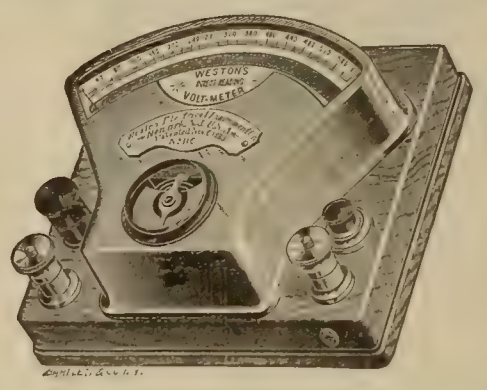
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J. B. TALTAVALL, Bus. Manager.
W. T. HUNT, Manager } Advertising Dept.
R. J. GRAY, Assistant }

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Southwestern Agency.—M. W. RUSSELL, 2633 Market st. St. Louis, Mo.

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NEW YORK, FEBRUARY 21, 1891.

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THE PROVIDENCE CONVENTION.

The ancient city of Providence, R. I., is this week the Mecca of all electric light people and those engaged in kindred pursuits. The meeting of the National Electric Light Association in that city has every promise of being the most successful of all yet held. It will be particularly interesting owing to the fact that, in conjunction with the regular business meeting, will be observed the tenth anniversary of electric lighting. Electric light people have been making great preparations for a proper celebration on this occasion, and there is every promise that this feature of the convention will be of extreme interest and importance.

To properly commemorate the decennial celebration of the birth of this great industry several well-known gentlemen engaged in the electrical profession, in one branch or another, who are regarded as the exponents of the particular department of electricity with which they are identified, have been invited to participate in the celebration as guests of the Association. The Association also invites all pioneer workers in electrical undertakings to participate in the ceremonies by their presence, and by contribution, for publication over their signatures, an account of some interesting episode in their early experience with electrical work. The morning session of the convention on Wednesday, the 18th, will be devoted exclusively to the recitation of such remembrances. It is earnestly hoped that all pioneer workers will improve this opportunity and be present, and also bring with them some reminiscences of the character suggested. It is a proper and fitting occasion for a collection of such historical data, and we hope that the most sanguine expectations will be fully realized. All contributions of this character will be published in the volume of proceedings after the convention, and will thus form a memorial of the beginning of the electrical industries. Let every pioneer renew his youth and live over again the struggles or triumphs of the good old times when he was the first who had ever thought of the thing he was trying to do.

Aside from the memorial features of the convention the programme is full of interest, and many valuable papers will be read by well-known gentlemen. The programme of the convention, and other interesting facts pertaining thereto, will be found on another page of this issue.

The question one hears on every side in the electrical trade at the present time is, "I suppose you will attend the Providence Convention?" and from all indications pretty much everybody concerned in electricity will be there.

A BEAUTIFUL SOUVENIR.—One of the most interesting features of the Providence Convention will be the distribution by the ELECTRICAL AGE, among its patrons and friends, of a valuable and unique souvenir, in the shape of a pure aluminum medal. The medal is the size of a silver dollar and is appropriately inscribed. This, we believe, is the first time that aluminum has ever been used for such a purpose, and no doubt the possessor of one of these medals will treasure it as something of real value and interest. It is an elegant and artistic piece of work, and we have no doubt that our effort to show, in a practical way, a valuable use to which this metal may be put will be appreciated. Our friends will also appreciate the enterprise displayed by the ELECTRICAL AGE in getting up this excellent surprise.

THE MAIN FEATURE OF THIS ISSUE.—The feature of this issue of the ELECTRICAL AGE, the Convention number, is the detailed description and excellent illustrations of the plant of the Narragansett Electric Lighting Company, Providence, R. I. When a person intends visiting some strange city or country he usually reads up in matters cencerning the places he expects to stop at and acquaints himself with all the points of interest in order that he may more thoroughly enjoy and appreciate what he sees. The Narragansett Electric Light Company's plant in Providence, of course, will be a place of interest to all members of the Electric Light Association, and it is with a view to enabling these gentlemen to appreciate what they will see there, that we produce the article in question. Our illustrations were made from photographs, and give some idea of the immense proportions of the plant. One of the views is of a section of the city itself, showing a portion of the harbor. Taking it altogether, this issue of the ELECTRICAL AGE will be of special interest to those in attendance at the convention.

A NEW PRIMARY BATTERY.

Much effort various localitiesis being in made by many electricians and inventors to produce a primary battery that will fulfil every requirement. There are many such batteries on the market to-day, and the good ones undoubtedly have excellent qualities. Each make usually possesses some feature of special merit, which others do not have.

One of the latest productions in this line is the galvanic battery invented by Mr. C. J. Hubbell of this city, and which we describe and illustrate on another page.

One of the objections to a certain class of batteries is the generation of noxious fumes. Mr. Hubbell's battery is of this class, but he employs means for oxidizing the fumes as fast as they are generated. This is accomplished in a novel manner, which is fully described in our article. That the fumes are successfully and completely oxidized is shown by the formula: showing the chemical reactions in the process, as determined by Prof. Prince of the Columbian University at Washington.

Another novel feature of Mr. Hubbell's battery is the manner in which he connects the elements. The terminals of the zinc and carbon electrodes run through the bottom of the cell, instead of being at the top, as is usual, and the porous cup and outer cell are rendered fluid proof at the points where the electrodes pass through by the employment of rubber washers. Mr. Hubbell claims some advantages in his underneath method of connection.

By another device Mr. Hubbell renders his battery cells fluid tight on top, which makes the battery a perfectly portable one. There is no danger of spilling of fluids.

One of the special applications of this battery is for miners' use, and an illustration of such an apparatus is given with the others. The miner's outfit is small, light and convenient, and it is remarkable how well four small cells arranged in this way sustain a three c. p. incandescent lamp.

Mr. Hubbell claims great efficiency for his battery, and if he gets the electrical energy he claims he does, at so low a cost, he will find a ready market for his goods.

COMPOUND DYNAMOS.—If the field magnet of a dynamo machine be wound with two coils, one of fine high resistance wire coupled direct to the brushes, and the other of stout low resistance wire, coupled in series with the brushes and the external circuit, and the latter be open, no current passes through the main or series of coils, and the magnetism of the machine is entirely due to the exciting power of the shunt coils. If the machine is properly designed, this amount of magnetism should produce an internal electro-motive force exactly equal to that which it is desired to maintain at all currents in the external circuit, provided the dynamo is driven at a constant speed. If a current is permitted to flow through the armature, the electro-motive force measured at the brushes is naturally somewhat less than that created within the armature coils, on account of losses through resistance and self-induction, the loss increasing with the current. To compensate for this loss it is necessary to increase the internal electro-motive force, and this is accomplished by an increase in the strength of the magnetic field. This is brought about automatically by the main current itself, which assists the shunt current in exciting the field magnets. In a correctly compounded machine the increase of magnetization due to the main coils is sufficient, and no more than sufficient, to keep the external electro-motive force constant at all currents which can safely be passed through the machine. We say the machine is accurately compounded for constant terminal pressure.

NEW PUBLICATIONS.

The Thomson-Houston Electrical Company have just issued a volume 10 x 13 inches in size, bound in buff cloth, containing maps of the United States showing the central station plants and electric railways and systems now in operation. These maps have been prepared from data collected from original sources by a thoroughly disinterested person. The compilation of this volume has proved to be a work of the most engrossing character, and it is believed that it is as nearly correct in every particular as the changing character of the electric light business at this time will permit, and it is thought this publication will prove of permanent and practical value to all interested in the electric lighting and electric railways. The most populous states are represented by maps by themselves on a page, and the various systems of central station and electric railway plants are designated by certain symbols. The work will be found extremely valuable to those interested, and in addition to the electrical information an accurate map is given of the various states, which will be helpful in many ways. The Thomson-Houston Company deserve the thanks of the electrical fraternity at large for the successful result of their work.

The Edison General Electric Company have just issued Circular No. 1, descriptive of the electric percussion drill (Marvin's system of percussion tools) as manufactured by the Edison General Electric Company. It contains an illustration of this machine.

THE PLANT OF THE NARRAGANSETT ELECTRIC LIGHTING CO., PROVIDENCE, R. I.

THE CITY.

Providence, the place of the 13th meeting of the National Electric Light Association, is the second city in size and commercial importance in the New England States. It has a population of 132,000, and is at the head of navigation of Narragansett Bay, 35 miles from the ocean. It is about 178 miles from New York by rail and 44 from Boston. The city is divided into three parts by two small rivers which unite in the centre of the town.

PLACES OF INTEREST.

Among the most notable buildings are the City Hall, built of granite, completed in 1878, at a cost of $1,050,000; the Narragansett and Dorrance hotels, the Butler Exchange, the Arcade, the Library building, Sayles Memorial Hall and Slater Hall.



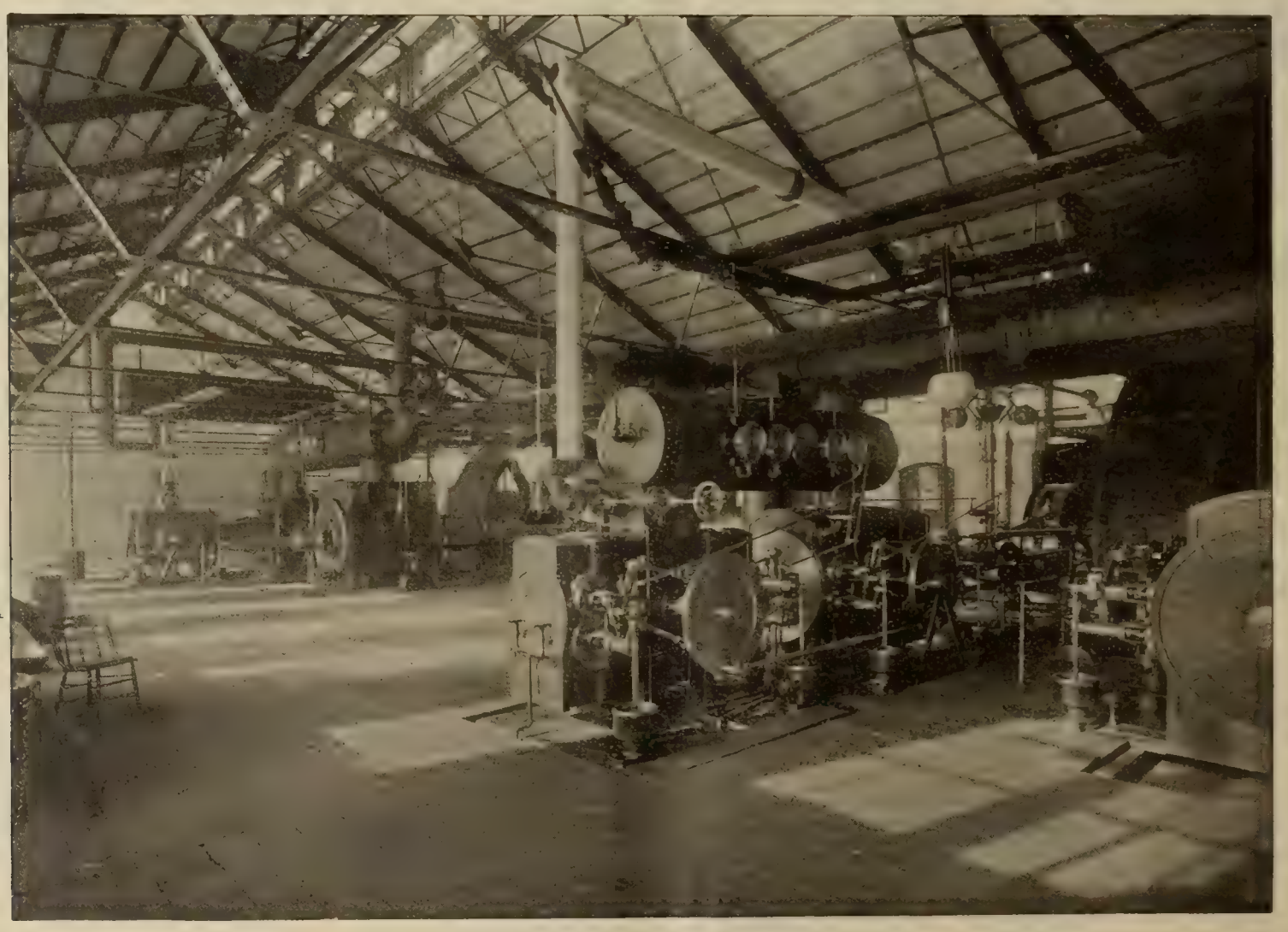
DYNAMO ROOM OF THE NARRAGANSETT ELECTRIC LIGHTING CO., PROVIDENCE, R. I.

MANUFACTURES OF PROVIDENCE.

The principal manufactures of Providence are jewelry, woollen goods, machinery, worsted goods, cotton goods, etc.

THE NARRAGANSETT ELECTRIC LIGHTING CO'S PLANT.

One of the most important and extensive industries in the city at the present time, and the one which will interest the members of the convention more than any other, is the extensive plant of the Narragansett Electric Lighting Company, several views of which, and one of the city, accompany this article.



ENGINE ROOM OF THE NARRAGANSETT ELECTRIC LIGHTING CO., PROVIDENCE, R. I.

Providence was settled by Roger William in 1636; was incorporated as a town in 1649, and as a city in 1832. The city has long been noted for its elegant residences, with beautiful and extensive grounds.

ORGANIZATION.

The present company was organized September 1, 1884, but the lighting plant had been in operation three months previously. The original plant was installed by the American Electrical Illuminating Company, and consisted of one dynamo, less than one mile of wire and nine arc lamps. Since the present company came into control the plant has been constantly and rapidly enlarging, until now it is one of the finest in the country. It is complete in every detail and is a credit to the city in which it is located, and a monument to the enterprise and energy of its incorporators.

LIGHT AND POWER DEPARTMENTS.

The capacity of the present plant is 1,450 arc lamps, fed by Thomson-Houston arc dynamos. Of these lamps 1,299 are installed and in service exclu-

sive of those employed at the station. The incandescent department comprises 10,000 lamps installed on the Westinghouse Alternating System; the capacity of the Westinghouse machines being 10,500 lamps. All of the incandescent lamps are on meters.

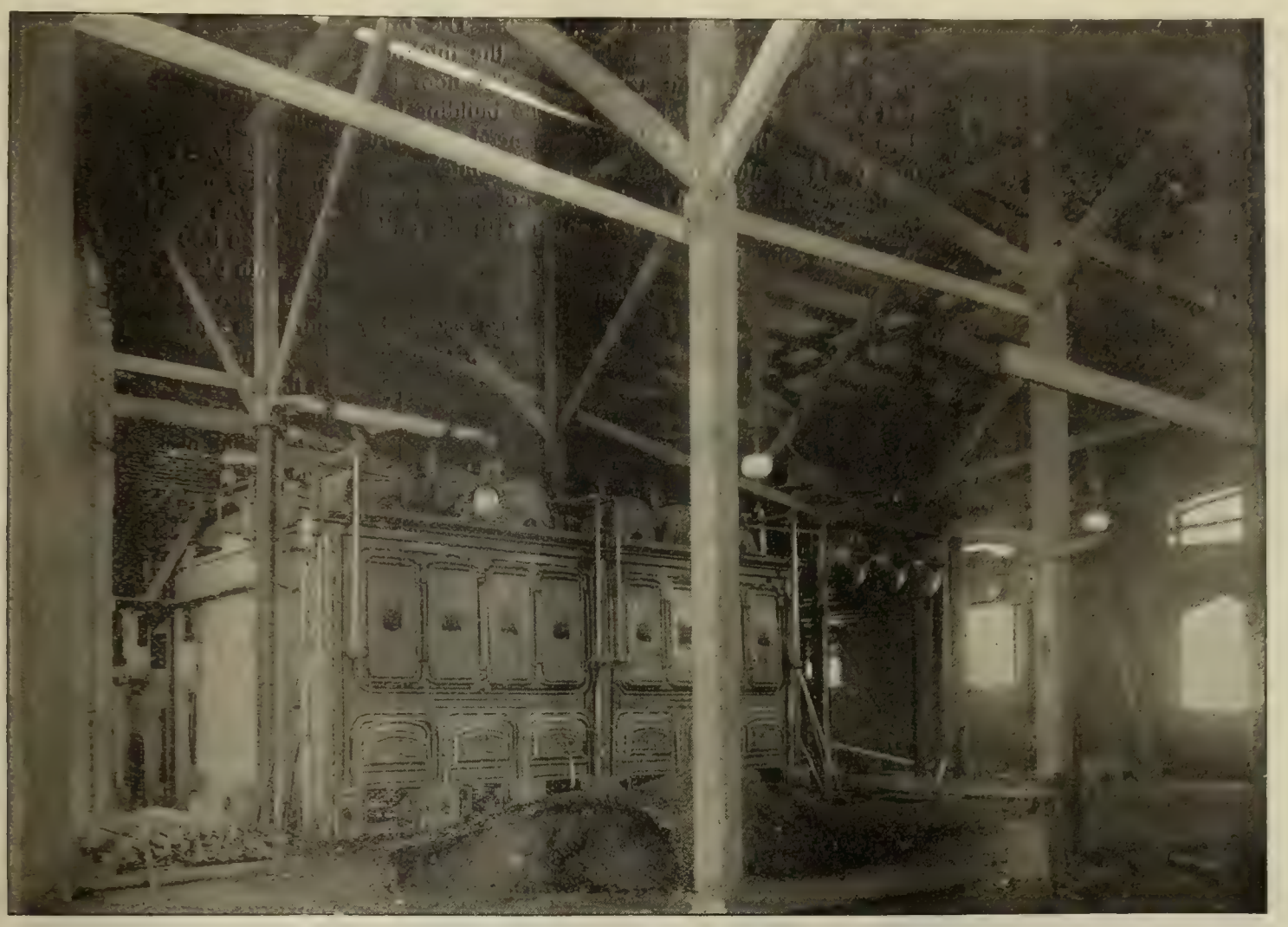
The company operate a large power supply plant, and have installed 88 motors, which aggregate 229 horse power. Thomson-Houston Power Generators are used in this department. The motors vary from ⅛ to 35 horse power.

engines of 500 and 1,500 horse power respectively, and one Armington-Sims engine of 200 horse power. The Reynolds-Corliss engines are of the triple expansion type, and have shown an efficiency of 12.9 pounds of water per horse power. They are designated No. 1 and No. 2, and were built by the E. P. Allis Company, Milwaukee, Wis.

The following data with respect to these engines will be of interest. Both have a piston stroke of 48 inches and a speed of 100 revolutions per minute.

the one on engine No. 1 having a 45-inch face, and that of No. 2 having a 73-inch face.

The surface condensing apparatus consists of circulating pumps 16″×16″ stroke; air pump, 24″ diameter×16″ stroke, and engine with cylinder 12″×16″ stroke.



BOILER PLANT OF THE NARRAGANSETT ELECTRIC LIGHTING CO.

The total indicated horse-power of engine No. 1, shown during a test on July 13, 1890, was 532.1, and the average steam pressure during the test was 125 lbs.



VIEW OF PROVIDENCE, R. I., FROM CHIMNEY OF THE NARRAGANSETT ELECTRIC LIGHTING CO.

DYNAMOS AND ENGINES.

There are 32 Thomson-Houston and Westinghouse dynamos in use at the present time for lighting, and the power is supplied by 7 engines, comprising Reynolds-Corliss, George H. Corliss and Armington & Sims machines. At the company's new station they are using two Reynolds-Corliss

The diameters of the three cylinders of each engine are as follows:

	High Pressure.	Intermediate.	Low Pressure.
Engine No. 1 (500 h. p.)	14 in.	25 in.	35 in.
" No. 2 (1500 h.p.)	21 "	36 "	50 "

The steam pressure used is 135 lbs., and the flywheels of both engines have a diameter of 16 feet;

The number of bricks used in the building of the engine foundation was 230,000.

The auxiliary engine, made by Armington & Sims, has a speed of 192 revolutions per minute. The cylinder is 16″×24″ stroke, and the power of the engine is 200 horse-power.

BELTING.

The belt on the 1500 h. p. Corliss engine is 72 inches wide, 125 feet long, 3-ply, and is said to be the heaviest in the country. It travels at a rate of a little more than a mile in one minute when running at its normal speed, and it was supplied by Fayerweather & Ladew.

THE STEAM GENERATING PLANT.

The steam generating plant consists of six boilers built by the National Water Tube Boiler Company, and Babcock & Wilcox Company. Two boilers of the former company's make are used at the Elm street station, where two of the Babcock & Wilcox make are now being put in.

The boilers are each 16 feet in length, and battery No. 1 has 162 tubes of 4 inches in diameter; battery No. 2, 144 tubes of the same diameter, and battery No. 3, the same as No. 1. The Locke Damper Regulator is used by this company.



VIEW OF STATION OF THE NARRAGANSETT ELECTRIC LIGHTING CO.

DYNAMO, ENGINE AND BOILER HOUSES.

The dynamo, engine and boiler houses are separate and are 200x60, 200x57 and 125x72 feet respectively.

The first of the 216 spruce piles (the caps of which are of hard pine 12x12 inches) used for the dynamo house was driven August 14, 1888. The dynamo house is 17 feet high in the clear, inside, with a floor 12 feet 3 inches above high water. The roof, made by the Berlin Iron Bridge Company, of East Berlin, Conn., is of iron, and covered with J. T. Henthorn's patent roof covering, consisting of asbestos board and asphaltum paper on a foundation of galvanized iron netting, and the whole covered with No. 24 corrugated iron. The Berlin Iron Bridge Company also made the iron girder. The crane was designed by Remington & Henthorn, and the trolley and supports were made by Beaman & Smith, of Providence. The walls of the building are 20 and 16 inches in thickness.

The roofs and roof coverings of the engine and boiler houses are similar to that of the dynamo house and were made by the same firms.

Forty feet of the engine house is at present used as a store house and stock room. The foundation, side and end walls are made of concrete.

The boiler house is made of brick, 613,300 of these being used in its construction. The brick work is 26 feet 1 inch in height, and the thickness of the walls is 36 and 32 inches. The floor is 4 feet 8 inches above high water. The building is in two sections, the first being commenced on February 9, 1889, and finished six months later. The building of the second section was not started until August 18, 1890, but by December 24th the entire work was completed.

THE CHIMNEY.

The chimney is a massive structure 250 feet 7 inches to the top of the brick and 257 feet 10 inches to the top of the cap. Its base is 28 feet 6 inches square and the diameter of the flue 14 feet. The first of the 350 piles under the concrete foundation, which is 48 feet square and 6 feet 9 inches in thickness, was driven in August, 1888. The brick-work was started May 31, 1889, and by November 29th 63 feet in height had been laid. On April 22d, 1890, when the spring had fully opened, the brick-work was resumed and was completed to receive the cast-iron cap by October 4th, 1890. There were 1,324,600 bricks, 695 barrels of lime, 1,025 barrels of cement, 98 barrels of soap-stone coloring and 3,793 barrels of sand used in the construction of this immense chimney. The weight of the wrought iron work is 7,309 pounds, and the cast iron, including the cap, 21,500 pounds. The cross-section of the chimney is octagonal, except at the base.

COST OF LIGHT TO CONSUMERS.

The price of lighting has been reduced fully 50 per cent. since the company started, the last reduction in price being in the incandescent department, where the lamps which had been sold to customers at cost to the company—about 60 cents—were reduced to 15 cents each, making a total reduction of about 15 per cent. on lighting bills. The price paid by the company is the same as formerly, they sustaining the loss.

INSULATORS AND BRACKETS.

The company recently discarded the use of blocks and rubber hooks for attaching wires to buildings, using iron brackets with glass insulators exclusively. For pins to hold the insulators in cross arms they use a special coach screw made to their order, with small heads and short threads, which is cemented into deep groove double petticoat insulators with plaster of paris. They have adopted the deep groove double petticoat glass insulators for all purposes and tolerate no other kind on their premises. In further explanation of the iron pins used in their cross arms, it may be added that by screwing these pins very tightly into the wood it prevents oxidization and keeps the water from entering the arm and rotting it out, a trouble often experienced with wooden pins.

POLES AND WIRES.

The Narragansett Electric Lighting Company's out-door plant consists of about 1,650 poles, nearly all of which are hard pine, and 300 miles of conducting wire.

OFFICERS OF THE COMPANY.

The officers of the company are: Harvey E. Wellman, President; Marsden J. Perry, Vice President and General Manager; D. A. Peirce, Treasurer and Secretary; V. A. Thomas, Superintendent.

A RELIABLE AMMETER.

A reliable means of measuring the electrical current has been the desire of all electrical engineers, with the result that instruments are now manufactured embodying all manner of principles, but it remained for Mr. Geo. W. Walker, of the Walker Electric Company, 50 Broadway, New York, to devise a meter consisting of as few and as simple parts as any we have heretofore seen.



THE WALKER AMMETER.

It consists of a non-magnetic tube supporting a coil of wire wound thicker at one end than at the other, giving it the appearance of a tapering helix, with a nearly circular core of partially hardened iron, carried upon a bar pivoted at the centre of the instrument on jeweled bearings. Upon the same centre is a needle or pointer extending outward beyond the core to the reading scale, and a small balancing arm bearing a small weight threaded so that it may be adjusted to bring the pointer to zero, if desired, when the instrument is not in use.

The peculiar winding of the solenoid, together with the small partially hardened core and the jewelled bearings, allow of practically uniform space readings.

The delicacy and accuracy of operation of this ammeter, reading in fractions of any ampere, will be fully appreciated by those who try them.

By using fine wire in wiring the solenoid. the instrument is changed into a voltmeter.

The instrument is accurate, durable, simple and cheap, and is giving the best of satisfaction wherever used.

On account of its simplicity it does not get out of order, and is always reliable.

The Walker Electric Co. are putting out a great many of these instruments, as well as their electric meters.

THE PRACTICAL APPLICATION OF ACCUMULATORS.—A CENTRAL STATION PLANT.

BY E. V. BAILLARD.

At the Waterloo Electric Company, Waterloo, N. Y., is an accumulator installation, consisting of 63 cells each of the "15L" type accumulators, manufactured and installed by the Accumulator Company, of New York. These batteries are operated in conjunction with two Edison 300 ampere dynamos on the three wire system, and have each a capacity of 300 ampere hours, with an available E. M. F. of 126 volts. The cells are placed on trays with porcelain insulators, and arranged on racks painted with P. & B. compound in a well ventilated room adjoining the engine and dynamo room. The wires from each series are brought to a common switchboard in the engine room, where the various combinations can be readily effected. In each series is included an ammeter, showing not only the amount but also the direction of the current. a rheostat of .6 ohm resistance which serves to regulate the respective rates of charge and discharge of each series and a switch wherewith one or more cells can be cut in or out of service. By an ingenious arrangement this is accomplished without either breaking the current with consequent fluctuation of the lights, or short circuiting any of the cells. From these switches start two double conductor flexible cables in rubber tubing, terminating in two double pole plug switches which practically constitutes the two terminals of each series.

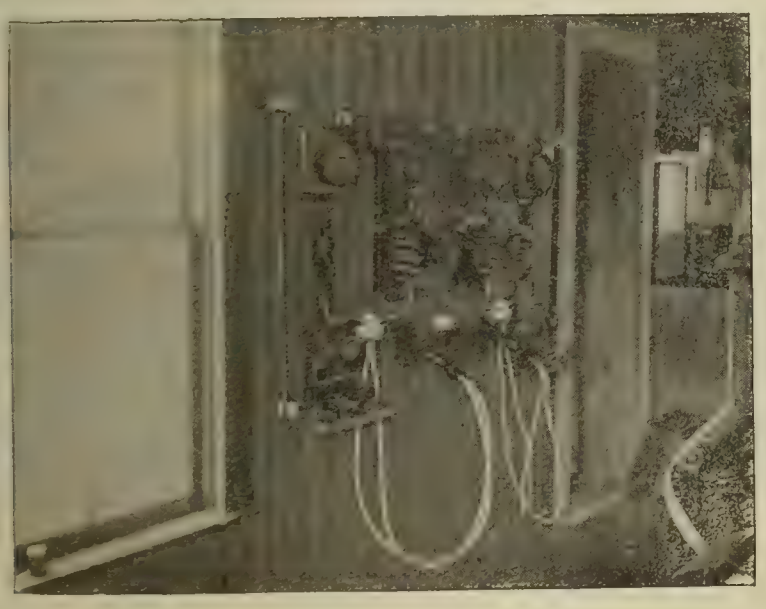
These plug switches are then inserted in either one of two double pole receptacles which are connected through a two way switch shown at each side of the switchboard (Fig. 1) to the "bus" wires of the station. When these two way switches are in one position, the current can pass direct to the feeders, and are usually so placed when the battery is discharging. When these switches are turned down as shown in the cut, the current is made to pass through automatic break switches placed directly underneath, by which the circuit to the dynamo is closed through the mercury cups. This is the path for the current when charging. If through any mischance the E. M. F. of the dynamos should fall or the dynamos cease generating current these switches automatically break the circuit, thereby preventing the battery current from "going back" on the dynamo to the detriment of both. It will be seen that this mode of installation enables either set of batteries to be connected to either side of the three wire system, interchangeably, that only one can be used if desired, or both on one side only, or on both sides, thus giving the plant great flexibility.

There is also a connection to the neutral wire so the battery can be made to supply or take up any difference between each side.

The end which it was desired to attain by the use of the storage batteries was to supply constant service without necessitating a double or even a triple force of men, and constant running of the machinery, which it was evident could not be accomplished without running at a loss for the greater part of the twenty-four hours. Before their introduction it was customary to start the dynamo some time in the afternoon, as the length or darkness of the day demanded, and run till midnight when the station was shut down. This was very inconvenient for the consumers, in a hotel, for instance, where the guests would be interrupted while reading or in a game of billiards, and recourse was had to oil lamps. The consequent ejaculations can better be imagined than described.

Besides, many would have been customers had they been able to depend on current for the twenty-four hours for running motors, occasional lights, etc.

After the batteries were installed, the hours of running the machines were not changed. The batteries were charged during the regular hours of running, and at midnight, when the station was shut down, the battery was left to take care of the supply for lights, fans, printing presses, etc., till nex



SWITCHBOARD OF THE WATERLOO ELECTRIC CO.



THE WATERLOO ELECTRIC CO'S ACCUMULATOR PLANT.

afternoon, the only additional expense for this service being the extra consumption of fuel, which was necessarily a minimum, for the machinery, running at a point nearer its maximum output, was working at a higher efficiency while running, and the cost per unit power was proportionately less. There is also the satisfaction of knowing that in case of any accident the batteries can supply lights pending the necessary repairs and the service is not interrupted. When the output of the station has slightly outgrown the capacity of the dynamo, the batteries can supply the deficiency during the hours of heavy load.

This plant has been in successful operation since the day it was started, October 5th, 1888, and has given no trouble whatever.

The writer had occasion to visit it a few months ago and found everything in excellent trim; the plates did not seem to have deteriorated in the least, notwithstanding very severe usage, and had never required any repairs.

Last week the Accumulator Company received a letter from Mr. Mercer, treasurer of the Waterloo Electric Company, in which he said that the accumulators were working all right, had practically cost them nothing for maintenance, and were apparently in as good condition as when first started, and were in constant use.

The necessary cleaning, watering and general attention to the cells is easily attended to by one of the firemen without in any way interfering with his other duties, and the switches are operated by the dynamo man when the machinery is running. When the machinery is stopped no attention whatever is required.

From the operation of this plant it is evident what a valuable adjunct to a central station the accumulators are; in fact, a central station cannot be considered complete without such an installation, and whenever installed and treated as at the above plant, the same degree of success will always be attained.

HEAT.—The law of the conservation of energy teaches us that force is indestructible, and it follows, therefore, that if energy has to be expended in impelling a flow of electricity against a greater or less amount of resistance, the equivalent of that energy mast be developed in some other form. This other form is usually heat; or, in other words, when



THE WATERLOO ELECTRIC CO.'S DYNAMO PLANT.

a body opposes a certain amount of resistance to the passage of electricity, heat is produced. the actual amount of heat being an exact counterpart of the energy expended in overcoming the resistance, and varying therefore directly as that resistance.

A NEW GALVANIC BATTERY.

Mr. Charles J. Hubbell, of New York City, has recently brought out a galvanic battery, which is, from all reports, remarkable for its efficiency. It has many unique features, and tests already made seem to substantiate Mr. Hubbell's claim that he has a battery of real merit.

Mr. Hubbell has recently received letters-patent on his improvements, of which we give below an extended description, which we think the value of the improvements justify. Illustrations are also given to aid in a better understanding of the invention and its applications.

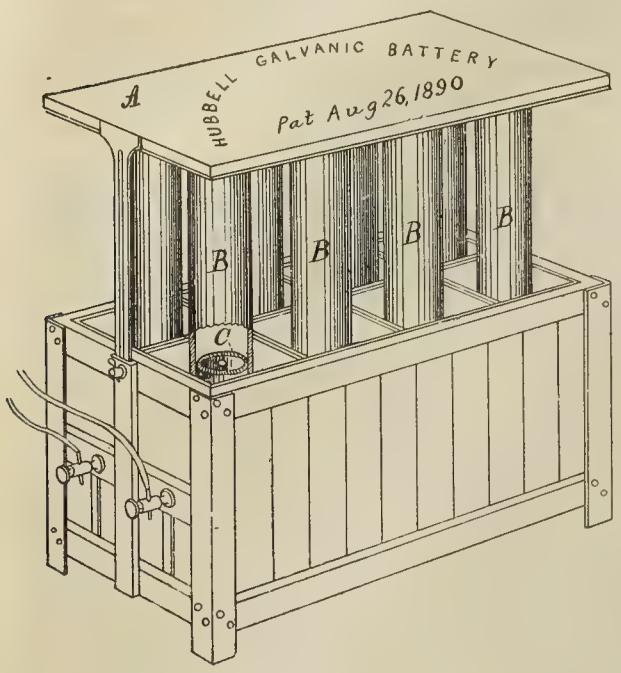


FIG. 1.—HUBBELL'S GALVANIC BATTERY.

The objects of Mr. Hubbell's invention are, 1st, to avoid the exhalation of noxious fumes; 2d, to prevent the admixture or assimilation of the two fluids, which always occurs in two fluid cells when the battery remains inactive for a comparatively long period of time. Mr. Hubbell accomplishes this result by temporarily cutting off communication between the two fluids.

Another object of the invention is to facilitate the grouping of the cells and to simplify and cheapen their construction.

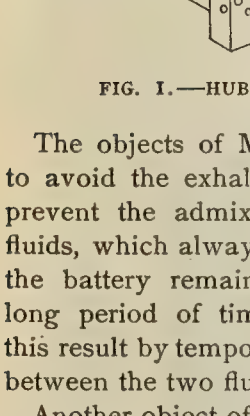


FIG. 2.

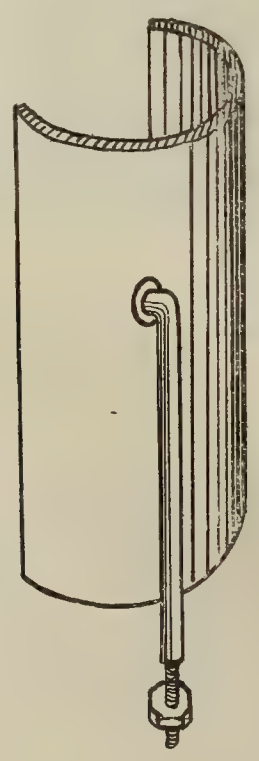


FIG. 3.

The elements used in Mr. Hubbell's battery are zinc and carbon, the latter being placed in a central porous cup. The terminals of the carbons and zincs are carried through the bottom of the cells instead of the top, as is usual, and there the connections are made with as great facility as if they were on top. The cells are rendered fluid-tight by means of screws and washers, about which more will be said further on.

The porous cup contains a solution of nitrate of soda and acid, while the solution outside of the porous cup consists of dilute sulphuric acid.

Fig. 1 represents a group of 8 cells of M. Hubbell's battery. The cover A shown in the illustration, can be raised or lowered at will. It will be noticed that attached to the cover are several tubes of insulating material, B, which fit over the porous cups, C, when the cover is depressed. The cylindrical cover nearest the observer is broken away to show the relative positions of the porous cup and the tube. These tubes or cylinders are made of fibrone or other similar material, and when the cover is depressed to its lowest level the porous cups are entirely enclosed within the tube. This, Mr. Hubbell claims, absolutely prevents any local action when the battery is not in use.

As already stated, one of the objects of Mr. Hubbell's invention is to avoid the exhalation of noxious fumes. He does not prevent the formation of the fumes, but provides means for absorbing and oxydizing them. This he accomplishes by attaching to the under cover of the lid a porous sack or pad, filled with asbestos or mineral wool. This pad is charged with bichromate of potash and the fumes arising from the action of the battery are conveyed to and brought into contact with the pad saturated with the bichromate of potash. The result of this is to oxydize the fumes completely as will be shown by chemical formula later on.

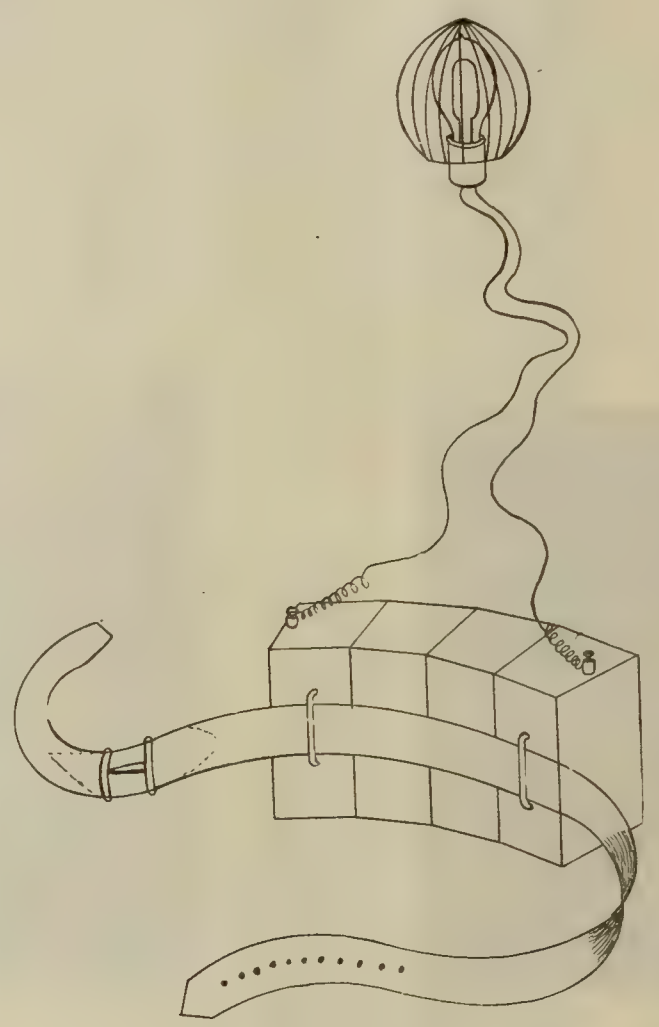


FIG. 4. MINERS' LAMP OUTFIT.

When the lid is depressed the pad rests on top of the porous cups, and the latter are completely covered on their exterior by the tubes, B, shown in Fig. 1. These tubes are of such length that when the cover is elevated to its highest point the bottom of the tube is about one inch lower than the top of the porous cup. Thus, it will be understood, the tops of the porous cups are never, in practice, exposed to view.

Fig. 2 represents the method of running the carbon through the bottom of the porous cup. It will be noticed that at the lower end of the carbon is a socket of brass, *d*, in which the carbon, *e*, is fitted tightly. The other end of the brass socket terminates in a screw, *f*, which protrudes through and below the bottom of the porous cup and cell.

By the use of a nut, *g*, and a washer of some insulating material, *h*, the brass socket holding the carbon is screwed tight to the bottom of the porous cup, and at the same time rendered fluid-tight. The brass portion exposed to the acid in the porous cup is insulated.

Fig. 3 shows Mr. Hubbell's method of attaching the electrode to the zinc element. He forms the connection at the centre of the zinc, as shown in the figure, instead of on the top edge as is usually done. Mr. Hubbell claims that by this method of connection he recovers in electrical energy a great percentage of the energy of the zinc, and there is absolute freedom from local action.

Both the zinc and carbon electrodes are, of course, brought through the bottom of the box and the connections are made and varied in the usual way, the only difference being that the terminals are underneath instead of above the cells. On account of the box cover already described it would be impracticable to have the terminals on top. The connections are easily and quickly made.

Prof. E. T. Fristoe, Dean of Faculty and Professor of Chemistry, Columbian University, Washington, D. C., reports as follows concerning the action of the pad used in Mr. Hubbell's battery:

"The fumes given off at the carbon pole have the following composition: $N_2 O_4$, or, as some have it, NO_2.

"Now, when the gas comes in contact with any oxydizing agent such agent is decomposed, and when water is present nitric acid ($H NO_3$) is formed. If the oxydizing agent contains any bases then salts of nitric acid are formed. Take, for instance, bichromate of potash $K_2 Cr_2 O_7$ then $K_2, Cr_2, O_7 + N_2 O_4 + (H_2 O)_3 = Cr_2 (H O)_6 + (K NO_3)_2 + O_2$. This would be the theoretical action, but in practice some chromic nitrate might also be formed, all of which would remain in the pad above. The standard size of the cells is three inches square by six inches deep, and are supplied eight in a box. Such a battery is very portable and fluid tight. Already charged the eight cells and box weigh twelve pounds, and the E. M. F. developed is sixteen volts. When the cells are in good condition the average current is seven and a half amperes. They will sustain a six c. p. standard incandescent lamp for fourteen hours at a cost of four cents for the entire period.

One of the most useful and important applications of this battery is for mining purposes. Mr. Hubbell is designing a battery and lamp outfit to be carried by miners in their work. Figure No. 4 is an illustration of this outfit comprising four cells of battery, conducting cord and miner's lamp, the latter of which, of course, is placed on the miner's hat in the usual way. The cells of the miner's battery it will be noticed, are not exactly square, but are thinner at one face than at the opposite. The purpose of this is to give a slight curvature to the combined cells, in order to conform to the shape of the back of the wearer. The cells are strapped around the waist by means of a belt, as shown in the illustration, and the current is conveyed to the lamp through a conducting cord. The dimensions of this battery are two inches in width, six in depth, and seven inches across the curve from end to end; and when charged it will sustain a three c. p. incandescent lamp for twelve hours. When charged it weighs three and a half pounds. The cost for one charged for the entire period of twelve hours is but 1½ cents.

SHAVER TELEPHONES IN VIRGINIA.—The Charlotteville (Va.) Shaver Telephone Company has been organized for the purpose of erecting a Shaver molecular telephone plant. Work has been carried forward with considerable vigor and enterprise, and the system will be completed by February 28th. This exchange when finished will be the largest of this class yet constructed. There will be eighty-five stations in the system, and the wires will run to Lymans, Fry Springs, University of Virginia, Observatory, and other points. Of the 85 subscribers 48 have already been connected up, and they are well pleased with the working of their instruments. Mr. L. F. Hankel is president of the company, and Mr. W. A. Lankford, manager, secretary and treasurer. The capital stock of the company is $30,000. Mr. W. A. Lankford is the leading spirit and controls the Virginia State rights for the Shaver system.

PLATINUM.—It is reported that platinum ore has been found in Australia containing nearly 160 pounds of that metal to the ton. Much energy is put forth in many directions with a view to discovering new platinum mines, so as to bring down the price of that precious metal, which is so indispensable in electric lamp manufacture.

ASSIGNED.—It is stated that the United Electric Equipment Company, of Philadelphia, has just made an assignment in favor of Henry M. Almy, of that city.

ELECTRIC POWER IN A HOTEL.

The most marvelous property of electricity is its flexibility of application. It can be taken to localities in large or small quantities and transformed into light, heat, or power as desired where it would be impossible to use other forms of energy.

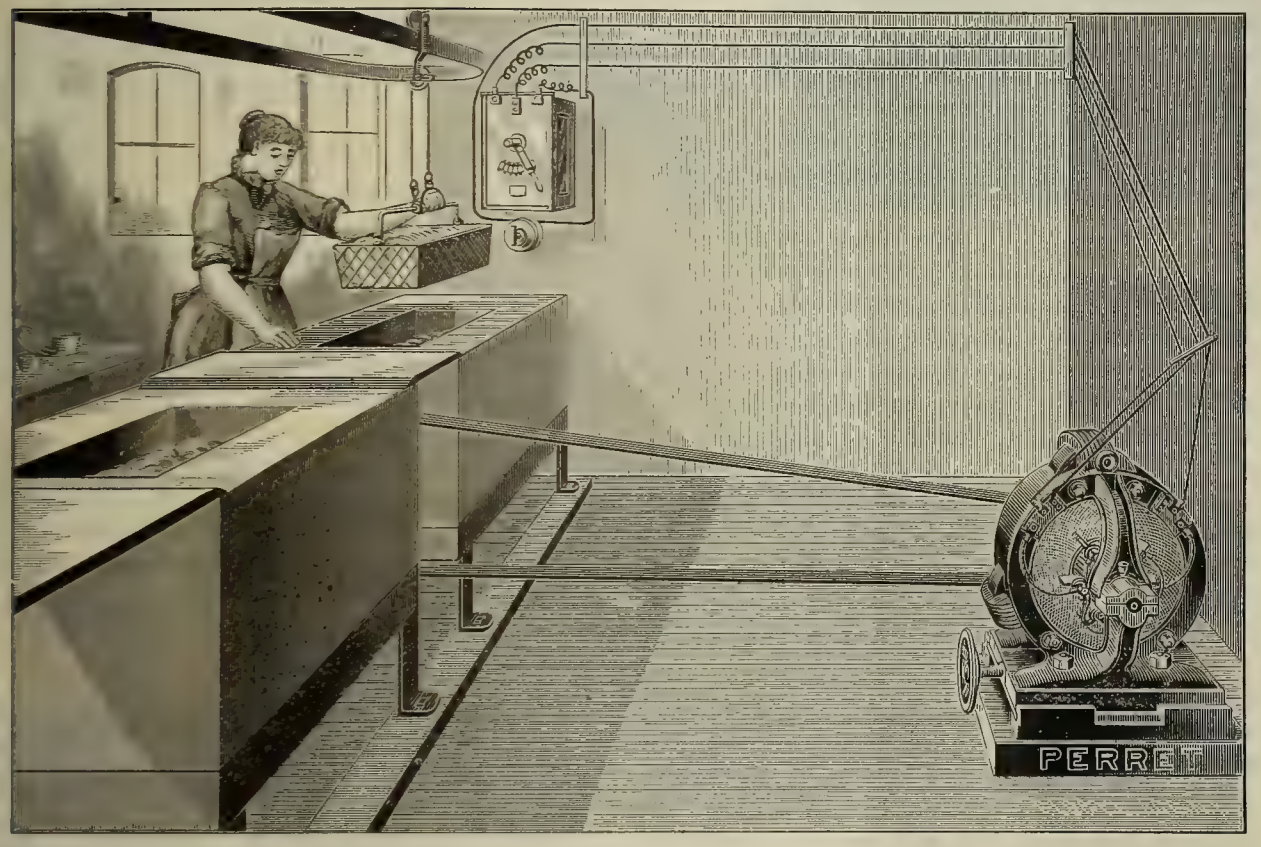
There is no other known power that is so serviceable to man as this subtle force. It is by far his most trusty and submissive servant. It will do any sort of work, and do it well and with very little fuss or noise.

There is no end to the applications of electricity, every day bringing something new before the public. All sorts of work, light and heavy, is being performed with the greatest ease, and its field of application is extending rapidly in every direction.

In the household it is a most valuable servant. Taken into the kitchen it can be made to do a large share of the drudgery.

Captain Tumbridge, proprietor of the St. George Hotel, corner Hicks and Clark streets, Brooklyn, who recently introduced electricity into his hotel, uses it for other valuable purposes than lighting.

Among the many uses to which he puts this power is driving the washing, drying and ironing machinery in the laundry with a 10 h. p. slow speed Perret electric-motor; scouring knives with a 1 h. p. motor of the same type, which also runs a fan for ventiliating the kitchen, and driving a very successful dish-washing machine devised by Mr. Tumbridge, with a 4 h. p. Perret motor.



ELECTRIC DISH-WASHING PLANT IN THE ST. GEORGE HOTEL.

The dish-washing machine consists of two tanks shown in our illustration, with four screw propellers in each which agitate and drive the water upon and between the dishes which are swung around in an open cage from an overhead track, the cage dipping into one tank filled with boiling water where they are thoroughly cleaned, then into the other where they are rinsed off, the whole process requiring but one minute of time. The dishes are washed cleaner and one man does all the work. From 9,000 to 10,000 pieces are washed in a day.

The speed of the motor is 600 revolutions a minute and is started and stopped by a hand-switch at the dish-washing machine.

The motors have self-feeding brushes which show no perceptible sign of wear after being in use four months. The self-oiling bearings require a fresh supply of oil but once a week.

The 10 h. p. electro-motor displaced an old style 15 h. p. upright engine.

The current for the motors iss upplied from dynamos in the hotel engine room.

In this connection it will be of interest to state that a few months ago fire was discovered in a room near the motor which is used for running the knife scourer and fan. The flames soon reached the motor, and the switch-box and connection blocks were soon in flames. Water was turned on the motor, etc., and the flames were extinguished, and notwithstanding the heat and severe drenching it received, the motor continued in operation through it all.

Our illustration shows in a clear manner the dish-washing tanks, and the method of transferring the basket containing the dishes from place to place by means of the overhead track. The motor is shown at the right of the illustration, and is belted with the propeller wheels referred to above, which are used in forcing the water between the dishes.

There is a constant current of water going through the tanks, which carries away all the dirty water after the dishes are washed.

This plant was installed by the Elektron Manufacturing Co., Brooklyn.

RESIDUAL MAGNETISM IN TELEPHONES.*

BY S. KALISCHER.

In December last the author observed that a Siemens telephone, the two ends of the winding of which were insulated from each other, gave out a sound if an induction apparatus in proximity to it was at work. The axis of the telephone was horizontal and at right angles to that of the coils of the apparatus. If the telephone was turned on its axis, or the coils on it short-circuited by a short wire, the sound diminished, and even became inaudible. If the axis of the telephone was parallel to the axis of the coils, no difference was noticeable in the intensity of the sound, whether the telephone circuit was opened or closed.

In order to study this interesting phenomenon, some thick wire was coiled in a single layer round a bundle of iron wires as a core. Two Tudor accumulators supplied the current, and a Wagner key placed outside the laboratory served to interrupt the current. Results similar in kind to those above recorded, though varying in intensity, were again observed. When the axis of the telephone was placed at right angles to that of the inducing coil, minima appeared when the limbs of the magnet were one above the other; maxima when they were side by side. When the telephone circuit was open, the sound was always louder than when it was closed.

The telephone circuit being open, the sounds could not be due to any current induced in its coils, so that the phenomenon is not electrical, but magnetic in its nature. This can also be proved directly by the employment of a telephone without coils, when a sound of the same character as before may be heard.

The reason why a telephone with its circuit closed gives out a less loud sound than one in which it is open is not clear, and the difference does not appear in telephones of some forms. Several considerations, however, concur to prove that the iron membrane is the cause of the sound. To test this the magnet was removed from the telephone leaving the membrane still free to work. The same sound was still observed, and was even increased in intensity. If the membrane was turned about a vertical diameter the loudness of the sound was changed, and in general it was easy to distinguish two positions of minima, the angle between them being 180 deg., and two of maxima, 90 deg. from each position of minimum. Maxima occurred when that diameter of the membrane which was parallel to the line joining the poles of the magnet was parallel to the axis of the induction coils, and minima when these two lines were at right angles to one another. It may, therefore, be concluded that the phenomenon is due to residual magnetism in the membrane.

* Wiedemann's *Annalen*, Vol. xii., part 11.

ELECTRIC MOTORS IN LONDON.—The London *Electrical Review* makes the following interesting remarks concerning the increasing use of electro-motors in that city: The use of the electromotor is extending, and some day the supply of power to drive them will be a great business. Generating stations already exist where current is used for driving the motors, but no public mains have been laid down for the purpose. In Kensington, however, some large stores are about to supply themselves with electro motors for driving chaff-cutters, coffee-grinders, &c., which will be furnished with current from the electric lighting circuits.

THE ELECTRIC RAILWAY IN HISTORY.—The paper read by F. L. Pope before the Electric Club in this city on January 22, on the Electric Railway, Historical, Statistical and Technical, is full of interest and valuable information. No one is more competent to speak on this subject than Mr. Pope, and for this reason it is not surprising that some hitherto unknown facts are brought to light. During his researches in the history of electric railways, Mr. Pope accidentally learned that a Green Mountain village blacksmith by the name of Thomas Davenport had constructed a model of an electric railway in Springfield, Mass., more than fifty years ago. This was undoubtedly the very first appearance of the electric railway in the history of the world. This man's name and the results of his labor in the electrical field would likely have remained unknown had it not been for the curiosity of Mr. Pope to learn something more about this almost forgotten person's achievements in the application of electric power for railways. Very few of the many electricians of to-day ever heard of Thomas Davenport prior to Mr. Pope's discovery that a man of his genius existed so long ago. Mr. Pope has done a grand work in reclaiming from the ruins of time the name of one who justly deserves the honor of being the first man to put into practical form the electrical railway idea.

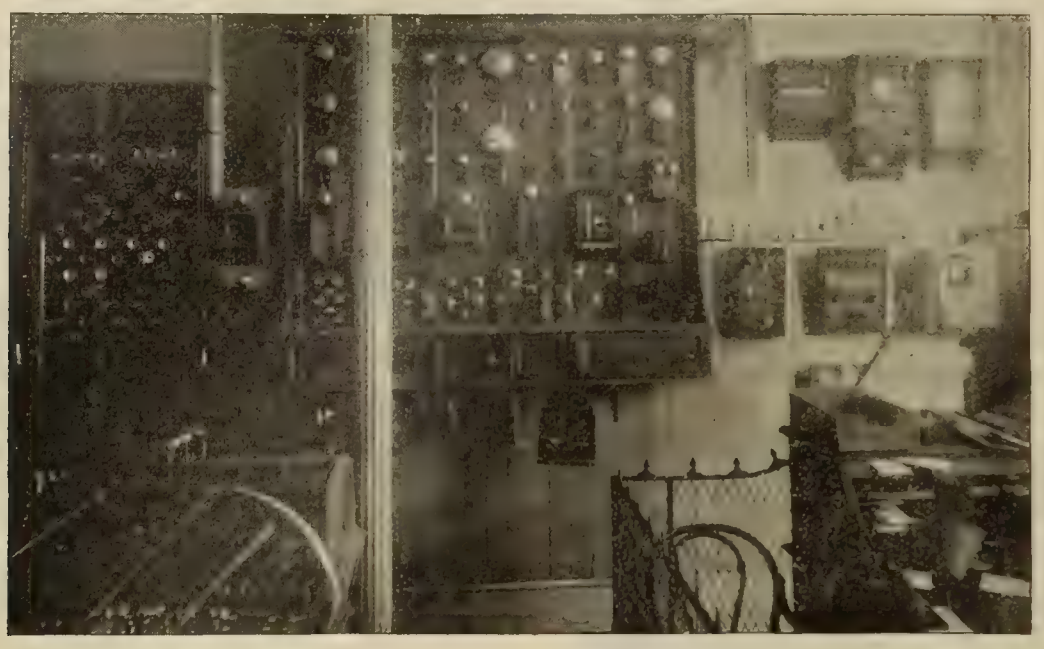
All theatres and places of amusement in Berlin capable of accommodating more than 800 persons have been ordered to be lighted by electricity by January next.

A telephone exchange will be opened at Tunis about the middle of February, and already about 100 subscribers have been obtained. The suburbs of La Goulette and of La Mersa will be included in the system.

CARBON FILAMENTS.—When a metal is heated, its resistance becomes greater; but, with carbon under this condition its resistance becomes less, consequently, the amount of current, which a lamp will take in practice, cannot be calculated by measuring the resistance of the filament, when the latter is cold. When the filament is heated it passes through the usual stages of dull red heat to white hot: and, if further heated, the distinct outline of the filament is no longer seen. At this point the filament is said to be in a state of irradition, and this is its proper incandescing point; if further heated a faint violet light fills the interior of the globe, due possibly to gases being given up from the platinum, and finally the filament breaks.

DISPLAY OF ELECTRIC BELLS, ANNUNCIATORS, ETC.

In the salesrooms of W. R. Ostrander & Co., 195 and 197 Fulton street, New York, is an attractive and artistic display of electric bells, annunciators, push buttons, speaking tube whistles, etc., etc. The articles are in large cases which hang up against the wall and are in such a position that the eye of the visitor is at once attracted to them. Among the articles shown are some of the bells of different sizes and shapes manufactured by this well-known concern.



DISPLAY OF ELECTRIC BELLS, ANNUNCIATORS, ETC.

It will be noticed in the accompanying illustration that the articles are arranged symmetrically and with the view to give an artistic and advantageous display. It is a recognized principle in business that a great deal depends upon attraction in the display of goods of different kinds. W. R. Ostrander & Co. are fully alive to this fact and are making the best of it.

The bells made by this company are efficient, well gotten up, and have a good many merits not possessed by bells of other makes. The Horseshoe Electric Bell of this company has a 7-inch gong and is claimed to be the best bell ever made, and is very efficient where large bells are required. In the matter of bells the company make all sorts of fancy shapes and every taste in this direction can be satisfied.

Annunciators and burglar alarms made by this company are so well known that it might seem superfluous to make any particular mention of them at this time. Suffice it to say that they are of first-class material and make and are thoroughly reliable. They are made of any desired wood. Some of them are combined with a fine eight-day clock with long pendulum movement. In one style of burglar alarm the clock disconnects automatically any portion of the house desired for two and a half hours.

The new Ostrander Electric Annunciator for halls, residences, elevators and manufactories contains the latest improvements. It is a thoroughly accurate and substantially made instrument. The whole movement is without spring or delicate mechanism, and everything in the make-up of the apparatus is strictly first-class.

Push buttons in every style are also among the specialties of this enterprising concern. Speaking tube whistles, for which this company has a great reputation, are effectively displayed in the wall case referred to.

The new bell alarm speaking tube mouth piece is an important piece of apparatus where speaking tubes are used. It consists of a bell as an alarm in calling attention to the speaking tube in the apartment where oral communication is desired. This alarm mouth piece can be attached to any tubes already fitted in buildinggs. The sound of the bell is more pleasant to the ear than that of the ordinary whistle, which is very disagreeable in many respects.

Electric gas lighting burners are also a specialty of this company, and they handle every kind and style of these goods.

In addition to their electrical goods, the firm handles a large line of bell hangers' hardware, bicycle gongs, pneumatic elevator annunciators, etc.

The reputation of the firm for enterprise and fair dealing is great, and they are constantly endeavoring toget up something new in their line.

A NEW STYLE OF TELEGRAPH TYPEWRITER DESK.

In our issue of January 17th, we published an interesting account, with three illustrations, of the electrical plant in the new offices of the United Press in the *World* building, New York. The article referred chiefly to the method employed of supplying the current for the operation of the telegraph instruments. This is accomplished by the use of two accumulator cells, which are charged by a small dynamo run by a motor deriving its power from the electric light circuit in the building. This plant, we are told, is giving excellent satisfaction, and accomplishing with ease all that was calculated it would do.

We give herewith a view of a portion of the operating room of the United Press, showing the drop



TELEGRAPH—TYPEWRITER DESKS IN THE OFFICE OF THE UNITED PRESS.

cabinets on which are placed the typewriting machines and the telegraph instruments. The instruments are located at the right of the writing machines, and the operator copies all press despatches from the instrument at his right directly on the Caligraph. When he wishes to transmit despatches, the machine is tilted back and dropped to a lower level by an ingenious arrangement of pivots, etc., and the space thus rendered vacant is covered over by the middle portion of the desk top which is hinged to the left-hand section. By this means the entire top of the desk is cleared of all incumbrances, giving ample space for the operator to lay his copy while transmitting. When he wishes to resume receiving despatches he simply lifts the top of the middle section of the desk, lays it over back on the left-hand section and then pulls the type-writing machine back into place, in which position it is shown in the illustration. These desks were made expressly for this work, and are found convenient and satisfactory in every way. They are made of antique oak, and highly finished to correspond with all the other fittings of the office.

OBITUARY.

M. Emile N. Reynier, the well-known electrical inventor, is dead in Paris, at the age of 40.

M. Reynier was born in Paris on May 17, 1851. In 1875 he made his *début* in commercial electricity by his invention of metal-coated carbons for arc lamps. In 1878 he brought out an incandescent lamp which worked in the open air. In 1880 he invented his regenerating alkaline battery, but soon abandoned it in favor of the Faure accumulator, with the inventor of which M. Reynier long worked. From 1881 to 1888 he occupied himself with the question of accumulator traction, a new theory of the chemistry of the storage battery, the propulsion of torpedoes, etc. It was during this period that M. Reynier published his chief works: "Les Piles Electriques et Accumulateurs" (1884), "Les Accumulateurs Electriques" (1885), and the "Traité de l'Accumulateur Voltaïque" (1888) the latter of which is now translated into English. In 1889 M. Reynier brought out his "accumulateur à compression externe," which, in the opinion of some, marks a decided step in advance in the history of the accumulator.

ADVANTAGE OF DRUM ARMATURE.—The great advantage peculiar to a drum armature, is the fact that conductors cut *all* the lines of force passing through the armature core. The only idle wire is that used for correction across the faces or ends of the cylinder; and no part of the conductor can generate a counter electromotive force.

PERMEABILITY.—While the permeability of iron decreases with an increase of the magnetic induction through it, that of air remains constant, and the difference between the permeability of the nearly-saturated iron of the field-magnets, and that of the air space is never anything like the difference usually given for unsaturated soft iron and air.

MAGNETIC FIELD.—The strength of an electro-magnetic field may be measured by the density of its lines of force or the number contained in a given area.

THE SHORT ELECTRIC RAILWAY SYSTEM IN MUSKEGON, MICH.

On the 20th of April, 1890, the Muskegon (Michigan) Electric Railway Company began operations under the Short system. The equipment at that time consisted of five motor and three trail cars, with two 60 h. p. generators. The length of the line on the date of opening was 3½ miles. From the trial the road was pronounced a success, and the increase in travel was so immediate and great that on May 5th a second order was given for additional equipment and an extension to Lake Michigan, two miles distant, was at the same time begun. Before the trial time of the first equipment had expired, the third order was given, each extension being opened as soon as the necessary car bodies could be obtained. In six months after the day of starting the railway company had about twelve miles of over-head construction, thirteen motor and eight trail cars.

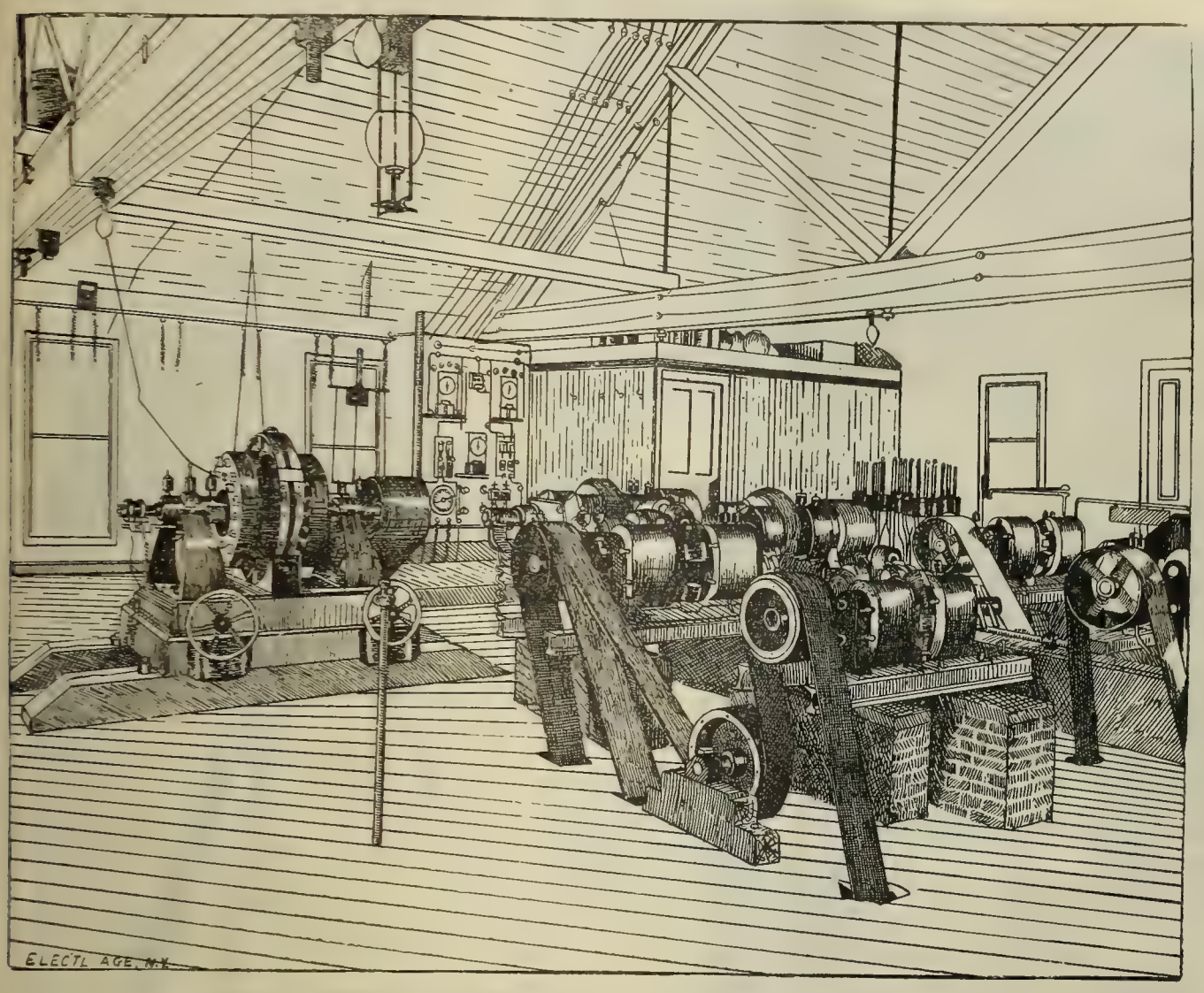


FIG. 1.—POWER AND LIGHTING PLANT OF THE MUSKEGON ELECTRIC RAILWAY.

During the months of July, August and September, 1890, the number of passengers carried on the road, as compared with the traffic during the same months in the year previous, showed an increase of 300 per cent.

The cost of operating the road when five motor and five trail cars were in service is $65 a day, including interest on the bonds of the road and all fixed charges.

The percentage of operating expenses to earnings in August, 1890, as compared with the same month, 1889, shows a decrease of 19.24 per cent.

The Muskegon Electric Railway is located on the main business streets of the town, and there are three heavy grades and five curves. It also crosses one bridge and eleven steam railway tracks. Since the system was put in operation no accident or injury to the apparatus has occurred. The company has been absolutely free from such troubles as burning out or grounding of armatures, fields, rheostats, etc. Although the cars, trucks, motors, and apparatus were entirely new and were put immediately into regular service, they have so far stood the test of daily business with remarkable success.

Each car is equipped with two fifteen horse power Short motors, and are so arranged that they can be run together or separately as may be desired. For all ordinary service, however, one motor is sufficient and capable of hauling its car and trailer, both loaded, without trouble or inconvenience. With both motors in service and two trailers, all three cars fully loaded can be readily and easily drawn around any curve, or up any grade on the road.

The over-head construction is simple, substantial, and efficient. The sliding shoe trolley is giving great satisfaction, and is a most serviceable device for securing contact with the trolley wire. Although there are variations of four feet in height of the trolley wire, on account of the steam railway crossings, the trolley arm readily maintains its position.

Figure 1 of our illustrations shows the generating plant of the Muskegon Railway Company. It will be seen that all of the machines are of the Brush pattern, including one of their new alternating current dynamos, which is shown on the left. These generators do their work easily, and are so effective in their operation as to require little or no attention, except for oiling, and the same may be said of the Short motors used by the company.

Figure 2 is an excellent illustration of the switch board of this plant, and shows every detail perfectly. It is so clear that it is hardly necessary to give any description of the same, as all the connections may be readily understood by anyone interested.

Figure 3 gives a street view in Muskegon, Michigan, showing a motor car and trailer. The cars easily attain a speed of twelve miles an hour, run almost noiselessly, and respond instantly to the operation of the lever in starting and stopping.



FIG. 3.—THE SHORT ELECTRIC RAILWAY IN MUSKEGON, MICH.

There is no jarring or jerking whatever to inconvenience the passengers. At night the cars are brilliantly lighted with incandescent lamps and present a very attractive appearance.

During the present winter Muskegon has suffered from several blizzards, but the electric road in every instance continued to operate through them all, and the railway company, as a result, are very loud and frequent in their praise of the Short electric system.

The Short Electric Railway Company, of Cleveland, Ohio, report the utmost satisfaction with this system wherever used.

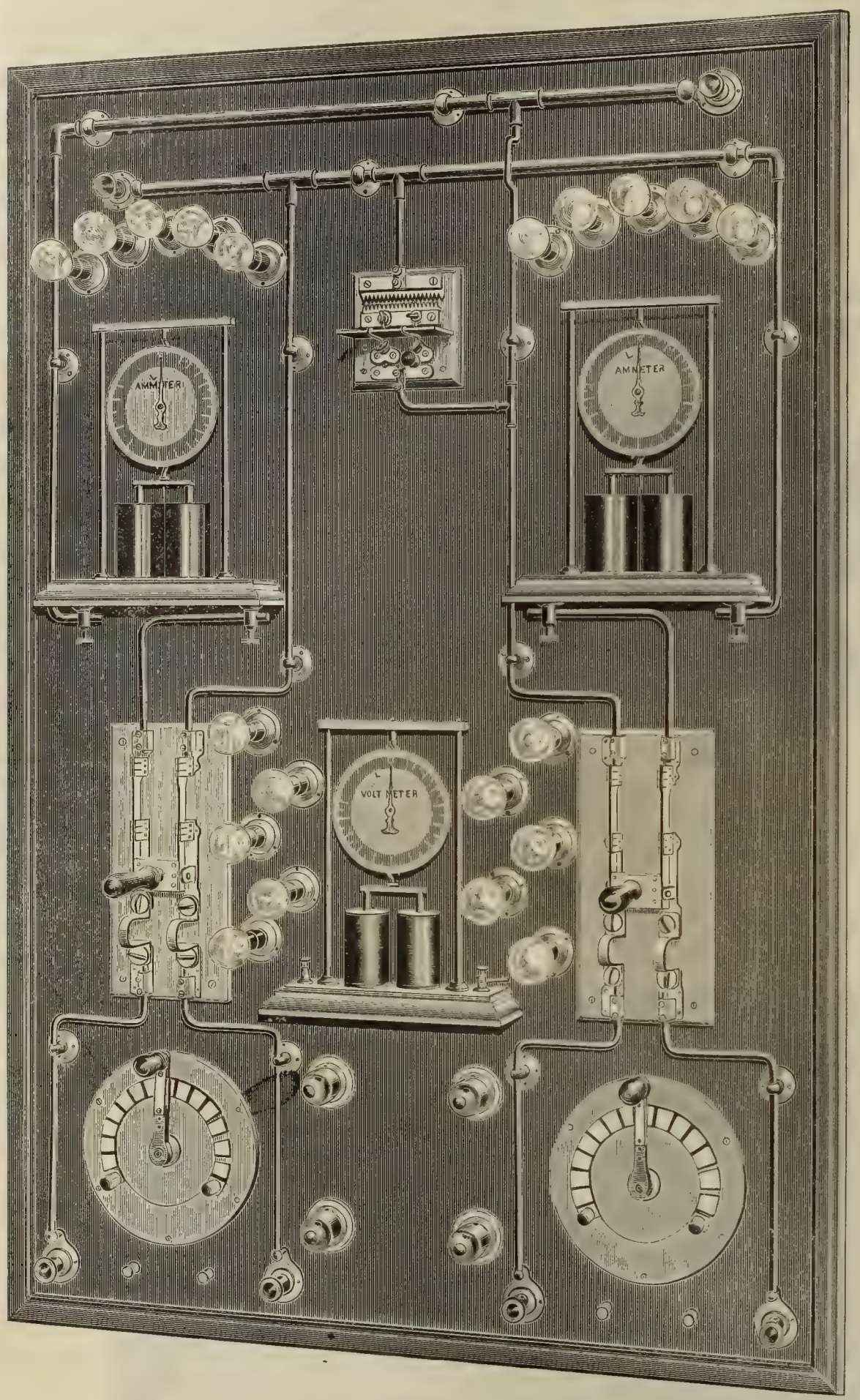


FIG. 2.—SWITCHBOARD OF THE MUSKEGON ELECTRIC RAILWAY PLANT.

NEW AND VALUABLE USE FOR THE FISKE RANGE FINDER.

Lieut. Hamilton Hutchings, United States Navy, proposes a plan for communicating by means of the range finder, from the upper deck to the officers in charge of gun divisions. The range finder, which is mounted on the upper deck, having determined the range, it next becomes of the utmost importance to transmit the value of this distance to the officers commanding gun divisions on the covered gun decks.

Lieut. Hutchings proposes to accomplish this by placing a Wheatstone bridge in the conning tower or at some other desirable point, the two galvanometer leads being run to a place in rear of or over the gun. The galvanometer or indicator will have a pointer moving over a scale on which will be marked the range in yards. The bridge will be in a slide-wire form with a scale of ranges attached.

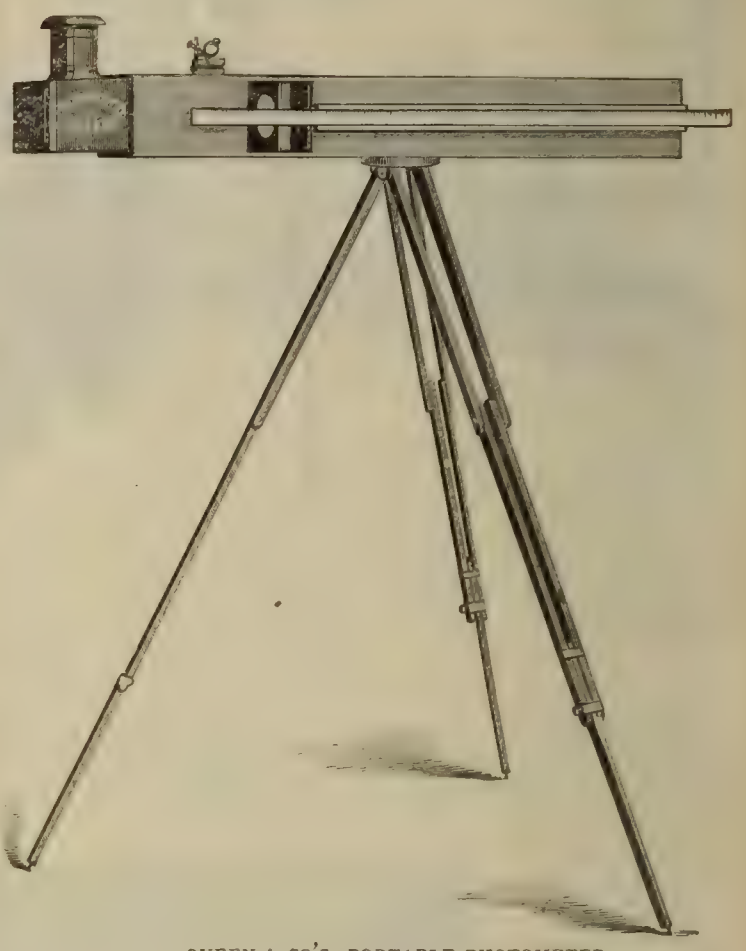
The value of the marks on the scale, as also those on the indicated scale, will be previously ascertained by experiment; in other words the apparatus will be calibrated. Then as the range finder shows a change in the range, the sliding contact will be moved its proper amount, so as to vary the ratio of the arms of the bridge, and the indicator at the gun will show the corresponding changes in the range. Two or more of these instruments can be worked at the same time, corresponding to the number of gun divisions.

MRS. EDISON'S RECEPTION.—Mrs. Thomas A. Edison, on the evening of February 10th, gave a reception at her home in Lewellyn Park, Orange, N. J., in honor of her sister, Miss Miller. The reception was followed by a dance for the young people, and a very enjoyable time was had. The drawing-rooms and halls of the Edison residence were beautifully illuminated by tiny electric lights with shades of different colors, and the grounds around the house were also very attractively illuminated in a similar manner. The interior decorations included cut flowers, plants, etc., interwoven with which were small electric lamps. The scene, as a whole, was most charming.

QUEEN'S PORTABLE PHOTOMETER.

To meet the demand created by the almost universal adoption of the electric light for town and city lighting, and the necessity of making frequent tests for the purpose of conforming to certain standard conditions, Queen & Co. of Philadelphia designed some months since a new form of portable Bunsen photometer. The instrument is very compact, being especially intended for street work by government inspectors and experts having occasion to make candle power tests of arc and incandescent lamps.

The apparatus, which is illustrated in the accompanying engraving, is mounted on a tripod, and is 5¼ inches square in cross section and 38 inches long, and made of polished cherry. The lantern, as shown, slips into one end of the box, where it is firmly held; a small adjustable holder carries the standard light, which may be either one or two standard candles. This adjustment regulates the height at which the flame stands, and also its distance from the screen; by making the latter distance exactly one foot, computation is greatly facilitated. Distances are measured by a graduated bar shown, which slides in grooves along the side of the box.



QUEEN & CO'S. PORTABLE PHOTOMETER.

To allow for the difference in vision between the right and the left eye the instrument is made reversible, that is, it may be turned completely over, so that the right eye observes the side of the disc before observed by the left, and vice versa. When not in use the lantern chimney slips out and can be placed inside the lantern itself, after which the entire lantern box may be pushed inside the photometer, and small slides made to cover the two ends and the sight hole of the instrument, making a solid box of it. A brass handle on one side allows the instrument to be carried as easily as a small hand bag. The box is 37½ inches long by 5½ inches square. The total weight, including tripod, is 13 pounds. A small incandescent lamp can, of course, be used as a standard instead of candles.

The range of this photometer is from 4 candles up. It is being introduced into central stations with most satisfactory results, and, considering the great importance of candle power tests from an economic standpoint, an instrument like the above should pay for itself in a very short time.

MAGNET.—When a magnet is so balanced that it can only move in a horizontal plane, then a large portion of the force, viz.: the vertical component—is simply exerted in pressing the magnet on the support. The remainder, or the horizontal component only, is effective in making the magnet point towards the magnetic north and south.

FOREIGN MATTER IN METALS.—The admixture of even a minute proportion of foreign matter very considerably reduces the conductivity or increases the resistance of a metal.

RESISTANCE.—When an alloy of two or more metals is tested, the specific or relative resistance of the alloy will always be found higher than that of either of its constituents.

THE OKONITE COMPANY'S OFFICERS AND QUARTERS.

The leading lights of the New York end of the International Okonite Company, Limited, New York and London, are the gentlemen whose portraits are here given.



WILLARD L. CANDEE.

Captain Willard L. Candee was born at Yonkers, Westchester County, N. Y., in the year 1851, from whence he subsequently removed to Brooklyn, N. Y. The Captain is well known socially in that city, where he holds the captaincy of Company B, in the crack 23rd regiment. He has been connected with the International Okonite Company since its start, and to his efforts is due largely the proud position occupied by this concern among American manufacturers to-day.

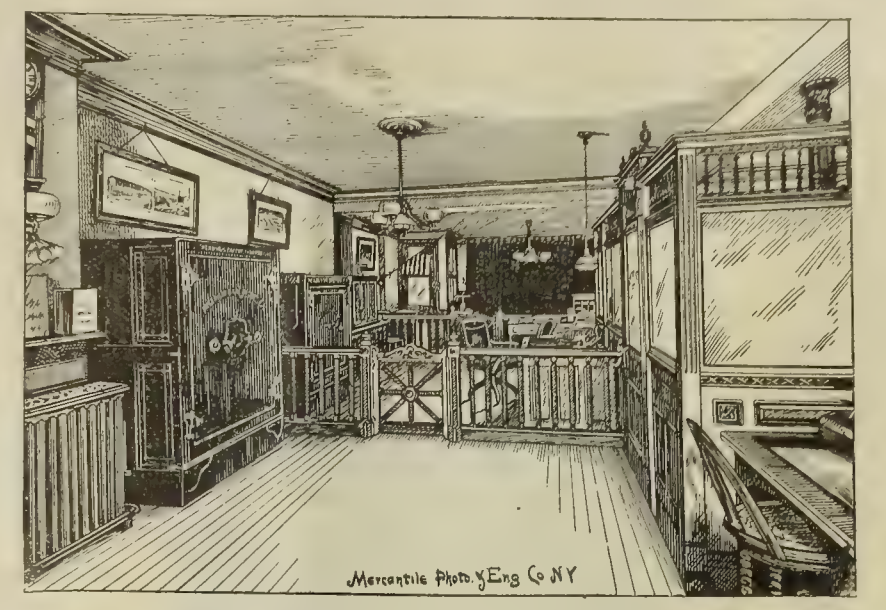
Mr. H. Durant Cheever, who with Mr. Candee, conducts the business management of the International Okonite Company in America, was born in New York City 25 years ago. Mr. Cheever is a graduate of Harvard and became associated with the company in July, 1888, directly after completing his course at college. He is a thorough business man, bright and progressive, and has no doubt a prominent business career before him.

Mr. George T. Manson is probably one of the best known men in the electrical field. He is a native of Massachusetts and 40 years of age, and has been connected with the International Okonite Company five years, where he co-operates with Messrs. Candee and Cheever in the business management of the concern. Mr. Manson was previously interested for many years in the New England Telephone and Telegraph Company of Boston, Mass. His whole-soul, genial nature has won for him a host of friends.

Mr. F. Cazenove Jones, General Manager of the company's factories at Passaic, N. J., was born in Maryland 25 years ago, and is a lineal descendent of Captain John Paul Jones, whose bold manœuvres struck terror to English commerce during the Revolution.

Mr. Jones has been connected with the International Okonite Company for many years, and his thorough knowledge of mechanics and long experience with the New York Belting and Packing Company,—he having for a long time charge of the manufacturing departments of this concern at Passaic, N. J. and Newtown, Conn.—fit him specially for the important position he occupies.

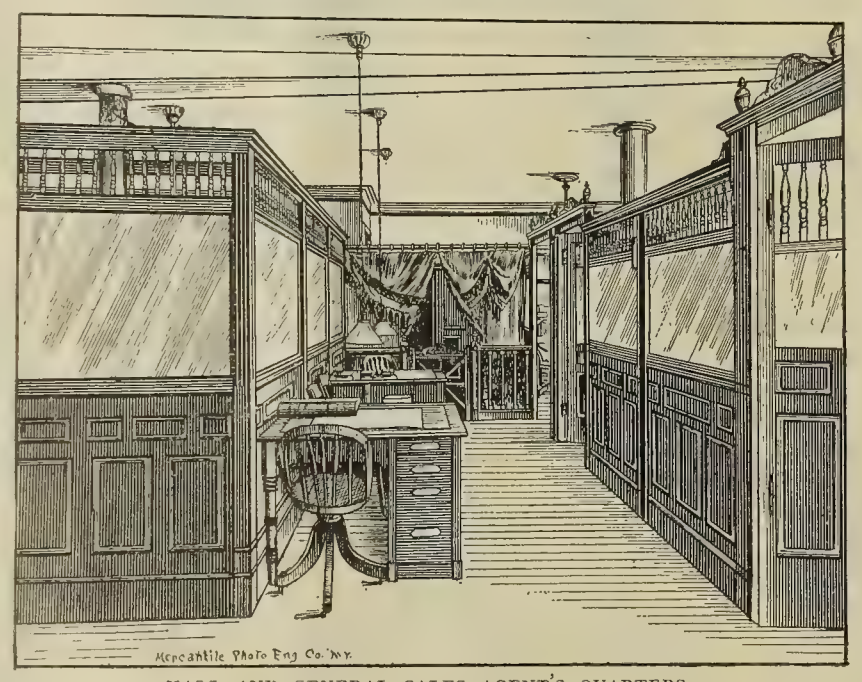
Our other illustrations are views of the new offices of the company, 13 Park Row, New York, and show in Fig. 1 the private office of Capt. Candee, which is well lighted, handsomely furnished and equipped with everything necessary in the way of office fixtures for convenience and comfort.



GENERAL VIEW OF OFFICES.



GEORGE T. MANSON.



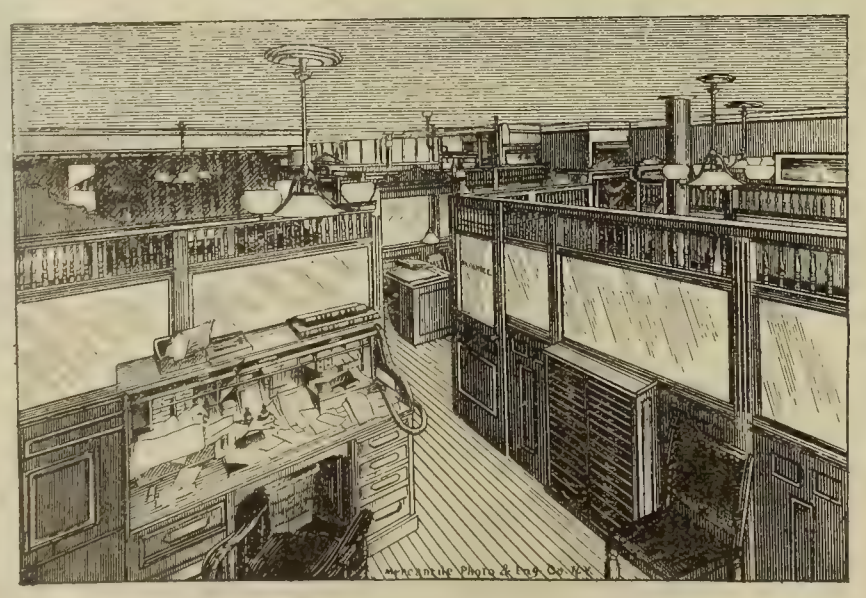
HALL AND GENERAL SALES AGENT'S QUARTERS.

In Fig. 2 we have a general view of the department presided over by Messrs. Hodgkins, Brumley and Ashton and the artistic oaken railing which separates it from the rest of the offices. The furnishings here are very complete.

Fig. 3 shows the hall into which open the private offices of Messrs. Candee, Cheever and Manson. Here Mr. McCoubray, general sales agent and assistants are located, and this portion of the company's new quarters is more cozy and artistic than any other. At the end of this hall is the lavatory screened by *portieres* shown. The entire establishment has an air of business and refinement about it that impress every one as they enter.



H. DURANT CHEEVER.



CAPT. CANDEE'S OFFICE.



F. CAZENOVE JONES.

CONSTRUCTION OF ARMATURES.

Roughly speaking, we may take it that air offers to the lines of force about 800 times the resistance of iron, and if we can contrive to fill part of the space between the polar surfaces of a dynamo with iron, a considerable increase of electromotive force, and consequently of current, will be the result. The space available for this purpose is that contained within the armature coil; in other words, to increase the power of the machine we must wind the armature coils over an iron core. An early dynamo constructed on this principle is that of Siemens, invented in 1855, and provided with the so-called shuttle-wound armature. The core consists of an iron cylinder provided with two deep longitudinal grooves placed opposite so that the cross section resembles a double T with rounded heads. The wire is wound into these grooves, and the two ends of it are joined to the plates of a two-part commutator. In the first machines the core was in one solid piece, but it was found to heat considerably on account of internal currents.

It is well known that if a solid body of metal be rapidly rotated between two powerful magnet poles it becomes hot. The reason for this phenomenon is that the outer portions of the metal in cutting through the lines of force become themselves the seat of electromotive forces acting at right angles to the direction of motion and to the lines, and powerful currents are started parallel to the axis which run in opposite directions, up on one side and down on the other side of the axis. In a solid armature core there is nothing to check the flow of these currents, but the resistance of the metal which on account of the large cross-sectional area, is extremely low. These wasteful currents are consequently very strong, and not only absorb much power, but they also weaken the current generated in the copper wire by induction. To avoid their creation, it is necessary to subdivide the mass of the core by planes at right angles to the axis, and to insulate as much as possible the subdivided portions from each other. This can be done by either cutting deep, narrow, circular grooves in the core, or by building it up of thin discs insulated from each other either by paper discs or by being coated with some insulating paint. These armatures

are not much used for dynamoss at the present day, having been replaced by more perfect forms but they are still extensively employed for small electro-motors.

The counter-electromotive force of these motors is a variable quantity depending on the angular position of the armature. If the heads of the double T core are opposite the field magnet poles, the coil is at right angles to the lines of force and the counter-electromotive force is zero. This happens precisely at the moment when the brushes touch simultaneously both plates of the commutator, and are, therefore, short circuited. A current sent through the motor while at rest in this position cannot start it, and this condition is expressed by saying that the armature has two dead points. When at work the momentum of the armature is sufficient to carry it over the dead points, and, apart from the inconvenience to have to start the motor occasionally by hand; these dead points present no mechanical imperfection. But it might be thought that they present a serious electrical imperfection for the following reason: The strength of the current which is allowed to pass through the motor at any given momentum depends partly on its counter-electromotive force at that particular moment. But since at the dead points there is no counter-electromotive force, the strength of the current will be a maximum, whilst at these moments the mechanical energy produced is ni.l

THE NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION.

PROGRAMME AND FACTS.

The Association headquarters will be at the Narragansett Hotel, and the meetings of the Convention will be held in the lodge room of the Masonic Temple.

The electrical exhibit will be held in Union Hall, which is but one block away from the Masonic Temple. The Narragansett Hotel stands between the two places.

The following is the Reception Committee:

Eugene F. Phillips, Chairman.

William G. Nightingale,	Ex-Gov. Herbert Warner Ladd,
Richard H. Deming,	Albert C. White,
James Richardson, Jr.,	Geo. H. Wood,
Gardiner C. Sims,	Henry A DuVillard,
Gen. Elisha Dyer, Jr.,	Col. Isaac M. Potter,
Ex-Mayor William S. Hayward,	Homer M. Daggett, Jr.,
Mortimer H. Hartwell,	Gen. William Ames,
Ex-Mayor Henry R. Barker,	Col. Arthur H. Watson.

The following papers will be read and discussed during the three days' sessions:

1. How can the National Electric Light Association best serve Central Station Interests? By C. R. Huntley.

2. Distribution of Steam from a Central Station. By F. H. Prentiss.

3. Distribution and Care of Alternating Currents. By T. Carpenter Smith.

4. Municipal Control of Electric Railroads. By M. W. Mead.

5. The Ferranti System. By C. B. Haskins.

6. Electric Lighting as Applied to Steam Railroads. By W. H. Markland.

7. The Electric Arc and its Use in Lighting, By Prof. Elihu Thomson.

Prof. Thomson writes as follows:— "I shalle ndeavor to make the paper an outline of the characters of the Arc scientifically considered, the characters of Dynamo machines which are useful for Arc lighting, the desirable features in Arc lamps and the difference in their workings."

Committees' reports will be made as follows: "Relation between Manufacturing and Central Station Companies," Marsden J. Perry, Chairman; A. J. DeCamp, E. R. Weeks, F. A. Gilbert, J. E. Lockwood, E. A. Armstrong.

"Committee on Data," A. J. DeCamp, Chairman; C. R. Huntley, E. F. Peck, E. R. Weeks, T. Carpenter Smith.

"Copper Tariff," Charles A. Brown, Chairman; George M. Phelps.

"Underground Conduits and Conductors," C. H. Wilmerding, Chairman; T. Carpenter Smith, David G. Evans, S. S. Wheeler, J. E. Lockwood.

"The Proper Classification of the Lighting Power of Incandescent Lamps," Louis Bell, Chairman; Allan V. Garratt, P. H. Alexander.

"National Insurance Rules," George Cutter, Chairman; C. J. Field, T. Carpenter Smith, H. Ward Leonard, S. E. Barton.

"World's Columbian Fair," Marsden J. Perry, Chairman; P. H. Alexander, George B. Edwards, S. J. Hart, George C. Roe.

On Wednesday the convention will celebrate the close of the first decade of Electric Lighting. By means of this celebration it is proposed to fix on the changeless pages of history, a true statement of the beginning of the Electrical Industries, made by those whose brains and hands were employed to bring forth the new and marvellous creations of the Nineteenth Century.

Every Pioneer will be afforded an opportunity to participate in person and by a contribution.

The first session of the day will be known as Memorial Session. It will be open to all members, their friends and invited guests.

The guests of the association named in the Proclamation will be present, and each will make a few remarks pertinent to the department of Electrical work represented by him that will serve as an introduction for an historical chapter to be prepared for the volume of proceedings.

When these exercises are finished the session will be open to whoever may desire to contribute a reminiscence of their pioneer days in Electrical work.

All persons who can make such contributions are requested to prepare a written copy for the Secretary. If not able to present it in person it should be mailed in time to be reported to the convention and thus become a part of the Volume of Proceedings.

The celebration will be continued in the evening at the President's Reception.

On Wednesday evening, between the hours of 8 and 11, the President of the Association will hold a reception at Spink's Assembly Rooms. Music will be furnished by the Hungarian Band.

All of the necessary current for use at the exhibition hall will be supplied by the Narragansett Electric Lighting Company.

There will be run into the hall, three circuits, viz: 1st, an incandescent alternating current converted to 50 volts; 2nd, a 500 volt direct current from ten horse generators; 3rd, an arc current of $6\frac{8}{10}$ amperes.

It is expected that this exhibition will prove very attractive to the Providence public, as well as to the members of the association. To exclude the street gamin element, a nominal admission fee (25 cents) will be charged, but it is intended to circulate complimentary invitations freely among the representative business men of the city. Exhibitors will be supplied with as many complimentary tickets as they may desire to distribute.

On Tuesday the Exhibition will be opened informally at 9 A. M.; it will be closed at 5.30 P. M. It will be opened again at 7 P. M., and formal opening exercises will take place at 8 P. M.

On Wednesday and Thursday the Exhibition will be open from 9 A. M. until 6 P. M.; and from 7 to 11 P. M.

The officers and Executive Committee of the Association are as follows:

OFFICERS.

President, Marsden J. Perry; First Vice-President, E. A. Maher; Second Vice-President, C. L. Edgar; Secretary and Treasurer, Allen R. Foote.

EXECUTIVE COMMITTEE.

C. R. Huntley, Chairman.

Marsden J. Perry,	E. A. Maher,
C. L. Edgar,	Allen R. Foote,
J. J. Burleigh,	Edward A. Leslie,
M. J. Francisco,	A. F. Mason,
John A. Seeley,	A. J. DeCamp,
E. R. Weeks,	C. H. Wilmerding.

PHILADELPHIA NOTES.

Mr. H. T. Paiste, of this city, accompanied by his expert foreman, Mr. J. F. Chamberlain, may be seen criticising the novelties on exhibition, during the Providence convention. The exhibit of H. T. Paiste will no doubt be the centre of attraction.

The Philadelphia branch office of the Fort Wayne Electric Company has done an immense amount of business during the past six months. This company manufactures the new and improved "Wood" system of arc lighting and the "Slattery" alternating incandescent system. They are represented in Philadelphia by Mr. G. A. Wilbur, whose office is at 907 Filbert street.

Mr. H. C. Roberts, formerly of the Connecticut Motor Company, and now a member of the firm of Vallee Bros. & Co., manufacturers and dealers in electrical supplies, No. 17 North 6th street, this city, will be present at the Electric Light Convention at Providence. Mr. Roberts will be pleased to meet any of his colleagues in business from New York city. His firm is doing a splendid business.

O. D. Pierce & Co., electrical contractors, have removed from their contracted quarters, 36 South 7th street to a more commodious building, No. 806 Walnut street, where they will be pleased to meet their old customers and happy to receive as many new comers as may call on them. Mr. Pierce will be present at the Providence convention with one eye open for any new exhibit in his line.

Merchant & Co., of Philadelphia, with branch houses in New York, Chicago and Kansas City, in addition to their tin plate importing and metal business generally, have added to their line all kinds of electrical supplies, such as office and annunciator wire, magnet wire, (single and double wound) pure bare copper electrical wire, fuse wire, commutator bar copper, brush copper, etc., and carry quite a large stock in all their branches of these goods.

Mr. J. W. Parker, of No. 38 South 4th street, electrical and mechanical engineer, has his hands full of business. He represents, in Philadelphia, the Ball engine and the C. & C. Motor and is also contractor for complete steam and electric power stations. He is at present engaged in furnishing complete steam power plants in various places in Pennsylvania, and his work is giving excellent satisfaction. He reports that the C. & C. Motor business in Philadelphia is excellent and the outlook encouraging.

Messrs. Walker & Kepler, who were formerly located at Nos. 106 and 108 South Fourth street, have moved to a large and commodious store at No. 531 Chestnut street, and are now prepared to do their large and rapidly increasing business. Their store room is 170 feet deep and 50 feet wide, the front portion being occupied by offices and the rear portion for store purposes. They employ sixty men and have in course of construction some thirty contracts at present. This firm started five years ago with three men.

Merchant & Co. of this city, importers, manufacturers and dealers in metals, have issued a handsome little book entitled "A Midsummer Night's Dream; being a Somnambulistic Ramble with Merchant & Co. and their Friends, the Brownies." The story is excellently illustrated, the idea, of course, being to convey some notion of the excellence and character of the goods handled by this firm. The book is artistically gotten up. The firm deal in electrical supplies, such as copper wires of all classes, bare and insulated, and fuse wire of any capacity. All metals used in electrical apparatus are dealt in by this firm and their goods have an excellent reputation. H. G. G.

Queen & Co., of Philadelphia, inform us that their exhibit at the Providence meeting of the National Electric Light Association promises to be most interesting. They will show a full line of their special instruments, and also a series of their new magnetic vane ammeters, which are specially intended for central station use. Regarding these ammeters the Brush Electric Co., of New York, say in a recent letter: "We very cheerfully state that your ammeters as used by us have worked accurately and given most excellent satisfaction." Queen & Co. have just completed negotiations with Profs. Bristol and Geyer, of Hoboken, N. J., for the control of their patent, which covers a new form of recording ammeter. These instruments are not yet perfected, but they promise well, and there is certainly a great demand for a reliable recording meter. E. G. Willyoung expects to look after the interests of the firm at Providence, and will be much pleased to receive a call from those in attendance and their friends. The exhibit will be in a most prominent position.

WIRING.—When leads pass through roofs, floors, walls, or partitions, and where they cross or are liable to touch metallic substances, such as bell wires, iron girders, or pipes, they should be thoroughly protected by suitable additional covering, and where they are liable to abrasion from any cause, or to the depredations of rats and mice, they should be encased in some suitable hard material.

CURRENT PATH.—When two or more wires are joined together so that the current divides between them, they are said to be joined up in "parallel," and when the end of one is joined to the end of another so that the whole current goes through both wires, one after the other, the wires are said to be joined up in "series."

MAINS AND BRANCHES.—All mains and branches ought to be laid on a system, and should start at centres. This is convenient for testing at any time or for running new branches. Wherever a branch starts of smaller section than the main or branch whence it is derived, a safety junction should be inserted; and, if extra security is desired, these fuses may be placed in both leads.

JOINTS.—Joints should be avoided in damp places, and, in all cases they should be well made, perfectly insulated, taped, and rendered waterproof with one of the many good compounds sold for this purpose.

LAMPS.—High volt lamps blacken less than low volt ones, which is a great point in their favor; and they are quite as lasting as if not overrun.

NEW TROLLEY WIRE CLAMP.

One of the principal features in the installation of an electric road is the proper construction of the appliances for connecting the Trolley wire to the span wire. Objections have been made to the present means of holding the Trolley wire for the reason that it has been necessary in most cases to either solder the connections, which necessarily weakens the wire, or else to hammer together the sides of a clamp which causes trouble and delay in adjusting the position of the insulator. To obviate these and other disadvantages the Electric Merchandise Company, Chicago, have just placed on the market the



TROLLEY WIRE CLAMP.

Brewster clamp which we illustrate herewith. It will be noticed that the clamp is made of two sections, of hard and tough brass riveted together with a steel pin. After the clamp has been placed upon the Trolley wire and closed, the insulator is screwed down upon it, firmly holding the wire without soldering or hammering, and presenting a perfectly smooth surface to the Trolley. This clamp can be attached to the standard trolley wire insulators of the different systems, or can be used in connection with any style of insulator.

AUTOMATIC FIRE AND HEAT ALARM.

A very valuable and reliable little apparatus is the "Iske" Automatic Fire and Heat Alarm, Fred'k Pearce, John St., New York, sole agent for N. Y. and other states. It is a simple, practical machine, and is always ready to report a fire. It is compact and portable; all that is necessary is to hang it on the wall, where it is ready at all times to perform the duty for which it is designed.

The illustration, Fig. 2, shows the internal mechanism of the device, which is extremely simple in its construction and can not get out of order. It is of particular value to traveling men, who can carry one of the instruments in their satchels. They are

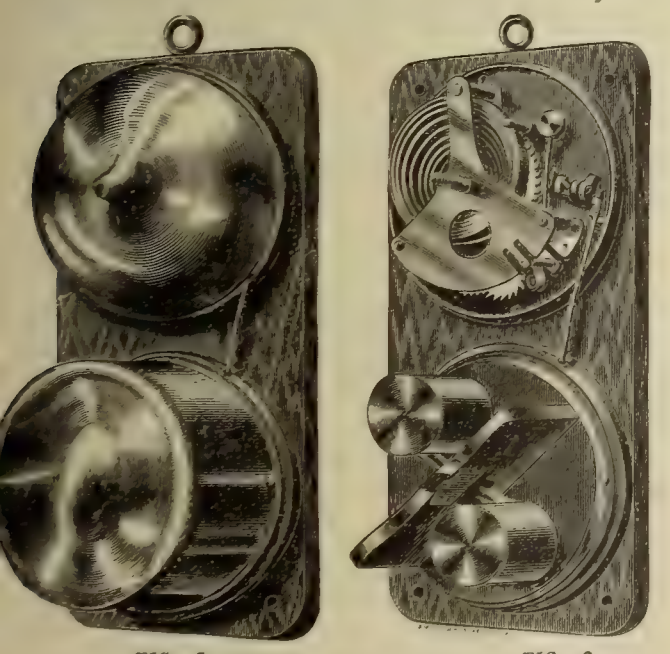


FIG. 1. FIG. 2.

"ISKE" AUTOMATICAL FIRE AND HEAT ALARM.

usually regulated to act when the temperature reaches 110 degrees, but can be adjusted for any other temperature when desired.

Fig. 1 shows the apparatus complete all ready for use. It is an absolute indicator of abnormal heat and never fails to work.

Mr. Pearce also controls an electric system, which he claims is not equalled by any other alarm system in the market, owing to the advantages it possesses, viz., cheapness, durability, simplicity of construction, and reliability.

The size of the automatic fire and heat alarm is four by eight inches, which is a very important feature of this device.

NEW ELECTRICAL FIXTURE CUT-OUT.

We illustrate below a new and valuable device just gotten out by the McCreary Electrical Specialty Co., 18 and 20 Cortlandt street. It is known as the McCreary thermal fixture cut-out, and is made for from one to three lamps. Other sizes are made for any number of lamps.

The No. 1 size is designed to be put in any fixtures, or on the circuit at any desirable and convenient point. It has the advantage of being very compact, and is the smallest cut-out in the market. The method of construction and making the connections will be understood by referring to figure 2. The connection between the ends of the fuse wire and the circuit wire terminals is effected by two screws, which are counter-sunk in the insulated body of the cut-out. The ends of the wires after

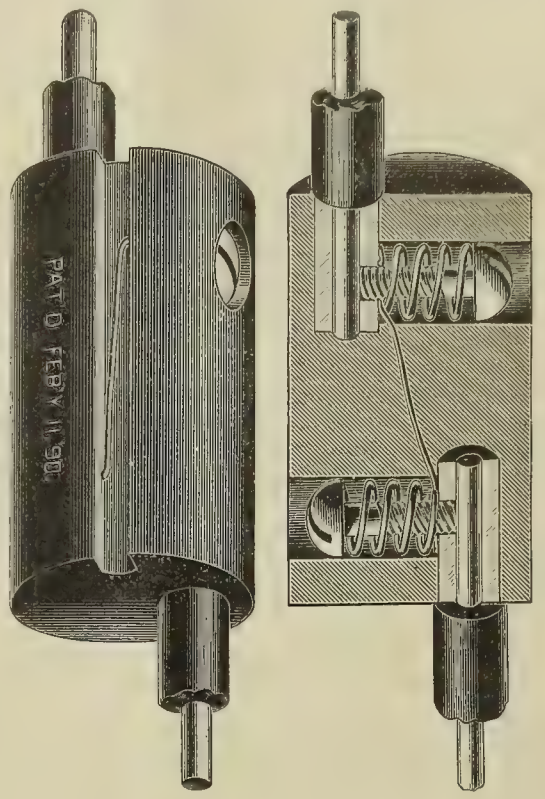


FIG. 1. FIG. 2.

THE MC CREARY THERMAL FIXTURE CUT-OUT.

having been bared of insulation, are inserted in the ferrules shown in the cut, which are made of brass. The contact of the wire ends is then made secure by the screws as shown, and at the same time the ends of the fuse wire are brought into firm contact with the brass ferrule, by means of a strong spiral spring.

By referring to figure 1 it will be seen that the fuse wire emerges from the compartment occupied by one screw, and is carried to the other compartment on the outside of the insulating body of the cut-out in a slot. Hence it will be readily understood that to replace a new fuse wire is a matter easy of accomplishment.

No tape is required in these cut-outs, and they are so simple in construction that any one can adjust them. There is a great demand for such an article as this, and no doubt it will find a ready sale.

The McCreary Electrical Specialty Company own the foundation and all improvement patents on this cut-out.

ELECTRIC RAILWAY NOTES.

On the 1st inst., electric motor cars were started for the first time on the Galveston, Texas, street railway. Twenty miles of this road have been completed, and regular operation is now carried on. There will be fifty miles of road altogether when the improvements are completed, which will probably be during the coming summer. This will give Galveston the distinction of having more miles of electric road and better street car service than any other Southern city of its size. The track is being relaid with 40-pound steel rails and cypress ties. The electrical equipment was supplied by the Detroit Electrical Works, of Detroit, Mich. This company's system is, perhaps, better known as the "Rae System." The over-head single trolley system is used, and the plant was installed under the supervision of Mr. L. A. Scovill.

The power-house is a handsome two story brick building and the smoke stack 175 feet in height, being the highest in the city. Messrs. N. J. Clayton & Co., of Galveston, were the architects of the building. The present steam equipment consists of four 100-horse power boilers. One 400-horse power Corliss engine and two 100-horse power Westinghouse compound engines. The furnaces are provided with the Brightman Automatic stokers, which feed the coal automatically into the furnaces, and is the first use of this apparatus in Galveston. The first train of the new system carried the city council, mayor and road officials to the Beach Hotel where a banquet was provided by President Sinclair.

The new electric railroad company which has been trying to gain admission into Reading, Pa., has finally received the necessary permission.

Salem and Quinton, N. J., are to be connected by an electric railway, if reports are true. Philadelphia capialists have the matter in charge and will construct the road.

The Rapid Transit Co., of Boise City, Idaho, have just closed a contract with the Edison General Electric Company, represented by Mr. W. T. McCaskey, for an electric single track road seven and a half miles in length. The road is to be completed June 1st.

The first electrical car on the Edison system to be run in Canada was recently put in operation in Winnipeg, Manitoba. Congratulations were exchanged and the event was considered a great success.

The Rae Company of Detroit recently received several orders for their motors from widely separated sections of the country. Three 80,000 Watts dynamos will supply the power for the operation of the People's Electric Railway, Springfield, Ill., which will be ready to begin business about the first of April. The company has also ordered fourteen 30 h. p. Rae motors, mounted on Sheffield trucks, for the equipment of the road.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE.
55 KILBY STREET, ROOM 61,
BOSTON, February 13, 1891.

At Strafford Springs, Conn., a company has been organized under the name of the Hyer-Shahan Electric Motor Co. with a capital of $25,000.

The material has arrived for an extension of the Whitman and Brockton electric road to East Whitman, and work will commence as soon as possible next month.

The largest private electric light plant in Connecticut has been completed by the Edison General Electric Co. for the Hartford Carpet Co. in Thompsonville. The number of lights is about 2,300.

Mr. H. E. Hunt lectured on "Aluminum" before the Society of Arts at the Institute of Technology, last evening.

A great many novelties in electric heating apparatus are reported among the entries at the Worcester electrical and industrial exhibition, together with a multitude of signal devices for domestic use.

The movement which is under way to connect Worcester and Millbury by means of an electric road is rapidly assuming definite shape.

The Worcester, Leicester and Spencer Electric Railroad is expected to be running by the first of July.

The Brookline Gas Company will soon build a new station in Brighton, which will contain about 700 h. p. in arc and incandescent light apparatus. Just what the equipment will be has not been decided as yet.

The subject of underground roads has reached Boston in the form of a petition for a charter from the legislature by Mr. H. C. Spaulding. He, together with President Whitney, of the West End Company, appeared before the legislative committee this week, and discussed the feasibility of such an undertaking. W. H. M. Jr.

PERSONAL NOTES.

Mr. F. W. Jones, Electrician and Assistant General Manager of the Postal Telegraph-Cable Co., is booked to deliver a lecture on "Quadruplex Telegraphy" at the Brooklyn Institute, February 20th.

President Lewis, of the Brooklyn City Railroad Co., made a visit to Boston recently to look into the operation and equipment of the electrical roads there. He intends to use the information thus acquired in connection with the equipment of his roads in Brooklyn with electric power.

Mr. William H. McDonald has severed his connection with the firm of Little, McDonald & Co., Buffalo, N. Y., and the business of the company will be conducted under the name of F. P. Little & Co.

AN EXCELLENT BOOK.—"Wood's Natural History of Mammalia" is for the first time issued in this country at a cost within the reach of all. No well-equipped library is complete without this work, and on the centre table of the home is a constant source of instruction and entertainment. See our special announcement on another page.

ENERGY.—Wherever a current of electricity flows, a certain amount of energy is expended.

NEW YORK NOTES.

Mr. F. A. Wyman, of Boston, was in this city a few days ago looking after business.

Dr. W. F. Bradner, president and manager of the Bradner Adjustable Hanger Co., Denver, Col., is in town.

One of the new Walker meters, an account of which was recently given in this paper, has been ordered for the laboratory of Columbia college.

Mr. Lea S. Robinson, of the firm of Ryland, Robinson & Co., dealers in electrical supplies, etc., San Francisco, California, is in this city.

Mr. F. P. Wisner, of the Consolidated Fruit Jar o., 49 Warren street, will be found at the convention in Providence ready to take orders for their s pecial manufacture.

Mr. P. C. Ackerman, the New York representative of the American Electrical Works, Providence, R. I., has just returned from a trip in the West. He reports much success.

The Hall Signal Company, of No. 50 Broadway, has appointed as superintendent of construction and maintenance, Mr. A. J. Wilson. The appointment is an excellent one.

Mr. C. S. Merrill now has charge of the belting department of the Underwood Manufacturing Co., No. 73 Cortlandt street. This company manufactures special electric light belting.

Mr. C. A. Benton, general manager of the railway department of the Detroit Electrical Works (the Rae system) was in this city a few days ago on business, and saw at the same time many of his old friends.

Mr. C. C. Foster, of the McCreary Electrical Speciality Co., of N.Y., now at Colorado Springs, Colorado, has been in ill health for some time is on the mend, and his many friends will be glad to learn of his recovery.

The great A. B. C. Co. (Alexander, Barney & Chapin), 20 Cortlandt street, will have their souvenirs for the patrons of the convention in Providence. I understand they are getting up in very elegant style an ingenious office novelty made of fibrone.

The Barriett Electric Company have already commenced the manufacture of the well-known and efficient motor designed by Mr. Barriett. The company are now located in their new quarters at 10 Cedar street, at which number the factory is also located.

The Shaver Corporation continue to receive many orders for new exchanges of their molecular telephone system, and the outlook for next summer is more promising than ever. Among the new exchanges to be established is one at Staunton, Virginia, with 104 stations, which will probably be constructed during March.

W. R. Fleming & Co. selling agents for "Harrisburg" Ide and Ideal engines, boilers, etc., are very busy putting in electric steam plants. During the past three weeks they have received several contracts for large steam plants, besides several small orders, making an aggregate of over 600 horse-power during that period.

Mr. A. T. Smith, of No. 6 West 14th street, is just now engaged in putting in a Watchman's Time Detector plant of 21 points, in the American Museum of Natural History, located just outside Central Park. Among the recent installations of Mr. Smith of this apparatus, is one at the Female Insane Asylum on Blackwell's island.

The Moore Electrical Manufacturing Company, successors to Moore Brothers, Nos. 106 and 108 Liberty street, are sending out notices of the incorporation of the company, which was recently effected. The officers are: John L. Moore, President; Erastus D. Moore, Secretary and Treasurer, and James H. Bates, Vice-President. The new company will be better prepared to furnish all classes of electrical goods with promptness, and will be pleased to do all in their power to satisfy their customers.

The Thomas Murray Company, No. 95 Liberty street, are doing an active business in the building of electrical railways. Among those they now have under way is the Grand View Beach Road which runs from Charlotte, N.Y., along Manitou Beach, Lake Ontario. It will be eight miles long and the power plant will consist of McIntosh and Seymour engines and Babcock boilers. There will be two Rae dynamos of 80,000 watts. Rae motors of 40 horse-power will be used on the cars which will be of the Brill and Newburyport make.

Mr. Thomas I. McLeod, the well-known electrical engineer of 91 Liberty street has, with Mr. William E. Ward and other capitalists, formed a co-partnership for the purpose of increasing and enlarging the present business. The firm will be McLeod, Ward & Co., and they will engage in the manufacture of electrical patented specialties. It is also their intention to equip their factory with every line of machinery for the manufacture of such goods. Mr. Ward, who has had large experience in manufacturing and experimental work, will have charge of this department of the new concern.

The Celluloid Novelty Company, of 313 and 315 Broadway, manfacturers of celluloid trimmings for all electrical purposes, recently bought and moved into the handsome and capacious building 427 and 429 Broadway, corner of Howard street. Taking advantage of the increased space of their new quarters they intend to enlarge their business by adding more specialties, particularly in the electrical department This firm has every facility for manufacturing all kinds of celluloid goods in sheets, rods, etc.. They always carry in stock a full line of staple goods, such as buttons, knobs, push-button shells, etc., in ivory, black and plain white.

Mr. George A. Pierce, New York manager of the Page Belting Co., 16 Dey street, is fitting up his headquarters extensively for carrying in stock all sizes of belts up to 36 inches wide. He will shortly extend the size up to 40 inches and possibly more. This is said to be the only agency carrying such an extensive line of belting in this country. Mr. Pierce informs me that since opening the new store he has received an order for 150,000 feet of belting. Included in the order was 55,000 feet of strapping. He will keep all the belting stock in the main store and will sell any quantity for the city trade. The goods are ready for shipment to any point convenient to the office.

Mr. Henry Hine, formerly general agent for the New York district of the Westinghouse Electric and Manufacturing Company, at 120 Broadway, has accepted the position of general manager of the Stanley Electric Manufacturing Company, of Pittsfield, Mass. Mr. Hine has been in the electrical field since its earliest conception, and to the writer's knowledge of this gentleman, extending over a period of eight years, he has always been ambitious for the success of the company with which he has been connected, and has closed many contracts for light and power in this and foreign countries. The Stanley Company can be congratulated on securing such an able manager.

Westinghouse, Church, Kerr & Co.'s sales and show rooms, 15 Cortlandt street, were all aglow February 13 with the faces of anxious seekers after knowledge. There were present a number of students from the Lehigh University, Bethlehem, Pa., who were being educated in the wonders of the Westinghouse engine, Westinghouse electric system, etc. Mr. W. V. Wright, O. L. Williams and J. C. Hicks, Jr., were the professors of knowledge, and explained the great advantages of the Westinghouse systems. Among the gentlemen from the University were S. D. Cushing, H. H. Dowd, C. Drayton, W. L. Jacoby, C. L. Keller, R. R. Kitchel, A. E. Leister, F. D. Randolph, C. K. Shelby, R. J. Snyder, C. O. Wood, W. W. Blunt, W. J. Lloyd, J. T. Loomis, R. Masson, E. H. Mohr and P. H. Smith.

Seely & Taylor, 22 Cortlandt street, are arranging to install a fire alarm system in Weehawken, Guttenburg and West New York, N. J. They have not yet decided what system to adopt.

Messrs. Seely & Taylor, No. 22 Cortlandt street, are doing an extensive business in electrical construction, and have finished their one thousand light plant in Buffalo for O'Day & Rockefellow. The current is furnished from the central station using the Thomson-Houston system. The firm have also lately closed a contract for their Union Hill, N. J., central station plant and ordered a 250 h. p. Ide cross-compound engine and boilers from the same company. They will extend this plant into Weehawken, Guttenburg and West New York, N. J., and when finished it will be one of the finest in the country. They are now using two Heisler dynamos, one of 400 lights and the other of 350, up to their full capacity, using 750 thirty-two candle power incandescent lamps on the Heisler system, 4 T. & H. 50 arc dynamos, and also boilers of the Harrisburg Car Manufacturing Works, Harrisburg, Pa. This firm are manufacturers of "sealine" insulating compound or paint, used for painting joints of wires of all kinds for interior, exterior and conduit uses. It will stand heat, water, acids, etc., and is meeting with a ready sale.

Mr. H. C. Whitney, Superintendent of the Consolidated Electric Storage Company, 120 Broadway, is meeting with wonderful success in the introduction of the Julien Storage Battery for light and power. Some six months ago Mr. Whitney became connected with this company as Superintendent of Agencies and has engaged representatives in all the principal cities of the United States through whom they are receiving large orders for their storage batteries. Among a few of the most recent sales of Julien storage batteries is one of 50 cells installed in a brewery in Providence by the Providence Electric Construction Company; 90 cells in New Haven, Conn., for lighting, and 52 cells in Thomas Tripler's Sons Planing Mill, New York, for all night lighting. Many other orders have been received for these batteries.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Motor Co			5.00
American Private Telephone (Parent)	50,000	100.00	98.00
American Tel-graph and Cable			
Anglo-American Electric M'f'g Co			1.00
Averell Insulating Conduit	3,000,000	100.00	5.00
Asbury Park, L. & P	50,000	10.00	
Ball Electric Light	2,000,000	100.00	
Bell Telephone			194.00
Boston Electric Light			105.00
Brooklyn Edison Electric Light	1,500,000	100.00	100.00
Brooklyn Citizens' Electric Light	500,000	10.00	*120
Brooklyn Municipal Light	500,000	100.00	122.00
Brush Illuminating (N. Y.)	1,000,000	100 00	70.00
Brush Swan E. L. Co. of N. E.	2,000,000	100.00	25.00
Brush Swan, (Ithaca)	50,000	10.00	
Bay Shore, Elec. Light (L. I.)	8,000	50.00	
Consolidated Electric Light			50.00
Complete Elec. Construction Co	50,000	100.00	175.00
Daft	1,000,000	50,000	
Edison Elec. 5s			*99
Edison General			94.00
Edison Illuminating	4,500,000	100.00	95.00
East River Electric Light Co	1,000,000	100.00	80.00
Edison Elec. Light (N. J.)	1,600,000	100.00	
Excelsior (N. J.)	500,000	100.00	
Fort Wayne Elec. Light Co	4,000,000	25.00	12.00
Hackettstown (N. J.)	25,000	20.00	25.00
Hudson Electric Light (N. J.)	100,000	100.00	
Harlem Electric Light Co	250,000	100.00	60.00
Hunt Engineering Co. (Brooklyn)	30,000	100.00	140.00
Interior Conduit			75.00
Jamaica Gas and Elec. Light (N. Y.)	1,000,000	100.00	95.00
Julien			
Law Telephone			
Long Branch Electric Light	50,000	100.00	70.00
Mount Morris 6s. (N. Y)			*95
Mount Morris Electric Light			90.00
Morristown, L. H. & P	50,000	100.00	
N. E. Telegraph and Telephone			51.00
N. Y. and N. J. Tel. and Tel 6s			*par.
N. Y. and N. J. Telephone Stock		100.00	96.00
North American Phonograph			20.00
Newark, L. & P	150,000	100.00	85.00
Newark, Elec. Light (Schuyler)	100,000	100.00	
North New York, Lighting	150,000	100.00	60.00
Postal Telegraph			
Passaic, Electric Light	15,000	100.00	92.00
Paterson, Electric Light	100,000	100.00	
Peoples, Elec. Light, (Trenton)	100,000	100.00	90.00
Plainfield, Electric Light	100,000	100.00	75.00
Port Richmond, (S. I.)	100,000	100.00	80.00
Russell Electric Lamp Co. (Boston)	300,000	100.00	90
Rockaway Beach Elec. Light	50,000	100.00	80.00
Richmond L. H. & P. (S. I.)	150,000	100.00	75.00
Saratoga Gas and Elec Light 6s			*86
Swan Incandescent	800,000	100.00	2.00
Thomson-Houston Electric Co			50.00
United Elec. Traction Co			2.50
United States Electric Co			40.00
United States Illuminating	1,000,000	100.00	70.00
United E. L. & P	5,000,000	100.00	
Westinghouse Electric Co	5,000,000	50.00	25.00
Westinghouse Elec. Co. Pref			50.00
West End, L. (Boston)			21.00
Yonkers, L. & P	50,000	100.00	

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate, but will be found very near the mark.

* Per cent.

FINANCIAL.

Hello!! Hello!! Hello!!! You need not go into mourning yet, central, you'r only about ten years old: even if there are a number of new "talk" companies started this season, all must have central stations and you will be more in demand than ever, now connect me with Electric Investor, please. Hello? Correct, this is the ELECTRICAL AGE. Mr. Ellery, I called you up to inform you that the air is full of rumors that telephone companies are being organized all over the country, if you want to get a seat on the excursion, from the captain, before the boats start you must make up your mind now which to invest in, or you will have to pay extra to be put aboard, and stand up at that. The separate discoveries made since the broad basis patent was granted, are being sorted out and consolidated into complete systems, and Stanley will take the present one back with him to central Africa to trade with the natives. Read the ELECTRICAL AGE carefully and you will find a wide range of electric investments beside telephone, as for instance, Electric Light, Car, Railway, Lamp, Construction, Supply, Plating, Belting, Fan, Wire, Motor, Conduit, Power, Insulating, Printing, Time, Signal, Manufacturing, etc. Bonds and Shares. Our advertisers are making large profits on a substantial, and constantly increasing business. Inventors always want money to introduce patents and many meritorious offers are open for your inspection. The steady advance of electric improvement is wonderful. Let me know what you want, buy, sell or exchange. The market is active and strong, money is easy and plenty, and likely to remain so till Fall. The times are ripe to exploit anything of merit or grow up with the busi-

ness. Whipple reports over 60 electric incorporations in January with a capital of over thrirteen million dollars. Good bye.

Now comes the question: What would be the result on manufacturing corporations if a prohibitory law, akin to the "Trust" act of Indiana were passed in such States as Ohio, Illinois, Pennsylvania, New Jersey or New York? No doubt it is against the public welfare to permit any corporation to control our food or raiment. The inevitable remains, that combination of capital only renders it possible to produce economically and commercially our present requirements. All corporations to-day have a statutary limitation, generally fifty years. Would it be possible for the Western Union, Bell Telephone, Edison General and Thomson-Houston to have supplied our wants, without combination of capital? Trust is only a modern name for it. Every shareholder in a corporation, under the laws of Indiana, caught on her soil is certainly liable to arrest, with fine and imprisonment in plain sight. Gentlemen send in your shares for sale or exchange, the purchaser will probably be in contumacy only, and as in the case of the late J. C. Fremont and C. B. Norton, that will not hurt much.

TRADE NOTES.

Mr. S. R. Hatch, dealer in electrical goods, Hudson, N. Y., has sold out his business to Mr. O. D. Jansen, and has accepted the position of electrical engineer for the Palo Alto Mining Company, California.

The International Okonite Company, Limited, New York and London, will be represented at the Convention by Messrs. Candee, Cheever, Manson and McCoubray. The company will probably show an interesting line of their Okonite specialties.

L. J. Wing & Co., No. 126 Liberty street, to which place they recently moved from No. 80 John street, have a large supply of their goods constantly on hand. These include "Wing" disc fans, high speed engines, electric motors, etc., etc. The location is an excellent one for the display of their goods.

We understand that the Weston Electrical Instrument Company of Newark, N. J., will have an exhibit of their standard voltmeters and ammeters at the Convention. This firm is doing a large business in these well-known measuring instruments, which are reliable, durable, accurate and convenient.

Mr. M. D. Van Buren, District Engineer of the Edison General Electric Company, headquarters at Toronto, Ont., has secured the contract for Niagara Falls, Ont., and will begin at once the construction upon an arc light plant for city lighting and an incandescent system for store and other uses.

Messrs. M. A. Vaslier and J. E. Mosquera recently formed a copartnership under the firm name of Vaslier & Mosquera, and opened a large establishment at Monte 33 and 35, Havana, Cuba, where they will deal in all kinds of electrical railway and steamship supplies. Mr. Vaslier was with The E. S. Greeley Company, of New York, for two years and starts in his new field with a large experience to draw from. The firm has a thorough knowledge of the Cuban market, and their services will be useful to those fitting up electrical plants in Cuba.

The celebrated Crosby Dry Battery is proving to be an unqualified success, It has now been placed on the market long enough to be entitled to the highest testimonials from some of the prominent houses and electrical concerns in the country. It has met a ready sale wherever introduced, and deserves to be spoken of "not only as the best dry battery," but also the leading open circuit battery on the market, and when the company can obtain such eminent testimonials as are herewith submitted, they are certainly deserving of the highest praises. We can only add to them that the Crosby dry battery received the medal of superiority at the American Institute, 1890; which was the highest award made.

PRESIDENT'S OFFICE, METROPOLITAN TELEPHONE AND TELEGRAPH CO., 18 Cortlandt street, NEW YORK, Dec. 3, 1890.

WM. L. MULLER, Esq.
Pres't. Crosby Electric Co.

DEAR SIR: In answer to your inquiry as to the service of the three cells of the "Crosby Dry Battery" which were in use in my office telephone, I have to say that they were connected in February of this year, and remained in almost constant service during the day until November, when they were replaced by others of your latest manufacture.

During the time they were in use they gave very satisfactory services for both long distance and local services, and required no attention whatever.

Yours truly,
(Signed) THEO. N. VAIL, Pres.

HEADQUARTERS NEW HAVEN FIRE DEPARTMENT, NEW HAVEN, CONN., Jan. 26, 1891.

MR. F. M. ARCHER,
Mgr. Crosby Electric Co., New York.

DEAR SIR: In response to your inquiry regardine the Crosby dry battery sent (long distance telephone size) would say that I have equipped all the fire department telephones with them, and have noticed a decided improvement in the service sinceusingt the Crosby dry battery. I think for open circui work it is the best battery I have ever seen.

Yours very truly,
W. C. SMITH,
Supt. Fire and Police Tel.

MINNEAPOLIS NOTES.

Mr. Hover, of the Standard Paint Company, was in the city a few days ago, and reports business booming all over the West in his excellent line of goods.

Clifford J. Ellis, sales agent of the Cambrian Iron Company, was in Minneapolis a few days ago, and was very enthusiastic over the prospect of the immense business in his goods to be done the coming year in the Northwest.

Private dispatches from Duluth state that the council of that enterprising place are seriously considering the advisibility of bonding the city, to either buy out the Hartman Electric Light Plant or of putting in their own plant for lighting the streets, and furnishing electricity to the inhabitants.

It is not known just what the railroad companies will do in reference to the loss of their trade between Minneapolis and St. Paul. Rumor has it that the Milwaukee road will take off the majority of their trains, and it is highly probable that they will do so. The Great Northern will likely follow suit, as the advent of the new thirty-foot cars of the street railway company will still further augment the strife, and cause the railway companies' business to drop far below a paying basis.

A long and hard legal fight may be expected in the near future if the Western Union wires do not go under ground. The council says they must, and the Western Union say they won't, and there the matter stands at present. The outcome is being watched with interest in the northwest. The Western Union is the only company at present in the city whose wires are not underground, or, at least has made no preparations to put them there. The limit has been extended time and again until the patience of the council has been exhausted and has ceased to be a virtue.

A bill regulating the fare to be charged on street cars in the State was brought up in the legislature last week. It provided that no person unable to obtain a seat in a car should be made to pay fare, and that during the busy hours of the morning, noon, and night the legal fare should be reduced to three cents. It was intended as a blow at Mr. Lowry, but it was so strongly denounced by the leading men of the city as an unjust and unnecessary measure, and caused so much confusion and hard words, that the fathers of the bill were glad to drop it.

The street railway company is experimenting with a new motor, which is the design of a workman in the company's shops. If it is successful it will be used upon the St. Paul line. It is said to be a stationary armature machine, with no wire upon the field, and the commutator is upon a separate shaft. The Robbinsdale line has been started, and at the present time it appears that it will be finished before the snow has left the ground. This line runs from Robbinsdale (the Northern Car Company's shops), to the city limits, there connecting with the Minneapolis Street Railway Company's lines, along which it enters the city.

This city is destined to become in the near future, one of the leading lights in the electrical world, if present prognostications are of any value. The apparent faith of capitalists seems to be unbounded, which no one can say is not a good sign of a brisk business in the future. The outcome of this is that hardly a day passes but that one or more companies are not incorporated for the purpose of dealing in electricity or to push some good electrical invention, and the companies are not mushrooms either, but backed by solid men who have plenty of good hard cash, and who not only have but are willing to put it along with their faith, and where they know it will turn them in a good income.

ELEKTRON.

KIDDERS' BATTERIES FOR DEBILITY OR IMPAIRED ACTIVITY OF THE NERVES.

ATLANTA, GA., Dec. 15th, 1890.

JEROME KIDDER M'F'G CO.,
New York City.

Dear Sir.—I have your machine bought in 1874. It is a 10 current and is to-day as good as ever. I have used it almost continously since then till I broke the jar. Have had to replace platinum element several times. * * * I have used other machines but yours is decidedly the best. The A. B. & C. D. currents I use very frequently and find them real nerve soothers and tonics. They afford the best currents for general faradic tonic effect on the system in the treatment of nervous women and general neurasthenia.

Yours very truly,
DR. JOSEPH ADOLPHUS,
44 S. Butler street.

WOOD'S NATURAL HISTORY OF MAMMALIA.

"Wood's Natural History of Mammalia" can be had as a premium and *only* as a premium. It is manufactured for that purpose and consequently the publisher is able to estimate exactly how many he can dispose of and can be sure that no over supply will destroy his profit.

The holder of a coupon in this work is entitled to the ten-color reproduction of Rosa Bonheur's famous painting, "The Lion at Home."

RESISTANCE FOR TESTING.—In the process of electrical testing it is frequently found to be necessary to employ wires of various resistance, either as standards for comparison, or simply for the purpose of placing in a circuit and varying the strength of the current therein. The wires are usually coiled up or wound on bobbins, so as to occupy little space, and are then placed in a convenient case or box: such a set of coils is known as a resistance-box, or rheostat. But if the coils are to be of any real value as standards, great care must be exercised, not only in accurately measuring their resistance, but also in selecting the materials of which they are made, so as to avoid deterioration or change of any kind. The wire must be completely covered throughout by some good insulating substance, to prevent contact between adjacent convolutions, and the material used for this purpose must be able to withstand without change the highest temperature to which it is likely to be subjected; and it must also be incapable of producing any injurious action on the wire. The best insulating material is silk thread, which is wound spirally over the wire in one or two layers. In selecting the material for the wire itself, several points should be carefully attended to. The metal must be free from any liability to alteration by oxidation, &c., (iron is, therefore, unsuitable). But the most important matter for consideration is the amount of its variation in resistance, with a given change of temperature. Copper is very unsuitable for resistance coils on account of its great variation in resistance, and, as its specific resistance is low, it would be necessary to employ either a very long or a very fine wire to make a coil of high resistance. Taking into consideration cost, durability, high specific resistance, and low temperature error, German silver is undoubtedly the most useful material for the purpose; and it is consequently used more frequently than anything else.

SHUNT MOTORS.—The shunt motor has no starting power, since its armature, when at rest, forms a short circuit of very low resistance. To start a shunt motor it is necessary to arrange the switch in such manner that the field becomes excited before the current is allowed to flow through the armature, and to avoid excessive sparking or heating of the armature, in cases where the motor has to start with the load on, additional resistances must be placed into the armature circuit, which are again cut out as soon as the motor has attained some speed.

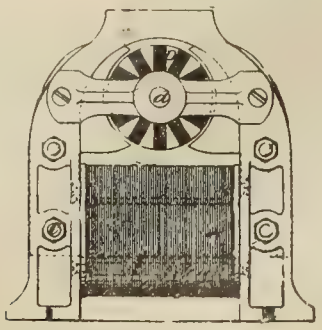
CURRENT.—The current passing through a motor will depend on its resistance, and on its counter-electro-motor force. The former is constant, whilst the latter increases through the speed. The faster we allow the motor to run the less current will flow through it, and the less power will be absorbed by it.

ELECTRICAL PATENTS.

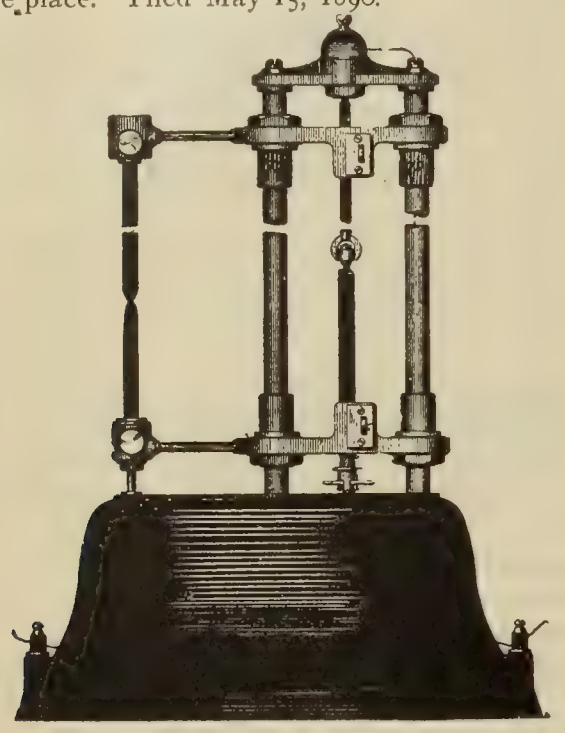
ISSUED FEBRUARY 10TH, 1891.

445,969. Electric Insulator. James R. Branch, Richmond, Va. Filed May 20, 1890.

445,991. Electro-Mechanical Indicator for Fire-Alarm Telegraphs. Thomas F. Gaynor, Louisville, Ky., assignor to the Gaynor Electric Company, same place. Filed May 15, 1890.



NO. 446,092. — DYNAMO-ELECTRIC MACHINE AND ELECTRIC MOTOR.



NO. 446,108.—ELECTRIC-ARC LAMP.

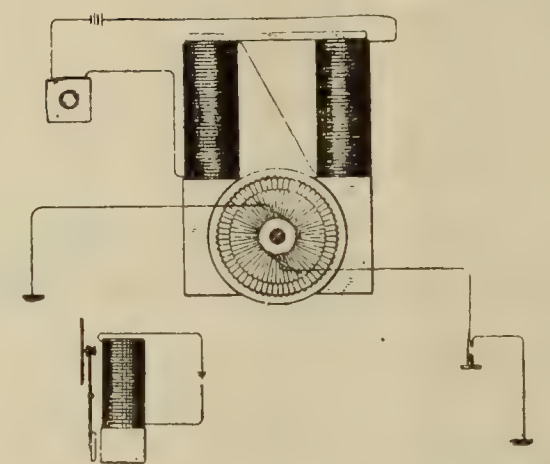
446,030. System of Electrical Distribution for Mines. Elmer A. Sperry, Chicago, Ills., assignor to the Sperry Electric Mining Machine Company, same place. Filed Apr. 1, 1889. Patented in Belgium.

446,031. Electric Switch. Elmer A. Sperry, Chicago, Ill. Filed July 2, 1890.

446,037. Extensible Bracket for Electric Lamps. Jonah E. Titus, Orange, Mass. Filed Mar. 14, 1890.

446,092. Dynamo-Electric Machine and Electric Motor. Edward K. Brown, Brooklyn, N. Y., assignor, by direct and mesne assignments to himself and George Phillips, same place. Filed Nov. 1, 1889.

446,104. Electrode for Secondary Batteries. Marmaduke M. M. Slattery, Fort Wayne, Ind., assignor to the Fort Wayne Electric Light Company, same place. Filed Apr. 6, 1889.



NO. 446,188.—TELEPHONE TRANSMISSION.

446,108. Electric Arc Lamp. Richard H. Mather, Windsor, Conn. Filed Jan. 24, 1887.

446,109. Arc Light. Richard H. Mather, Windsor, Conn. Filed Oct. 11, 1886. Renewed Oct. 27, 1890.

446,142. Electric Signal and Search-Light Lantern. George W. Martin, Somerville, Mass., assignor of one-half to Josiah Knight, same place. Filed Feb. 28, 1890.

446,159. Switch and Signal Apparatus. George Westinghouse, Jr., and Jens G. Schreuder, Pittsburg, Pa. Filed Mar. 19, 1888. Renewed Jan. 10, 1891.

446,174. Electric Cooking Apparatus. Jeremiah O'Meara, New York, N. Y. Filed May 1, 1890.

446,180. Insulating Coupling Block and Cut-Out. Sigmund Bergmann and Charles J. Klein, New York, N. Y.; said Klein assignor to said Bergmann. Filed Mar. 11, 1890.

446,188. Telephone Transmission. James W. McDonough, New York, N. Y. Filed Aug. 28, 1885.

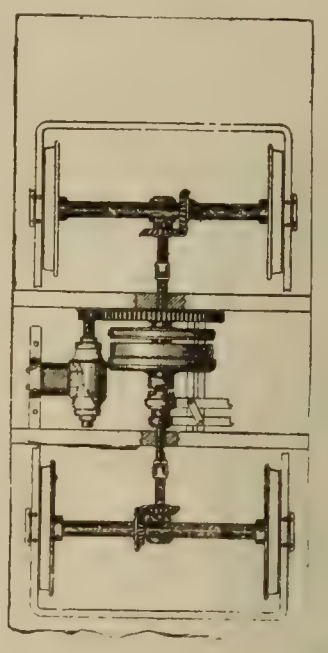
446,199. Multiple Call Box. Frank B. Wood, New York, N. Y., assignor to the Brewer & Smith Visual Signal Company, New Haven, Conn. Filed Jan. 6, 1890.

446,200. Fire Indicator and Extinguishing System. Stephan Broichgans, Milwaukee, Wis. Filed Oct. 29, 1890.

446,212. Heat Regulating Apparatus, George L. Shorey, Lynn, Mass. Filed Apr. 28, 1890.

446,214. Method of Laying Electric Cables. Charles H. Wilson, Chicago, Ill. Filed Sept. 19, 1889. Renewed Jan. 5, 1891.

446,229. Regulator for Electric Motors. Lander S. Harris, Detroit, Mich. Filed Aug. 30, 1890.



NO. 446,245.—ELECTRIC LOCOMOTIVE.

446,245. Electric Locomotive. George R. Baldwin, Montreal, Canada. Filed July 17, 1890.

446,284. Automatic Potential Regulator for Electric Currents. Alvirus 'Lonzo Ellis, Kansas City, Mo. Filed July 3, 1890.

446,297. Electric Arc Lamp. Carl J. Schwarze, Brooklyn, N. Y. Filed Oct. 2, 1890.

446,298. Arc Light System. Carl J. Schwarze, Brooklyn, N. Y. Filed Oct. 9, 1890.

446,313. Electric Signal System for Railroads. Edgar C. Wiley, Bristol, Tenn. Filed Nov. 13, 1890.

446,403. Track Instrument for Railway Signals Mahlon S. Conly, Chicago, Ill. Filed June 5, 1890.

An Attractive Exhibit.

We extend a most cordial invitation to the members of the ***NATIONAL ELECTRIC LIGHT ASSOCIATION*** *and their friends to carefully examine the*

Standard Electrical Test Instruments

which we expect to place on exhibition at the ***PROVIDENCE MEETING.***

Send for illustrated Catalogue 1-66 of Electrical Test Instruments.

QUEEN & CO.,
Philadelphia.

Mason's Electric Lighting.

WITHOUT MACHINERY.

AWARDED MEDAL, American Institute EXHIBITION, NEW YORK, 1890, ILLUSTRATED CATALOGUE of Electrical Supplies mailed on applicasion to

JAMES H. MASON, Manufacturing Electrician,
118 & 120 Park Ave., Brooklyn, N. Y

VULCABESTON

H. W. JOHNS
Manufacturing Co.,
87 Maiden Lane,
NEW YORK.

PLATINUM JAS. SCHAWELL & CO., 29 JOHN STREET, NEW YORK.
Importers and Melters, Wholesale and Retail. Scrap Purchased.

THE ELECTRIC GAS LIGHTING COMPANY,

MANUFACTURERS, IMPORTERS AND DEALERS IN

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NEW YORK, FEBRUARY 28, 1891.

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THE PROVIDENCE CONVENTION.

The most successful convention ever held by the National Electric Light Association was that of last week in Providence. The attendance was larger than ever and the enthusiasm exceeded that at any preceding convention. The utmost good feeling prevailed on all sides, and nothing whatever occurred to cause any friction or discord in the meetings. Indeed these were characterized by unusual harmony. They were, moreover, of exceeding importance to those interested and the fact that good-feeling prevailed to such a degree shows that the members are being drawn closer together by bonds of common interests.

The special feature of the convention was the celebration of the decennial of electric lighting. This important event was most successfully and appropriately celebrated, and the papers read on this occasion will be of extreme value for all time.

Those living in these days of plenty, with every convenience and luxury at hand, cannot appreciate the sore trials and difficulties experienced by the early settlers of this great land. We were born and brought up amid all the advantages resulting from these early trials, and are apt to attach little importance or give little thought to the struggles of these pioneers. The same applies to the development of the great electrical industries, and it was a happy idea to bring together on this occasion recognized representatives of the various branches of electrical industry to tell of their early experiences and difficulties, for the benefit of the present and future generations of electricians. Everyone engaged in electrical pursuits in this day may now appreciate how much of their success and advanced knowledge they owe to the pioneers in the electrical field, and we cannot but admire the pluck and perseverance of these stalwarts, many of whom are still with us. The history of electrical development will shine with illustrious names and the achievements of these persons, through difficulties and discouragements, will teach the young men of future generations the value of these qualities, and inspire them to accomplish something for the good of mankind.

The papers read at the convention were each of great interest and value. They were all thoroughly practical and full of information; that of Mr. T. Carpenter Smith particularly, on alternating currents, was adjudged to be the most important of all to the electric light operator, for it touched subjects most familiar to him. It was an extremely interesting document and he discussed the subject with such ease and covered so much ground as to entitle the paper with the distinction of being a model of its kind.

All the other papers were as valuable in their line but Mr. Smith's appealed more to the electric light station operator on account of its practical bearing. It therefore deserves the most careful study.

All of the other papers are worth careful reading and thought.

MONTREAL THE NEXT MEETING PLACE.

On the suggestion of the ELECTRICAL AGE, Mr. A. J. Corriveau, of Montreal, renewed, in a communication from him, printed in our issue of February 14, the suggestion made by that gentleman at the Cape May convention of the National Electric Light Association, that the next summer meeting of the association be held in Montreal. Mr. Corriveau, in his letter, gave several good reasons why a meeting should be held in Montreal, the main one of which would be the great benefit that would result to the electrical trade on both sides of the border line.

Our Canadian friends, of course, are not so far advanced in electrical matters as we are on this side, and no doubt it would stimulate them to do greater things in that direction were the American society to honor Montreal by holding a convention there.

The ELECTRICAL AGE perceived long ago the mutual advantage that would result to both parties concerned, and brought the matter to a head in the manner already referred to.

We seconded the proposition ourselves in the same issue, and we are happy to state that our arguments prevailed. The next meeting of the National Electric Light Association is to be held in Canada's metropolis.

Mr. Corriveau, it will be remembered, bespoke for the members of the association a hearty welcome by the citizens of Montreal, and all those who know how well her people can dispense hospitality will understand that they were no idle words.

We were shown a letter at Providence from the Mayor of Montreal, in which that officer states that the City of Montreal would feel honored by the presence of such a body of men in convention, and promised that the city would do all in its power to make their visit a pleasant one.

We think the committee which had in charge the matter of selecting a place for the next meeting, acted wisely in selecting Montreal. Much good will certainly result to American electricians by going there, and there is no question what the effect of their presence will be on our Canadian neighbors.

Our electrical houses should leave nothing undone to have a most complete and extraordinary display of their goods at Montreal, and the exhibition should be made a feature of transcending importance. Such a display will open the eyes of thousands of our Canadian neighbors, and will give them an insight into the wonders of electricity, of which they at present know little. It is characteristic of Canadians, as with Englishmen, to be slow but thorough in what they undertake. They have been comparatively slow to put electricity to the many and valuable uses that we have, and there is no gainsaying the fact that an exhibition among them showing what we have done and what we are doing, will give electrical industries in Canada a wonderful impetus. They need a stimulus of this sort, and when Canada is annexed to the United States, or, as the Canadians say, when the United States are annexed to Canada, American enterprise and invention will have an enormous additional field for expansion. It is well, therefore, to pave the way for the coming of this possible result, and the first step in this direction will be the Montreal convention.

Apart from the business aspect, the members of the association may depend that their trip will be an enjoyable and agreeable one. There are many places of interest around Montreal, and the trips along the St. Lawrence are unsurpassed in beauty of scenery. A good time, therefore, may be anticipated.

OUR CALLERS AT THE CONVENTION

One of the pleasantest duties the staff of the ELECTRICAL AGE had to perform at Providence, during the convention, last week, was to receive and entertain the host of friends who called at the ELECTRICAL AGE headquarters to pay their respects. All had a compliment to pay to the new ELECTRICAL AGE, and we appeciate the hearty good will that our friends entertain toward us. The ELECTRICAL AGE register of callers was generously filled with names, and many names of prominent "electric lights," shine on its pages. Close on to three hundred autographs were secured, and the record will occupy a prominent place among the archives of the ELECTRICAL AGE.

THE RAPID TRANSIT PROBLEM IN NEW YORK.—The New York *Commercial Advertiser* of February 16th, published an extremely interesting article on the rapid transit question now being agitated in New York City, from Mr. Frank J. Sprague. The article consisted of the expression of Mr. Sprague's opinions in answer to a series of questions propounded by the journal named. It is a most complete exposition of the subject, and Mr. Sprague, of course, advocates the use of electricity as the only solution of the great problem which is now agitating the public mind in New York. We regret that our space does not permit of the reproduction of the article, as it is well worth careful reading. Copies of the paper were distributed at the Electric Light Convention at Providence last week; and Mr. Sprague's masterly handling of the subject was very favorably commented on.

THE ELECTRICAL AGE ALUMINUM MEDALS.—The distribution of pure aluminum medals by the ELECTRICAL AGE, at the Providence convention, last week, was one of the main features of the meeting. ELECTRICAL AGE badges were met with everywhere, and everybody wore them in the button hole. The ELECTRICAL AGE was heartily and generally complimented for its enterprise as exemplified in the medal. Everybody who had one wore it, and felt himself a highly honored and privileged character. Indeed, it was generally acknowledged that our badge carried with it the freedom of the city, and it served as a pass more than did the Electric Light Association badge. The ladies who accompanied some of the members to Providence were all decorated with our medals, and wore them on all occasions. The ELECTRICAL AGE was more talked of than anything else, and the badge was a decided and positive hit.

THIRTEENTH ANNUAL CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

HELD AT PROVIDENCE, R. I., FEBRUARY 17, 18 and 19, 1891.

FIRST DAY'S PROCEEDINGS.

President Marsden J. Perry called the convention to order at 11:15 a. m., in Freemason's Hall.

The President: Gentlemen of the convention. It is very gratifying indeed to me to meet you here at my own home. Already I discern evidence of earnest purpose that will accomplish most excellent work before we go hence.

I have great pleasure in now introducing to you Hon. Charles Sidney Smith, Mayor of the City of Providence, who will bid you a formal welcome to the city. (Applause.)

ADDRESS OF WELCOME.

Mayor Smith: Mr. President, Ladies and Gentlemen. I esteem it a high compliment, the kindness which your President has bestowed upon me in asking me to extend to you a cordial welcome to our city. My fellow citizens feel highly honored by your presence among us. I wish very much that the conditions overhead might have been more pleasant, less tearful. I certainly wish that your semi-annual convention might have been held here in the summer months when we could have shown you an institution peculiar to ourselves, and to which I very much doubt that the application of electricity as a motive power would have in any way improved, to wit, our method of despatching clams. (Laughter.) It is an institution peculiar to Rhode Island. Our city is large in population, has industries diversified, and some of them of the finest, and many of them of the largest, I think, in the world. We are perhaps not so thoroughly acquainted with the subjects which you will discuss as we ought to be, or as many of us desire to be. There is an element in our community like all others fearful of its results. Some men by reason of their habits of life, I may say, are always fearful of death; men often flee when no one pursueth—"The wicked flee when no man pursueth." Before you get through with your convention I hope you will be able to tell us whether there is any danger in that matter which we are so earnestly discussing at the present day, namely, the application of electricity as a motive power to street cars. We need it very much in some form or other, and we are only endeavoring to find out if death will ensue hourly by its application. (Laughter.)

Gentlemen, the subjects which you are to discuss I have no knowledge of and am entirely unacquainted with them. Sometimes I speak upon matters which I have no knowledge of, but it is never when I know it. Therefore I shall not undertake to discuss these subjects, but undoubtedly before your convention closes I shall know more than I do today. I have therefore prepared no remarks, but simply desiring to express our gratification that you have assembled with us, and to express to you the pleasure which it will afford us to show you through our manufacturing industries and also leaving you to the tender care and the loyal service which I know that our committee will render to you in making your stay agreeable and pleasant, and, I hope, profitable.

Again, Mr. President, and gentlemen, I thank you for this kindness. (Applause.)

The President then read his annual address, as follows:

MEMBERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION:

Gentlemen:—At this, our Thirteenth Convention, we have a double duty to perform. A duty to the past, a duty for the future. We who are absorbed with dealing with the problems of to-day, and in attempting to reach a little way into the future by anticipating the demands that may be made upon us, can well afford to pause a moment to pay a fitting tribute to those whose labors in the past have made our present possible.

We are here to pay to the pioneers of the Electrical industries, a tribute of intelligent appreciation of intelligence, and to recognize in a formal manner the magnificent realization of the inventors' hopes and the scientists' dreams, to erect a milestone that shall mark the closing of the first decade of the practical commercial application of electricity, a development which has shown grander results than ever before known in the industrial history of the world. I ask you to step back a few years, to the time when no electrical work as we now know it was in existence, and from that standpoint measure the meaning and value of what has been done.

We are told that Franklin's kite experiment was made in 1752, and that in 1753 he invented the lightning rod. The age of electricity may be reckoned from that date.

In the year 85 A. F. (after Franklin) the first electrical company in the world was incorporated by a charter granted by the State of Rhode Island. This charter was granted in June, 1838, to E. J. Mallett and his associates, successors and assigns. By whose genius it was conceived, and what became of those aborigines of the electrical age, I cannot tell you. That Mr. Mallett and his associates, whoever they were—no other name is mentioned in the charter—were true prophets of science and industry, is unmistakably shown in their marvelous conception of the possibilities of their undertaking. The third section of their charter is as follows:

"The said corporation shall have power to cause experiments to be made in electro-magnetism, magnetism and galvanism, with a view of the development of said sciences, as a motive power for machinery or other useful purposes; also, to manufacture the necessary machinery and other apparatus therefore, to build and construct boats, vessels, railroad cars, and engines to be moved by electro-magnetism, magnetism of galvanism."

Has any one to-day broader views of the possibilities of electric power than this?

In selecting Providence for a meeting place of your Thirteenth Convention, you builded better than you knew. You not only at this time celebrate the first decade of electric lighting, but you celebrate it in the birthplace of far reaching appreciation of electric power.

In the year 91 A. F. (after Franklin), Morse constructed the first practical telegraph line. He connected Washington with Baltimore by telegraph in 1844. Seven years before that he exhibited his telegraph in the University of New York; between invention and success there were seven years of working and waiting.

In the year 113 A. F. (after Franklin), Field laid the first successful ocean cable in 1866. Eight years before, there were eight years of patient, courageous work, such as man has seldom had the power to endure.

In the year 122 A. F. (after Franklin), Bell gave the telephone to society in 1875, and made all the people of the town neighbors. His years of faithful work preceding crowning success are well remembered.

In the year 125 A. F. (after Franklin), Brush exhibited a light that caused people to think the sun had forgotten to set at the ordained hour. The first time the public ever saw a lamp burning in series was at the exhibition of the American Institute, held at New York, September 11th to November 23d, 1878.

Two isolated plants were then sold, consisting of a six-light Brush dynamo and six series lamps. One went to Losier & Co.'s, dry goods merchants of Brooklyn, N. Y. The other went to the Messrs. Freeland, Loomis & Co., Continental Clothing House, in Boston, Mass.

The first arc Light Central Station was installed by the California Electric Light Company, of San Francisco, in 1879.

In the year 127 A. F. (after Franklin), Edison divided the electric current and produced miniature suns that might be placed wherever more light was desired for use or pleasure.

The first Edison isolated plant was installed in the printing establishment of the Hinds & Ketcham Co., Brooklyn, N. Y. A paragraph in a circular issued by this company under date of February 1st, 1881, is as follows:

"Our building is 40 x 160, four floors lighted on all sides and fitted throughout with Edison incandescent lights, operated by a special dynamo electric machine operated on the premises. We are the first manufacturers in the world to put into practical operation this great triumph of American Genius, which is a true substitute for daylight (showing all colors in their natural hues), and our friends are invited to call and see the operation of Professor Edison's wonderful subdivision of the electric current and vacuum lamp."

Mr. Hinds writes: "I think the proudest moment of my life was when I turned on the switch for the first time and saw the room lighted up by what seemed to be the greatest wonder of the world, the incandescent lamp."

The first steamship electric plant was one of Edison's, installed with 120 lamps in the steamship "Columbia" of the Oregon Railroad & Navigation Co., Jan. 10th, 1891.

The first Edison central station was installed with 4,000 lamps in Pearl street, New York City, September 4th, 1882. To start this plant Edison had to overcome more than electrical, mechanical and financial difficulties. He had New York Aldermen to deal with. The following occurs in an interview with Edison, published in the New York *Herald*, Jan. 20th, 1881.

"When will you be ready to light New York?" Edison replies: "I am ready now but we have no permit. * * * I find it hard to get the requisite aldermanic condition; the company laid an application before the Board. * * * The application was referred to the Laws Committee and was reported back saddled with conditions which savor of a body of gas men rather than public servants. They wanted, in the first place, the company to pay ten cents per lineal foot for all wire laid down. That would be twenty cents for every foot of street, for we would run wires on both sides. That is over $1,000 a mile. * * * This, too, when gas companies pay not a cent. The second clause was that we should light the streets at 10 per cent. above the actual cost; * * * the third clause was that after five years, three per cent. of gross receipts shall go to the city."

This is an example of encouragement given by the first city in America to American genius, skill and enterprise.

Ten years ago the only electric currents in use were the feeble currents of the telegraph and telephone. There was then not a lineman nor a workman of any kind who had ever heard of the high tension currents we are using to-day for the services of light and power. No man had ever handled conductors carrying such currents, nor manufacturing apparatus for operating them excepting in an experimental way. There was not an educational institution giving a course of technical training in electrical engineering. Consider this, then behold what has been accomplished in the first decade of electric lighting. A period of time no longer than Morse, Field and Bell were compelled to wait and work to span the chasm lying between invention and practical success.

Confine your observation exclusively to the United States and you will find the electric light in use by six thousand isolated plants. Seven hundred steamboats of American register, 350 gas companies furnishing electric light and power, 200 street railroads operated by electric power, 1,500 electric lighting and power stations. Facts like these need no embellishment to make them eloquent.

Now look beyond the limits of this country and see the development of electrical industry throughout the world, during this first decade. Never before has such a transformation taken place. And this is not the end of it, but the beginning of things that are to be.

American genius, skill and pluck, has in all departments of industry secured within this century benefits of high value for all mankind. That this truth may be known for all time, it is our duty to preserve in the most instructive form proper records of the achievements of all American Industrial Pioneers. Soon, a fitting opportunity will present itself for the celebration of the first one hundred years, by duly honoring the beginning of the second century of the American Patent System. In that grand marshalling of those who made prophecies and who fulfilled them, who had the genius to see, the skill, courage and patience to execute, we must see to it that electrical workers occupy their rightful place of honor. The interest begun here should reach full tide, and should culminate in placing in the National Museum at Washington a collection of drawings, models, relics, etc., illustrating the birth and development of electrical industries in America. Such a collection would give at a glance to the unskilled workman or the general public an intelligent idea of successive steps of progress and invention and construction that have led from the beginning of the telegraph and telephone to those systems of communication as at present perfected, from the first production of an electric spark to the light we now have, from the first lifting of a weight of an electric magnet to the present marvelous manifestations, distribution of electric power. It is of the highest importance that such a collection be made and preserved, not alone for the instruction of the people of our own time, but as a history for all, written in the forms of the things we use, thus enabling future investigators to determine the relative influence of the electrical industries in forming the character of our civilization, and in enhancing the degree of our prosperity.

One point is worthy of emphasis while engaged in this review; this is the year 138 after Franklin. Would society consent to be placed back to the conditions it was in when Franklin made his kite experiment, if it could thereby recover from the pioneers in electrical work all that they have personally retained from the wealth that has been cheated by developments from their initial undertakings? No, not for a single day. They have given to society benefits a thousand times more valuable than all they have received, or that it is possible to confer upon them. Their services are of that divine order in the measuring of which money values are impotent. Limits of time and space are unknown to them. They are with us, and others, but they take cognizance of no country, no race or generation. Their field is in the universe. The benefits of their service are for all men. They receive tribute of grateful honor from all intelligence. Their work is

of the past. Our work is from the future. What report shall be made at the celebration of the close of the second decade of electric lighting and power? The first Edison station has increased its capacity from 4,000 to 15,000 lamps in eight years. At this rate of increase, this plant will be supplying 60,000 lamps ten years hence. We cannot measure the limits of future developments. We have done much, but we have produced only a sample of what is to be. An observer states that there is not a plant in existence having a sufficient capacity to supply one-twentieth of the demand for light and power that now exists within practical working limits of its area of distribution. If this be true, then within ten years if each station is to fully occupy its territory, and keep pace with the growth of population, the capacity must be increased many times.

The central station men of this country do not realize the possibilities of development that lay before them. They do not see many sources of income that are as yet untouched. The accelerated pace at which progress is now moving, will render the work of the next ten years enormously greater than all that was accomplished during 138 years after Franklin. The car of progress will not stop for us any more than it did for those who were before us. We have given it momentum, but we cannot hinder it. Let it be our ambition, then, as it is our duty, to supply every demand for every kind of light and power service within reach of our stations. Those of you who do not do this, will induce competitors to come within your limits, to divide your business and erect an obstacle in the way of your growth that can be overcome only by buying out or selling to the intruder. To-day, the whole territory is yours to hold, to occupy, to serve. Be the equal of your opportunity and at the second decennial celebration of electric light and power, the capacity of your plant may be many times what it is to-day.

The records of the beginning of the electrical industries are being written for the imperishable pages of history. We have gained the strength of the difficulties that have been overcome like the armies of volunteers that made ours a free nation. The forces now engaged in electrical work were recruited from every avocation. To-day, over thirty educational institutions of high grade are preparing the best brains among young men to do scientific and technical work. The practical American workman who has proven by what he has done that his rank is second to none, the peer of skilled workman of the world, is educating his helpers and associates in the practical school of daily occupation.

Enterprise is very young. We are incidents. When an industry, like human energy and force will go on for ever; when we tire and seek our rest, younger men will be eager to fill our places. Let us then begin where we may. Let us honor ourselves by fulfilling our double duty, which is, to duly honor those who have placed us under obligation for the work they have done in the past, and so to do our work that our successors shall have equal cause for honoring us.

The President then declared the thirteenth Convention open for business.

Secretary Foote read invitations:

First, from Henry Howard, President of the Providence Telephone Co., extending the courtesies of that company to the members of the Association during their stay in Providence.

Second, from Gardiner C. Sims, Vice-President of the Union Club, Providence, tendering the freedom and hospitality of the Club's rooms to the members of the Association.

Third, from President C. H. George, of the Providence Board of Trade, an invitation of like nature.

Fourth, from William B. Sherman, Secretary of the Corliss Steam Engine Co., to visit the works of that company.

Fifth, from the Rhode Island Tool Co., to visit their establishment.

President Eugene F. Phillips, of the American Electrical Works, extended an invitation to the members of the Association and ladies to attend a house warming tendered in their honor at the new factory of the American Electrical Works, Stewart street, Providence.

An invitation was also read from Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers, to the members of the Electric Light Association to attend the meeting of the Institute of Electrical Engineers at their rooms on Thirty-first street, New York, Tuesday, February 24th.

The first order of business was then taken up, being the report of the Committee on Copper Tariff, Mr. Charles A. Brown, chairman.

Mr. Brown: Mr. President, the Committee on Copper Tariff has practically no report to make. At the last Convention we reported the progress that we had made at that time. The reduction of the duty on copper was, as you all know, embodied in the McKinley Bill, which became a law, and there is now a very low rate of duty—something like twenty per cent. of the former rate of duty on copper in its various forms. This bill having become law, and this being now the duty on copper, and no further action being required at the hands of this committee, I would suggest that the committee be discharged. (Carried.)

Mr. Brown read a telegram from Mr. John P. Barrett, Chairman of the Bureau of Electricity of the World's Columbian Fair, expressing his regret at his inability to be present at the Convention on account of sickness in his family.

Mr. W. H. Markland, Electrician for the Pennsylvania Railroad at Altoona, Pa., then read a paper on "Electric Lighting as Applied to Steam Railroads." Mr. Markland's paper will be found on another page.

Mr. DeCamp: I remember six or seven years ago that it was reported that the Pennsylvania Railroad Company had appropriated, if I may so put it, a certain amount of money to the experiment of lighting cars, which has been referred to in Mr. Markland's paper—not only electric lighting, but experimenting with various forms of lighting by gas and oil. I had some knowledge at the time of the use of the storage battery. The other methods of car lighting by electricity I know nothing about, and heard very little about it; but I presume they have come to some definite conclusion upon the subject. If the gentlemen can tell us, or is at liberty to state, what are the precise conclusions of the railroad company as to the relative merits of electric lighting as compared with any other form, and particularly as to the different methods used in electric lighting, either by battery or by direct current from the dynamo, I think it would be very interesting and useful to the association.

Mr. Markland: I may say that the question of lighting cars by electricity is somewhat out of my department, but I should say that six or eight years ago we tried experiments with the storage battery. We first had the storage battery under the car. That was tried for a while, but not with very much success. Then the railroad company made nine or ten cars for use between Jersey City and Philadelphia. Those were all lighted with the storage battery. We had a certain amount of success. It was rather a difficult matter, though, as we had to fill the batteries up at Jersey City, and it so happened that if we had rather a dark day and then had to run the cars back again to Jersey City at night the chances were we would have to come back with no light, which was of course not very pleasant. I think they equipped probably fifteen or twenty cars with the storage battery under that plan, and they tried almost every kind of a storage battery without any great success. I might say, by the way, that we have thrown the batteries all away now and have put in gas. The Pullman Limited, as you may all know, is lighted with a dynamo which is located in the baggage car and connected with storage batteries in the cars, where they pump the electricity into the storage batteries and use that. Of course, that does pretty fair; that is, they get very good light on that train. But when you come to figure up the cost you will find it is pretty heavy. About the time that electricity came out, however, several systems of lighting cars with gas came in. The Frost system, I think, and several others came in, which I suppose you are all familiar with, in Philadelphia. The old way for lighting with compressed illuminating gas cost us in the neighborhood of ten cents an hour, with six burners, but since we have got this Frost system (I think that is the name) why, the cost of lighting is so small that we can hardly find it—not over five cents an hour for seven burners and they are, I should judge, of about twenty c.p.

Mr. M. J. Francisco: I have been very much interested in Mr. Markland's paper, especially in reference to that part of it regarding the lighting of railroad cars. I have been furnishing light to the Central Vermont Railway Company for the last two years, lighting the railroad yard, the station and the round-house. His theory of the best plans is the same that we have adopted there, by placing lights upon the tops of poles. Our poles are fifty feet above the ground, with lamps on top of them. In the round-house we find very serious trouble. It is the old style of round-house, with a dome at the top, and a platform in the center to transfer the engines to different tracks. Of course, our lamp hangs in the center, and every engine that comes in stops on that platform, and opens her pipe, and throws the dust and soot and everything up where it settles on to the lamp. Naturally, it covers not only the lamp but the whole top of the building, so that in many cases you will find the dirt an inch deep. We have trouble in getting short circuits on the lamp from that stuff gathering and making one solid block on the lamp. Now, if Mr. Markland has any suggestions that we can give to correct that, we should be very glad to know how it can be done. This top is covered with soot, smoke, and cinders, which, combined, make a regular paste. In the stations we use the arc lights, suspended from different parts of the station. We have had a great deal of trouble in protecting the lights from being short circuited.

This principle of applying electricity to the lighting of cars and to the motive power of cars is one great point. People at the present time do not seem to understand it; they cannot understand electricity. It seems to be a sealed book to almost the entire mass of the people. And there is where the trouble at the present time lies in our advancing the cause of electricity and the way we have to meet it.

Mr. Pope: It is one of the arguments against electricity always that it is dangerous, and one of the reasons why it has been adopted for car lighting (although it has been expensive) is because it was safe. In going out on the Jersey Central Road the other day, I saw a Pullman car with half a dozen of the windows boarded up on the outside. The next morning I read in the newspapers: "Gas explodes under a car. Two men severely injured in the New Jersey Central yard." I do not know that such an accident is usual, but they are now introducing the gas system on the New Jersey Central Railroad, and the plant which they set up cost them $75,000. Why this accident occurred has not yet been ascertained, but I presume it was not due to electricity because there are no wires in the cars (Laughter).

Mr. DeCamp: As I take it, there is no question of the desirability of electric lights on the part of railroad companies; but it is simply a question of cost. I also take it, in the spirit of progress the railroad companies weigh very carefully the relative value of it. It is not that it lessens the cost in one case ten cents an hour and gas costs five cents. They don't stop with that fact, but they stop with the considerations after having duly considered whether it is worth that difference, the safety of it and the comfort of it being given due consideration.

This closed the discussion on Mr. Markland's paper.

The president then announced that on account of the large number of important papers and reports to be presented, and also on account of the memorial session, the executive committee have decided to extend the meeting so as to include two sessions on Friday, making a four day's meeting.

On motion, the Convention took a recess until 3 P. M.

On reassembling the report of the Committee on Underground Conduits and Conductors was read as follows:

Report of the Committee on Underground Conduits and Conductors.

C. H. Wilmerding, Chairman.

The Committee on Underground Conductors begs to submit the following report for the last half year. The change which was made recently in the chairmanship of this Committee, delayed, to a great extent, any active work on its part. The further delay in getting our printed matter, which it was intended to send to all companies operating Underground Conductors has left us without any information on the subject in hand. It was proposed to follow out the lines indicated in the report of the Committee at the Twelfth Convention. Only one company has reported, viz., The Chicago Arc-Light & Power Co., which reports as follows:—

Miles of duct occupied by High Tension Underground Conductors, ... 28 1-2
Miles of lead-covered cable in ducts 79
Miles of cable in iron pipe or bracketed under sidewalks for distribution, ... 72
Total number of miles of underground high tension cable, ... 151
Total number of cases of trouble on underground cable, 1890, ... 31
Divided as follows:—
Result of mechanical injury, ... 18
Result of defective joints 4
Result of defective insulation, ... 2
Other burnouts, cause not accurately determined, 7

During the year 1890, 33 8-10 miles of underground conductors were laid by this company, and during that period there was only one case of trouble on this 33 8-10 miles, the trouble being in a defective joint. They further report that their rebates during the year for defective service amounted to one-third of one per cent. of the gross earnings; and they estimate that possibly one-third of these rebates are attributable to circuit trouble; the balance to defective lamps, dynamo and engine troubles and miscellaneous causes.

The longest underground circuit is 7 1 2 miles from pole to pole, and carries an electromotive force of 2,500 volts. They add that blizzards have not in any way affected their service.

The Committee in offering this report, realize that the information is of a very meagre character, but is of the opinion that if similar reports, or still fuller reports could be had from all companies operating underground conductors, very interesting and instructive data could be laid before the convention;

and they request that when questions are published and sent to various companies they will receive attention, and that the information required will be given fully and cheerfully by all those whom the circulars may reach.

The report was accepted and the Committee discharged.

The report of the Committee on "The Relations between Manufacturing Companies and Central Stations" was then read as follows, and on motion it was ordered received and its recommendations adopted.

REPORT OF COMMITTEE ON RELATIONS BETWEEN MANUFACTURING AND CENTRAL STATION COMPANIES.

MARSDEN J. PERRY, CHAIRMAN.

The functions of this Committee are almost defined by its title. The idea of and the necessity for this Committee is to have a recognized counsel for mutual conference and conciliation in case either a Manufacturing or a Central Station Company should feel aggrieved by the business methods of those with whom they have dealings or be called upon to contend in business competition. In cases of this kind the Committee can take no action unless requested so to do by one of the aggrieved parties. No such appeal has been made to the Committee.

This Committee is also intended to represent the general interests of Central Station Companies in case of unwarrantable competition in cutting prices for public lighting contracts, or to secure franchise rights in a town where a company is already in active operation and ready to perform all forms of service required at reasonable rates. Your Committee is glad to state that no case of this kind has been brought to its notice since the twelfth convention. It has therefore not been called upon to use the influence of the Association in that direction.

It is thought advisable to continue the Committee as one of the standing Committees of the Association The time may come again, as it has certainly existed in the past, when it will be necessary for this Committee to exercise functions such as those indicated, or conduct negotiations of a different character under instructions from the Association.

The next order of business was the reading of a paper by Mr. F. H. Prentiss on "The Distribution of Steam from a Central Station." Mr. Prentiss's paper will be found on another page.

During the discussion which followed the reading of this paper Mr. A. L. Ide made the following remarks on the subject:

MR. A. L. IDE:—My experience in heating has not been very long or extensive. Last fall we put in about 2,000 feet of main, about one-third eight-inch, the balance six-inch. Our station is favorably located in the central business portion, and we conceived the idea of selling our exhaust steam. We have a five-year contract for furnishing power for an electric railway. At present they are running ten cars. We also run a motor circuit that is now using about fifty h. p. We made a contract with seven store buildings to heat them for five years with exhaust steam at a price averaging about $200 a year. The buildings contain about 100,000 cubic feet of space each. We did not contract for any more at that time because we wanted to be sure to have sufficient exhaust steam to supply them. We have now given about four months' service, which has been very satisfactory in every respect, warming the buildings satisfactorily in the coldest weather. We never have exceeded four pounds back pressure. Ordinarily we carry two pounds back pressure, and the gauge shows a reduction of about one pound at the extreme end of the mains. We estimate that the expense of furnishing this exhaust steam is trifling. We do not notice any difference in the consumption of coal required, and we now find that, with the surface exhaust steam, we do not utilize over half. Next summer we expect to add about 1,000 feet more main. We think our present steam will be sufficient to double our capacity. We estimate that the receipts we get from steam are about one-half profit. It does not require any additional attendance. It is simply the interest on the investment on the plant and the slight additional fuel it requires.

Mr. Weeks considered the matter of the distribution of heat from a central station a very important question, and one that he thought the near future has a solution of in store for us. He hoped that the solution would be an electrical one, "but, so long as the best electrical heaters require from 300 to 400 watts to boil a cup of tea, we cannot hope for very satisfactory results in the balance sheet by using that system. It occurred to us in Kansas City that we were having, as the doctor called it, a bye-product, which we might possibly get something out of. We therefore contracted with the Holley Company to put in a few hundred feet of pipes in connection with our station, which is located in the business centre of the city, and arranged with our neighbors in the immediate vicinity, within the block, to do their heating for them. We have found that we have never carried over six pounds back pressure, and from that it ranges down to two; it usually runs about three or three and a half pounds. We have had the plant in operation now for about fifteen or sixteen months and have been very much pleased with its operation so far. We have cleared about fifty per cent. of the cost of that plant during the first year."

The President: The next paper on the list on the Municipal Control of Electric Railroads has not been presented. The next after that is the report of the Committee on National Insurance Rules—George Cutter, Chairman.

Mr. Francisco: The committee has accomplished nothing, and it has consequently nothing to say. I move that the committee be discharged. (The motion was carried.)

The President then read the following recommendation which was adopted:

THE PRESIDENT: "I recommend that a standing committee be appointed to formulate, and, from time to time, revise a code of instruction to be known and published as Instructions of the National Electric Light Association for the safe and economical wiring of streets and buildings for the service of electric light and power, and for the proper inspection and maintenance of the same."

The chair was on motion authorized to appoint the committee, after which the meeting adjourned until 10 o'clock Wednesday.

THIRD SESSION—WEDNESDAY, FEBRUARY 18TH, 1891.

The Convention was called to order by the President at 11.10 A. M.

The President: It seems eminently proper that we should pause a moment in our advancing course, like a traveller ascending a mountain side, to look back upon the path he had already traversed. There will be many things of interest, and many things to remember that are gay and some that are sad, for they are not all with us who started out in the morning of our work.

There are those here who represent the ocean cable and the overland telegraph and telephone, that which has enabled two continents to converse together, the inhabitants to hold familiar intercourse with each other; those who witnessed the first division of the electric current and saw the glow of the infant incandescent lamp; those who witnessed the first uncertain sputter and flare of the arc lamp in its early state; those who by their energy and perseverance have dotted the country all over with the little stars of the incandescent or vacuum lamp, and the sun-like brilliancy of the arc light, until they vie with the firmament above us, and those who have seen the transmission of this mysterious energy by the hundreds of horse power over a little conductor no longer than our grandmother's knitting-needle to revolve the wheels of our industrial establishments and propel in all directions vehicles for the transportation of passengers and freight.

These are only a few of the triumphs which have attended the development of the industry which we represent, but it is not my desire to entrench upon the time which belongs to you. I wish, however, to relate a single instance of my experience. One of the first duties which came to me as manager of the Narragansett Electric Lighting Company was the laying out of a new circuit.

When I first came into the Narragansett Company, six years ago, Mr. Thomas had just been appointed Superintendent, and the first duty we had was to lay out a new circuit within two or three days after we came together. He was somewhat new to the business and I myself but little acquainted with it, and we thought we would draw it out on paper, and we looked down this street and back again into this building and out again and it was a very crooked affair, and I said, "Thomas, this will never do. We know electricity is not going around those corners; it is going to fly right off the angle of the wire, straight into the ground and go into the buildings." He said, "No; when I was working for the burglar alarm system we used to coil the wire on a pencil, and I think the idea was to give it a whirling motion so that it would go around those corners." So we put out the circuit crooked and it worked ever since.

Judge Armstrong then read the letters of regret at their inability to be present from H. H. Bigelow, Worcester, Mass.; Charles F. Brush, Cleveland, Ohio; Cyrus W. Field, New York; Dr. Norvin Green, New York; George G. Ward, New York; Alex. Graham Bell, Washington, and Francis A. Walker, Boston.

Mr. Thomas D. Lockwood of the American Bell Telephone Company was then introduced and gave a few historical remarks on the telegraph from its earliest beginning down to the present time, which were of extreme interest. He also treated the telephone in a like manner, and in closing his remarks said:

Prior to 1876 we had not many industrial applications of electricity. Probably eighty per cent. of the persons interested in it were engaged in telegraphy, and the remaining twenty per cent. was divided between instructors of youth and persons engaged in electrotyping and electro-plating. I think we should do all honor to the men, who, largely by rule of thumb it is true, yet carried on some of the grandest uses of electricity from almost the invention of the Voltaic pile in 1800 until the present time, without knowing much about it, without any literature on the subject, with only five text books up to the present time which touch upon it at all, and yet who made that business a success.

All this is changed. The civilized world glows with the illumination of electricity; the electro motor is abroad doing our work, and the long suffering car horse and mule are at last encouraged by the application of power to street railroads to believe that Spring has visited them; while five hundred thousand telephones in the United States, and as many more in other countries, attest the fact that people will and must talk.

Those of you who know anything about the deeds which sometimes may go on in rooms like this—those of you who know anything of capitular masonry will agree with me when I say "This is a good work." (Applause).

But I wish to say more. I wish to say that all of this work which has been done is attributable to two things; a quality and a practice, enterprise and experimentation. There is no lack of the former in the United States, but I fear that we do not as yet fully appreciate the latter. It is impossible that I or any one can ever over-estimate the value of experiments.

Those of you who have studied the story of electricity and its triumphs well know how it was experiment that guided Oersted to the missing link between electricity and magnetism; which gave Davy the honor of discovering electrical illumination; which enabled Faraday to patiently fish out bit by bit the pieces of the puzzle composing the one department of electricity, which more than all others has made electrical illumination, traction, and oral communication living realities; magneto electric induction.

It was experiment that enabled Spencer, Jordan and Jacobi almost simultaneously to discover the art of electrotyping; and the Elkingtons with their associates about the same time to introduce electroplating; arts which useful from their inception have now become ornamental also; and which have put into the hands of true artists a ready means of reproducing the beautiful in a surpassingly beautiful way. It was experiment that carried Bell to the invention of the art and apparatus of telephony; and Thomson to the art of electric metal working.

And looking at the other side of the case, it is equally certain that it is the neglect of experiment (which is our means of conversing with Nature, asking questions of her and receiving her replies) and the neglect of reasoning based on experiment, which prevented electricity from advancing a single inch for the first 2000 years of its history, from the time of Thales the Ionic Philosopher to the time of Gilbert, the Elizabethan sage; the founder of electricity as a science.

We find in Holy Writ that when the prophet stood on Mt. Sinai the manifestations of the proximity of the Divine Presence were successively—a strong wind, a fire, and a still small voice; and I rejoice to-day that the still, small voice has been found worthy of being asked to take part side by side with the fire and the earthquake and the hurricane." (Applause).

At the conclusion of Mr. Lockwood's remarks Prof. Elihu Thomson was introduced, and spoke as follows:

"I suppose I am to be called upon to-day to represent the fire, the earthquake and the hurricane. I feel that the vastness of this representation is appalling. I will do a little toward such representation, but I will make it rather mild, so that you need not fear the fire, the earthquake or the hurricane.

We are here to celebrate the completion of the first ten years of the great industry of electric lighting—great now, but ten years ago very slight indeed. We are here also to recall circumstances, to recall incidents of our early experience in this industry and kindred industries. I will begin by recalling a few circumstances which happened to me in 1889 and which made a lasting impression. It was my privilege to visit the Royal Institution in London and there inspect the original manuscript records made by Sir Humphry Davy and by Faraday—the two great mains, lying, as it were, at the foundation of the sign, at least of electric lighting,—to inspect also the apparatus and even to handle the apparatus which Faraday used in his early experiments. I can say that I did it reverently, undoubtedly. These two mains are coupled with the beginnings of our great industry. Sir Humphry Davy was the first man who ever saw the electric arc: the first man who put two wires together tipped with carbon,

drew them apart and got the flame which we now call the electric arcs. He called it the electric arch, I believe, or an arch of flame. I saw the record of this original inscription, and the inscription in Davy's rapid hand that this was a gorgeous experiment. He did not, apparently, realize what it might come to as a gorgeous industry, as a splendid industry to be established; to flood the world with artificial sunlight; to utilize the sources of energy which are in the bowels of the earth—taken out, put under the steam boiler in the form of coal, chemical action allowed to produce heat finally to produce electricity and, as it were, turn back upon us the radiant energy of the sun which charmed on this planet probably millions of years ago. That is what we are doing. I say he did not realize that probably; but he simply admired the experiment from the scientific standpoint. His enthusiasm was of the scientist and it is a worthy enthuasiasm in all cases. The scientists may discover something which may not, at first, have the slightest connection with practice, but sooner or later, no matter what the idea, no matter what the discovery is, whether small or great in a scientific sense, I have full confidence that the time comes eventually when such discoveries are utilized in practical life as this discovery of Davy's was.

It was quite a contrast—the difference between Davy's style of recording his experiments and Faraday's, and there is that contrast even to be seen in their work. Davy was, as it were, brilliant, jumping from one thing to another and getting thereby a great leap; while Faraday's was the painstaking work of the scientific investigator who thought out carefully what he was about, and when he had concluded his experiments wrote out just as carefully what he had obtained. The records of Faraday's are models of neatness, they are models of precision in every way. I recall this as a reminiscence. It is a late reminiscence but it carries us back to the time when Faraday was at work in the discovery of the action of currents in magnetic fields. It is to Faraday that we owe the discovery of the principle which underlies the generation of current by the dynamo. It was he who moved armatures in magnetic fields. It was he who found that the magnet was capable under proper conditions of yielding currents. He was perfectly satisfied to investigate that fact and the condition under which it occurred and he expressed his confidence that the time would come in which those facts and principles which he was investigating purely from the scientific stand-point, would be applied on a large scale in practice. He said it was not for him to do that however; there were others who would take up that work.

Coming down to more recent periods after these investigations we find occasionally efforts made to employ these principles in procuring light and one of the earliest was the running of a lighthouse by a magnetic machine constructed in accordance with the principles which Faraday discovered; but it was a solitary instance for quite a number of years. Then came upon the scene M. Gramme with his wonderful dynamo and machine, the elements of which were known before—in fact, were known when Faraday made his experiments and published them—were known in a crude way in other prior types of machines. In fact, the very principles on which the Gramme dynamo was founded were well known, but the construction of the machine was unique, and it was afterwards found, indeed, that this construction was, in the literature, due to Pacinotti, an Italian professor, but it had rested in obscurity for a number of years. Gramme, however, constructed a machine which would produce electricity economically, and he applied it to the production of light by the electric arc. He was, perhaps, the first to time that impetus which resulted in a few years in a considerable expansion of dynamo electric machinery as applied to lighting. These experiments of Gramme were carried on for a few years. His machine, I think, was built about 1869, and it was not until five or ten years had gone by that the machine began to be known in the scientific world. I saw a small Gramme machine about 1874, and it was a strikingly excellent example of a dynamo. All we had to do was to turn a little crank and a small wire was heated to bright incandescence, apparently with very moderate effort, showing that the economy of the structure was high—that there was really very little waste—very little power being thrown away. One of my reminiscences is that I met M. Gramme in 1879 at the Paris Exposition, and I found him to be a retiring, modest man, who bore his honors very well indeed, but who had the peculiarity of never appearing in public when he could help it. It is very difficult, they tell us, to get him out where he can be seen, and he only appeared on the occasion of the meeting of the Electrical Jury at the exhibition. I think we should honor Gramme, not, perhaps, for the fact of his discovering a principle, but for the fact of producing for the first time a type of dynamo which was really well adapted to use in the industries.

Before his time there had been discovered an important principle in dynamos; that is, that a dynamo could start itself—magnetise itself and furnish its own magnetic field, as we term it the reaction principle, it is called. Even this idea came only by degrees, and was finally elaborated by a number of observers about the same time or very nearly the same time, but even at the time this reaction principle was well worked out, the machine was not such a structure as Gramme produced. Leading on from Gramme's time we find the Centennial Exhibition, and there we find in the exhibition an exhibit of Gramme apparatus and this exhibit certainly showed some remarkable advances. There were arc lamps in operation, but there was also a little exhibit which was a very striking one—two Gramme machines, one driven by a belt and connected to the other, the other driven by the current developed by the first machine and working a little pump, producing, as it were, a miniature cataract of water; a very striking experiment, indeed, and one which we now see applied on a large scale in the transmission of power. We had in that experiment the production of electricity from steam power, its conveyance by a wire only ten or fifteen feet across the space reserved for the Gramme exhibit, and we had the machine pumping water and producing a miniature waterfall. We sometimes reverse that process now. We have the waterfall and we turn the machine: then we carry the current a distance, and we take the power, put it on a belt, and use it to drive our machinery. These are precious reminiscences. They show us the beginning of the great industries which are now developing.

I took up the subject myself of investigating dynamo machines about the year 1874 and began the construction of small models. My attention had always been drawn strongly toward the electrical fields and it might be of interest now to recount some of the difficulties experienced in the early days. I must now leave out here that the Gramme apparatus was not the only machinery devoted to electric lighting which was found at the Centennial Exhibition. An enterprising American firm, Wallace & Sons, had constructed machinery known as the Wallace Foundry machine, based on the ideas of Prof. Farmer, the venerable electrician, and they were applied to these machines in the Centennial to the lighting of the ground at night and the lighting of Machinery Hall in part, and the whole exhibit of the Wallace-Farmer machine and the apparatus showed that we had in our own country the nucleus of an expanding system, had it been pushed and caused to progress as the Gramme machine had. Even the machinery shown by the Wallace people was, some of it, more advanced in type than the Gramme apparatus. From this time we find the arc growing by degrees. We find that in 1878 the Jablochkopf candle is lighting streets of Paris. The lamp for the Jablochkopf candle is only a form of the arc lamp. We find along the two sides of the Avenue de-L'Opera a system which had, however, a comparatively short life on account of its expense. The lights were certainly very beautiful. The Paris Exposition of 1878 showed this apparatus in use and alongside the Jablochkopf exhibit. I remember distinctly seeing the ice machine of Pictet turning out tons of ice daily by steam power in the same room with the Jablochkopf exhibits, and Pictet was at that time well known on account of the fact that he had liquefied those gases which formerly had been regarded as incapable of being liquefied. He was the man who put such pressure and cold to bear on oxygen, nitrogen and other gases which up to that time had been regarded as Pictet's gases that they were turned into liquids, and even hydrogen, the thinnest of them all, had yielded to his persuasion.

To recount my own experience in electric lighting, I built a small dynamo about 1876 which would run an arc light. It was my first attempt at a machine of that size. It was successful and it led to the construction of other dynamos. When we came to the commercial end of the business, which began somewhere in 1878 and 1879, we found it was not enough—not by any means enough to build a machine to run a light There were difficulties to be overcome, and not the least of those difficulties was the getting of steady power to run the machine. I could tell story after story of the discomfitures depending largely on the absence of steady power, or the presence of unsteady power. I remember distinctly that our first machine that was intended to be a commercial machine, and in fact the first machine which embodies the principle used in the Thomson-Houston arc apparatus—the three-coil armature—was a machine capable of running four to eight lights in series. In fact the three-coil construction had never been used in any machine before, and this machine was a large machine. I remember distinctly that when the machine was put up for the first time—I had wound every inch of wire myself and insulated the whole thing myself—the machine was elevated on a planer bed in the little shop in Philadelphia where it was made, and the belt from the engine, which they call the ten horse-power engine, but I do not think it was more than five, was put on the machine and it was found necessary to tighten up the belt back to the engine. The machine could only be driven at a very moderate speed, and it astonished the machinists around to see how a thing which apparently did not touch anything in revolving could use up so much power. Everybody was confident—they were all confident—those who had anything to do with the construction of the machine—that that would not take anything—that that engine would do it, that it would run a dozen such machines. There was nothing to do but turn that machine around in air. Another incident in this same connection I may mention—it is rather an amusing one: We had got into making two or three machines in a small shop in Philadelphia, and a man came from the other side of the street where he had a small establishment and he said he had just the motor for the machine. He put his foot on the pulley of the dynamo on the floor and pushed it around. He said "I have just got the thing that will drive that machine." I asked him what it was. He said "I make a little sewing machine motor that runs sewing machines very nicely; why do you put such a big pulley on that machine?" I told him that if he would come in sometime when we were running the machine we would show him why the big pulley was on. He did come in later when the machine was under power. The power was a very bad power. It was so poor I found that the crown sheet of the boiler had been burned out after testing the machine and the whole contents of the boiler had escaped into the fire box. Fortunately there was no explosion and nobody was hurt. He came in and saw this machine operating with a big pulley, the belt on the one side being tied to the other side comparatively loose, and they showed him that by pushing the machine up and tightening it it did not make much difference. There was still the pull there and he was very much puzzled indeed. He looked the machine all over and all around to see if there was anything rubbing between the armature and the field, and he went away and said he could not understand it. He came to me a few days later and said he had got it now; he understood it perfectly. I said, "What have you made out of it?" "Oh," he said "I see it; that machine makes electricity in a globular form, like globular lightning, and when it gets hold of that machine it just holds it there." (Laughter.)

In starting our arc light experience, our first apparatus—our first machine, the one I spoke of as being mounted on a planer bed and finding such difficulty to drive it—was put up in a bakery in Philadelphia where it was used all night and it was rather tenderly nursed by us. We had to be up there nights giving it as close attention as many babies require. Sometimes we were up all night attending to this baby and under conditions which were not altogether agreeable in mid summer either, because, as you know bakeries require pretty large ovens and there is a good deal of waste heat about. The temperature by the thermometer in the room was frequently 140, and to live in that all night was somewhat difficult, as you may know. Well, I found that I could do it by doing only one thing. That is, I used ice water in excess. They tell us we must not drink ice water, but I must say that ice water saved me there. I believe in ice water on a proper occasion. (Laughter). The two parties that were working with me, Professor Houston and a gentleman named Mr. McCollin, who was somewhat interested in the development of the lighting apparatus, thought I would kill myself if I stuck to ice water. They did not recommend anything else. I told them if they did not stick to ice water they would find they would be the ones which would suffer. We were working the machine for some few days in this high temperature in mid-summer when both came around one day and one said "I have been rather sick. I cannot stand this much more" and the other said, "I feel so too; I have got symptoms of sunstroke I cannot stand it." I said, "I told you so; if you had stuck to ice water you would have been saved." I certainly kept my temperature within limits, but I had to suffer for it in other ways, the perspiration dripping through every pore and the ice water no sooner entered my system than it was out again through every pore in my body. I stood the racket, however, and came out unscathed. We then found that parties were interested in the development of electric lighting, and at last a company was organized which is not the Thomson-Houston Electric Company. It was organized in a modest way in the little town of New Britain, Connecticut, where I removed. I had previously been teaching in Philadelphia in the high schools and I became electrician of this small company. Before it was organized an exhibit of apparatus was made at New Britain in a basket shop, as they called it—an old wooden building used at one

time to make baskets—and there happened to be old machinery, basket moulds and forms and all kinds of machinery in the shop for the former use of basket making. It was turned into an electrical exhibition—that is what it amounted to. The lamps were scattered about the building. There was an adjoining building with a motor which was driven by current supplied from the main building. There was an engine which had the hardest work to furnish power, and the man in charge told me one day that the steam was getting down on him and he had taken a lot of those basket machines and burned them, and he asked me what I thought about it. I said it was all right, so long as he kept the lights going. But I have no doubt that many of you in your early experience of electric lighting recall incidents somewhat akin to feeding hogs into the furnaces on the Mississippi steamers in order to keep up steam. There was need at that time of something more inflammable than coal, especially when the steam pressure gauge was going down at a lively rate. There was no let-up in the dynamo. The dynamo must exert its back pressure. It has a certain current and a certain torque, and, if we are using steam at sixty pounds, we may be able to keep the thing going, but if we are using steam at forty pounds we are on the ragged edge of despair very soon, and we are forced to take heroic measures, even if it does mean the sacrifice of a lot of basket machines.

These were the beginnings of our experience. We soon got into another shop at New Britain, and began the making of apparatus for commercial use. Even here we had the difficulty of power—steady power was what we wanted in order to be enabled to tell what we were doing, and I have no doubt that all those who had experience in the early days with electric lighting felt the necessities that we felt. But if anything had done more than another thing to develop the steam engine, it has been electric lighting. I think the steam engineering business owes as much of its present development to electric lighting as to anything else—in fact, owes all of it, nearly. The engines, which were good enough to drive mill machinery and to drive ordinary machinery, whether the speed ran up or down, were not good enough to keep a steady glow in the lamp. They were not good enough to keep up just the same pressure and just the same volume of current under the conditions of practice, and the engine builders soon discovered that that was the case, and I may say that we have here in Providence the representatives of some of the most progressive engineers, who were the first to recognize the fact that the old style engines were not altogether the best suited for electric works—the Armington and Sims people.

After we got into operation our difficulties were not by any means over. We had to develop all sorts of devices; we had to overcome difficulties which were constantly arising to discourage us and dishearten us, but by keeping at it we finally succeeded in getting our apparatus where it could be taken care of by an ordinary man; where, in other words, we could put it in a factory or in a station, and not require a highly skilled electrician to look after it. When this was accomplished we were met by other reverses. The Brush Company saw our beginnings of success. They were then the chief parties in the field of arc lighting. They bought up the majority interests in our little company in New Britain, apparently for the purpose of swallowing us and laying us on the shelf, to use a common expression. Subsequently, however, in the same year certain parties in Lynn purchased the majority interest in the stock of what was then the American Electric Company, of New Britain, and started operations in Lynn. The Brush Company, I may say, as you are probably all aware, now has been swallowed up by this infant that they tried to swallow. Such is fate. (Laughter.)

I need not prolong this statement much further. I have merely to say what you all know, that we have the supremest confidence in the expansion of the electric industries. We are absolutely certain that our business is going to be greater and greater as time goes on. We are sure that we are living in an electric age and I may say that we look to you, gentlemen of the National Electric Light Association, and we are ready to state our obligations to you fully for that which has made it possible for us to carry on our works for the commercial expansion. We look to you to see that the country is covered with plants. You have done noble work in the past. You have done more than the people fully realize in standing at the times when discouragements came, at the times when things were not altogether as bright as they might be, in fact when the lights were not as bright as they might be or as steady as they might be—in standing in the breach with us and overcoming the difficulty—with you it was the difficulties of commercial exploitation, the systematizing of those things which concerns station operations and commercial developments. For ourselves we have had to overcome difficulties and to provide for this and that in the way of invention and development to manufacture. The work will go on progressively. We have call now to-day for dynamos up to 500 to 1,000 horse power where a few years ago we thought it would be an unusual thing—it was indeed an unusual thing—to have 100 or 150, or a two hundred horse power machine spoken of, and it looks very much as though in the near future machines of much larger capacity would be demanded for electric installations.

I am down on the programme to-day to say something about electric welding. I was going to say here that I did not know exactly when that art was discovered and that I believe that the formation of the National Electric Light Association was one of the steps in the process, figuratively speaking. (Applause.) It is gratifying indeed to see the electric welding operation going on here. These meetings undoubtedly bring together and harmonize the various members of the electric light fraternity—the men who produce the machines and apparatus and carry on the manufacture, and the men who use them in commerce. Our interests are undoubtedly common. Our interests is to produce the best that can be had and to use it in the best way possible.

Coming now to the actual, not the figurative electric welding, I may say that my time has been largely given lately to electric light matters rather than to welding. It was my fortune to come upon the fact and develop the fact that metals could be worked, welded especially, and so on, by electrical heating and to apply it in practice. The art is a growing one and quite a number of machines are now in active operation doing this kind of work. I may touch here upon a matter of interest which is akin to electric welding and that is the general subject of electric heating. We sometimes are asked the question as to whether it will ever be posible to heat our houses by electricity, whether heating this, that and the other can be done. I should answer that question as I have done frequently. It is not at all likely that we will ever heat extensively by electricity unless we can find some way of converting the energy of coal into electricity far more directly and less wastefully than is done in steam engines of the present day. When we consider that under the very best conditions, with the very best engines, we can realize only a small per centage—ten per cent. perhaps of the energy of the coal—the heating energy of the coal—in electricity and that when we turn that ten per cent. of electricity into heat we simply get nothing more than ten per cent.—that is the most we can get and we generally get a little less due to waste here and there—it is evident that we cannot afford—it is not likely that we can afford to burn nine pounds of coal to get the heating effect of one pound of coal, whereas by burning the coal directly, near at hand, we can use the heat directly and in almost full amounts. I noticed that a part of the discussion yesterday, as reported, was the utilization of the waste steam from the electric light plant for heating purposes, and indeed that seems to be a direction in which much valuable work can be done. There you have got through, as it were, with the steam; you have got all the power you can get out of it, or nearly all, and you have got an immense amount of heat left which is good enough for general heating purposes. There is a case, of course, where we can combine the two, not developing the heat by electricity but rather taking the heat that it left over after we had got our electricity and using it for heating, but of course exhaust steam does not apply to special cases where the heat is required to be very high. In that case we may find a moderate expansion of electrical application, as in cooking on a limited scale. It is so simple a matter to turn on a current and turn it off, getting a moderately high temperature out of the resistance through which the current passes, that there is not any question in my mind but what there is to be a considerable expansion of heating apparatus worked electrically where the conditions of economy are not so pressing as in the case that I have mentioned in general heating.

I might close my remarks by simply stating that in regard to the electric railway I hope indeed to live to see the time when some of our larger roads will be in operation, as they should be and can be, by electricity. I hope, also, that the time may come when we shall have at our command an easy, direct method of obtaining electricity from fuel. That is the great cry nowadays—can we burn coal and obtain electricity directly from the coal without going through the steam engine and boiler, which must involve a large loss? It almost seems from all that we, who are actively engaged in looking up matters in this connection, can say—it almost seems to us that we must wait for some new discovery—for another Faraday to come forward and show us principles which are not now known, some relation between electric energy and heat energy whereby we can convert even thirty-five or forty per cent.—we will be satisfied with that—of the heat energy into the electric energy. We hope it may be so. But look what it means if such a thing should come about! Our electrical industries to-day would be of pecunious character. The steam engine would disappear. The steam locomotive would disapppear. The steamship would be propelled no longer by the steam boiler and the burning of fuel under a steam boiler. That fuel would be burned, undoubtedly. We should have to rely on the use of fuel in one way or another, but it would be burnt to produce currents. The apparatus which would propel the steamship would not be a steam engine, with its reciprocating motions and its racking strain, but it would be that quiet rotary motion which characterizes the modern electric motor. It is not at all impossible to construct machines of that kind which would work up to many thousands of horse power, and thereby parallel the modern steam engine which is used on all steamship lines.

Thanking you for your attention, I conclude my remarks. (Applause.)

Mr. F. H. Monks, of the West End Electric Railway of Boston, was next introduced and spoke on Electric Railways, with particular reference to the company he represented.

Mr. Monks gave the following facts regarding the West End road: On the first day of January, 1889, after several months of preparation, the first electric car was started under the Sprague system, and later the Thomson-Houston system was put in operation in Cambridge. Since that time there has been no backward step and there have been continued and renewed expressions of opinions both by the officials of the company and by the public generally of confidence in the system of the propulsion of street cars by electricity.

We have had our difficulties in Boston, of course, but we have also a glorious history to record in regard to what we have done. Last summer during the visit of the Grand Army to Boston, we carried on our entire system 3,000,000 of passengers in one week, and out of the three millions we carried more than one million on our electric cars in one week, and that without the slightest hitch of any kind, without any trip being missed and without any person being injured in any degree (Applause). At present we have sixty miles of electric track with something over three hundred cars. We are running about eighteen thousand miles a day electrically or about three-quarters of the distance around the globe and we are carrying from 100,000 to 125,000 passengers by electricity. The experiment if such it may be called at this late date, in Boston, has passed to a stage where the public not only consents to its extension but actually demands it. From all the quarters—and we cover a very large area, having some two hundred and sixty miles of track laid through the popular towns and cities surrounding Boston—we have constant demands, and repeated demands and urgent demands for the immediate introduction of the electric system, so that where it has been a matter of grave and great difficulty hereto to pacify the public mind respecting the matter of introduction of electric roads, with us in Boston it becomes now simply a question of not getting in too quickly—too fast, I mean, in the sense of saving ourselves the investment of a large amount of money in machinery which next month or next year may be regarded inadequate. But after all is said and done we are but in our experimental stage; we are in our infancy. Much remains to be done by the electric companies in regard to the improvement in motors. Much remains to be done by the electric companies in the way of cheapening their product so as to give it to the railway companies at a very decidedly cheaper price than it can be sold at to-day. Much remains to be done to perfect the system in regard to the proper form of car to be used, in regard to the proper form of rail to be used, and a thousand and one details remain to be perfected in order to make an electric system in a metropolitan city a great success. For many reasons the electric locomotive is decidedly preferable to the use of motors under a car. The first one and perhaps the most important is the fact that in Boston, in Providence, in Worcester, in fact all the large New England cities a double equipment of cars is necessary. We need motor cars for winter use. We need motor cars for summer use. What we want to find in the practical ends of the business is a medium or force or power which will enable us to draw our box car on the morning of the fourth day of July, when it is cold and rainy, and to use the same force or power to draw our open car in the afternoon of the same day when it comes out fine and beautiful and the thermometer registers 70 degrees. The present type of motor car which is now so widely known does not give us those opportunities, and I doubt very much whether any street railroad can afford to go into the problem of buying electrical motors with all the electrical machinery incident thereto for two

equipments, one for the box car and one for the open car.

On the conclusion of Mr. Monks' remarks, President Perry introduced Prof. J. Elfreth Watkins, curator of the Smithsonian Institute, Washington, who read an interesting paper on the place of Electrical Invention and development in history. It was a scholarly paper and was well received.

On motion of Mr. R. W. Pope the following resolution was unanimously adopted.

Resolved, That the National Electric Light Association assembled to celebrate the decennial anniversary of the establishment of the electric lighting industry in the United States, fully appreciating the value of the discoveries and inventions of Joseph Henry, heartily approves of the proposition now before Congress to bestow substantial recompense upon the daughter of the great discoverer who during a lifetime devoted to science received no financial compensation for the benefit he conferred upon mankind.

Resolved, That a copy of these resolutions be forwarded to both Houses of Congress.

Mr. Chas. W. Price was then introduced and read a paper on "The Organization of the National Electric Light Association."

Mr. Price gave in an interesting manner a brief history of the early work of the Association, and his remarks were of much historical value.

After Mr. Price, Mr. J. H. Herrick, first vice-president of the Edison General Electric Company was introduced and made a few interesting remarks on incandescent lighting.

Mr. E. Wilbur Rice, of the Thomson-Houston Electric Company, Lynn, Mass., followed with an interesting account of the growth of the Company he represented. Speaking of Prof Thomson's early work on the dynamos Mr. Rice said:

I saw there [the Central High School, Philadelphia] a dynamo which the Professor assured me was the first one that he had ever built. This dynamo, curious to relate, was so wound and connected by Prof. Thomson on different occasions that it involved many of the principles which have since become well known but at that time were unknown. He had the winding so arranged that it could be used in shunt in series and in series shunt, which is practically known to-day as the compound winding, and which is used so much in connection with incandescent lighting. Prof. Thomson did not publish it at that time and told me that he did not think he was doing anything particular. I may say in this connection that Prof. Thomson did a great many things of this kind that were equally great, but which seemed to him so ordinary and such a matter of course that he neglected to say or do anything about them.

The first machine which we built in the old factory, continued Mr. Rice, was a one light machine which weighed something like one hundred and fifty to two hundred pounds. I remember well that we used to exercise our strength in attempting to lift it, and a great many succeeded. To-day we are building machines weighing 65,000 pounds. The output of those little machines was one arc light, measured in our electrical nomenclature 500 watts. To-day the machines that I am speaking of will give an output of over 500,000 watts. This little machine of which I am speaking required about one and a half to two horse power to drive it and the large machines we are building to-day require about 700 horse power. I think after the close of the year 1881 we had in use something like one hundred arc lights all told. To-day I believe there is something like one hundred thousand arc lights in operation. This gives you some idea of the growth of one company and of one branch of its work, and there is no question but that the general electrical industry has developed in like manner. (Applause.)

On motion of Mr. George M. Phelps a resolution was unanimously carried expressive of regret over the illness of Mr. George Worthington, and wishes for his early recovery of health.

The President then introduced Mr. Frank J. Sprague, who spoke as follows:

Mr. President, ladies and gentlemen: I feel somewhat embarrassed by being called upon to speak here to-day. The request that I should do so has been somewhat sudden. While the hum of the motors may be called the song of emancipation, like the hum of many another song, it is best when quietest. Since my musical education was early neglected I am not able to compose a music to go with it. I once made the remark that I owed much to Providence, energy and the industries of Providence for some of the earliest success in electric railway work. A gentleman looked at me and said in a somewhat sarcastic manner, "I think you do owe much to Providence." Our thoughts to-day seem to run in a reminiscent past, and I will indulge in a little bit in that direction myself, simply because the commercial history of electric railway is well known, while perhaps some of the inside history of it you do not know, and the story that I shall tell in a very brief way is nothing more or less than the story which is common to every earlier enthusiast in the commercial development of electric railway or electric light. I remember, in 1879, I was on duty on board of a naval vessel of the United States on the coast of Japan. I had before that time been at the naval academy, graduating there in 1878, and just at that time Edison, Bell, and other electricians were prominent in the field, and there grew up in my mind a love for electrical matters and the desire to be associated some way with electrical developments. The United States Navy Department at that time was not very encouraging to any such ambition. I went the way of all other midshipmen and drifted out to Asia, but the stories came of the discoveries being made in electric lighting by Thomson, Brush, and Bell, and they drifted out there, and I became very nervous under it and at that time was trying to invent an electric motor, and I meditated very seriously sending a request to the Navy Department to be allowed to come home on a sailing vessel, as I could not well afford to come home in any other way. Well, by some good intervention, I was ordered back to the United States, and I went to Ansonia, Conn., and saw an experiment in the transmission of power which greatly impressed me. Mr. Wallace, of Wallace & Sons, of Ansonia, is a man whose position in the history of this enterprise has never been fully appreciated. I went there, knowing him personally, and was taken through his factory, and he said, "Sprague, let me show you something." He had one of those old four-pole armature machines. He had it connected with a dynamo. He turned on the current, and pretty soon this thing was running two or three thousand revolutions a minute. He said, "It is no good." I said, Why? He said, I will show you. And he turned to one of the men—a large strong man—and said get hold of the armature. This armature, I suppose, was about ten inches in diameter. He got hold with the brake on the arm of it and finally began to bring it down, lowering its speed, and finally brought it to a dead rest. In that simple experiment he outlined and he overlooked the most important fact that he had to deal with—that the energy which was being developed was not the sole question to be considered, but there was also to be considered its torsional effort multiplied by the speed with which it was traveling. Had Mr. Wallace seized on that single point, or had I or had anybody else seized upon it at that time the transmission of power would then have been very much advanced. Mr. Wallace at that time, if I remember rightly, was building a machine invented by Mr. Farmer—certainly one of the earliest and most esteemed pioneers of electric science in this country. Mr. Farmer was then a crippled man confined to his chair. He was attached to the torpedo station at Newport, and he had invented a machine for use in torpedo work on board ship. One of his machines was one of the first machines that I ever had the pleasure of dealing with.

With a lack perhaps of some little formality which is necessary in official life I applied for the whole second floor of a machine shop in the Brooklyn Navy Yard. I think that was in 1880 or 1881. I got one lathe and in that lathe I set up a Wallace-Farmer machine and tried the first experiment I ever tried in the building of a dynamo or motor. My work from that time fell off. My duties called me out of the United States, and it was not until 1882, at the electrical exposition in London that I was brought to a consideration of the tremendous advance that electricity was making. Few of you are familiar perhaps with the inside difficulties with which we had to deal in the history of the electric railway enterprise and the amount which it was necessary to conceal from the general public.

The contract for the road in Richmond was taken in 1887. I had never seen the road. I remember to this day the impression that came over me. I had been talking with John Stevenson the pioneer car builder of the United States and he said, "I do not believe that any self propelling car can be operated under street car conditions I am acquainted with fourteen of them in the city of Paris." I said, "Mr. Stephenson, there has been one difficulty with those—not one of them utilizes the weight of the car for purpose of traction." The first machines that were built were built for storage battery experiments on the West End in Boston. Subsequently when I went to Richmond I saw a grade of ten per cent. My heart fell within me and I said it is utterly impossible for any car to climb that hill. I came back to New York and had some consultation in a retired room in New York, that settled this question. Is it possible for any car to mount a ten per cent. grade? Everybody said it is not, and I confess that I myself thought it was not. Shall we use a cable on that ten per cent. grade and trust to electricity for the balance or shall we change the gearing of the machine. We had a single geared machine. Mr. Johnson, who I think is a sort of John the Baptist in the electrical profession a sort of forerunner of good things said we had better find if we can get up the grade at all. Back to Richmond I posted. I started out one night when there had been an election and when the streets were filled with a crowd of drunken men. We went down in great shape and then just before us was this grade. I said to the Superintendent. "We cannot mount it." "Well," he said "it will go up and I will bet you five dollars I will take you up. We started and we mounted the hill. When we got to the top it had settled the question of traction on a ten per cent. grade. It had settled likewise that the motors we had were altogether too small and too light, because they were hotter perhaps than the furnace in an electric welding apparatus. On getting to the top we thought the best thing we could do was to stand still a little while. I remember one of my assistants, Mr. Green, was with me. I said to him, "Green, I think we better send for some instruments; I think a little accident has happened to one of the machines." So we laid down in the bottom of the car until he brought those instruments. They were four strong mules, for it was nccessary to get that car back into the car shed that night. As I say, we are indebted very much to Providence skill and energy for the success of the road That fact brought me face to face with the fact that it was necessary to make a complete change on sixty machines in Richmond in the matter of gearing. I was thoroughly at a loss what to do. There was no factory that I could go to to get that built excepting one, and that was the shop of Brown & Sharpe in this city. I said to the foreman, "We have met the worst obstacle I have ever seen in Richmond. We have got sixty cars we are under contract to run. If we fail there it will delay the electrical development in this country; we likewise personally will go up. Now, I said, I have got everything at stake. My associates have got every dollar at stake. The electric railway in this country is liable to be at stake. I said the road has got to go and go it must. Will you do for me what I ask and put as many men and as much money and material at my command for twenty-four hours a day as will be needed, until I recover the position we have lost?" He said, "I will." They went to work and made probably the most difficult piece of gearing they were ever called on to make.

In the course of four or five weeks we started again in Richmond on the 2nd of February, 1888. The gearing had all stuck for lack of oil. Then the next thing we found was that the armatures were too large and so we had to resort to electrocution—we had to cut off their heads. We were using a four hundred and fifty ground circuit—a machine that was covered with water and mud. Every field magnet had been wound and rewound three or four times. Our next experience was that our commutators were going to pieces. We had tried no less than sixty-five different kinds of trolleys and had not got one that would work reasonably satisfactorily. We were attempting to run motors in both directions and with a brush that was difficult to handle, and after trying a great variety of brushes we finally settled upon square bars of brass about three-eighths of an inch square, and every time a car would go through the street you would see a shower of brass dust, so that we had the whole road marked from one end of the town to the other with a sort of golden path. The copper we were using was costing us $9.00 a day and it was raw material. Subsequently we adopted the use of carbon. That inside history of some of the work at Richmond has of course not ordinarily been told. I think the time has come now when there is no harm in its being told. I think that people would have looked on electric railways as out of the question if they had known of the straights we were going through.

In the last three years you have become perfectly familiar with the first-geared machine; that is, a machine that is concentrated on the driving axle, and geared to the car axle. It was built by the Brown & Sharpe Company. They have one of the elevated railroad trucks in their shops some five or six weeks, and I think they are satisfied it will be the last they will have. The Armington & Sims engine was the first engine we ever had, and the engines put in in Richmond have never to my knowledge been changed or caused the slightest trouble from that day to this. The wire we first used was made by the American Electric Company, in this city. The forgings we used were from Bridgeport, near by. So, almost all the material and the work done at Richmond, either emanated from Providence or from places within a short distance of it. There is a profession which owes much to the efforts of the electric railway people; that is the legal fraternity. I see a representative here of an enterprise and industry with which we had some conflicts—the Bell Telephone Company. I have heard since I have been here a criticism that I should have been an advocate of an overhead wire—one only, remember

—and had taken upon myself to get out an injunction against the Metropolitan Bell Telephone Company, of New York. About two or three weeks ago we had a very providential storm, and in what I considered one of the most beautiful portions of New York there was a magnificent line of poles with 170 beautiful wires in all directions and one to cap them, making 171 wires. A flaky fall of snow occurred and we found this army of poles lying flat in the street. We thought that the telephone company had so well built its lines that providence never would aid us. But we immediately had a meeting of property hol lers and by the next morning we had an injunction against the erection or maintenance of any poles or wires on the street. I have been somewhat criticised, but I think it nothing more than turning the tables on that company which for the past two years has been so successful in sitting down on the infringers of its patents. And I think the public has s me reason to be satisfied, because the grounded circuit telephone is very largely disappearing from use and that more perfect telephone service is being adopted and sixty per cent., if I remember rightly, of the lines in New York City are now underground and we hope to see the balance of them there.

As to the future of the electric railway I heard with some interest what Mr. Monks stated. His objections to the double equipment have been based somewhat upon the cost. I think we all know the experience that the electric lighting apparatus has gone through and none of us can doubt from the experience the electric railway apparatus has gone through that it is going to be made more simple, lighter, stronger, more reliable and at much less expense; so that the objection which he raises, I think, is not entirely a sound one. It is based upon past results, not upon future promises. The gearing of the present motor will disappear from the electric motor of the future, and it is a very near future. It will also be an electric motor driving direct without any reduction whatever. Its revolutions will be coincident with the revolutions of the wheel. The day of the gearing is fast approaching and those who have had experience of gears with electric motors can surely feel encouraged by that fact. Of late I have been in exactly the position of Mr. Thomson where the infant swallowed up the larger specimen and I have also been very much in the position where the infant got very thoroughly swallowed up.

But the electric railway problem in New York city—the question of rapid transit is coming to the front. That we shall have there electric railway transit, I think no man who knows the future of this industry will doubt. What form it will take no man will tell. While I am an advocate of one wire, if necessary overhead, I am an advocate of everything being put underground as far as possible. I do not believe in the theory of God's free air in New York City where the air is monopolized by three things—buildings from ten to fourteen stories high, the elevated railroads, and the Bell Telephone Company. But I believe in God's free earth where we can go independent of grades and independent of weather conditions. We have a most remarkable example of the perfection of that operation in London. I had the pleasure of visiting the Suburban and South London Railway under the guidance of Mr. Hopkinson, the engineer, and I told him there could be no question of the success of that enterprise I think information since received of the progress has fully justified that prediction. I thank you, gentlemen, for your kindness. (Applause.)

After a few remarks by Mr. F. S. Terry, of Chicago, on the preliminary organization of the National Electric Light Association, the convention adjourned till the afternoon.

At the opening of the afternoon session letters were read from the Providence Steam Engine Company and the Providence Y. M. C. A., extending courtesies to the members.

Prof. Elihu Thomson was then introduced and read a paper on The Electric Arc and its Use in Light. (This paper in full will be found on another page of this issue.)

At the conclusion of Prof. Thomson's paper, and after a few remarks on the same subject by Mr. M. M. Garver, Dr Louis Bell read the report of the Committee on the Proper Lighting of Incandescent Lamps.

Dr. Bell said: Your Committee had not proceeded very far in the investigation of its topic before it discovered that the topic was growing—and growing with a prodigious rapidity, so that we have been able to formulate, so to speak, only a partial report, a report that necessarily must leave untouched many things we would have wished to touch, but which we hope embodies certain suggestions that may be of interest to those who have occasion to use incandescent lamps.

In the first place, the necessity for some legitimate rating of the candle power of incandescent lamps becomes evident in the experience of nearly every central station manager who is enterprising enough to keep track of the lamps he is using. At the last convention of this association your President gave some admirable samples of the way in which the candle power of alleged sixteen candle power lamps varied anywhere from 16 to 18. Now evidently it is both for the interest of the Central Station man and of the consumer that each should know exactly what is intended by a 16 candle power globe. It should not be left to the choice of the lamp manufacturer to make any sort of incandescent lamp he fancies and label it 16 candle power. There have been improvements in this direction, as every central station man knows, although the manufacture of incandescent lamps has been very much improved, as we all know.

Now the questions that came up were about as follows: How should we classify the power of incandescent lamps at all? Shall we classify it entirely by the candle power; or, if not the candle power, to what standard shall we refer the light? Shall we classify it by what is consumed with specifications for efficiency or by the Watts consumed, and the candle power which it gives within the limitation of efficiency?' After a considerable amount of deliberation—aided, I am glad to say, by consultations with a large number of gentlemen who are practical experts on incandescent lamp matters—your committee came to the conclusion that the last mentioned method of classification was the simplest one, to enforce: that is, incandescent lamps should be classified by the Watts consumed, the actual power for which the consumer pays; but with the specification as to candle power that limits the efficiency of the lamp to practical values By practical values, I mean such as will not, on the one hand produce an inordinate waste of energy, or, on the other hand force a lamp far above its proper candle power and consequently burn it out. Now, having determined the proper way, in general, of classifying incandescent lamps, then arose the all important question of the proper limits to be set. We have been so long used to speaking of and dealing in 16 candle power lamps that it seemed inadvisable to abandon that standard. Given, then, the proposition that we are to have a 16 candle power lamp—A candle power that has been sanctioned by very long use—what do we mean by that 16 candle power? Do we mean that the lamp shall give 16 candle power in a determined direction? Does sixteen candle power mean horizontal illumination, or what? Inasmuch as the horizontal illuminosity is that with which we have to do in those cases, your committee was emphatically of the opinion that the mean horizontal candle power should be specified; in other words, that the normal sixteen candle power limit should give 16 candle power, taking the average of the horizontal illumination.

Next came the question of practical limits within which the candle power might be allowed to vary. Of course, if we tied ourselves down to a candle power of mean horizontal intensity, we will be establishing a standard which no lamp manufacturer could approach. In other words, it would be commercially impracticable to make a large number of lamps at a low price and have the candle power of each one exactly the same—certain limits have to be set.

Taking the lamps as they are we find in actual practice we have to set those limits possibly 7 or 8, possibly 6 limits, on each side of the 16 candle power. Those limits your committee found to be entirely too wide, and therefore it entered into consultation with lamp makers for the purpose of finding how close to 16 candle power the limits could be set and yet leave the manufacturer a simple and practical process. The result of this deliberation was to settle upon about one candle power on either side of 16, as on the one hand, the largest variation which we cared to admit in defining a normal lamp, and, on the other hand, being a variation which comes easily within the lines of the commercial manufactures.

These two points determined, next came the unfortunate question of efficiency, as to the possible efficiency of incandescent lamps. Given a reasonably long life, there are as many opinions as there are makers of lamps, besides a very few stray opinions advanced by theorists and still fewer advanced by practical men. A large amount of consultation was had on this topic. Some of the experts in lamp matters advocate the use systematically of lamps giving the candle power on not less than four volts. Others loudly proclaim that three or two and a half volts is quite a practical and reasonable figure. In this regard I shall have to appeal to the central station manager. Your committee was necessarily at sea to a certain extent in determining this particular point; but, after a large amount of consultation, both with central station men and lamp manufacturers and experts, it would suggest that, for the average central station to use, taking into account the fact that sometimes we are supplying lamps by contract and sometimes by meter, an efficiency of less than four watts per candle is undesirable, particularly if the electricity is furnished by meter. When the consumer has to pay for more than four watts per candle power he becomes inclined to kick and object seriously to the bills.

Then, as to the inferior limit of efficiency. On how small a number of volts is it possible to produce the candle power and at the same time have a lamp of reasonable long life and giving a reasonably uniform efficiency throughout its life? The very best commercial practice seems to set the figure a little over 3 watts. Without specifying them, the efficiency for normal standard lamp, your committee would suggest that a lamp giving over 15, and not over 17, mean horizontal candle power on a consumption of less than 60 and not less than 55 watts represents the average conditions of central station practice, perhaps better than any limit that could readily be found.

Dr. Bell then, with the aid of several diagrams, explained the methods adopted for the determination of the mean horizontal candle power on which standard lamps should be based.

Judge Armstrong next read the report of the Committee on Legislation. This report was very lengthy and contained many valuable suggestions in the direction of legislation. A short discussion followed the reading of this report, after which the convention adjourned until Thursday, Feb. 19, at 10 A.M.

FIFTH SESSION.—THURSDAY, FEB. 19TH.

The convention was called to order at 10:20 a.m. and Mr. C. B Haskins read a paper on the Ferranti system. (This paper in full will be found elsewhere in this issue.)

An interesting discussion followed the reading of the paper, after which Mr. R. W. Pope offered a resolution, which was adopted, thanking the Providence daily papers for the publication of the complete and accurate reports of the proceedings of the convention.

Mr. T. Carpenter Smith was then introduced and read a paper on "Distribution and Care of Alternating Currents."

Mr. Smith began by stating that there are a great many points covered in the care of the alternating currents as used for electric lighting that apply with equal force to all others at present in use for commercial purposes. "It is always the unexpected that happens," he continued, "and no doubt many points arise in practice which are never known outside of the station in which they occur, being treated as matters of course. If, therefore, I seem to omit any point which should be covered it must be remembered that it is my intention as much as possible to avoid recapitulation in such cases, but only describe some peculiarities of alternating current distribution which render certain precautions especially necessary and valuable.

To more easily arrive at these it will be well, however, to briefly state the different forms of electrical currents now in commercial use and what we may call the governing characteristic of each. I leave out those which come first in the history of the question; namely telegraph, telephone, district call and fire alarm currents. They, are only worthy of note for their generally poor installation (Laughter), the telephone lines especially being a perpetual nuisance to all of the others. This arises chiefly from their being of such light gauges of wire that they will not stand any exceptional strain such as is placed upon them by sleet storms or heavy gales, while the effect of rust and deterioration from atmospheric causes rapidly reduces them to the point beyond which they will not carry their own weight. I need not say that the moment they fall upon any electric light or power wires they become a menace not only to the company operating the wires on which they fall, but themselves become dangerous to passers by in the streets who have not yet learned that any dangling wire is worthy of avoidance.

Perhaps the strongest reasons why these wires are present in such overwhelming numbers in most cities is the fact that their value as "scrap" material will not pay the cost of taking them down. In other words a short sighted policy decides that it is cheaper to leave them up, and they are abandoned until they either fall down or are taken down by some other company which has reason to fear them.

The first that we consider of the currents now in general use from central stations are the "Arc lighting circuits" To take the most powerful current generally operated on this system we may place it at about 10 amperes, and from 2,500 to 3 000 volts on a single wire. In this current we have, as a rule, the governing characteristic of a very high tension, but with small volume; and it may be well to note the particular form of danger to which it gives rise. Its high tension makes it dangerous both as to life and fire from its liability to leap through the insulation, and when the current has once been started, to form a long arc. On the other hand, the danger is limited by the fact that the volume of current is small and that the short circuiting of the line by any other conductor tends as a rule to simply cut the lights out rather than to cause any great danger at the point where this happens, while nearly all the machinery of this type in general use automatically reduces the energy supplied at once.

The chief points to be guarded in these currents are, therefore, practically covered by the general precautions of good insulation and protection against leakage by moisture reaching the wires, while the danger to life is very largely eliminated by the usual practice of placing all lamps and appliances well out of reach of the public and confining their care entirely to employes who are presumably skilled and who will therefore handle the matter intelligently.

In the second great division of electrical currents which we consider, the "low tension direct current" system, the ruling feature is the large quantity. We may say that this current is practically not dangerous to life, but very dangerous as regards fire if not properly installed and protected. It is, however, a simple matter to properly protect these wires, and, the low tension not putting any great strain on insulation, we may discuss it as fully covered by the ordinary rule of the Fire Insurance Underwriters, who, in this respect, owing to the nature of the business have even more interest in the saving of property from fire than the central station itself. The great danger, however, lies in the fact that the volume of current is so great that any short circuit on the main lines developes an enormous amount of energy, at the point of accident, sufficient—on the authority of Mr. Edison himself—to reduce the pavement to a molten mass for many feet. (Laughter.) The general public also must necessarily have consiederable care and control of the distributive appliances and in their ignorance will often put grounds on the wires, or replace fusible plugs by copper wires, and this all has to be watched for.

And that is a danger that I think central stations ought to interest themselves more in. In Philadelphia we have got to a very good point with the fire underwriters, and they keep inspectors constantly at work; they do not merely inspect the work when it is being put in, but they go to a man's building at odd times and look all over his wiring again, and if they find any such foolishness as copper wire replacing fuses they will very often order his lights to be taken out; and it has only taken one or two instances of that kind to awaken the public to the fact that there are rights which the central station has and there are certain precautions which they themselves must take.

The third great branch, and the one with which we more particularly concern ourselves to day, is comparatively a new one, but has in the short time it has been in existence had so phenomenal a growth that it is no wonder that we find even the commonest precautions oftentimes neglected in its use.

In the "alternating" or "converter" system we may say at once as regards the secondary distribution, i.e. from the converter to the lamp, that the rules already laid down for the installation of Low Tension Direct Current Wires will practically cover the case. The alternating current of fifty volts, which practically is the standard to-day, will work successfully with insulation, and under conditions which would lead to trouble immediately with even the one hundred volts direct current; and this fact in itself often leads to poor work, either from intention or ignorance The wiring, of course, must be proportionately heavier for this current than for the direct, which perhaps adds some slight risk of under-sized wire being used; but this is an evil which will generally correct itself owing to the diminution in light, making itself felt before the danger point is reached. The fact also that the converter cuts off all connection between the customer and the company removes the great danger of grounds on one building affecting the whole system.

There are certain peculiar features, however, which should not be overlooked; namely, that moisture will often cause sufficient leak in the way of a short circuit to heavily overload the wires, while not sufficient to start the "dead" short circuit, which would blow the fuses. For this reason special care should be taken that the wires are properly "fused" and that in the event of a fuse persistently blowing with only its proper number of lamps, search should be made for leaks.

The general tendency in the electric light business being now very largely to make the consumer responsible for all the wire upon his own premises beyond the converter, narrows the subject down to that on which I wish more particularly to speak—"High Tension Alternating Current Distribution." This current has, to a certain extent, the governing characteristics of both those mentioned above, and this has excited a disproportionate fear of it. Its tension of 1,000 volts (to take that oftenest used) is high enough to make a first-class insulation necessary as a precaution against leaks, which may soon break out altogether, and its being a constant potential system allows the whole power of the dynamo, or rather of the engine driving it, to be possibly developed at any point by a short circuit.

Without going into the fiercely-debated question of direct *vs.* alternating currents, I would call attention to one fact. With high tension "direct" currents I have seen linemen, in repairing lines or cutting in circuits, handle an arc circuit of perhaps 2,000 volts when they should hardly touch it, and, by taking a quick hold and keeping it, make a connection while really in a position of great danger, since a ground coming on the line elsewhere would surely kill or injure them, though they would not believe this, since they could only feel the current at the moment of taking hold or

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DISTRIBUTION OF STEAM FROM CENTRAL STATIONS.

PAPER READ BEFORE THE NATIONAL ELECTRIC LIGHT CONVENTION BY F. H. PRENTISS, OF THE NEW YORK STEAM HEATING COMPANY.

What has the distribution of Steam from a Central Station to do with Electric Lighting? This question can be answered much after the Yankee fashion of asking another. What has coal-tar, ammonia, aniline dyes to do with making gas? These articles are bye-products in the manufacture, which were once thrown away as useless, but which have now a value hardly second to that of the gas itself. Is it not true that the exhaust steam of Electric Light Engines is a bye-product in the making of light and for heating purposes has a value scarcely less than the electric light itself? Since in a steam engine the amount of heat converted into work is relatively very small, the value of the bye-product or the exhaust steam is too large to suffer neglect. It is only a question of finding a market for it, and obviously this can only be done by a system of distribution from a central station. Will it pay to market this bye-product? The answer to this question depends upon many complications and varied circumstances which in no two plants would be found alike.

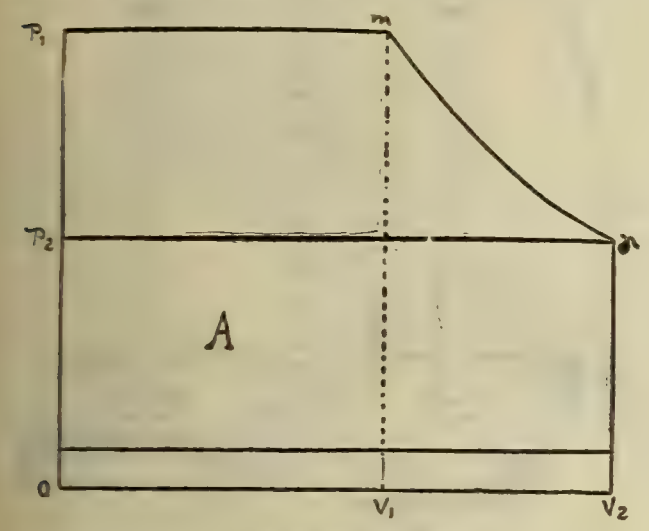


DIAGRAM A.

The History of Commercial Electric Lighting covers hardly a decade. The same is true of the sale of steam from underground pipes radiating from a Central Station. In both of these enterprises, frequent failures have been met with and many lessons learnt. I believe it is a fact, however, that all present existing Steam Companies more than pay expenses. A few have paid dividends while many have been obliged to re-invest their earnings in improvements or in remedying defects in original construction. The very few absolute failures have been due to faulty design, or defective engineering at the start. In the city of New York, two companies were started less than ten years ago, one of which, owing to faulty design failed and gave up business, the other known as the N. Y. Steam Co., is supplying steam for power and heating to nearly seven hundred consumers, and sells the product annually of more than 100,000 tons of coal burned under boilers aggregating nearly 20,000 H. P.

In its distribution of steam through underground pipes the company has had many obstacles to contend with, the chief trouble having been the securing of absolutely tight joints. This difficulty has been completely removed by the method employed during the last four or five years as is well attested by the net-work of pipes on Madison Avenue and the adjoining streets between 53d and 70th streets, where nearly three miles of pipe are in perfect operating condition and practically without a leak. The engineering difficulties which in an enterprise of this kind would strike one as more difficult to provide for, namely, the expansion of the pipe and the losses due to radiation were most perfectly provided for at the start, and therefore with the improvements which have been attained through practical experience of nearly ten years, the system has been brought to a state of perfection where in new work but little more can be desired. The pioneer work has been done and the electric lighting companies are therefor in a position to reap the advantage of the experience gained and to begin their work where the Steam Co's have left off and can therefore feel certain in seeking for a market for their bye-product (their exhaust steam) to meet with no mechanical difficulties of construction.

The joining of two enterprises together such as Electric Lighting and the distribution of steam from central stations has both its advantages and its defects, and we must weigh one against the other. The Electric Light Station is already in possession of its boiler house equipment, and for this reason has much less to charge up to the construction expense of steam distribution than a Steam Co., since its boilers are available for supplying steam directly to the street mains, when light is not called for or when the engine load is at a minimum, and can furthermore by proper adaption deliver the exhaust steam from the engine into the street mains, and for the purpose of heating realize the larger portion of the original heat value of the steam. Again in a combined plant the general expenses of management superintendence and so forth, need not greatly exceed the cost for the same items in a single plant alone. An obvious disadvantage is the increased back pressure put upon the engines. I am assuming of course that the engines are of a non-condensing type. The prejudicial effect of this back pressure is a subject which will well repay a little study.

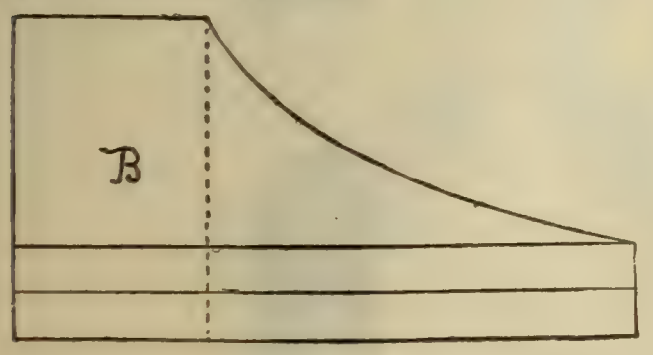


DIAGRAM B.

Thirty lbs. of water per H. P. per hour is the recognized standard of boiler capacity and is also a fair statement of the amount used by an engine of fair size exhausting into the atmosphere. A portion of the work of such an engine is spent in overcoming the atmospheric pressure of 15 lbs. per sq. inch and when therefore in addition to the pressure of the atmosphere an increase of back pressure is incurred, the useful work of such an engine is diminished by a corresponding amount. If the increase of back pressure is only that required for the passage of the steam for heating purposes the increased consumption per indicated H. P. per hour will not be greatly augmented in consequence, provided the pipes are sufficiently large and properly run.

The heating of residences by steam supplied from our 58th street station is now effected with steam at a pressure of one or two pounds. As is well known there are several systems in use where exhaust steam is employed for heating in a manner so as to make it possible to produce a vacuum in the heating coils. The back pressure of the engine therefore in a system where the engines discharge into street mains, mains depends almost solely upon the size of the mains and the quantity of steam carried. A loss of pressure of 10 pounds in a half mile of pipe provides a carrying capacity reasonably in accordance with the cost of the pipe. Of course if this difference of pressure exceeds 10 lbs., the cost of transportation becomes relatively less, while the loss at the engine becomes greater, and vice versa in case the loss of head producing flow of steam is less than 10 lbs. This like many other details must be determined upon in each particular case. In order to illustrate this point I will present some calculations based upon a back pressure of 17 lbs., absolute (about 2.3 pounds ordinary gauge) with an initial pressure of 92 lbs. absolute (or about 77.3 lbs. ordinary gauge pressure). We will call this Case No. 1.

For Case No. 2, let us take the back pressure at 30 lbs. absolute (about 15.3 gauge) and the initial pressure at 105 lbs. absolute (or about 90.3 lbs. ordinary gauge).

In Case No. 3, let the back pressure be 105 lbs. absolute and initial pressure 180 lbs. absolute. The last case is interesting, since it called for a theoretical consumption of steam per indicated H. P. in an engine with an initial gauge pressure of about 165 lbs. and a back pressure of about 90 lbs. gauge. The diagram marked A shows the cycle of changes of steam used under the above conditions,—omitting the practical considerations of wire-drawing, compression, early release, and so forth, which are the interesting characteristics of an indicated diagram. The tremendous amount of unutilized work due to the excessive back pressure is clearly shown by the area of the rectangle $P_2 V_2$. In this diagram P_1 and P_2 are laid off as ordinates to represent the initial and back pressure, while V_1 and V_2 are laid off as abscissæ to represent the volume of 1 lb. of steam before and after expansion. The expansion curve *mn* is supposed to follow the law $P V^{\frac{17}{16}} =$ constant. The diagrams B and C represent case 2 and 1.

At pressure P_1 (180 lbs. absolute) Figure A, the volume V_1 of one pound of saturated steam is 2.49 cu. ft. and at pressure P_2 (105 lbs. absolute) the volume V_2 of one pound of saturated steam is 4.14 cu. ft.

Neglecting all cylinder losses due to condensation, leakage clearance, &c., and supposing the expansion curve to conform to the formula $P V^{\frac{17}{16}} =$ constant, we have for the total work in foot pounds of one lb. of steam,

$P_1 V_1 \times 16 (P_1 V_1 - P_2 V_2) = 95645$ ft. lbs. Deducting the work of overcoming the back pressure ($P_2 V_2 = 62597$), we obtain (95645 — 62597) = 33048 indicated ft. lbs. and as 1,980,000 ft. lbs. per hour is equivalent to one horse power, it is evident that an engine working under conditions above named would require $\frac{1980000}{33048} = 60$ lbs. of water per. H. P. per. hour.

In similar manner it may be shown that between the limits of pressure 90 lbs. (105 lbs. absolute) and 15 lbs. (30 lbs. absolute) there would be required 26 lbs. per indicated H. P. per hour. This covers the case of an engine exhausting into low pressure street-mains.

An engine exhausting into the atmosphere with 2 lbs. back pressure (17 lbs. absolute) and receiving steam at 77 lbs. (92 lbs. absolute) would require 19.7 lbs. of water per H. P. per hour.

In actual practice the losses due to clearance wire drawing, incomplete expansion, cylinder condensation, &c., would have to be added to the amounts above given.

If in the last case (C) we add 10 lbs., making about 30 lbs. per H. P. per hour we shall have an average practical result as obtained from automatic single cylinder engines of fair size.

The great loss due to cylinder condensation is largely dependent upon the difference of temperature between that of the steam at admission and that at exhaust. In cases A, B and C, this difference is respectively 42°, 81° and 102° and hence with the same size cylinders in each case it is quite sufficient to make the same allowance of not more than 10 lbs. additional for B, and C, making for B— about 37 lbs. per H. P. per hour and for C, 70 lbs. per H. P. per hour.

Now in an engine operated in such a manner there would be during expansion a loss of heat due to conversion of the internal energy of the steam into work amounting to $\frac{16 (P_1 V_1 - P_2 V_2)}{772} = \frac{31104}{772} = 40.3$ thermal units per pound of steam, which would produce a condensation amounting to 3.3 per cent. The total thermal units (above 32° F.) per pound of steam at 105 lbs. (absolute) pressure is 1182.4 or (1182.4 — 181) = 1001.4 above the temperature of the feed water (212° Fah.) Hence the available heat in the exhaust would be 1001.1 x .987 = 968.35.

Before entering the cylinder, however, the steam at 180 lbs. (absolute) contained (1195 — 181) = 1014 thermal units per pound above the temperature (212° Fah.) of the feed water. Hence the total loss due to conversion of heat into work is $\frac{1-968.35}{1014} = .045 = 4\frac{1}{2}$ per cent.

In addition to this loss in the cylinder of the engine we must consider a further loss at the boilers owing to the fact that by raising the pressure we have increased the temperature of the steam 42°.

Now assuming that the increase of the temperature of the escaping gases amounts to 42° (and it certainly can be no greater) and allowing 24 lbs. of air per pound of coal, we have 42 x 24 x .238 = 240 thermal units lost per pound of coal burned.

Now assuming that one pound of coal evaporates at 105 lbs. pressure (absolute) 8 pounds of water which is equal to (1182.4 — 181) x — 8 = 8011 thermal units. The loss at the boilers therefore may amount to $\frac{240}{8011}$ = about 3 per cent. Adding this to the previous loss of 4½ per cent. we obtain a total loss of 7.5 per cent. But this loss must be figured on a basis of 70 pounds of water per H. P. per hour and hence when computed at 30 pounds becomes $7.5 \times \frac{70}{30} = 17.5$ per cent.

Therefore we have practically obtained our work in the high pressure electric light engines at the rate of five and a quarter pounds per indicated H P. per hour, the re-evaporation during exhaust, together with the unbalanced motion of the steam due to eddies, wire drawing, &c., appearing again as steam or useful heat in the street mains.

This is clearly an extreme case, but for this reason it better serves as an illustration. The percentage of steam condensed to water through the conversion of heat into work during expansion would be greater in cases 1 and 2, but in these cases it would hardly be necessary to consider any possible extra loss at the boiler.

Diagram D is the representation of an indicator card taken from an engine operating under condit ons of excessive back pressure similar to case No. 3, diagram A. The back pressure in this instance was about 55 lbs. above atmosphere and the initial pre sure about 130. The engine was an automatic cut-off type taken from the salesroom of a well-known engine builder, having been built for ordinary duty and not especially designed or altered for work of this unusual character. The engine was directly belted to a 750 light A. C. Westinghouse Dynamo, which supplied current to about 600 incandescent lamps in the Lenox Lyceum 59th street and Madison Ave.

The building was wired throughout on the Edison three-wire plan and the converters were arranged two in series with a middle wire to suit these conditions. The plant was supplied with electric meters and the various station instruments, and represented, therefore, on a small scale, a Central Electric Lighting Station. The exhaust pipe of this engine was directly connected with our street mains where an average steam pressure of about 55 lbs. was always maintained. The steam from the street mains was used in part for operating elevators in apartment houses and for running engine and in part for heating. If we follow the steam in its course through the Electric Light engine, thence through the elevator, engines and pumps and other engines along the line of the underground steam mains and thence to the radiators where condensation takes place it will be evident that an economy is attained similar to that in a compound condensing engine, the electric light engines playing the part of the high pressure cylinder, the other engines playing the part of the low pressure cylinder, and the radiators taking the place of the condenser.

This engine was operated under these conditions three or four evenings a week for about a year, affording a perfectly steady and satisfactory light from the incandescent lamps. The running of the engine was not attended with any special difficulties and gave no more care and occasioned no more trouble than if exhausting into the atmosphere. On several occasions the exhaust of the engine was shut off from the street mains and turned into the atmosphere the initial pressure being reduced at the same time to correspond. At other times the reverse of this change was effected and the exhaust turned from the atmosphere into the street mains without in either case producing a noteworthy fluctuation in the light from the incandescent lamps.

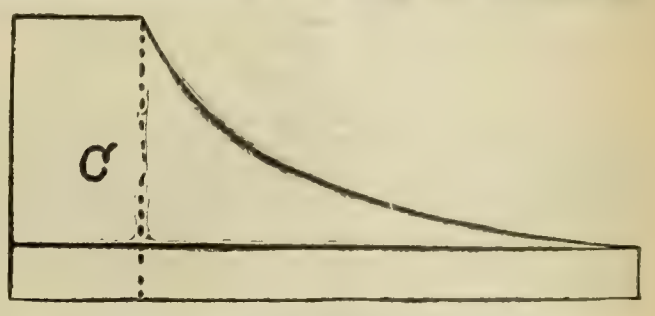


DIAGRAM C.

The gross revenue to be derived from the sale of steam for the heating of buildings may be estimated at from $2.50 to $5.00 per thousand cubic feet of space heated per season. The amount of heating to be obtained per mile of street mains will evidently vary very much according to locality and in the dozen or more district Steam Companies, it is interesting to note what this variation is. In the smaller towns where systems of underground steam distribution exist, the space heated seems to vary from 1 million to 2 million cubic feet per mile of street main and in the case of a larger city reaches 5 millions, and in the city of New York exceeds 15 millions.

The cost of plant (which in these figures includes boiler house and boilers), varies from $20,000 to $30,000 per mile and in one instance reaches $50,000.

In New York City the cost very much exceeds these figures owing in part to the difficulties encountered and in part to the fact, that the street mains were laid with a view to supplying steam for power. In the N. Y. Plant the pressure of steam in street mains is above 80 lbs. and furnishes a supply to over 500 engines and requires for this purpose in the summer time about 250 tons of coal daily, and including heating reaches 500 tons daily in the winter. The cost of plant, is greater in cases where steam is furnished for power as well as for heating. The actual cost of a district steam plant, where the business is confined to heating alone, seems to vary from $10.00 to $20.00 per 1000 cubic feet of space heated. Here again this cost includes boiler house and boilers.

In order to make it clear beyond dispute that the business of a district steam company can be added to that of an electric lighting company without prejudice to the latter, two points only need be established. First, the possibility of utilizing the exhaust of electric light engines without detriment to the light, and without introducing any serious complications or expense in the management of the station. Second, the certainty of an extra revenue, the net profits of which will equal or exceed the profits from the lighting plant for equal amounts of money invested. I have already touched upon both of these points and need, I think, only refer to the practical working of the combined system at the 58th street station of the New York Steam Co., where the back pressure of the engine was 55 lbs. (with no inconvenience and with no extra expense, save an almost indeterminate increased consumption of fuel) to prove that with a back pressure of only 15 lbs. a practical mechanical success is assured. Of course to get the same power from the engines, it would be necessary unless previously running with a light load to increase the initial pressure 15 lbs. or to the same extent that the back pressure is increased. The effect of this, as I have shown, will be merely to pass a little more steam through the engine per H. P. which ordinarily would be a bad practice and a waste of fuel, but when distributed and sold for heating purposes has nearly the value of live steam taken direct from the boiler. There would be times of course when the demand for heating would be slight and when therefore it would be more economical to use a free exhaust, or where there were several engines to have only a portion of them deliver their exhaust into the street mains. The experiments of the New York Steam Co., previously cited, showed that the engines could easily be shifted from one exhaust pressure to the other without detriment to the light, and therefore be easily possible to secure at all times a maximum of economy which a combined system would permit.

So far as profits and dividends are concerned a very considerable saving would follow by the mere union of the two interests without even taking into account the value of the exhaust steam. Since, however, so much is dependent upon local conditions it is impossible to give figures which would apply to anything more than a hypothetical case. The amount of heat lost by radiation from the pipes of the New York Steam Co. showed the loss to be about 3 per cent. of the carrying capacity of the pipes. It may be well to add here as having a most important bearing on the profitableness of such an investment some of the details of the cost of underground steam work. The sizes of pipe most common in practice are those having diameters of 4 in., 6 in., 8 in. and 10 inches, the carrying capacity of which with steam flowing with an initial head of 15 lbs. are respectively about 50 h. p. 150 h. p., 300 h. p. and 600 h. p. The cost of the underground construction, which includes valves and the special appliances such as variators, service boxes, anchorages, insulation, etc., may be roughly estimated at $7.50 per foot for the 10 inch, $6.00 for the 8 inch, $4.50 for the 6 inch and $3.50 for the 4 inch. In many instances where large buildings adjoin the lighting station, many of the appliances may be omitted and much of the expense spared which must usually be counted in the cost of long distance work.

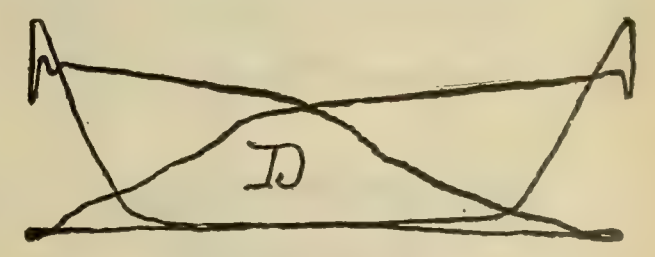


DIAGRAM D.

The average price received for steam from the aggregate of consumers large and small is somewhat more than double the cost of producing the steam at the boiler house. This average price is one willingly paid by the consumer, owing to the saving in cost of labor and to the many conveniences and advantages to be derived from having steam on tap like gas and water. Out of these gross earnings, which exceed 50 per cent. of the receipts, there must be subtracted the cost of maintaining the street system, leaving a balance applicable either for dividends, improvements or new constructions, or as often

is the case in new enterprises this balance must be expended in reconstruction made necessary through defects arising from lack of experience at the start.

The entire annual gross receipts of a plant is, of course, limited by the carrying capacity of the pipes and may be estimated at about 40 per cent. of the cost of construction, and therefore net earnings of 25 per cent. will permit of 10 per cent. dividends. Since the cost of steam amounts to fifty per cent. of gross receipts. it is evident that if one-half of the steam sold for heating can be obtained from engine exhaust the saving effected in this way alone will amount to enough to pay a ten per cent. dividend.

In this paper I have attempted to show the complete practical and commercial feasibility of combining a system of steam distribution from a central station with an electric light plant in a manner to utilize the exhaust.

I have given data that will assist in investigating the value of the plan in any locality where heating by steam could be introduced, but have purposely omitted to give any description or details of mechanical appliances and construction of underground steam work, as it seemed to me that the more important issue for discussion was the question: What has the distribution of steam from a Central Station to do with Electric Lighting?

THE ELECTRIC ARC AND ITS USE IN LIGHTING.

ELIHU THOMSON.

It is curious that notwithstanding the fact that as a source of illumination the electric arc has been known since the beginning of the century, the scientific study of its nature has been but little pursued. It began to be known as a sort of scientific curiosity, being at first set apart as one of the many phenomena observed in the use of powerful batteries. It was not till about twenty years after its discovery by Sir Humphrey Davy that any proposals were made to use it in lighting, and, subsequently, for many years it was occasionally employed either in lecture demonstrations or in obtaining an intense light for some special purpose.



FIG. 1.—ENCRUSTED CARBONS.

The efforts to use it in lighthouses led to the designing and construction of machines on the magneto-electric principle to replace the cumbrous and costly batteries otherwise required. I remember vividly the hours of labor and time necessary to prepare a battery of forty Bunsen cells for use in working a single small arc light for, at most, two or three hours. But I remember far more vividly the suffocating fumes and risk of acid spilling, with accompanying ruin concomitant on the taking down of a partially exhausted battery. Even to work with the arc for an hour or two was, however, adjudged a sufficient compensation for the disadvantages in obtaining the current. All this has, however, been changed, and the past ten or fifteen years has made the arc as a source of illumination one of the indispensables of a progressive community. Instead of the original, little short sticks of boxwood or other charcoal used as "points," which were only "points" because it was not expected that the arc would be burned for more than a few minutes without exhausting the battery, there came later on the little hard carbon sticks about two inches long and 3-16 inches square, sawn from hard gas-retort carbon, or from battery plates, and, lastly, came the moulded and forced carbons made from a paste in a powerful press, millions of which are now required every week to keep the lamps at present in use supplied.

The charcoal points of Davy were touched together horizontally after attachment to the wires of the battery and were then separated. The stream of hot flame which followed or joined the points being deflected by air currents took the form of an arch or curve which gave the name to the phenomena. Even with one carbon directly over the other, the curved form of the stream is the rule when the carbons

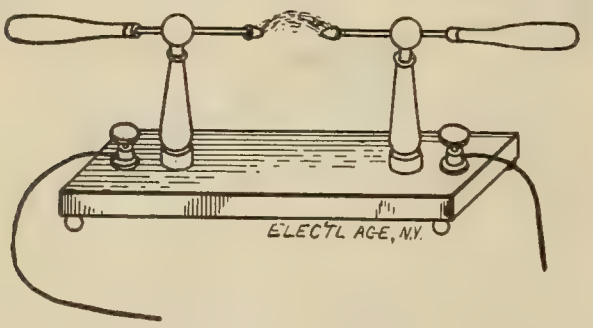


FIG. 2.—ELECTRIC ARC FROM DAVIS' MANUAL.

are widely separated. Davy's original experiment was made with a battery of 2,000 cells, with zinc and copper plates about six inches square, the exciting fluid being very dilute sulphuric and nitric acids.

Davy's description is as follows: "When pieces of charcoal about an inch long and one-sixth of an inch in diameter were brought near each other (within the thirtieth or fortieth part of an inch) a bright spark was produced, and more than half the volume of the charcoal became ignited to whiteness; and, by withdrawing the points from each other, a constant discharge took place through the heated air in a space equal at least to four inches, producing a most brilliant ascending arch of light, broad and conical in form in the middle." This was evidently a long-flaming and horizontal arc. I find this form shown in a book published as late as 1846; Davis' Manual of Magnetism. Indeed I know of no more forcible example of the persistency of old ideas than is afforded by the accounts given in the books concerning the nature of the electric arc. The persistence of old cuts is also equally exemplified, even down to the latest publications, giving pictures of the electric arc. The carbons are generally shown crusted over with dense masses of impurities melted into globules or adhering to their sides (Fig. 1.) Such figures would not now be recognized as resembling arcs formed with good, pure carbons, such as must be used for commercial results in arc work.

Figures 2 to 4, inclusive, show the development at least in illustration concerning the electric arc.

Fig. 2 is from Davis' Manual, referred to.

Fig. 3 is one of the figures showing the arc, taken from Ganot's Physics, published in 1863, though the figure is from the 7th edition, 1886. It is virtually the former figure made vertical.

Fig. 4 is a figure of a modern arc.

In regard to the ideas put forward as to the nature of the electric arc there is even a wider divergence than in the figures used for representing it. But these views are remarkable for their general inaccuracy or crudity and evidently have been handed down with modifications. Few of those who have written about the electric arc, at least in the text-books, seem to have had the courage to look at the arc, or they may have seen it "through a glass darkly and not face to face." It would require too many and lengthy quotations to give these various views. In most of them the light of the arc is attributed to intensely heated carbon particles transported by the current from one pole to the other. In most of them the idea of carbon vapor as a possible factor never seems to have arisen. Others attribute the arc to the heated air between the carbons which carries carbon particles, some of which are burned.

The following quotation from a book on electric lighting, published in 1884, is a type of many such accounts:

"In arc lamps, as we have already stated, the resistance which "converts the current into heat is that of the heated air between the "ends of two carbon rods, from one to the other of which the cur-"rent passes. The light is produced by the incandescence of the "ends of the carbon poles, and of the minute particles of carbon "which become detached and float in the heated air between them. "The heated air containing the particles of carbon forms what is "called the electric arc."

Here the heated air and carbon particles floating therein are definitely stated to form the "electric arc." Nothing is said of carbon vapor having anything to do with it.

Even the statement that the positive carbon burns twice as fast as the negative is very frequently found unqualified in any way whatever. The experience of the lamp trimmer is, I need scarcely say, not in accordance therewith, the fact being that the rate of consumption even in direct current arcs with the same size carbon in both holders varies sometimes quite widely from the proportion stated. However, we shall make better progress if we discard at once the older notions, and, adhering only to that modicum of truth which often accompanies error, supplant the error by the results of our own observations and experiments. My endeavor will, therefore, be to state as briefly as I can such views of the nature of the electric arc as seem to be borne out by observation during many years, and under greatly varying conditions of its production.

Let an attempt be made to separate any part of a circuit in which the current is maintained by a sufficient E. M. F. or potential and we find that if the separated ends are moved quickly we get a flash or spark of varying length which becomes a flame of great heating effect if the current be of large rate of flow. If the separation of the two parts of the circuit be made slowly a continuous flame or discharge will take place between the ends if they be not too widely separated or so widely separated that the potential or pressure of the current is not sufficient to force current across the space. With considerable potentials and heavy currents a space of many inches may thus be bridged. Whether the separated ends be of iron, copper, carbon, platinum, zinc or other conductor the hot discharge is still formed. Therefore while the electric arc is generally spoken of as that flux occurring between *carbon* ends separated, of course it can not be so limited and we frequently, therefore, refer to copper arcs, iron arcs, carbon arcs, to distinguish one from the other. What then is the arc so formed? Is it heated air between the ends separated containing detached particles of the conductor in process of carriage, as was apparently thought for a long time to be the case? No, the arc proper is composed of a stream of vapor arising from the actual boiling or vaporization of the solid or fused ends of the separated conductors. In so far as the surrounding air mixes or combines with this vapor stream it is modified by the presence of oxygen and nitrogen, but the air or any other gas is not essential to be present and is merely incidental to the formation of the true arc stream in air. Indeed it may seem strange to some to speak of vapor of carbon, copper, iron, platinum, &c., but their production is merely a question of temperature in any case. In the electric arc there is a real distillation of the conductors forming it and this accounts for the variation of color and temperature to be found in different arcs. The copper arc evolves a peculiar green light which is exceedingly trying to the eyes as those who have experienced its effects well know. Zinc gives a whitish blue, while the carbon arc proper is purplish in tint. The arcs from various metals give in the spectroscope the characteristic lines of the vapor of each metal.

As a curious incident, showing the presence of the metal vapor in the arc, I may mention the fact that when by accident a person has had a portion of his clothing bathed for an instant in a heavy copper arc caused by a short circuit of heavy current mains there has been found a considerable deposit of copper, enough, in some cases, to give the reddish color of copper to the surface bathed, which if moistened turns green by oxidation. It also gives a deep blue to dilute ammonia in which it is washed, thus showing the presence of copper. In like manner these metalic arcs will give a deposit of the metal on cold surfaces which they touch.

It appears to be the positive pole which gives out the vapor stream. With carbon the positive vaporizes steadily and is consumed much faster than the negative. In the use of the arc, however, for lighting we have learned to distinguish between what is called a "short arc" and a "long arc" system. In "short arc" systems the carbons are burned much nearer together than in the "long arc" systems. Let us suppose the case of two carbons touching each other with a current passing and then that we very slowly separate them, stopping to observe effects. When the contact is light before actual separation, a visible heating of the meeting ends is seen. On attaining a small separation the space between seems filled with hot vapor and we have a short arc where the separation is perhaps not over 2 to 3 one hundredths of an inch. There is also noticed an active transfer of carbon from the flattened end of the positive and a deposition of copper on the end of the negative carbon. This deposited carbon takes the form of a mushroom end after a time, and breaks off. Meanwhile combustion goes on at both poles and wears away the sides of the positive carbon while the transfer of carbon wears away its tip or crater. The burning also wears away the negative at the sides, while the tip is built up by the mushroom deposit from the arc. But the cutting in of the negative finally severs the mushroom tip and it falls away. Hence both carbons are eventually consumed. To develop a "short arc" there is required a little over half the potential that is needed for a "long arc," or about 25 volts more or less, and therefore to give out equal heat energy in the arc the current must be double in the short arc over what it would be in the long arc. The short arc is subject to the objection of a continual frying sound emitted and great variations of luminosity; it requires a very dense and hard carbon to conduct the current without great loss, and involves line losses of at least four times the amount with the long arc if equal gauge wires be used.

In fact, while in the past such arcs were common, their number is diminishing, as they are being replaced by the more efficient and completely developed arcs called "long arcs," which are so called to distinguish them from the "short arcs." Returning to our separating carbons we find that as the space or arc is lengthened from the short arc condition we pass a stage of great flickering and unsteadiness and a fluctuating potential between the carbons, and then reach the stage of production of the long or quiet arc. With ten amperes the separation may now be about 1-16 to 1-10 inch or more. Smaller currents require less separation and larger ones an increased separation. At this stage the arc is quiet, with good, pure carbons very steady, and the potential difference remains at about 45 volts, if, of course, the carbon is properly fed to make up for combustion. The perfect arc is really a beautiful phenomenon. While the positive carbon still loses by volatilization from its tip or crater and by combustion from its sides, the negative gains no deposit but wastes at a less rate than the other, and by combustion only. The carbon vapor carried off from the positive is consumed by the oxygen of the air before it can deposit on the negative. Hence the outer, zone of flame which can easily be distinguished from the central zone or arc flux proper, is probably a zone of combustion similar to that existing in ordinary flames. The removal of carbon by vaporization from the positive end, gives rise to the crater or cup which is so prominent a feature of carbon arcs produced by continuous currents. The size or area of the crater is a rough measure of current strength but varies with different qualities of carbon. With very long arcs the crater or hollowed end disappears and the ends become rounded. A well formed crater with the arc or flame confined thereto means usually a steady light, since the chief source of

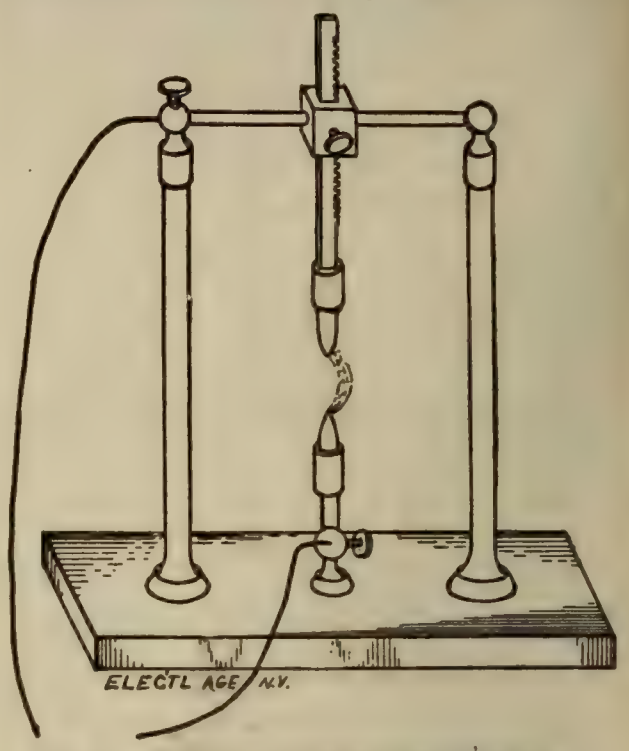


FIG. 3.—ELECTRIC ARC FROM GANOTS' PHYSICS.

light in an electric arc is from the positive crater which shines like a diminutive sun and represents the hottest part of the arc. The vapor light proper or flame light is comparatively very feeble and of a purple quality in air. Hence the arc light is as truly an incandescent source of light as is the incandescent carbon filament, with the difference that to run the latter at the temperature of vaporization or boiling point of carbon, so to speak, means instant destruction, while by the necessities of the case the light obtained from the arc is chiefly that emitted from a surface of carbon at its temperature of boiling, or more correctly of sublimation at atmospheric pressures. This temperature is exceedingly high, and accounts for the well-known superior economy in light production of the arc over all other kinds of lighting. The temperature of the positive carbon crater is so high that the carbon exists there in a soft or plastic condition capable of receiving an impression like putty. I have proved this with very large arcs of 150 to 200 amperes by suddenly forcing the carbons together when the current had been cut off and finding that they would fit each other perfectly, the negative impressing its form on the positive crater.

As an interesting fact in this connection I may state that I have been able to bend carbon sticks of 3-16 to ¼ inch in diameter by passing current through them of sufficient amount to almost vaporize the sticks and cause them to emit an intensity of light approaching that of the arc.

These facts would point to the possible fusion of carbon into liquid carbon at arc temperature under a high pressure of inert gas. No one has as yet seen carbon in this liquid condition, and the electric arc alone has made us acquainted with carbon vapor. One cannot fail to be impressed with the fact that the conveyance of carbon in the arc has a striking resemblance to a plating process where metal is taken up by the bath from the positive plate and deposited on the negative. In the arc the hot vapor stream of flame takes the part of the bath and probably acts by molecular interchanges of carbon atoms in molecules of carbon to cause the transfer which occurs, just as in the plating bath the molecules of the plating compound are polarized and allow atomic interchange which results in conveyance of metal through the bath.

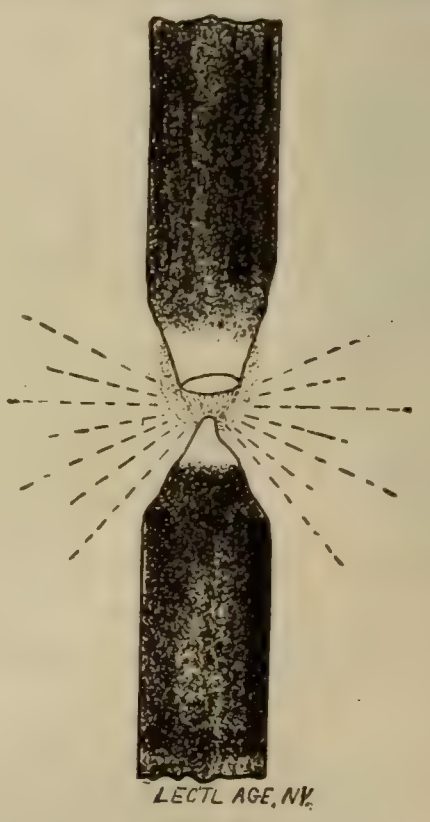


FIG. 4.—MODERN ELECTRIC ARC.

Another curious fact in relation to the arc is the distribution of potential in it. Dr. J. A. Fleming has recently shown that the difference of potential between the positive carbon and the arc flame is about forty volts and the few volts which express the difference between the flame and the negative make up the total potential, say forty-five volts. Hence the real work of the arc is not in the flame, the energy is not used in overcoming flame resistance but chiefly in vaporizing carbon in the positive crater. It is certainly not strange that with forty volts and, say, ten amperes or 400 watts expended virtually at the crater surface of the positive carbon the temperature and luminous effects should there be so great

The distribution of potential in the arc just noted was also brought out about the year 1884 in some testimony in an interference in our

Patent Office concerning an arc lamp cut-out which I had invented and which took advantage of the potential differences between the carbons and the arc flame to cut out the lamp when the arc was too long. It is of course well known that the value of an arc light for general illumination is greatly enhanced by the fact of the distribution of light being mainly in a downward direction in continuous current arcs. This of course follows from the fact of the positive carbon crater being above, such crater being the part from which most of the light comes.

This matter has been quite thoroughly investigated and many diagrams of distribution are to be found in the literature of the subject as published from time to time. They show that with the long arc the maximum intensity of light is from 40° to 60° downward from the horizontal and that the horizontal intensity is generally much less than one half as great, while of course the intensity diminishes above the horizontal direction and ultimately becomes zero before reaching the upward vertical direction. In like manner the approach to the downward vertical from the direction of maximum intensity is attended with similar rapid diminution.

attempts have been made to prolong the hours of burning of a carbon by enlarging its diameter beyond certain limits it has resulted in injury to the character and distribution of the light. Large diameters of carbon may burn too blunt to let the light out between them.

Likewise, where attempts have been made to prolong the hours of use by employing a harder or denser carbon than before it has frequently been found that a sacrifice of light has been incurred, rendering the results much less satisfactory.

One of the chief obstacles to the employment of quite small arcs with currents of three or four amperes is the difficulty of obtaining suitably uniform carbons.

Arcs of even as low as two amperes at 45 volts are easily produced and such small arcs might even have commercial utility if the difficulties in relation to carbons were removed. An arc consuming 90 to 100 watts means of course about 7 or 8 to the electrical horse power.

On the other hand very large or heavy current arcs are difficult to control. They are apt to be unstable at times and when they get to hissing, or rather roaring, it is difficult to restore quietness and steady

than myself have experimented in this direction. I have however, produced lights with two positives and one negative, with one positive carbon or crater and two, three or more negatives and with two positives and two negatives. I have caused arcs to cross each other, as when four carbons are used, pointing toward a center the two pairs opposite being respectively connected with different circuits. In this way direct arcs have been, as it were, mixed with alternating arcs and a curious compound effect produced by crossing two arcs made with two alternating currents the waves of which are displaced in phase. Without going fully into these experiments I will present figures showing two good examples. Figure 5 is formed by two currents sent into a positive P and dividing after passing the crater into two streams going to the two negatives. In this case the positive crater is fully exposed horizontally and gives a most intense light in a direction forward. Such an arc is well adapted for projection by mirrors or lenses.

Figure 6 shows the arc formed by crossing two alternating currents out of phase. In this case there is at successive times an exchange of current between all four carbons in varying directions so that the arc

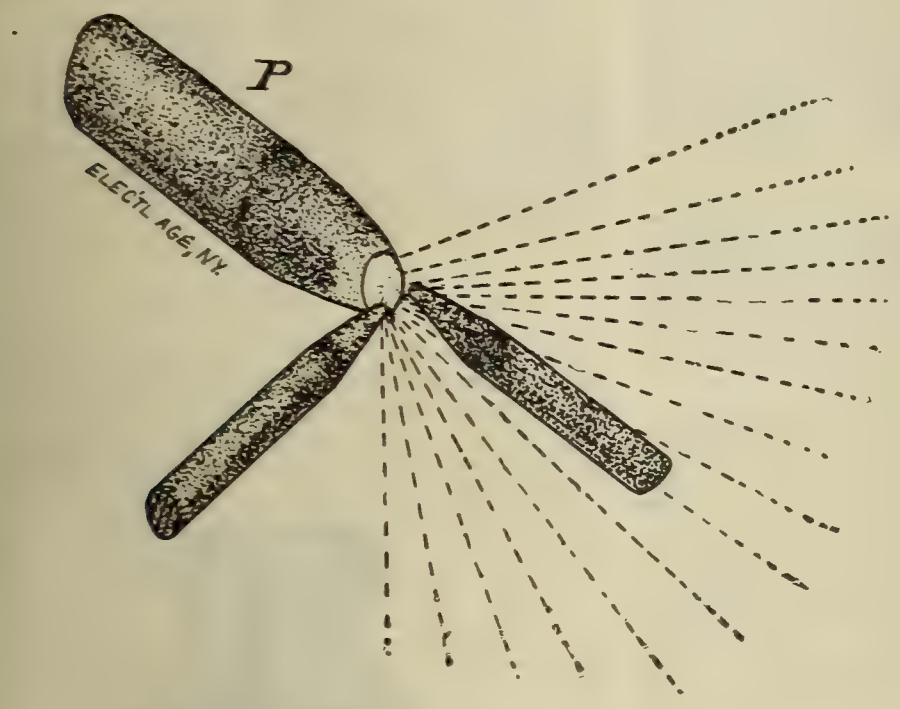


FIG. 5.—ONE POSITIVE AND TWO NEGATIVE CARBONS.

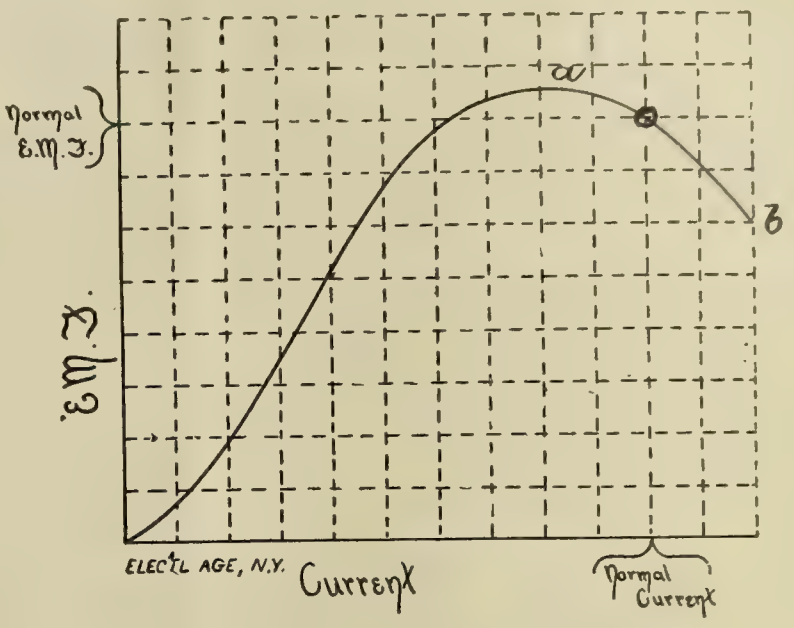


FIG. 7.—CONVEX CURVE OF ARC DYANAMOS.

The spherical candle power of arc lights would therefore be only a fraction of the rated candle power which is generally taken at the maximum light obtainable in the best direction from the particular arc or kind of arc in question.

For this reason the term 2000 C. P. arc has little significance as indicating the illuminating power of an arc. It is a convertion only and a poor one at that. It is now generally taken to mean an arc with ten amperes and not less than 45 volts potential difference between the carbons or a 450 watt arc. The quality of the carbons will determine whether the 450 watts will be expended in obtaining the most light or not or whether that light will have a maximum intensity at one angle or another within certain limits.

When arcs are operated on by alternating currents, the effects mentioned are only partially exhibited and the phenomena of the crater are of course masked or obliterated on account of reversal of function of the carbons. Unless the alternations are rapid such arcs are liable to extinction at the zero points of current, particularly when run in a draft of air. A strong draft of air or a displacing magnetic field may of course so disturb an arc as to cause its extinguishment.

In the early years of the growth of arc lighting as a means of illumination the effects obtained were not of the best. Unsteadiness was the rule and it required much persistent effort to discover the causes and find the remedy.

The prominent defects were, and we may add are still, hissing, sputtering, flaming and general unsteadiness. Hissing or frying comes of course with too short an arc and may be connected with too vigorous vaporization. They may also be due in some cases to a carbon of too coarse a grain. Sputtering may arise from impurities in the carbons and flaming from too long arcs, from impure carbons, or from carbons insufficiently baked and containing unexpelled gases. Running an

action. The introduction of cored carbons for the positive has, however, done much to remedy the difficulty, and indeed to render it possible to obtain very uniform results from arcs in general wherever such results are indispensable. The introduction of the central soft core into the carbon seems to locate the arc centrally, hold it from fluttering or shifting its position on the end of the positive; in other words the core fixes the position of the crater, and so benefits the light.

It follows from the fact that the voltage required to sustain an arc with large or small currents ranges about 45 to 50 volts that the larger the current passing in an arc the less its electrical resistance. Hence well developed arcs with 4 amperes will have about 11 ohms, with ten amperes 4.5 ohms resistance and with 100 amperes .45 ohms. This fall of resistance with increasing current is easily explained by the broading or thickening of the arc stream and the widening of the crater on the positive carbon. This widening of the crater also gives increased illuminating power without increase of temperature. It is probable that the actual crater temperature is as great in the small arcs as in the large ones, in fact this is implied by the quality of the light remaining the same. Nevertheless the larger the arc the greater the economy or the greater light giving power per unit of energy. This would naturally be expected as the concentration of heat and lessened chances for escape of heat by convection and conduction would conduce to that result.

The fall of resistance with increase of current has an important bearing on the construction of dynamos for arc lighting and the running of lamps on constant potential or incandescent circuits; and will be referred to later on. Attempts have been made at various times to save carbons in arcs by excluding the oxygen of the air which is the cause of their waste or consumption by burning. The gain has not

flame becomes, as it were, a ball or disk of very hot flame supported by the four carbons. These experiments have not been fully described as yet, owing to the lack of time, but they show very well that even when we have fully studied the single, simple arc we will not then have exhausted the subject as these compound arcs may be varied in character to a great extent and present new effects.

In regard to that portion of our subject which concerns the use of the electric arc for lighting, it is true that there is a wide field before us. I cannot hope to do more in this paper than to outline in addition to the considerations already alluded to some of the other prominent features of the subject. It is well known that by far the larger proportion of electric arc lights in operation is run on circuits of constant current, the lights being in series.

If arc lamps be connected in parallel, as on low potential incandescent mains, special devices are required to keep the current supplied to each lamp at the right amount.

It may appear at first to one who has not had occasion to closely study these matters that, given a constant potential circuit of fifty volts, arc lamps requiring fifty volts could be connected in multiple or parallel without difficulty. The fact is, however, that the condition of electric arcs being supplied with a constant potential involves a theoretical impossibility. Theoretically such an arc would take an infinite current and energy. Practically the current in an arc with constant potential becomes very heavy and if the carbons be separated to cut the current down as by a lamp magnet mechanism, a condition of fluctuation and instability results. This is a direct consequence of the fact before stated that the resistance of an arc is not like a wire resistance but falls with increase of current and vice versa. For stability the resistance should not be dependent wholly on the current passing. To remedy the instability a resistance known as a "choking

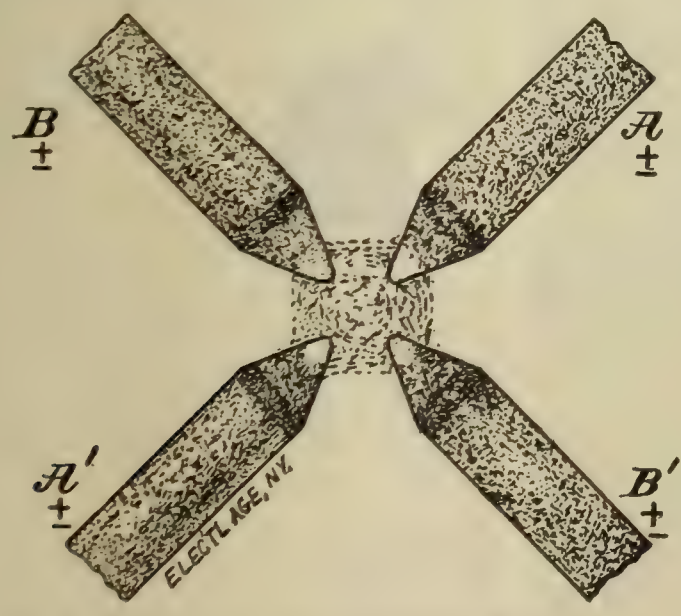


FIG. 6.—CROSSING OF TWO ALTERNATING CURRENTS.

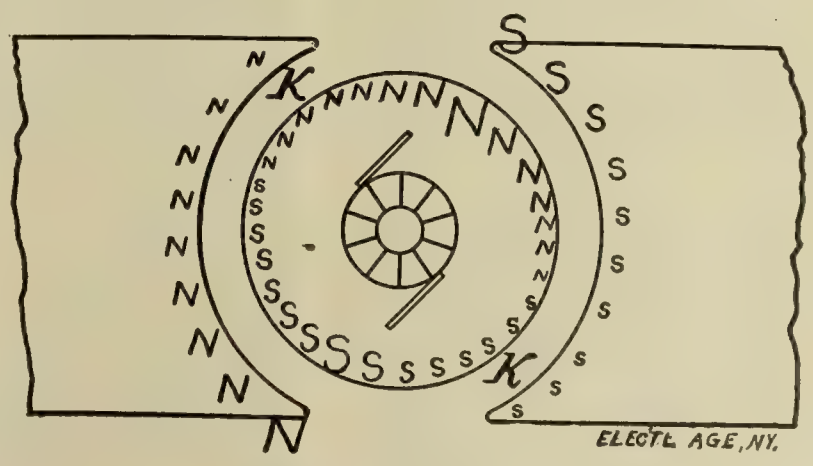


FIG. 8.—THE BALANCE OR CONFLICT OF OPPOSING POLES.

arc at a length between the long arc condition and the short arc condition may cause great unsteadiness of light. There is in fact a critical point in the length below which there is a considerable fall of luminosity and a drop of nearly one third of potential. As an arc lengthens by combustion of its carbons beginning below this critical point great unsteadiness will be manifested on arriving at the critical state and a little longer arc brings about a sudden and very marked increase of potential of illumination and of steadiness.

Any observer may easily detect these conditions without special effort. The earlier carbons used with arc lamps in the United States were both badly conducting, impure, and badly made. Copper coating was a necessity. French or Carré carbons were much better but were too costly to import. The use of the petroleum carbon or the carbon obtained by the carbonization of the tarry residue left in the distillation of crude oil made a wonderful difference in the purity of the carbons, and improved machinery gave accuracy of form and cheapness. To one familiar with the former cost of carbons for battery arcs the reductions in cost are very striking; carbons 3-16 inches square cost a number of cents an inch before the year 1878.

Another important matter in relation to carbons is that the size of section or diameter must be proportioned to the current used. Where

apparently compensated for the disadvantages incurred, particularly as the total exclusion of oxygen means that the carbons become blunt. They would be prevented from pointing themselves or acquiring tapered ends by burning, a condition essential to good working and distribution of light. Even when the arc is formed in a vacuum the carbons, though not burned, are slowly consumed and carbon deposited as a soot on the sides of the vacuum chamber, an effect consequent upon the vaporized carbon in the arc being carried off and condensed again as soon as the vapor escapes the heat of the arc stream.

In fact I have found it possible to coat objects on the inside of a bulb with silver or other metals volatilized suddenly by arcs in vacuo, and have obtained in some cases coherent brilliant deposits. The metal is raised in vapor as a metallic arc and distills and condenses on the surfaces near at hand.

Before passing to the consideration of the running of arc lamps in series, or in multiple; and the conditions to be fulfilled in each case, we may state that although in ordinary cases an arc is formed by a single pair of electrodes or carbons, and by a single circuit current, compound arcs, or arcs produced by combinations of two or more currents with three or more electrodes are possible. I am not aware that any others

coil" or "sluggishing coil" is inserted in the arc branch and the potential raised say to 65 or 70 volts. Under these conditions, that is with a resistance taking up 15 to 20 volts in series with the arc it may be run in multiple with incandescent lamps or with other arcs. There is, however, a waste of energy equal to the product of the current strength by the loss of potential, 15 or 20 volts, in the resistance. A great deal of useless experimenting has been, and probably is yet carried on with the vain endeavor of getting rid of the resistance or choking coil in this case, but the difficulty is inherent in the nature of the arc, the relation of resistance to current giving rise to instability of current in the arc.

Similarly, not all dynamos, even if of sufficient potential, will run arc lamps in series. Arc machines require special properties or the current will be unstable and the lights will fluctuate or "surge" as we sometimes call it, possibly to an extent amounting to extinction and relightings occurring at short periods apart. This action like the other is dependent on the relation of current and resistance as inherent in electric arcs, and the series of lights would in each case require dead resistance up to a certain amount in circuit to render the current stable. Then whether a series be operated or a single arc be operated, either a dead resistance must exist in circuit or the current sup-

feeding apparatus must have special properties. The arcs produced from batteries were stable because the resistance of the battery itself was sufficient to ensure this. Arcs are not stable as fed from accumulators of very low internal resistance unless the arc is one of enormous current.

Briefly, the property required to be possessed by an arc dynamo is that as its current rises above the normal the electro-motive force must fall as the current diminishes to a little below the normal the electro-motive force of the dynamo must rise. It is not sufficient to secure this changing E. M. F. by regulators, as they are generally behind time for causing stability of current however well they may operate to regulate for varying numbers of arcs in the series to be supplied.

The properties of dynamos are sometimes expressed by what are called "characteristics", or "characteristic curves", obtained for example by laying off vertically or on the ordinates the electromotive forces corresponding to varying currents given out by a machine, which currents are laid off horizontally or as abscissas. In arc machines the curve so produced is convex upward and droops at its outer end *b*, Fig. 7. Assuming normal current at 10 amperes and an E. M. F. of 500 volts at 11 amperes the E. M. F. may have fallen to 420 volts and at 9 amperes risen to 530. We would then be working on the "droop" *a* to *b* of the curve when at 10 amperes; and such a machine is stable as to current for running arc lamps. There appears to be required not merely a droop in the curve for securing stability but more than a certain amount of rate of droop or dip. If the line could be made to droop or dip vertically after passing the normal current the machine would regulate without a regulator or be a constant current automatic machine.

In what respect then do arc dynamos differ from others to produce this relation of droop in the characteristic curve? Without doubt the effect is mostly due to the reactionary effects of the armature on the field, which effects in arc machines are made greater than in others, and the field magnets meanwhile are frequently saturated magnets, so called, and not greatly sensitive to the current in their coils. The armature of an arc machine is indeed so powerful an electro-magnet that it is able to control the magnetism of a portion of the field in which it turns. A sort of balance of magnetic forces is established at certain portions of the field which on an increase of current in the armature produces polarity opposing the field polarity at the portions mentioned, such as will cut off some of the lines of magnetism from entering the armature core and so lower its electro-motive force; while a lessened current in the armature will weaken its polar portions and an increased number of lines will enter the armature core from the field and so increase the electromotive force at the brushes of the commutator. In the figure 8 the portions at K K are those at which the balance or conflict of opposing poles of armature and field magnet exists, namely at those portions near the diameter of commutator or position of the brushes on the commutator.

Could the droop or fall in the characteristic curve be made a vertical, as stated before, then we should have a self-regulating machine not needing a regulator to preserve a constant current under all loads. This condition is more easily arrived at in alternating machines, one of the first, if not the very first example of which is found in the Chertemps-Dandeu machine which was tested by Robert Sabine, as described in Dredge's Electric Illumination, Vol. 2, 1885. This machine had the remarkable property of permitting ten arc lamps to be cut out or put into its circuit in series in any way without causing a variation in current strength of more than ten per cent. The interactions occurring between the armature and field accounted for this regulating property. In these cases the armature currents react upon the field with a force producing at times a balancing of magnetism between the two. The distortive power of the armature upon the field is made very great, which amounts to the same thing.

In the recent alternating machine for constant current brought out by Mr. Wm. Stanley we have an excellent example of the application of similar principles of construction, together with the difference that the arc lights which were fed direct in series from the Chertemps-Dandeu machine, are run from transformers with the primary coils in the Stanley apparatus.

The relation of current to constancy is, however, in continuous current dynamos for arc lighting generally effected by regulators as they are called, which so alter the dynamos on a slight increase or decrease of current as to raise or lower its electromotive force according to the resistance in circuit or speed.

In one form of regulator the effect is obtained by changing the field magnet strength by automatic mechanism, weakening the field when lamps are cut out and strengthening it when lamps are added to the circuit. Another means of regulation is the rotation of the commutator or brushes so as to take current from positions corresponding to increased or decreased electro-motive force in such a way that the current obtained is constant. The former method first appeared in the Brush arc apparatus and the automatic commutator brush movement in the Thomson-Houston machines. The latter method renders the machine completely automatic under variations of load while in the former there still is required a manual spark adjustment of the brushes as the field magnet is altered in force under different loads. The two methods were subsequently combined by the writer in conjunction with Mr. E. W. Rice, in such a way that the necessary brush adjustments were made automatically at the same time with the variations of the field under different loads. This combined method has been used for some time past in the Excelsior machines constructed under the patents and designs of Mr. Hochhausen, whose name is so well known in connection with arc lighting and plating and other electric apparatus in this country. On account of the fact that with the addition of arc lights in a series a higher and higher potential difference is required at the terminals of the dynamo, it becomes a question how far this increase may properly be carried. It is not unusual in the present practice to run from fifty to sixty lights in a series, each demanding from 45 to fifty volts, or a total of say three thousand volts. In going beyond this amount the difficulties of insulation are greatly increased as well as the dangers of high potentials, while the consequent risk of breakdowns resulting from failure of insulation or leakage are often sufficient to offset any saving of wire conductor that might be obtained by running more lights in series. Instances have occurred in which with ordinary wiring and precautions 120 to 150 arcs have been run for days together, but such a practice is to be condemned as involving hazards of all kinds.

It has been supposed by some electricians that there existed a peculiar fitness for arc lighting in series in dynamos of the open coil type, such as the Brush or Thomson-Houston over those of the closed coil types, such as the Gramme or Siemens forms. Whilst, personally, I have never been prepared to admit this peculiar fitness, constructors of machines of the closed coil types have certainly succeeded in removing any doubts on that score. Mr. J. J. Wood has, in building his form of Gramme machine up to the highest capacities for series work, taken a leading position in this respect. In fact the simplicity of the commutator and the ease of insulation of machines of the open coil type undoubtedly rendered them more capable of retaining insulation at high potentials than the early commutators with numerous segments used on Gramme and Siemens machines, as such commutators were at first constructed. Likewise improved methods of insulation and winding have gone far to put both types of machine far in advance of what they were fomerly. While on this subject of arc machines it may be well to say a few words as to the action of flashing which can occur in all machines of high potential under certain conditions. In the first place the term flashing, as here used, is not intended to refer to sparking at the commutator, but rather to a flash or continued spark carried over during revolution of the armature from one brush towards the other, either all around the commutator or part way only. This action occurs when any two successive segments in the commutator continue their discharge one towards the other over the insulating space between them during a considerable part of the revolution. An arc forms in the slots or between segments and moves with them. This action while not very damaging where the segments are massive and insolated with air spaces is more serious with insulation filling between the segments, as it is apt to cause a burning out and either short circuit the armature coil sections by connecting the segments or seriously roughen the edges of the segments and the face of the commutator.

Bad setting of brushes may both cause sparking as well as flashing; and dirt, in some cases, or too much oil, may cause it Slipping of belts or sudden fluctuations of speed may also provoke it. Or a machine overloaded may flash by an opening of circuit due to too many lamps, the electro-motive force required for which number the machine can not maintain. The presence in a circuit of one or more lamps which do not feed properly may cause momentary cessations of current and flashing to occur, especially when the machine is carrying its full load. With all arc circuits there should, of course, be a surplusage of capacity on the dynamo, i. e., the machine should not be run to the limit of its electro-motive force. It has become customary with the best makers to so rate this capacity that there will always be a margin of excess to meet contingencies. The line resistance may, of course, be, in the case of long circuits, such as to cut down to a considerable extent the working capacity or number of lamps in series which can be run from the dynamo, and due allowance should always be made for this resistance in estimating the true capacity. Instances are not uncommon in which by improving the contacts of switches, hangers, joints, etc. a gain of two or three lamps may be made in circuits of fifty or more lamps in series. An improvement in the insulation of a line will often have a similar effect in adding to the apparent capacity.

I had intended at the outset of this paper to discuss in a general way the question of the different types or classes of lamps used for arc lighting. It is a department of the subject which is of considerable importance, but I find that the paper has become too long already, and for the present I will simply allude to one or two general features. Concerning the manner of feeding the carbons the mechanisms in use may roughly be divided into clutch and gear mechanisms. Among clutch mechanisms we find certain well known forms while the gear mechanisms best known are of the escapement order. Both types have undergone many modifications, and combinations of the two exist.

Whether one or other type is to be selected will depend largely on the conditions of use, assuming both to be equally well constructed and kept clear. Into these questions, however, we can not now enter.

Arc lamps may also be divided according to the way in which the magnet system acts to control the feed of the carbon. Before arc lamps were run in series it was sufficient to have the controlling magnet in the main circuit and this was the case in almost all the older forms of lamp. The Lacassagne and Thiers lamp of 1856 was a notable exception in that the control of the feed was differential or dependent on the difference of power between a main circuit coil and a high resistance shunt circuit around the arc.

I have, in fact, made an exact reproduction of the Lacassagne and Thiers lamp according to their patent specification and have found that its action is perfect when used in series with other lamps except that it requires to be helped to separate its carbons. If the carbons are quite pointed at the start even this is unnecessary as the points soon heat and burn away and form the arc The feeding depends on the flow of mercury through a small valve which is adjusted by the differential magnet system, and the feeding is so continuous and imperceptible that the arc is beautifully steady and constant in length.

At the present time the differental lamp magnet system is of several kinds, according to the relative disposition of the main and shunt coils.

In the commercial Brush arc lamp they are disposed one over the other on the same axis and affecting the same magnetic cores. The only objection to this disposition, which has the advantage of simplicity, is that the shunt circuit can never act positively to feed the carbons or release the clutch or gear, but can only weaken the effect of the main coil or overpower its lighting or separating action on the carbons.

Other forms of differential lamp embody the two circuits acting on separate magnets pulling in opposite directions, the main circuit to separate the carbons and the shunt to feed them. In this case the action of the shunt is more definte and positive as it is not limited simply to overcoming the force of the direct or main magnet.

A third arrangement involves the application of the repulsive action of the two coils as when the direct coil is wound on a fixed magnet and the other, or shunt, upon the feed controlling armature therefor and tending to cause repulsion of the armature from the main magnet. This arrangement is both simple and positive in its action

The differential types of lamp act well when the circuit current is kept constant and require readjustment generally for each change of current strength by which they may be operated. Hence, if a portion of a line be leaky the lights are apt to burn badly owing to diminished current, while the dynamo may be furnishing full current. Of course such a line ought to be condemned and its insulation improved. Nevertheless I have frequently seen lights suffer from leakage on extended circuits in cities, especially in very wet weather. This is a state of things which the line superintendent can do more than any one else to correct, by attending to the correct disposition of the wiring, and its character as regards leaks.

The type of arc lamp in which the shunt magnet alone controls the feed of the carbons is not sensitive to slight variations of current but maintains a full quiet arc with the current it gets. This is because the main current is not concerned in the feeding action, but the action is solely dependent on the potential difference of the carbons. Hence its behavior is on the whole more uniform than the differential type and within limits it does not require readjustment for different current strength.

This principle has been extensively introduced in the Thomson-Rice lamp of the Thomson-Houston Company. In this lamp the carbons are separate at the start and are brought together on the first passage of the current, after which they separate solely under the influence of the shunt circuit magnet and the feed is likewise controlled thereby. The carbons in these lamps are not so apt to slide by or alongside each other by jarring when no current is on the lamp as may occur, particularly with careless trimming in those lamps in which the full weight of the upper holder and carbon must be borne by the under carbon when the lamp is not lighted.

Arc lamps have been made with many variations in the magnetic arrangements controlling the carbons, a brief statement of some of which is as follows: Carbons lifted or separated by direct or main magnet; shunt magnet acting on a variable resistance to cut out the main magnet in feeding. Carbons lifted by main magnet as before and shunt acting to put the main magnet (made movable) into position for feeding.

Carbons separated by main magnet armature; shunt circuiting magnet acting to divert or shunt the magnetism of the main magnet from its armature.

Carbons separated by main magnet and shunt acting to free the carbon holder independently of the support given by the main magnet.

Carbon separated by a spring allowed to act by the main magnet lifting a weight which otherwise holds the spring from acting: shunt magnet acts against the spring to feed and regulate length of arc.

One carbon, generally the lower, separated by main magnet, while the other holder is released for feeding only, such feeding being under the control either of a differential system or a shunt magnet only.

Carbons separated by main magnet which lifts the shunt and its armature together, while the shunt magnet armature acting on the feeding mechanism controls the arc and feed of the carbons.

Carbon feeding mechanism independently attached to main magnet armature and to shunt armature, so as to receive opposite movements of separation and feed from each respectively.

Carbons separated by a feeding mechanism moved by the main magnet and fed by a further movement of said mechanism causing release or return of same under the accumulated force of both shunt and main magnets acting in the same direction.

Differential clock gear for separation and feed of carbons under control of the regulating magnet system either simple or differential. Some of the older clock-work lamps embodied this principle

Carbons controlled by armature of a small electric motor under control of a differential field which turns the armature in one direction for separating and in the other or reversed direction for feeding the carbons. Tchikoleff's early lamp was of this type.

Carbons controlled by a motor running at a certain speed when the arc is of normal length and varying in speed when the arc is too short or too long, combined with a centrifugal governor on the shaft of the motor acting on variations of speed to gear motor shaft to screw carbons together or apart as needed to maintain the normal arc. This mechanism has been applied by me to large arc lamps such as naval search lights and has the advantage of great positiveness and an ability to handle heavy mechanism.

There are also a considerable number of modifications from these principles stated which cannot be referred to here.

Another excellent mechanism and one of the most powerful and positive in feeding the carbons embodies a main magnet separating the carbons and striking the arc and an intermittently acting shunt magnet for working a pawl which by a suitable gearing forces the feeding action on approach of the carbons as required. I have used an endless screw gearing with the pawl acting on a ratchet wheel to turn the screw, the worm wheel being on a shaft carrying a pinion meshing into a rack on the carbon rod. The worm wheel gearing is lifted by the main magnet to strike the arc, and the shunt magnet in operating its pawl breaks its own circuit and repeats its feeding action as often as may be necessary.

It is interesting to note in this connection that I have built such lamps in which each feeding movement of the carbon is not over one-five-thousandths of an inch and that if the upper carbon rod is held in a vice the mechanism will lift the whole lamp of about twenty pounds weight in feeding, so positive is the action. At the same time the length of the arc is maintained constant at all times. With so slight and yet positive a feeding action the feed takes place almost continuously.

In the foregoing brief review many matters have been simply touched upon which might readily have been singly expanded into a paper as long as the present one. Material enough now certainly exists and could be collected for making a good technical work dealing with the science and practice of arc lighting. My purpose will have been fulfilled if I have succeeded in the present paper in adding some things of interest and instruction concerning this general subject from the standpoint of one who has constructed very many forms of apparatus for arc work and who has had a continuous and growing experience with such work from its beginnings up to the present great commercial expansion.

FLUID INSULATORS.

The accompanying cuts illustrate a type of insulator comparatively unknown in the United States, although used extensively in other countries.

They are manufactured by Johnson & Phillips of London, England, who also prepare the insulation fluid by a secret process.



ORDINARY INSULATOR.

As will be seen from the cuts, the insulating fluid fills a recess, well protected from the weather, in the porcelain body of the insulator, thus interposing a clean and a highly insulating medium between the line and the earth, making them especially efficient in rainy weather, or on coast lines where the glass or porcelain quickly becomes coated with a conducting film of salt. The fluid, it is claimed, does not freeze, evaporate, support a film of dust or moisture, allowing both to sink to the bottom, or creep like paraffine or mineral oils. One gallon of the fluid is sufficient for about 200 of the smaller or 150 of the larger insulators, and will last three or four years, even in an East Indian climate.



LEADING IN INSULATOR.



SIPHON.

These devices, which were designed for the purpose of obtaining the highest insulation by preventing surface leakage, and are made in a large variety of patterns of either porcelain or brown-ware, are handled by the Electrical Supply Company of Chicago, Ill., who, we believe, are sole agents for this country.

MAGNETIC CONDUCTIVITY.—Iron offers a far easier path for lines of force than the air does—so much easier, in fact, that they will alter their circular shape and extend a considerable distance from their respective portions of the wire in order to pass through a piece of iron. This affords us a ready means of leading the lines to, and concentrating them at almost any point we please. It may be mentioned that the relative facility with which the lines of force are propagated by good soft iron, or the electro-magnetic conductivity of the iron as compared with that of air, may be as high as 20,000 to 1.

CURRENT STRENGTH.—Current strength is measured by the quantity of electricity which flows past any point in a circuit per second The unit is that current strength which, when one centimetre of its path—that is to say, one centimetre of the conductor carrying the current—is curved into an arc of one centimetre radius, exerts a force of one dyne upon a unit magnet pole placed at its centre.

THE ELECTRIC LIGHT AS APPLIED AND USED BY STEAM RAILROADS.

BY W. H MARKLAND.

Among the first to make use of the advantages afforded by electric lighting were the steam railroads; not as a means for lighting trains, but for lighting buildings, etc. In the year 1881 the Pennsylvania Railroad introduced its first electric lighting plant in a new shop in Altoona. That proved quite a success. It might also be mentioned that the same dynamo and lamps are in use to-day. In the year 1885 the Pennsylvania Railroad commenced lighting its depot shed in Altoona by arc electric light from its own dynamos, which proved a success as compared with the previous gas light, although it was crude to what the company now has.

The question then presented itself: Can freight yards be successfully lighted by electricity to reduce accidents, facilitate business and prevent breakage of cars and contents? The two latter items are quite a money consideration on any railroad. Some previous attempts had been made at lighting railroad yards by electricity, but without much success previous to the attempt in Altoona. I speak particularly of the Pennsylvania Railroad in Altoona, as I am very familiar with the lighting that has been done there, and also because what the Pennsylvania Railroad does is liable to be copied by other roads; and we sometimes get good ideas from other roads

In Altoona, when drawing up the plan for lighting the yards, the question presented itself: How high and how near together shall the lights be placed? The problem of lighting the freight yard was more complicated than lighting a city; as in lighting a city lamps can generally be placed at street corners and quite low, the general public being not over-particular, so that under, or near, the lamp the light is quite brilliant, but in the space between lamps there is less brilliancy.

For lighting, where engineers and trainmen have to work, it is not the brilliant light that is wanted, but the evenly distributed light. If a light be too brilliant, trainmen when near lamps will be partially blinded, as we might call it, for a short time; so in the event of their leaving a lighted space, it would be difficult for them to distinguish objects or signals, and would lead to complaints.

In order to get an evenly distributed light, lamps, in Altoona, were placed on top of 65-foot poles, these being about eight feet in the ground, and set so as to illuminate switches and crossovers where the yards were narrow. Where yards were wide and long, lamps were placed about 600 feet apart, a row on one side of the yard and a row in a broad alley, that was wisely left between tracks near the opposite side of the yard, the lights of the two rows being zig-zagged to prevent shadows and to better diffuse the light. This plan of lighting does not make a brilliant light at any point, it being possible, but difficult, to read fine print. A light more like moonlight was the result, and proved very good in practice. Even a clear globe was objectionable on account of the shadows of side arms. A lower half ground globe was preferable, it having been proved by experience that it was better to lose a little light than to have shadows.

One noticeable result followed the introduction of this light. It enabled the car inspectors to examine cars much more thoroughly, and, as you all know, perfect car inspection is very important. A decreased amount of pilferage also followed, as the watchmen were able to see persons at a great distance at night. The breakage of cars and their contents was but little, if any, greater at night than in the day time. I cannot say how much money was saved by the introduction of electric light from pilferage and breakage of cars and contents, yet I believe it was really more than the cost of maintaining the lights.

Undoubtedly, the introduction of the electric light has prevented accidents to employees; of course, I cannot say to what extent.

The electric lights are certainly a great help in shifting cars, as it enables the trainmen to see the tracks and position of switch points about as well at night as in the day time, on account of the light shining on the top of the rails, they being generally bright from the passage over them, making a sort of reflector. Also in coupling and dropping cars it enables the brakemen to gauge the distance the cars are apart fully as well at night as in the day time, so cars can be coupled without any more jar or danger than by daylight. It also assists in dropping or switching cars very fast, as is often necessary during a time of increased traffic. It enables the switchmen in the towers to tell when a car is over a switch, so that they can quickly throw the switches with less danger of throwing the cars off the track or on the wrong track.

A few words about the erection of arc lamps and poles for freight yards. Poles must be very well set in the ground, and guyed so as not to sway from heavy rolling stock passing, or from wind. The poles, being high, receive the full benefit of the wind. A good, true chestnut pole for lamps, if possible to obtain, answers very well. They will cost when shaved, stepped and erected with hood about $35. The price will be governed largely by the cost of timber. Short poles must also be well put up, so that there may be no breaks.

Railroad people are very exacting; it does not do to have any stops or shut downs. The lamps must be kept in good order. Maintaining arc lamps near railroads is quite different from maintaining lamps in most stores. If there is a poorly insulated part in the lamp, the soot will soon find a path for the current across the poor insulation, and out goes your lamp. Your cut-out contacts will corrode very fast. When it comes to your rods, expect to have a lot of dirty ones. In a railroad yard there are things to contend with not common with most lighting, and that is smoke and steam. I have seen poles covered from one end to the other with a film of soot from engines. This in getting on the hanger boards is sure to make escapes unless the insulation be very good. The insulation should also be good to enable the inspector to work at a lamp, in case of its failing to burn, when the current is on.

Get a good, reliable, direct current, double carbon arc lamp that is well insulated. A lamp that is heavy, bulky, or having hoods is not well adapted for the purpose, on account of the difficulty of carrying it up the pole. Do not rely on the hooks of lamps for connection between the lamp and the hanger board, as they will corrode and cause trouble. It is better to always put a piece of flexible wire from the hanger board to the lamp to carry the current. Always use a good insulated wire and good insulators when running up poles or side arms. It is better to splice on a piece of the very best insulated wire. Experience has proved that the wooden part of hanger boards is better for having some waterproof insulation between it and the side irons to prevent leaks.

I do not favor double-pole switches on hanger boards in freight yards, as they require extra contacts, the brass work of which soon corrodes so as not to make good connections and leads to trouble.

The dynamo should be self regulating and easily kept in order. As there may be 100 lamps, taking, say, two dynamos for all lighting at one point, it is better to put a little more money into dynamos than to pay high wages to the dynamo tender.

Keep as far away from telegraph and telephone lines as possible. If any damage is done to either of the above, the railroad generally gets the worst of the suit.

If you are going to hire the lights from a central station, see that they give you good work, and make a contract with a rebate and fine for the time lights are out.

If you once properly put electric lights in a freight yard, you will never get them out again; the trainmen will not stand it, as they would be in the dark in more senses than one if the lights were taken away. But if the lights are not properly put in, say, on low poles, under 40 feet above ground, or not properly spaced, the chances are there will be complaints on account of too much light at some one point and too much darkness at some other point. Great care should be taken to place lamps so they will not interfere with signals. I have seen cases where electric lights were so placed that a signal could not be properly distinguished on account of the electric light shining on the lenses and blending the colors. A case like this can generally be avoided by placing some arrangement so the electric light will not shine on the signal.

The electric light is rather a help to distinguish the position of the semaphore arm, although trainmen at night look for the color of the lens rather than the position of the arm.

The electric light is something of a help in distinguishing the switch signals, on account of the lights shining on the lenses. These being low, the light will rarely show through them.

If it comes to a question of moving an electric light or a signal, you will find that the electric light will have to go every time, as railroads will not allow any interference with signals.

If you go too high, you will not get the full benefit of the light, as has been proved where the tower system of lighting is in use.

In laying out freight yards, a broad alley, say 12 feet between tracks, should be allowed for placing the lamp poles, where the yards are over 300 feet wide.

As to the other uses for electric lights for railroads, I do not know. I do not know that there is much out of the regular run. The light is used quite extensively for lighting depot sheds, where it is more economical than gas and decidedly better. This class of installation requires the very best of work and insulation, as the smoke and steam nuisance enters in here. Even though depot sheds are dry inside, porcelain knobs should not be used, glass with a double petticoat being the only kind now on the market that answers the requirements well, on account of the soot settling on the insulators.

It does not do to have a depot in darkness; for that reason a depot shed should be wired with two complete circuits, having every alternate lamp connected to one circuit and the remainder to the other. Then, in the event of a break in the wire, only one-half the lights are out.

Experience has proved that the arc light is much superior to the incandescent for depot shed lighting. With incandescent lights the necessary volume of light is costly to maintain, and also the globes of incandescent lamps soon become dirty from steam and smoke, which interferes with the light, or if cleaned off necessitates considerable labor.

For freight transfer stations the arc light is very satisfactory. It enables the men to quickly distinguishmarks on merchandise and also enables the foremen to see what the men are doing, preventing loafing. One 2,000 nominal candle power arc lamp to about 1,500 square feet of floor space will generally light a transfer station where lamps can be zig-zagged. Where transfer stations are narrow more light per square foot should be allowed. On a platform about 10 feet wide, as they generally are, one light every 60 feet gives good illumination.

I doubt if the arc light can compete with gas for this purpose as far as cost is concerned, taking transfer stations as they are generally lighted by gas, and as they should be lighted by arc lights. Yet, I believe, taking the amount saved in labor and from pilferage, that the electric lights more than pay for themselves.

Another point comes in here. We all know that on a wet, dark day we do not feel inclined to work as we do on a bright, sunny day. The same is the case at night; if you give men good light it brightens their spirits up and they will work much more cheerfully; and getting men cheerful means more work done.

For offices and shops the electric light is used considerably, much the same as for other places of like nature.

I hear that an electric headlight has lately been brought out which it is claimed will illuminate a track for a mile or more. I am of the opinion that the light will not come into general use. In the first place, a light for this purpose should not be too strong, or it will blind an engineer coming in the opposite direction, this being a serious objection. Most of the roads east of the Ohio are not very straight, and the chances are that while on curves the neighboring corn field will receive more light than the track ahead, as no one has invented a light that will show around the corner.

If any inventor wishes to get up an electric locomotive headlight, let him confine himself to one of low candle power—the present ones are about 20 c. p. I do not think one of over 100 c. p. will be in demand until railroads are illuminated from one end to the other by electric light, which will be the case in the future, and then the headlight will not be required.

These points are necessary for an electric headlight: First, and all important, reliability; second, simplicity. Economy you can leave out. If you can get 50 per cent. of what can be attained in a station, it will do. One thing must be borne in mind—engineers are not electricians. Thus a dynamo and lamp must be as simple as the air-brake, and no more liable to get out of order.

The experiment has been tried of lighting cars by electricity. While it has proved a success in some cases, as far as convenience is concerned, financially it has not proved a success. Electric lighting of trains is a luxury to-day, and will continue to be until some more economical plan is invented. The advance that is being made with the use of gas as an illuminant for cars is leaving electricity behind. From the best information I can get, it costs 50 cents per hour to light a car by electricity from storage batteries, against five cents per hour from carburetted air

The electric light is used to some extent by different railroads for lighting wrecks or any construction work that requires night work. For this purpose the Pennsylvania Railroad and the Cumberland Valley road have a car fitted up with boiler, dynamo, engine, water tanks and coal bunker, and all the tools necessary for a central station. With a car of this description, quick work in getting lamps in place is all important In one case, after the Johnstown flood, I, with the help of four men and the engineer, put up six arc lamps, put up the poles for the lamps, which were designed for the purpose and carried on the car, ran the wire, coupled up the lamps, and had the lamps going in 35 minutes from the time we, with the car, lamps, poles and wire, arrived on the ground. The lights were distributed some distance, one being about one-third of a mile away. I doubt if construction work was ever done quicker.

I will not go into a description of this car, as it was very ably explained by Mr. W. F Taylor, of Altoona, at the convention of railroad telegraph superintendents at Niagara Falls, June 19, 1890.

To give an idea of what the Pennsylvania Railroad Company thinks of the electric light, I might say that its new Juniata shops at Altoona, having about 100,000 square feet of floor space, are lighted entirely by the electric light; there is not a pipe for illuminating gas in any of the buildings. All the traveling cranes are run by electricity.

The Pennsylvania Railroad Company believe that good electric work pays. I doubt if any station, central or isolated, has more reliable or better designed appliances, or more artistic work than can be found at the Juniata shops of that company.

THE FERRANTI SYSTEM.

BY CARYL D. HASKINS.

Gentlemen.—I keenly appreciate the compliment which your committee has paid me, in naming me to appear before you to-day to read a paper,

I fully realize that much is expected of me, and I believe I even more fully realize my inability to handle the subject with the completeness which I could wish.

My connection with Mr. Ferranti was not of long duration, and it is now some time since I severed my connection with him, so that my information, whilst pretty complete as far as it goes, is not as thoroughly up to date as it should be.

The Deptford station was far from finished when I left London, and 10,000 volts generated direct from the dynamo was still a matter for surmise and conjecture.

Under these circumstances the best thing I can do, I believe, will be to take up each feature of the system separately, and describe it to you in its various forms and applications as thoroughly as I can. Starting with this plan in view, I have arranged my paper under the following heads:

Methods of Distribution:
Ferranti Dynamos.
Ferranti Transformers, Fuses, etc.
The Ferranti Meter.

Starting, then, with Mr. Ferranti's methods of distribution, I will deal first with the old and somewhat famious Grosvenor Gallery station, from which current, at a pressure of 2,500 volts, was distributed throughout the most wealthy portion of London's West End, by means of overhead wires.

At the Grosvenor station there were two dynamos, each of 625 horse-power nominal. These machines I will describe later on.

From these generators the circuit was carried to five double-pole, double-throw switches, each having a break of two feet and breaking both sides of the line at once.

Each of these switches represented a circuit, there being five circuits in all run from the Grosvenor station. It will readily be seen, therefore, that the switchboard of this station, which distributed light to no less than 35,000 lamps, was an exceedingly simple affair, yet, with their five switches, any lesired combination of machines and circuits could be made.

It has quite frequently been stated, I believe, that these two machines at the Grosvenor were run in multiple. This is in no sense true, though since the removal of these dynamos to Deptford station, they are to be connected in this manner, I understand.

From the five main switches the current was carried through Ferranti plug fuses of rather peculiar construction, having a break of two feet. These fuses I shall describe later. From the fuses the circuits were carried on ordinary wiring to an overhead distributing pole. From this center the wires branched in five directions, being carried over the house-tops and not through the streets, as is our custom in America.

Stranded steel cables 7–16 B. W. G. are stretched from pole to pole, and from these cables the mains are supported at frequent intervals by means of leather thongs or slings, thus saving undue chafing and straining of the conductors. This method of supporting the mains presents many marked advantages; the wear of insulation is reduced to a minimum, and the liability to a ground is very much diminished. The leather slings stand the wear and weather exceedingly well, and renewals are much less frequent than would be expected, especially if one take one's foot wear as a basis for calculation.

All streets are crossed at right angles, and no difficulty is experienced with the ubiquitous telephone man.

Contrary to the custom in this country, the primary wires are generally run into the house to be lighted, where they are connected to the transformer, a Ferranti fuse being placed in the circuit.

The secondary circuits are of 50 or 100 volts pressure, as may be required, and the house wiring is quite of the usual style, having a principal secondary fuse at the transformer, and a Ferranti recording meter in series with the lamps.

The Grosvenor Gallery as a generating station is now a thing of the past. It has been reconstructed, and is now one of the four transforming centers of the Deptford system, which draw their energy at the phenomenal pressure of 10,000 volts from the machines in the great station on the Thames.

This heavy pressure is reduced at these central points by means of large transformers, and is distributed over the London house-tops at an E. M. F. of 2,500 volts in the manner I have already described, the only difference here being that these overhead mains are on a secondary instead of a primary circuit, and the house circuits become tertiary instead of secondary.

The portion of the Ferranti system of distribution which has given rise to the most interest and which has been most talked of, is the present primary circuit, extending from Deptford to the four central distributing stations in London.

Many curious and wonderful letters regarding this have appeared in our journals at various times, and have given rise to much confusion and many wild conjectures, whilst the real facts of the matter are, I believe, but little understood.

The shape and principle of Mr. Ferranti's concentric main is familiar to all, but a few words descriptive of it may not be out of place here.

Over a copper tube, about 1¼ inches in diameter, insulation is wound in the form of a stout manilla paper, thoroughly saturated with a special insulating compound. This insulation is wound to a thickness of one half inch by a machine specially designed for the purpose by Mr. Ferranti; over this insulation a second copper tube is placed, of the same sectional area as the inner one and this is drawn down till tight.

The cable is made in lengths of twenty feet, and stands static tests of immense pressure. Special plug and expansion joints are provided for connecting the lengths, which are also thoroughly reliable.

The original intention was to lay these mains with the outer tube directly to earth throughout its entire length, thus rendering the system absolutely safe, since only one side of the circuit could be touched by the hand, and there would be no difference of potential between this and the ground.

Alternating circuits, and grounded telephone lines do not agree, however, and the law demanded that the Ferranti mains be laid duly insulated from earth; this is therefore done, but one terminal of the machine is still connected to ground, and comparative safety is the result, since it will readily be seen that to short circuit through the body it would still be necessary to touch the inner tube of the conductor. This would necessitate cutting through the outer tube and insulation, which would mean a short circuit from tube to tube, through the cutting instrument, a dead short-circuit on the machine certainly, but perfectly safe for the meddler.

At the collector boxes of the machines an accident is impossible, since the collectors are inclosed within an iron box, the lid of which is magnetically locked by the exciting current—nor can the machine generate when the box is open, since the exciting circuit is not complete till the box is closed. Unfortunately time was an object in the starting of the Deptford station, and much contract-made cable was laid; the greater part of this was the lead-covered cable so frequently mentioned; this was not of the concentric pattern, but an ordinary stranded cable—I understand that it was guaranteed to stand considerably above 10,000 volts, but after being laid it was found not to stand 10,000 at all, and to give but poor satisfaction even at 5,000

This unfortunate trouble has given rise to much talk, and has been scarcely well understood by the general public.

Several other kinds of cable were tried, but gave equally unsatisfactory results, and all mains have, doubtless, by this time been replaced by the Ferranti concentric cable, which stands the pressure perfectly, and gives most satisfactory results.

Of the various expedients to which Mr. Ferranti had recourse during this trouble with the cables, I am not prepared to speak, first because I am not fully informed regarding them, and secondly, because they form no portion of the Ferranti system of distribution. They were simply makeshifts, necessitated by an unfortunate happening and by lack of time, and they have probably given rise to more discussion, both in and out of the papers, than has the system itself.

I will now pass on to a description of some typical Ferranti dynamos. First among these a few words are due to the original form of Ferranti alternator, which, while it is no longer manufactured; still, without doubt, was a machine of marked efficiency and great originality.

The characteristics of this earliest dynamo are, I think, about as follows: the figures are not based upon my personal experience, for the machine was out of date long before my time, but upon various fragmentary notes from my pocketbook, and a generous quotation from Thomson's Dynamo-Electric Machinery.

As in the Siemens machine of similar type, the fields formed, as they do now, "two upright circular crowns of electro-magnets with opposing poles." There were 16 magnets on each side, 32 in all.

The peculiarity of the machine lay in the armature, which consisted of a series of zigzag loops, eight in number, wound or folded one layer upon another, and separated by alternate ribbons of strip insulation of similar width. The winding was in three multiple circuits, each strip making 10 turns around the zigzag coil, 30 layers of winding in all

Each of these three coils are connected at one end with a solid star-shaped brass boss, which bolted together from either side through the loops of the zigzag coil, forming a solid center for the disk armature, and at the same time connecting directly with one of the collector rings, the three coils all again uniting in an inner star-shaped piece of brass, which in its turn communicated with the second collector.

This disk armature was 30 inches in diameter and one-half inch thick. Its extreme thickness permitted the magnet poles to be brought very close together, enough space only being allowed to insure safe clearance. The natural result of this was a very efficient field.

The dynamo was calculated for a speed of 1,400 revolutions per minute, and maintained a pressure of 100 volts. The armature weighed less than 100 pounds, and the entire machine rather less than 1½ tons.

Most of these old machines are still in use, principally upon British war ships, and are doing good service.

An excellent type of all the more modern Ferranti machines is the 150 horse-power dynamo, which has been manufactured in considerable numbers, and is the alternator generally in use in most of the smaller stations using the Ferranti system.

In this machine the number of parts has been reduced to a minimum, and the efficiency is very high; it will fully illuminate 3,000 ten candle-power lamps, requiring an average energy of over 35 watts each.

The fields are arranged as in the old machines, and have 20 magnets on each side. The distance between the opposing faces of the fields is rather less than three-quarters of an inch, and within this narrow space the coils of the armature rotate at a speed of 400 revolutions per minute. The armature being four feet in diameter, this makes a peripheral speed of 4,800 feet per minute. The diameter of the armature shaft is 4½ inches, which at first sight seems rather large, since there is no great weight to carry, but the size is needed since the armature is overhung.

This armature is without iron, and consists of a central boss of gun metal, into which are fixed 10 carrying-arms of brass. These are insulated from, and held into, the core by a special mixture of sulphur, which is poured in a liquid state and sets harder than metal itself.

This sulphur insulator is one of Ferranti's specialties and prides, and much of the success of his machine is, I believe, due to it. I never, during my stay with him, met with a ground on an armature shaft.

Each of the ten carrying-arms which I have just mentioned, holds two coils or bobbins of copper tape tightly wound by machinery on a center made up of alternate strips of asbestos and brass. Terminating at one extremity is a gun-metal butt-piece, the entire coil being fastened to the carrying-arm by a single bolt passing through this butt-piece and drawing the bobbin into place.

The winding of the bobbins themselves is of alternate layers of corrugated copper and fibre ribbon, the object of the corrugation being to prevent lateral slipping—a very necessary precaution.

The thickness of the bobbins, which form the only portion of the armature projecting between the fields is one-half inch, which leaves a margin of less than one-eighth inch clearance on each side.

The coils are connected in two parallel circuits, which are conducted away through the carrying arms and the rods within the central boss itself, to the collector rings, where the current is taken off by Ferranti collectors—two half circular pieces of metal like the two halves of a severed ring, which almost surround the collector rings and are held together by bronze springs, making an extremely good and constant contact, and not running at all hot.

The machine can be very quickly repaired; the two fields are divided at the center and slide back very readily, right and left, on extension bases, by the aid of a simple levering device. The armature is then exposed, hanging in its usual position, and it is but the work of a moment to take out and replace a burnt coil with a new one.

A few details regarding the two 625 horse-power machines formerly used at the Grosvenor station and now being installed with changed winding, to take the light day load at Deptford, may be of interest here, before I pass on to a description of the giant machines of the Deptford station. These two dynamos are in construction almost exactly like the 150 horse-power type which I have already described. The machines were originally designed to give current for 10,000 ten candle-power lamps each, but have frequently carried as high as 19,000 lamps without apparent effort. The weight of these dynamos is 35 tons. The height from floor is 9 feet 6 inches; the floor space required, 9 by 11 feet; armature diameter, 8 feet, 6 inches; potential maintained, 2,500 volts; speed, 280 revolutions per minute.

There are forty coils or bobbins in the armature and 40 field magnets on each side, 80 in all. The pulley is grooved for rope driving. Mr. Ferranti being fully convinced that this is infinitely better than the best belting.

It has probably been already remarked that I have made mention of no regulating device for the dynamos. Mr. Ferranti makes no provision for automatic governing, nor is it needed. It must be remembered that there is absolutely no iron in the armature, and that the machine is, therefore, self-regulating to a very large degree

There is no compounding of the field, the field circuit being entirely simple and separate. At the Grosvenor the exciters used were Siemens machines, giving 108 amperes at 100 volts. At Deptford, Kapp machines coupled direct to Allen engines are used. These Kapp machines have rheostats in their field circuits, not for use in regulation, but in starting up and in case of emergency. It will be noticed that the two machines I have just described have not armatures arranged with the zigzag winding, adopted in the original Ferranti machine This zigzag winding was abandoned for several reasons. It was impracticable for large armatures and a winding made up of separate bobbins or coils, which could readily be removed and replaced, was found to be exceedingly desirable. To meet these requirements, therefore, the method of winding was changed to an arrangement similar to what is generally spoken of in text-books as the "Siemens alternating armature."

It now remains to me, before passing on to the less important apparatus of the Ferranti system, to give a brief description of the two sizes of dynamos which are installed, and being installed, at the Deptford station.

So much has been said and written about these during the past year or more, that I almost hesitate to mention them at all, so sure do I feel that almost every one here is familiar with their general character and dimensions.

The Deptford machines will be of two sizes, the portion of the station to be put into immediate use calling for three dynamos, two of 1,500 horse power each and one of no less than 10,000. Of these the two first are now installed and running, whilst the 10,000 horse-power machine is still in course of construction; it being far too enormous a piece of machinery to admit of hurrying.

Each of the 1,500 horse-power machines are driven by means of forty five inch ropes from a compound vertical condensing engine of marine type, having a grooved drum or driving pulley 24 inches in diameter.

The carrying arms of the armature, which support the winding, are fixed directly into one end of what may be called at once the pulley and the armature boss, by means of sulphur insulation Into these carrying-arms are fixed the 48 bobbins which constitute the winding The total diameter of the armature is 12 feet, 6 inches The fields are arranged as in the smaller machines and have 48 magnets on each side, 96 in all. The copper strip composing the winding of the armature is three quarters of an inch in width and 1⅛ millimeters in thickness.

There is only one inch of space between the opposite magnet poles, and within this the armature rotates, having one half inch clearance on each side. Small, fan-shaped ears are cast onto the carrying arms of these, and the other machines which I have described, which, when the machines are in motion, force a constant current of air between the armature and the field, keeping up a very perfect ventilation and removing any dust which might accumulate upon the face of the magnets. This dust, if allowed to remain, would be apt to cause a short circuit from winding to magnets, as one pole of the machine is to ground; as an additional precaution against this the faces of the magnets are covered with a thin layer of vulcanite.

The frame divides as in the smaller machines, and slides back on extension bases to afford access to the armature, a special engine being provided to do this work.

Of the 10,000 horse power dynamo, I can say but little; it will differ from the others only so far as its enormous size renders necessary. The armature will be no less than 40 feet in diameter, and will rotate at a speed of 60 revolutions per minute. It will be coupled direct to two compound vertical condensing engines, each of 5,000 horse power, one on each side of the armature.

The shaft is the largest forging ever turned out of the celebrated Clyde workshops, and one of the largest ever made in the world. It is no less than 36 feet in diameter, 28 inches in the bearings. I really do not dare state its weight. There will be 132 bobbins in the armature and 132 magnets on each side The enormous size of this machine is quite beyond the comprehension of one who has not seen its parts.

The station instruments which are used in connection with the Ferranti dynamo, are the Sir William Thomson gravity direct-reading ammeter, and the Sir William Thomson statical voltmeter.

I will now pass on to a brief description of the Ferranti transformer, meter, etc. I am aware that I have been able to give but the merest outline of Ferranti's dynamo construction; the subject is far too intricate and wide a one to be treated at all in detail within the limits of a short paper.

Before describing the Ferranti transformer, I should say a few words about the Ferranti fuse. Its position seems naturally to be between dynamo and transformer. This is an exceedingly simple device of porcelain having a long break. It consists of two removable plugs, to which are fastened a number of thin strands of fuse wire, according to the current to be carried. These wires pass through a narrow crevice, or slot in the earthenware, from plug to plug, the crevice being broken at short intervals by cup shaped hollows, this construction preventing arcing. The fuse has a convenient earthenware cover, can be placed anywhere, and has always proved entirely trustworthy.

The Ferranti transformer is seemingly as little known as the dynamo in this country. It is a very simple affair, of decidedly high efficiency, consisting of a number of bundles of very thin, soft, hoop iron, spaced apart with wedges, clamped tightly together and wound at their central portion with insulation. Each strip of iron is insulated from its neighbor for half its length, on each side, by paper pasted on This, when the irons are turned back, as I shall presently describe, leaves a strip of paper between each layer of iron, but does not prevent a perfect magnetic circuit.

On these bundles of irons, at the portion wrapped with insulation, is wound the secondary, which is in its turn wrapped with insulation; on to all this the primary is slipped, in the shape of a number of coils, wound elsewhere on former blocks. These coils are slipped on, one by one, and separated from one another by washers of shellaced cardboard.

The projecting irons are then turned back over the coils from each end, lapping each other, first one way, then the other, like shuffled cards, and the last two are fastened off by a simple double "L" or tinsman's joint. Half of each bundle is turned back in each direction, up and down, forming complete magnetic circuits in two directions.

The transformer is extremely convenient in case of repairs, when the irons are readily straightened out and burnt primary coils replaced.

It seems, however, to have several marked defects, the flat side of the lamination is presented to the penetration of the lines of force, which, according to Kennedy, is incorrect construction, and the transformer is inclined for this reason, both to heat rather badly, and to hum, the latter trouble being partly due doubtless to the fact that the iron cannot be held so firmly in this style of converter as in the more common type, where the iron forms a solid block.

The transformer is incased within a cast iron shell, from which it is insulated and into which the primary and secondary terminals are fixed by means of the Ferranti sulphur insulation.

These converters are made in five sizes: 25, 50, 100, 150 and 200 lighters. The large transformers for reducing the 10,000 volts of the primary to the 2,500 volts of the street circuits, are of the same construction as those I have just described, the insulation being, of course, increased to bear the enormous pressure.

This is not the original transformer used by Ferranti; that was of the Gramme ring type, and rather more efficient than the present one, I believe, but scarcely practical from a mechanical standpoint.

There now remains to describe only the Ferranti meter, a most ingenious recording instrument largely used in connection with Mr. Ferranti's London circuits. This meter consists of a coil, of a few turns, in series with the lamps, which passes around a core of soft iron, and terminates in a composition metal ring, which is split to prevent Foucault currents, and is bolted on to a soft iron base, being however, insulated from it. Thus it will be seen that the ring, the base, and the soft core around which the coil passes (the lower portion of which is burnt or cast into the ring also) form, respectively, sides, bottom and top of a hollow and tight trough; the iron is continued from above the coil, by means of a horseshoe shaped laminated piece of iron which passes down outside of the coil and makes contact with the base; thus we have a magnetic pole at the top and bottom of the trough.

This trough is filled with mercury, making contact with three-fourths of the inner circumference of the ring, and the center of the base. The current entering the coil, passes around it to the ring, and from the ring through the mercury to the base on which is the other terminal.

Under the combined influence of the magnetic field and the current passing through the mercury from center to periphery, and *vice versa*, the quicksilver is caused to rotate.

A shaft passes from a jewel in the base, through a small hole in the iron core to a train of wheels at the top; on this shaft is an aluminium fan suspended in the bath; this is all balanced so nicely that it actually floats in mercury.

Now, since the resistance to rotation due to friction is approximately proportional to the square of the speed, and the turning moment is proportional to the square of the current, the number of revolutions performed in a given time is a measure of the current which has passed through the meter during that period.

Owing, however, to the rule of friction not following this law absolutely, and owing to the additional and irregular friction of the gear, a sensible error is introduced. This difficulty is overcome by placing a shunt coil of high resistance around the series coil, which secures an excess of electro-magnetic action, when the friction is greatest in proportion to the torque, thus assisting the low loads.

The meter is very accurate, and has a quite wide range, 1 to 50 amperes being the capacity of the 100 volt instruments; it is equally serviceable on direct or alternating currents of any frequency.

This meter, while undoubtedly accurate, has many very apparent weak points, however; the mercury volatilizes quite rapidly, especially when the instrument becomes warm; the meters must always be kept upright or their contents will spill, and they cannot be carried from place to place without being emptied and refilled, which, as the quantity of quicksilver varies, is apt to introduce errors. In view of these troubles, Mr Ferranti is now also manufacturing and using a number of meters of small capacity, similar in principle to the well-known Shallenberger instrument, which are sufficiently accurate for general use; these are manufactured under the English patents of Mr. Wright, one of Mr. Ferranti's staff.

ENGINEERING DIFFICULTIES.—The chief difficulties which beset the electrical engineer are internal and invisible, and they can only be effectually guarded against by testing with special apparatus and electric currents. They arise from leakage and from bad connections and joints, which lead to waste of energy and the production of heat to a dangerous extent.

RESISTANCE.—The ordinary methods of measuring the resistance of leads has no value for alternating currents, since they set up a spurious resistance which varies with the number of alternations per second.

HYSTERESIS.—The effect of successive reversals of magnetism in iron causes it to heat, and this phenomenon is termed hysteresis.

LAMINATION.—The effect of lamination is to interrupt eddy currents, which are produced in the iron and increase its temperature.

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letting go. With the alternating, however, the effect is constant, and so intensely disagreeable that a very slight leak indeed will discourage any one from running the least risks on live circuits. I may mention in this connection that as far as my experience goes, (and I believe some of the learned doctors agree with me) the action of a heavy shock of alternating current is to force the diaphragm up into the chest compressing the lungs, and literally squeezing the breath out of one, causing the cry which seems peculiar to those caught in this way. If the person is stunned, dash cold water on the face and chest, loosen the clothing, especially at the neck, and use artificial respiration as for the drowned. One of our linemen who was badly caught, was brought around by these means, after being to all intents and purposes dead for nearly ten minutes, no breath or pulse visible.

Coming now to my subject proper, the first precaution which I think we should take in any case is to properly lay out a system of distribution according to the circumstances of the installation. Almost the first point to be thoroughly settled is the size of unit dynamo which it is proposed to use. This should be kept as large as possible, for the reason that practically a large dynamo takes no more care to look after it than a small one, while at the same time care must be taken not to get it too large, since an underloaded dynamo and engine is not economical to run.

The second point is that as alternating current dynamos are easiest run separately and not in multiple arc, the planning of the pole lines, feeders and mains for the various circuits should be such that these units can be economically used.

Another point to be looked at in the general plan is that wherever possible the sizes of mains and feeders should be kept the same throughout, thus reducing the number of sizes of wire used in street work, and keeping the pole lines and fittings as uniform as possible.

It is astonishing how few different sizes of wire are really needed if care be used in planning, for it is always a good fault to keep the sizes up both for mechanical and electrical reasons.

It must not be forgotten that however much we may be able at the present, or have been able in the past to control the condition under which we shall supply the public with any article, it is only a question of time when the public will decide for themselves, not only under what conditions, but in what quantities and under what prices they will take what we have to supply.

In the early history of electric lighting, and we may say even to the present time as far as arc lighting is concerned, the contract basis will be the one upon which the light is sold. With incandescent lighting for many years the contract system seemed to be the basis, but as soon as a good and reliable meter was placed upon the market, that moment the conditions were changed.

It is a part of our human nature to desire only to pay for that which we use, and it is equally a part of our human nature to try and get something which we have not paid for, and for this reason there will always be those who desire the meter system and those who desire the contract system, but the weight of public opinion is so heavily in favor of the meter system, that we may, to all intents and purposes, consider it as the adopted method of sale.

Electric lighting is after all only a lighting business, and those who are concerned in the furnishing of incandescent electric lights will learn many a valuable lesson from the gas companies, who, as I have more than once reminded you at these conventions, did not reach their present methods and conditions by having them schemed out at the start, but through much tribulation and many trials, so that their present methods are simply another instance of the survival of the fittest. For these reasons, in deciding on unit sizes remember to count on probable load and not on probable number of lights rented.

To begin with the dynamos, we may say that the best unit to use will be probably found by taking the maximum all day load. In some cases, however, this will be very light compared to the loads thrown on during the "heavy hours," and in such cases it may be better to use a much larger machine for the sake of uniformity with its many advantages. If multipliers of a unit are used, only one or two spare parts need be carried; the feeders and mains can all be laid out alike, and any dynamo is ready to take the place of any other without any preliminary cutting and changing of circuits.

The question of subdivid d power is a vexed one and one on which we can never hope to see all agreed, and I therefore do not make any suggestions beyond noting that a dynamo which can pull up its driving engine without injury to itself is a good thing; that running a small engine as a relay is cheaper than running a large one; and that in incandescent lighting the customer, not the central station, regulates the load. Of course, these remarks apply only to engines of the same type. I do not set a small high-speed single expansion engine against a large compound or triple expansion one.

Keep dynamos well insulated, but put collectors to lead off static electricity from the bolts. If there is a slight leak on one of your circuits the easiest path for the spark may be to jump into the armature and so to line and ground, and this spark will punch through almost any insulation and gradually keep making it weaker, till, some day, the current generated in the armature follows the spark and your armature is gone. Look carefully to all screws and bolts; the alternating current seems to have some peculiar effect (perhaps by mechanical vibration, perhaps by actual molecular expansion and contraction) in loosening screws, causing small arcs which may melt off connections or may make bad contacts. Nothing is more annoying than to have a dynamo operating perfectly until shut down and then refusing to start up again. This comes often from such poor contacts, the current following and bridging over as long as it is kept going, but failing to make the first jump necessary to start. In arc lighting machinery this used to be got over by "jumping the machine," or short circuiting it for an instant, and I have known alternating incandescent dynamos ruined by being served the same way.

A small air pump and tank with lines of pipe through the station and a hose to direct a strong jet of air into the armatures will be found a valuable addition to station equipment, and the amount of dust and copper which can be blown out after the hand bellows has done its best, is surprising.

Have your switchboards so that circuits and dynamos can be easily and quickly changed.

One feature which Ferranti seems to have early foreseen, and that is a feature which in our American practice I think has been somewhat neglected, is the use of fuses with a very much greater distance between the points of attachment, and some ready means of replacing the fuses without danger to the person so doing, even if a short circuit should still exist on the line which is being handled.

For this reason, also, it is a great mistake to crowd switchboards too closely. There could be abundant room given both for the operator to stand in front of the board and to beat a hasty retreat without the danger of being caught by machinery or bolts behind him, and to allow the free use of the hands and arms without the danger of being burnt by fuses in the immediate neighborhood which may go off at any time. While an alternating current will not make much of an arc when a fuse melts simply from overload, it does make a wicked and demoralizing one when a short circuit is present, especially when it has a heavy machine behind it.

There will always be some hesitation, I think, as to the adoption of devices for putting in fuses which do not have a positive contact, such as a screw connection, or one which I think Ferranti used, a plug which can be twisted in at every application, thereby keeping the contacts clean. I think, however, that we shall soon see a fuse adopted which shall be in the form of a switch which can be opened and closed as often as needed to keep the contacts bright and clean.

In fitting up the fuse blocks and switchboards it is well to leave no points or sharp corners exposed, since the alternating current will jump from such points if it be trained across or induced to do so by the presence of the lead vapor from a fuse which has blown.

It was one of my earliest experiences to see an arc jump in this way, from the ends of wires which had been pushed so far through the connections on switches as to show their ragged points beyond the metal of the switch. The arc which was formed on a blowing out of a high tension fuse bridged between two such points a distance of nearly ten inches, and held there for some fifteen or twenty seconds, in which time it had pretty thoroughly melted up the brass parts of the switches. In this case the arc had been started by throwing in a 100,000 Watt dynamo on a short circuit.

While high insulation is needed on a switchboard, which leads many to the use of rubber wire, I would say that I think a far greater danger is introduced by its use, namely, fire. On an incandescent board, fuses may go at any moment and draw a heavy arc with them. If coverings and fittings be used which will not carry flame, all is clear for new fuses in a few seconds; but if once fire starts and the other fuses let go, there is no saying where the damage will stop. While the voltage was enormously higher, and we do not know under how much more difficult conditions they labored, the destruction of a switchboard in the Grosvenor Gallery Station in London, and the consequent shutting down of 30,000 lights, is a warning which all should heed.

It is always best not to have any wires concealed anywhere about a station, and they should be run on porcelain or glass insulators so as to be perfectly safe from fire even if they should be soaking wet. With wires running this way there need be no fear of throwing water on wood-work which is in danger of catching fire, since the worst damage that can be done would be the blowing of the fuses from a short circuit. Of course the covering of the wires should be of a kind which will properly protect those who are working among them. A separate ammeter and voltmeter on each circuit of feeder, while apparently an expensive luxury, is in reality a very great saving and convenience in a station which has lines over a half mile in length. The ammeter enables one to tell precisely on what feeders the load is heaviest; and where more than one feeder runs to any district it is a convenient means of knowing just upon what circuit to cut in the lights for any new customer. If the system in use allows any compensating device for indicating the correct voltage at the point of distribution instead of in the station it will be so much the better; and also to have on all feeders if possible, but certainly on extended ones, some arrangement for raising the electro motive force in order that both short and long feeders may be operated from the same dynamo. Of course there are many cases where it pays to run a separate dynamo at higher voltage for a particular feeder or set of feeders on which there is a heavy drop. But even in such cases it is often useful to be able to run these feeders with those on which the drop is small from the same dynamo.

Put pilot lamps on each feeder, which will often attract attention to a circuit being out quicker than the voltmeter, and put pilot lamps also on each field circuit. If separately excited dynamos are used, put pilot lamps also on both the main circuit and field circuit of the exciters. These pilot lamps need not, of course, be up to candle power; high resistance lamps or lamps placed in series will be quite sufficient, and the amount of current they use inappreciable, while the saving in time which the lamps afford in case of any failure of current by enabling an attendant to locate the trouble at once between certain points is often considerable. Thus, if the pilot lamps on the main feeder and on the field circuit of the alternator have both gone out, while the pilot lamps on the exciter mains and exciter fields are still lit, it shows that the trouble is somewhere between the pilot lamps on the field circuit and the exciter mains, being probably loose contacts in the switches or something of that kind. If the pilot lamps of the alternator only have gone out, there is no use looking for any trouble about the fields or the exciter circuits, since the pilot lamps, being lit, there shows at once that the trouble is further on in the chain of connections. It may seem a refinement to put in such arrangements for the sake of saving a few minutes or even seconds in locating troubles; but it must be remembered that the public are more and more demanding that incandescent lighting shall be as continuous and reliable as any other method, and when all the lights in a building go out at once, a few seconds' delay may be a very serious matter. The public are not concerned with what the cause of the trouble may be, but only have one question, "Why do I not get the light that I pay for;" and the man who rents one light is often more troublesome than the man who rents a thousand.

Separate exciting, I think, will be found to give the easiest handling of dynamos, and also has the advantage that as long as the alternators each have their independent rheostat, the regulation of the exciting current regulates all the lights with very little trouble.

For small stations self-exciting machines have their advantage, since it gives less actual machines to look after; but I doubt whether this advantage is not more than covered by the fact that it is a simple matter to carry a spare armature for the small exciter, which can be slipped out in a few minutes, rather than to have to change the heavy armature of an alternator because of some slight trouble with its exciting coils or commutator.

While alternating current dynamos are best run separately, and the need of synchronizing is not often felt, when it is wanted it is wanted badly; and it is a good plan to carefully speed all machines and engines so that they will all run at one speed when light, and at a certain increased speed when loaded. This can generally be done with separate engines by changing the governors, and where shafting is used, by slight changes in pulley diameters, and this will enable the dynamos to be run together if required, with as little trouble or danger as may be.

The keeping of a careful log in boiler, engine and dynamo rooms I need hardly refer to; for some years now in the larger and better equipped stations it has been customary to weigh the coal used under the boilers and to keep an hourly or half-hourly record of the load upon each dynamo and feeder. Now, that reliable meters can be had for use on high tension circuits, I think it would be a matter of the greatest importance to have one of these meters placed in the circuit of each separate feeder, since by that means we are enabled to check up the difference between the amount of current furnished to the feeder at the station each month, and the amount of current which is charged to the various customers on that same feeder. There is nothing more than the station meter of the gas company and its value as a means of detecting leakage on the lines, whether from bad insulation or from theft of current, cannot be over estimated.

One point we must always keep clear before us, and that is that, as long as the contract condition of selling light existed, the cost of making this light did not bear so invariable and fixed a value with reference to the profits of the station as it does where a meter is used.

With the contract system there might be many contracts made for the use of a certain amount of light, which amount of light would not be used, resulting in a direct profit to the company, which, in such cases, received money for what it did not furnish; but, with the meter system, the only receipts of the company are for the current which is delivered to the customer and the difference in the price charged to the customer per watt hour, and the cost of producing this current per watt hour is the measure of success or failure.

It is, I suppose, hardly necessary to refer to the advantages of keeping careful records of dynamos and converters and all repairs to same. The advantage of such a system of records can only be appreciated by those who have used it. There are certain classes of machines in which armatures will last without giving a sign of trouble for from two to three years, and then one coil after another will commence giving out. It may be found that, when a machine has been running for perhaps a few months and a coil gives away, that this coil may have given out from some local defect or injury in itself, and it will be worth while to repair only this coil. On the other hand, if at the end of four years a coil gives out, and then a month or two later another coil, it may pay better to rewind the whole armature rather than to do any patching, since the chances are that the whole armature is weakened and will keep on breaking down until the whole has been rewound anyhow. The same with convertors; there will occasionally be found a convertor which is always in trouble. It may keep blowing fuses or burning out switchboards continuously, and in a short time the extra cost of taking care of it would soon amount to more than a complete repair.

I do not mean to include in the regular repair book such small items as the placing of fuses; but it is astonishing how much can be learned about convertors by persistently following them up. The meters which are now in general use cannot be too carefully watched. There are numerous little troubles which arise with them chiefly from poor contacts and dust. By keeping a careful record of the readings of each meter from month to month a great deal may be learned about them, and some of the apparently unaccountable changes in their records traced up.

Among some of the minor points which must be looked out for are first to see that spiders and insects do not get into them and stop their motion, and,

Secondly, that the growth of electrical knowledge among the customers does not tend to make them try to beat the meter. We have found cases where this was done by drilling a very fine hole in the case of the meter and dropping into it a fine wire which should touch the vanes and so stop the meter recording, this being done for perhaps two weeks in the month, so as not to arouse suspicion by a total cessation of the record, while at the same time allowing a wide interval of time during which the meter inspector might call without detecting the presence of this wire.

The short circuiting of a meter has been practised to some extent, but this can usually be guarded against by running both wires to the meter under mouldings, which as a rule the customer does not care to meddle with. In one type of meter we have seen large pieces of iron placed beside it to interfere with its record, and this will affect I believe almost any mechanical meter. The electric meter being as a rule placed like its cousin, the gas meter, in the darkest and most inaccessible spot in the building, is not always easy to keep closely watched, but if it is a few good examples will often do away with a large measure of the trouble.

To take up the second great branch of my subject, that of the "Outside Distribution," let us return to the point where we spoke of the importance of outlining the plan and lay-out of the circuits, in connection with the decision as to the size of unit dynamo.

For the outside distribution, the first point that we have to consider is the question as to whether the wires are to be run overhead or underground. Without expressing any preference for one or the other I would mention, a few points in each should be carefully looked after, before deciding upon the use of either. If underground work be possible, what advantage do we gain by its use. We may say that we practically get rid of all the trouble connected with storms, and fire, and other incidents of like nature. We also remove a great deal of the public clamor against the use of electricity, and we avoid the annoying interruption to work, which goes on from the mere fact that our operations have to be conducted in full sight on the public streets. We also, to a certain extent, get a kind of claim upon premises where the current has been introduced underground, since, as a rule, the connections are not visible from the outside; and, when the current has been cut off, we are not required to remove them as is often the case with overhead wires. All things considered, the maintenance of underground cables would probably be less than that of overhead wires, providing that the fixed charges due to the enormously increased cost be left out, since accidents to overhead lines generally occur together, from storms, etc., compelling the carrying of a larger force of wiremen, or a proportionately longer time to make repairs.

The greatest disadvantages of underground wires are undoubtedly the uncertainty as to their life, both from want of experience and from ignorance of the exact causes which lead to their destruction; and also that their enormous first cost raises the cost of the production of the electric light to a point which compels us to charge the public more for their light than they are inclined to give, which fact in many cases actually prohibits its introduction. A very peculiar series of phenomena are introduced when wires are placed underground in such close proximity to one another, as they necessarily must, where a large number are run in conduits together, and these results are not very well understood so far even by those who have had the most experience with them. I may cite as an instance of this, the effect which has been observed in Mr. Ferranti's 10,000 volts mains from the Deptford Station, where the electro motive force at the London end is higher than that at the generating station. There seems to be some doubt as to what causes this condition, and so far some controversy over it, though it would appear from recent utterances to be fairly well proved that it is due to static capacity, one thing seems certain that a similar effect has been observed on some overhead lines; but in the

latter case it has not been sufficient to interfere with good running.

If the overhead system be determined upon, nothing but the very best wires should be used. It must not be forgotten that the majority of accidents which have occurred from overhead wires have nearly all been caused by poor construction. I do not think I am far wrong if I say that all accidents which have occurred to others than employes of the companies have been caused either by poor construction or gross carelessness on the part of those injured. With employes the case is somewhat different. Undoubtedly many have been killed by their own carelessness, but there is a certain class of accidents which occur to the most skilled men and under the most extraordinary conditions, which must be put down simply as true "accidents," and against which no better provision can be made than by careful construction and inspection.

I think if I detail the method which was followed in laying out the feeders for a large central station, a modification of this will be probably found in most cases.

The bulk of the lighting was expected to be on two main streets of the town running parallel with one another on a long curve for about a mile and a half, and the central station was located about halfway between the centre and end of this line, and about one-half miles distant from the nearer of the two streets. There were five cross streets available, running from the central station in almost a straight line to different points of the main lighting district, and the question was raised as to which would be the best to use for running the main feeders. Approximate calculations showed that the full load of the largest machine proposed, 3,000 lights, could be carried between any two of these cross streets or feeder junctions with the maximum drop proposed if No. 3 wire were used for the mains. It was therefore decided to use a No. 3 wire continuous from end to end for the mains to start with, proper arrangements being made to cut this main into sections as fast as the load should increase, so as to render the splitting up of the load on to one or more machines necessary.

To determine the size of feeder the only point raised was as to which was the heaviest wire which could be run upon poles and handled easily. It was determined that No. 0 Brown & Sharpe would best fill the conditions, and five lines of No. 0 Brown & Sharpe wire, one on each street, were run up and tapped into the mains at the junctions of both streets. The maximum number of amperes that could be carried by each feeder with 2 per cent. loss was then calculated and marked on the feeder at the switchboard and on the plans, thus: No. 1 feeder being the longest would only carry 22 amperes; No. 2 feeder would carry 40 amperes; No. 3 feeder would carry 80 amperes; No. 4 feeder would carry 65 amperes and No 5 feeder would carry 30 amperes. These would all run the one switchboard, and as soon as the ammeter on any one of these feeders showed that the maximum load during the night's run reached its limit, a second No. 0 wire would be run on this pole line and multiplied with the first, doubling the capacity of the feeder at once. In the same way as long as the total load on all the feeders did not reach above the first 3,000 light machine installed the mains were left continuous; but as soon as this limit was reached the mains were cut at such a point as to about divide the load into two (2) parts, and two machines were started.

This progress will be kept up indefinitely, the feeders being always kept below two per cent. loss, and the mains cut to accommodate the unit of 3,000 lights of dynamo capacity.

The feeder which had the smallest available load, No. 1, carrying twenty-two amperes, happens to be the feeders which runs to the district where the fewest lights are expected, and in all probability will never be doubled up, the district being thinly populated and with no immediate prospect of its being built up very much.

In this plant another detail was introduced of making the breaks in the mains by means of switches, so that in the event of a breakdown of a feeder line the closing of these switches would enable the lights to be taken care of by the machine on either side.

The plan, in fact, makes the whole system of mains one large switchboard, allowing for the transfer of lights up and down the line among the different sections.

In laying out long feeders, try and keep those which belong to different circuits as far apart as possible, since wires which run parallel with each other for long distances will cause interference, especially if the voltage of one circuit be considerably higher than that of the other, and still more if the static capacity of one be much larger. In putting in new lines, be very careful to avoid the effects of induction from live circuits, which sometimes rises to an unexpected degree. I have known of a case where men received a heavy enough shock to throw them down in taking hold of the bare end of a wire, totally disconnected in every way from the circuit, but which ran parallel for about a half a mile with a 1000 volt feeder. Had these men been handling a bare end on an iron pole they might have received shock enough to throw them down and injure them seriously from the fall, when we should have had another "mysterious accident" with electricity. In placing converters, while in many cases they can be placed with perfect safety inside of buildings, they can generally be placed outside in positions where they can be got at easily for refusing, and without disfiguring the buildings to any extent. A very good rule is to allow no porcelain insulators on outdoor work; nothing but glass put on iron brackets so made that the glass can always stand upright to prevent filling with water. No loops should be allowed to be cut in on the circuits between poles, but all connections should be made at a pole. And in the case of converters placed inside buildings, a double pole switch should be placed at this point though I should not think it absolutely necessary in the case of converters placed outside of buildings.

Run converters separately as much as possible, and if it is absolutely necessary to run them in multiple arc, keep a close watch upon the fuses, since when run in this way converters have a trick of blowing fuses without any apparent cause. Never change high tension fuse.

When converters are brought back to the station for storage they should be kept in a warm, dry room to prevent the condensation of moisture on the interior of the cases, which will damage them quicker than leaving them in service out of doors.

It must not be forgotten that the thoroughly sound over-head construction is the strongest argument which can be advanced today against companies being compelled to spend large sums of money on underground work. I have been so much interested in the pole-line work done in this city that I have examined it with some little care, and I find some points that surprise me, though I was well aware that their construction was of the best, and I relate some of these points for your consideration. All new poles are made of sawed yellow pine tarred where sunk in the ground, and painted above it; no less than 8" square being used anywhere and the majority being 10" and 12".

The cross-arms are not only heavy in themselves but are rendered even more so by the kind of pins used. These are not of wood, but are made by placing a lag bolt with its head in the glass insulator and cementing it in solid with plaster of paris; these lag bolts being then screwed directly into the cross arm, avoiding the weakening of the arm by large holes bored into it and doing away with snapping pins.

All new wire strung is of high grade insulation, and all low grade wires, wherever taken down, are re-insulated with high grade insulation before being replaced. All joints in the line are soldered, and nothing but iron brackets and glass insulators allowed for outside work. Not only have the iron brackets been made for all situations, but they have been made in pairs so that the leading wires shall always be kept a uniform distance apart, which adds enormously to the trim and workmanlike appearance of the lines. I think all will agree with me that those who are willing to spend the enormous sums that such work costs have established a right to ask that they be not expected to do anything in the way of underground work until underground work has been demonstrated as successful in every way as the work that they have done here, and, more than this, that such underground work shall possess decided advantages to compensate for the increased difficulty of locating and correcting trouble in which respect the over-head line is undoubtedly far superior.

If municipalities wish to place themselves in the front rank of progress and at the same time encourage local industries let them rather expend their energies in insisting on and compelling the proper carrying out of well tested methods of construction rather than in demanding that untried principles and methods be experimented with, often under conditions which preclude their success. (Applause.)

After an interesting discussion on Mr. Smith's paper, Mr A. J. De Camp expressed the opinion that it was the ideal paper for this organization, and suggested that the formal discussion on the same be deferred until the next meeting of the association.

The suggestion was followed by lengthy and interesting arguments *pro* and *con*, and it was finally adopted as the sense of the meeting.

Mr. Smith obtained permission later on to make an addition to his paper, and he made an interesting statement.

I wish to say, said he, that if there is any city in this country that has done more to damage the electric light business than any other, it has been the City of New York. I also wish to say that about one year ago in walking up Broadway I saw a converter of well known make placed on the exterior of a building by being laid upon its back on one of those wide window sills in a building where the basement was used as a business office. The wires from the secondary of the converter ran down through a rubber tube without any tape, right down underneath and into the basement. The primaries were connected to the main line with wire that looked to be of a very inferior weather-proof line wire tape, and the tape over these joints was hanging from that in strips. Right by this converter was an iron stairway reaching to the first floor of the main building and any one could stand on that stoop and put his hand on that converter After we had all this question in New York and this fearful cutting of the wires, and so forth, I naturally supposed that they would be one of the first converters to be swept away. Not two months ago I walked up Broadway and that converter was there still. No rules you can make as to putting converters inside and outside of buildings will make them safe when such criminal recklessness as that is indulged in.

The next paper read was on "Mutual Insurance of Accounts," by Mr. Frederick A. C. Perrine, and a brief discussion thereon ensued.

Mr. A. J. DeCamp, Chairman of the Committee on Data, then read the report of that committee, which was, on motion accepted, and the committee continued.

The President: The last item on the calendar for this morning is the report of the Committee on the World's Columbian Fair, myself as Chairman. I will report that I have notified Director-General Davis, of Chicago, of the appointment of this committee and of its willingness to co-operate with him in a way to secure the success of the exhibits. I received a reply that my invitation had been received and placed on file, and at the proper time would be answered by the proper person.

The report was, on motion, received and the committee continued.

An adjournment was then made until 4 P.M.

AFTERNOON SESSION.

The following officers were elected for the ensuing term: President, C. R. Huntley, Buffalo, N. Y.; First Vice-President, James I. Ayer, St. Louis, Mo.; Second Vice-President, M. J. Francisco, Rutland, Vt.

EXECUTIVE COMMITTEE.

CLASS 1.—E. H. Peck, Brooklyn, N.Y.; John Seely, New York City; R. Fabian, Jr., Toledo, O.

CLASS 2.—Albert J. Corriveau, Montreal; H. H. Fairbanks, Worcester; A. J. De Camp, Philadelphia.

CLASS 3.—J. J. Burleigh, Camden; A. N. Robinson, Minneapolis; E. W. Rollins, Denver.

The recommendation of the Committee of the Whole that the next meeting be held in Montreal in the month of August was adopted, the Executive Committee to arrange the date.

The following resolution, offered by Mr. Shaw, was adopted:

Resolved, That within thirty days of his election the incoming President shall appoint a committee of three active members of the association whose duty it shall be to formulate such amendments to the constitution as may be deemed necessary, and to submit their report at the next semi-annual meeting of the association, the amendments thus reported to be introduced at the semi-annual meeting and lie over under the rules and be considered at the next annual meeting of this association.

The Chair announced the following committee on "Underground Conduits and Conductors:" Messrs. De Camp, Barton, Brophy, Law and Smith.

The report of the Committee on Incandescent Lamps was accepted and the committee discharged with thanks.

The Committee on Legislation was continued.

Mr. Huntley, speaking on the subject referred to him at the last meeting, "How can the National Electric Light Association best serve central station interests?" recommended that the advisability of having but one meeting a year be considered. He was not prepared to say that the time had arrived yet for that change, but he believed that it would soon come.

President De Camp, as one of his last official acts, then introduced Mr. Edward Weston, of Newark, N. J., in fitting terms.

Mr. Weston said:

The President has requested me to make a few remarks, gentlemen, in regard to electric measuring instruments and their methods of use and care. A few years ago such a thing would have seemed to me almost impossible. The growth of the industry has been so enormous and the money invested so great that it gives me indeed great pleasure so see that the gentlemen who are engaged actively in this business every day realize the value and necessity of accurate work in the mechanical departments and in the electrical departments. Like almost every other industry there is an experimental state which is probably the most trying stage, when disappointment after disappointment occurs, first with the apparatus, and later on from a lack of knowledge of its limitations. As that disappears people become better and more fully acquainted with the need of a stricter and closer attention to all the details in order to assure complete commercial success. In 1881 and 1882 a proposition to place a volt meter of excellence or an ammeter of excellence on every plant or in connection with every dynamo, as was suggested here to day by Mr Smith, would have been met, I think, very largely by ridicule. That was not the fault of the users as much as it was, probably, of the people who were engaged in pushing forward the commercial end of the business. The users could not be expected to understand that matter or to appreciate that if they did not use such appliances it in the end made considerable loss. I was greatly pleased to day with the paper of Mr. Smith. It embodied so many excellent suggestions in regard to the care of plants, the exact means of finding out where difficulties arise, of locating them instantly and removing them quickly. The necessity for continuous hard service has been fully recognized. Mr. Smith dealt very fully with the details of the arrangement that he planned to secure those desired ends. He dealt very fully, also, with the methods of switchboard construction, certainly a much needed reform. Almost every serious fire that has occurred in an electric lighting station has owed its origin and done most of its mischief through the agency of the switchboard. I have had occasion to examine quite a number of the results of such fires and I have almost always traced it back to their switchboard where there was an amount of inflammable material collected which was bound to give rise to some serious trouble. That is nearly wiped out: Wooden constructions are rapidly disappearing. Dangerous insulating materials likely to carry fire from one section of a building to another are being given up The question of insulation is of less importance inside the station than the question of safety from fire. Compared with the early stages of the art it was indeed gratifying to me to find that these things had gradually become recognized as a necessity and not only so recognized but urged upon the attention of a body of intelligent men such as we have had here to-day.

In regard to instruments I would say this—that almost every instrument has its peculiarity. To speak of them generally you will find that all of them have their defects and all of them have their merits. They must all be used properly or any one of them must be used under certain conditions in order to yield certain and accurate results. The voltmeter of the Cardew type, which is supposed to be a very permanent form of voltmeter for use with alternating or direct currents is so extremely sensitive to changes in temperature from external sources as to make quite a perceptible error and one which would in the end cause a station considerable loss. If any would like to satisfy themselves about that let them place such an instrument in circuit near a window through which the sun is shining, shield it from the sun's rays, turn the current an observing the reading. Let the sun's rays fall on the tube and notice the change. I think most of you will be considerably surprised to find that the percentage of change is very large even under those conditions. The Cardew instrument properly used will yield excellent results. It should not, of course, if accurate readings are desired, be placed in a vertical position. The index moves too much, and I believe you all fully realize the fact that a volt or two volts additional on an incandescent lamp enormously shortens its lifetime besides adding largely to your coal bills.

In direct current instruments it will be supposed by many persons that because many contain no permanent magnet, that their readings are not affected by their proximity to a dynamo. Do not believe it. It is not so. It is a very easy matter to ascertain how much their readings are affected under different conditions, but you will find that they are very seriously affected, and in general no instrument that is being used for the purpose of making an accurate determination should be placed near any disturbing force, either conductors carrying powerful currents or other magnetic fields. That should be strictly avoided. The Cardew is less affected in that respect than some others, but it is not entirely free from that difficulty either. Those instruments that are least affected are instruments of the zero type. That is to say, where you balance a known electro-motive force against the unknown electro-motive force by means of a rheostat—the potentiometer type. Those are less liable to be affected than any of the so-called direct reading instruments. But they also are affected their sensibility is reduced. In making readings they should never be placed very near dynamos. Permanent magnet types of instruments which have certain very desirable qualities for general use in direct current measurements should never be taken very close to dynamos. If the magnets are properly made and the magnetic construction is good, you may trust permanent magnet instruments implicitly for years, supposing they are used with due care. The most careful examination has revealed the fact that after three years' continuous use the change has amounted to less than one-tenth of one per cent. Now, how is that secured and how is it maintained? It is secured in the first place by very careful selection of the steel and very careful artificial etching, and also in the design of the instrument. Those three things come into play there. After they leave the instrument maker's hands they sometimes get pretty badly abused. People are not very apt to think how much labor has been spent in making those instruments. They should not be used roughly by any means. They should be carried with extreme care and not very much jarred, because the jarring, while it does not affect the magnet at all, jarring and jolting that they get striking car seats and such things, jumping them down on tables, is likely to damage the pivots or jewels which carry the moving parts and so introduce the element of friction. The element of friction is a very serious thing in a very large number of instruments. In some the error will amount to three or four per cent. In others it is much less. In voltmeters there is another source of error which should be looked after, particularly in some forms of instruments, very carefully. Voltmeters whose coils are wound with copper, unless they have compensators or some device for compensating for the change in the temperature of the copper are not reliable instruments to use for station work. It is commonly known, of course, that the co-efficient of error of temperature, as it is commonly called, is very large for copper. It amounts to about one per cent. for every five degrees Fahrenheit. Therefore a change of twenty degrees introduces an error in such instruments of about four per cent.; a larger change of course introduces an error correspondingly greater. German silver does that to a less degree of course, but even there there are serious difficulties

to be met in getting an instrument which at the same time that the temperature co efficient is low will not heat too much by the passage of the current. So that no instrument should be sent out as a standard voltmeter, or as a voltmeter to check other voltmeters without an absolute statement of its temperature error and some means of providing for its ascertainment. It does not suffice to notice the temperature of the surrounding air, because the temperature of the coils inside the instrument may be very different from that of the surrounding air, especially after the instrument has been in circuit a short time. The way in which electricity acts is so well understood that all those cases have been pretty well worked out, but in getting accuracy in the instruments there is a great deal to be done.

Some years ago I had the good fortune to discover an alloy in which the temperature co efficient was practically nothing. We have used that to some extent—not to the extent that I should like to see it used and expect to use it later on. That alloy has given us a great deal of trouble in working. We have had to learn how to work it and I do not think we fully understand it yet; but when we get that alloy in shape, then the temperature error will be practically eliminated entirely. How near we have approached this elimination you can judge when I tell you that our ordinary standards—I am speaking of voltmeter, I do not speak of ammeter—the changes are less than one-quarter of one per cent for thirty-five degrees Fahrenheit.

Regarding the use of instruments it has been very strange to find— of course this is not in stations; it is generally in isolated plants, but we have found instruments with which you are all well acquainted, on the switchboard—nailed up—nails driven through the bases, not even holes bored in. Now the type of instrument we have put on the market we never intended for switchboard use. It was intended as an absolute standard to be kept with care for checking other cheaper forms of instruments for general use. As a matter of fact no one meter, strictly speaking, exactly meets the requirements of central station work. The index does not move far enough to enable you to see the minute changes —apparently minute changes—at any reasonable distance from the instrument itself. An instrument should be for station work—should have a very large movement for a single volt, so that a man can see across the room quite readily a change of a single volt. Of course that can not be done with the form that we put out. There have been some instruments of that type put upon the market. Some had very good qualities; unfortunately some had very bad qualities. There has not been any complete solution I think, of that problem. The nearest approach to it was two instruments, one made by the United States Company, the other by the Edison Company. Both forms had serious objections. The one did not remain constant; the other did remain, but it was a very delicate instrument and after being in a station was more or less affected—in fact considerably affected by external influences. That problem remains to be solved, so to speak, yet, so as to produce a satisfactory volt indicator with a very wide range for a very small change.

Ammeters are, of course, of less consequence. There is not so much loss there as there is when you have the voltage changing. Your lamps do not suffer quite as much. Ammeters are based, of course, upon the same general principles as voltmeters. The forms of them are too numerous, almost, to mention, and too well known to need describing. Some new forms have recently been brought out which I think on test will be found to be very excellent. In a station ammeter you should have at least this one element, that it should not be affected even by the most intense fields because it has got to be placed very close to the main conductors on the switchboard. It will be of very great importance—much greater importance later on—than it is now when more machines are coupled in multiple arcs, especially when alternating current machines are coupled in multiple arcs. The load that each machine carries should be pretty fairly distributed amongst the various machines. To insure that good instruments must of course be used. Any instrument which is seriously affected by external fields does not exactly meet the requirements of the arc. There is no doubt about that. Furthermore its index should be prompt, positive—not slow, coming to rest, and always moving naturally to the same position from the same current strength and for very little magnetic lag. Most of the ammeters, of course, are based on the action of the coil upon a mass of iron—most commercial forms of ammeters. A great many of them have a very large amount of lags. Some of them I have found to be upwards of fourteen or fifteen per cent. lag put out with endorsements, and endorsements sometimes of very high authorities as to their excellence and general accuracy. Tests show them to be just the contrary.

The ammeter question, with permanent magnets, is a much more serious matter to deal with than the voltmeter, and of course any permanent magnet would not do at all for alternating current work. A really portable form of alternating current instruments, similar in general character to the portable forms of direct current instruments, capable of being read readily is a very great necessity, and, I think, will be supplied in a very short time—practically, it is now—an instrument that could be carried around with the same degree of comfort that you carry a direct current instrument. I need not enlarge very much on this matter of instruments, except to say that if instruments are used with greater care, I am satisfied that the members of the association will get far better results if the help are instructed in regard to their care, and it will result in profits to the stations most assured.

At the conclusion of Mr. Weston's remarks the recommendation made through the Executive Committee that he be elected to honorary membership was carried by a standing vote.

Mr. Weston thanked the association for the honor and promised to do a little more active work in the future before the association than he had done in the past.

Pending the motion to adjourn the president spoke as follows:

Before putting that motion I have just a word to say in bidding you an official good-bye. I have to thank you one and all for your uniform courtesy, your earnest and heartiest sympathy and assistance which has been rendered to me all through the year. I feel it and feel it very keenly. It is very pleasant to have you come down here and sever my official relations here at my own home and I am very glad indeed that you have come here and have an opportunity to inspect what I myself have been trying to accomplish in the way of advancing the electrical industries of the country, in promoting it, putting it on a substantial footing. I do not know there is anything more I wish to say.

The convention then adjourned.

THE FOLLOWING IS A LIST OF THOSE PRESENT AT THE CONVENTION:

E. P. Atkinson, of C. A. Seniéren & Co., New York.
P. C. Ackerman, manager N. Y. office American Electrical Works, New York.
P. H. Alexander, Alexander, Barney & Chapin, New York.
Robert Amory, president Economic Electric Manufacturing Co., Boston, Mass.
J. M. Anderson, A. & J. M. Anderson, Boston, Mass.
D. A. Andrews, Jr., the Pettingell-Andrews Co., Boston, Mass.
George L. Austin, Editor *Practical Electricity*, Boston, Mass.
C. Lee Abell, manager Thomson-Houston Electric Light Co., Buffalo.
E. A. Armstrong, president Camden Lighting and Heat Co., Camden, N. J.
Olney Arnold, secretary American Screw Co., Providence, R. I.
T. Ahern, Ahern & Soper, Ottawa, Canada.
James I. Ayer, general manager Municipal Electric Light and Power Co., St. Louis, Mo.
W. P. Bradner, the Bradner Adjustable Hanger Co., Denver, Col.
M. E. Baird, Eddy Electric Manufacturing Co., Waterbury, Conn.
J. P. Burdick, H. W. Johns Co., New York.
Fred. G. Burton, Ansonia Brass and Copper Co., New York.
W. I. Barker, *Electrical Review*, Boston, Mass.
Col. Lewis W. Burnham, president Electric Gas Lighting Co., Boston, Mass.
C. E. Bibber, Holtzer-Cabot Electric Co., Boston, Mass.
F. E. Barker, Massachusetts Gas and Electric Lighting Co., Boston, Mass.
F. C. Bates, Thomson-Houston Electric Co., Lynn, Mass.
E. T. Bubier, Lynn, Mass.
Cyrus O. Baker, Jr., Baker & Co., Newark, N. J.
G. M. Buck, A. W. Harris Oil Co., Providence, R. I.
H. Durant Cheever, Okonite Co., N. Y.
Wm. W. Castle, P. & B. Conduit and Const. Co. New York.
R. B. Corey, manager Electric Construction and Supply Co., New York.
A. T. Clark, American Circular Loom Co., Boston, Mass.
H. W. Chase, Boston, Mass.
Walter G. Chase, Treasurer Mason Regulator Co., Boston, Mass.
E. M. Carhart, Specialties, Providence, R. I.
Percy Alfred Clisdell, Electric Eng. & Supply Co.; Syracuse, N. Y.
E. L. Cook, Nubian Iron Enamel Co., New York.
Edward Caldwell, of the *Electrical World*, New York.
F. R. Colvin, *Electrical Engineer*, New York.
Captain Willard L. Candee, manager of the International Okonite Co., New York.
S. L. Coles, *Electrical Review*, New York.
David Chalmers, Alexander, Barney & Chapin, New York.
George Cutter, Chicago, Ill.
W. J. Cooke, Vice-President McGuire Mfg. Co., Chicago, Ill.
E. L. Clarke, Secretary Illinois Electric Material Co., Chicago, Ill.
W. F. Collins, *Electrical Engineer*, Chicago, Ill.
George E. Cabot, Treasurer, Holtzer-Cabot Electric Co., Boston, Mass.
H. J. Conant, manager Evans Friction Cone Co., Boston, Mass.
Henry Cram, Treasurer, Bernstein Electric Co., Boston, Mass.
A. E. Carrier, agent Faraday Carbon Co. Pittsburgh., Pa.
Z. Chaffee, Secretary Brown & Sharpe Manufacturing Co., Providence, R. I.
Thomas L. Coles, Muncie-Coles Subway Co., New York.
David J. Cartwright, Boston, Mass.
E. E. Cabot, Boston, Mass.
F. A. Crawford, Jarvis Engineering Co., Boston, Mass.
O. T. Crosby, Thomson-Houston Electric Co., Boston, Mass.
E. V. Cavell, *Street Railway Gazette*, Chicago, Ill.
T. B. Crouse, Standard Carbon Co. Cleveland, Ohio.
H. F. Coggeshall, Fitchburg Gas & Electric Co., Fitchburg, Mass.
Albert J. Corriveau, Montreal, Canada.
Edward A. Colby, Weston Electrical Inst. Co., Newark, N. J.
H. A. Cleverly, Cleverly Electrical Works, Philadelphia, Pa.
T. J. Cope, Philadelphia, Pa.
Fred. DeLand, *Electrical World*, New York.
Col J. Frank Dillont, the *Electrical World*, New York.
D. B. Dean, Electric Merchandise Co., Chicago, Ill.
Albert E. Davis, *Electric Power*, Boston, Mass.
A. J. DeCamp, general manager Philadelphia Electric Light Co., Philadelphia.
E. W. Davis, Perkins Electric Switch Manufacturing Co., Hartford, Conn.
Paul A. Draper, Thomson-Houston Electric Co., Lynn, Mass.
A. A. Dion, Moncton, New Brunswick.
A. L. Daniels, Eureka Tempered Copper Co., North East, Pa.
Frank S. De Ronde, Standard Paint Co., New York.
S. A. Douglass, Edison General Electric Co., Boston, Mass
Julian F. Denison, Audubon Electric Machine Works, New Haven, Conn.
Major Everts, Simplex Electric Co., Boston, Mass.
Alonzo Elliott, president Electric Light Co., Manchester, N. H.
Howard P. Elwell, Providence, R. I.
J. O. Ellinger, John A. Roeblings Sons' Co., New York.
C. P. Elieson, electrical expert, London, England.
E. L. Edes, Plymouth, Mass.
C. L. Edgar, General Manager Edison Elec. Illuminating Co., Boston, Mass.
Herbert H. Eustis, President Eastern Electric Cable Co. Boston, Mass.
W. C. Fineout, *Electrical World*, New York.
James Ferguson, Superintendent Municipal Electric Light Co., Brooklyn.
Charles R. Faben, Manager Elec. Light and Power Co., Toledo, Ohio.
Charles P. Frey, electrician The Greeley Laboratory, Albany, N. Y.
Allen R. Foote, Washington, D. C.
M. J. Francisco, Manager Rut and Electric Light Co., Rutland, Vt.
H. N. Fenner, Treasurer, New England Butt Co., Providence, R. I.
W. H. Fleming, Manager *The American Reporter*, New York.
C. J. Field, Field Engineering Co., New York.
A. T. Faver, N. Y., Insulated Wire Co., New York
E. D. Floyd, Thomson-Houston Electric Co., Boston, Mass.
A. B. Field, Thomson-Houston Electric Co., Boston, Mass.
L. B. Favor, Thermal Electric Co., Gloucester, Mass.
J. B. Fowler, New Haven, Conn.
T. F. Flanagan, Portsmouth, N. H.
W. B. Ferguson, N. E. Agent Rae Electric Railway System, Boston, Mass.
R. J. Gray, ELECTRICAL AGE, New York.
Edgar B. Greene, superintendent Edison Electric Illuminating Co., Altoona, Pa.
M. M. Garver, Newark, N. J.
Frank M. Gilley, *Electrical Enterprise*, Boston, Mass.
A. B. Griggs, Boston, Mass.
Lieut. H. K. Gilman, Great Western Elect. Supply Co., Chicago.
E. F. Gennert, E. P. Gleason Manufacturing Co., New York.
J. W. Godfrey, general manager New York Insulated Wire Co., New York.
W. H. Gordon, of W. H. Gordon & Co., New York.
C. E. Gregory, manager Sperry Electric Co., Chicago, Ill.
W. T. Hunt, manager advertising department ELECTRICAL AGE, New York.
W. J. Hammer, electrical expert, New York.
D. L. Hungerford, manager Wallace & Sons, New York.
Caryl D. Haskins, T. H. Electric Co., Boston, Mass.
J. H. Herrick, Prest, Edison Gen'l Electric Co.
C. R. Huntley, secretary Buffalo Electric Light and Power Co., Buffalo, N. Y.
W. E. Harrington, Atlantic City, N. J.
John T. Henthorn, Remington & Henthorn, Providence, R. I.
Walter C. Harlow, Joseph Ketchum & Co., New York.
Warren S. Hill, Boston, Mass.
A. H. Hamblett, Charles A. Schieren & Co., Boston, Mass.
Webb C. Hayes, treasurer National Carbon Co., Cleveland, Ohio.
Wells E. Holmes, Newton, Mass.
Edward C. Hughes, Providence, R. I.
C. W. Holtzer, Holtzer-Cabot Electric Co., Boston, Mass.
E. B. Hatch, secretary Johns-Prat Company, Hartford, Conn.
A. Walter Harris, A. W. Harris Oil Company, Providence, R. I.
C. S. Haley, Thomson Houston Elec., Co., Boston.
Percy Hodges, Thomson-Houston Elec., Co., Boston.
W. F., Hanks, *Electrical World*, Philadelphia.
G. Hess, Edison Elec. Illum. Co., Williamsport, Pa.
A. L. Ide, Springfield, Ill.
W. J. Johnston, *Electrical World*, New York.
Myron A. Knapp, manager Knapp Electrical Works, Chicago, Ill.
W. A. Kreidler, *Western Electrician*, Chicago, Ill.
F. L. Kenfield, *Street Railway Review*, Chicago, Ill.
F. E. Knight, manager *Power Steam*, New York.
A. H. Kimball, Fitchburg, Mass.
Joseph Ketchum, Joseph Ketchum & Co, New York.
W. S. Key, *Modern Light & Heat*, Boston, Mass.
W. R. Kimball, Fort Wayne Electric Company, Fort Wayne, Ind.
I. George Kaelber, Western Electric Company, Rochester, N. Y.
Geo. W LaRue, Crocker-Wheeler Elect. Motor Co., New York.
Z. Latshaw, New York.
J. G. Lynch, editor *Electric Enterprise*, Boston, Mass.
C. Fremont Lee, Gould & Watson Co., Boston, Mass.
W. B. Lewis, Thomson Welding Company, Lynn, Mass.
W. S. Love, Pond Engineering Company, St. Louis, Mo.
L. C. Lincoln, Electric Machine and Power Company, Woonsocket, R. I.
L. Lewisohn, Lewisohn Bros., New York.
Theo. Larbig, Holmes, Booth & Haydens, New York.
P. E. Laehy, East River Electric Light Company, New York.
Thomas D. Lockwood, American Bell Telephone Company, Boston, Mass.
C. L. Libby, Bridgeport, Conn.
R. E. Lee, Chelsea, Mass.
H. Ward Leonard, general manager Edison General Electric Company, New York.
H. L. Lufkin, manager C. & C. Electric Motor Company, New York.
H. P. Lucas, manager Great Western Electric Supply Company, Chicago, Ill.
F. H. Leonard, Jr., manager Electrical Engineering and Supply Company, Syracuse, N. Y.
Hon. John Lynch, president Washington Electric Conduit Company, Washington, D. C.
M. D. Law, Denver, Col
Geo. M. Lane, Electric Light & Power Co., Asbury Park, N. J.
J. H. McGraw, *Street Railway Journal*, New York.
F. H. Marks, West End Street Railway, Boston, Mass.
F. H. Monks, general manager West End Railway, Boston, Mass.
T. B. McCoubray, International Okonite Co., New York.
George T. Manson, International Okonite Co., New York.
Jas. P. McQuaide, treasurer National Conduit Manufacturing Co., New York.
W. J. Morrison, Fort Wayne Electric Co, New York.
A. P. Mitchell, manager *Hardware*, New York.
W. J. Murray, National Electrical Manufacturing Co., New York.
Frank A. Magee, The E. S. Greeley & Co., New York.
George H. Meeker, Metropolitan Rubber Co., New York.
E. S. Mendels, manager Universal Arc Lamp Co., New York.
T. C. Martin, editor *Electrical Engineer*, New York
W. R. Mason, general manager Electric Merchandise Co., Chicago, Ill.
G. W. Mansfield, Thomson-Houston Electric Co., Boston, Mass
A. F. Mason, general manager Simplex Electric Co, Boston, Mass.
Alfred F. Moore, Philadelphia, Pa.
Geo. C. Maynard, *Electrical Review*, Washington, D. C.
A. H. Mills, Steele & Johnson Manufacturing Co., Waterbury, Conn.
J. W. Marsh, secretary Standard Underground Cable Co., Pittsburg, Pa.
Geo. H. Meeker, N. Y. Insulated Wire Co., New York.
Jas. E. Magee, Thomson-Houston Electric Co, Boston.
Alf. W. Minor, Union Glass Co., Boston.
W. P. Mullen, Shultz Belting Co., Boston, Mass.

W. H. Markland, P. R. R., Altoona, Pa.
Fred S. Minott, Bristol, Conn.
C. H. McIntire, Newark, N. J.
Norman Marshall, manager the Star Electrix Co., Philadelphia, Pa.
W. H. Merrill, Jr., Eastern Agent ELECTRICAL AGE, Boston.
Willis L Nichols, Hope Valley, R. I.
E. L Norris, Gloucester Electric Co., Gloucester, Mass.
A. D. Newton, manager Eddy Electric Manufacturing Co., Windsor, Conn.
C. E. Newton, manager Jewell Belting Co., Hartford, Conn
Frederic P. Nichols, manager Toronto Incandescent Electric Light Co., Toronto, Canada.
J. B. O'Hara, editor *Western Electrician*, Chicago, Ill.
J. M. Orford, president Union Electric Manufacturing Co., Bridgeport, Conn.
T. F. O'Conner, Standard Underground Cable Co., New York.
R. F. Outcault, *Electrical World*, New York.
C. M. G. Paine, *Western Electrician*, New York.
Sidney B. Paine, Edison General Electric Company, Boston, Mass.
Jarvis S. Preston, Gould & Watson Company, Boston, Mass.
D. F. Potter, Thomson-Houston E. L. Co., Boston, Mass.
F. E. Pettingell, Pettingell-Andrews Company, Boston, Mass.
E. S. Perot, National Conduit M'f'g Co., New York.
Fred M. Patrick, H. W. Johns M'f'g Co., New York.
Chas. A. Place, N. Y. Insulated Wire Company, New York.
F. S. Pearson, West End Street Railway, Boston.
O. S. Platt, New England Switch, Bridgeport, Conn.
Dr. H. E. Paine, Dixon, Ill.
Willard H. Platt, Manager Green, Tweed & Co., New York.
Ralph W. Pope, editor *Electric Power*, New York.
G M. Phelps, president *Electrical Engineer*, New York.
J. C. Pierrez, Goodyear Hard Rubber Company, New York.
Chas. W. Price, editor *Electrical Review*, New York.
E H. Peck, Phœnix Glass Company, New York.
E. L. Powers, *Electrical Industries*, Chicago, Ill.
E. F. Peck, general superintendent, Citizens' Electric Illuminating Company, Brooklyn, N. Y.
W. J. Pilicy, *Whipple's Reports*, Boston, Mass.
H. T. Paiste, Paiste switches, Philadelphia, Pa.
F. A. C. Perrine, electrician Jno. A. Roeblings' Sons Company, Trenton.
W. D. Packard, manager Packard Electric Company, Warren, Ohio.
E. F. Phillips, president American Electrical Works, Providence.
Marsden J. Perry, Providence, R. I.
R. W. Ryan, official stenographer, New York.
S. Rosenstamm, Lewisohn Bros., New York.
Mr. Rich, manager Hunt Engineering Company, Brooklyn, N. Y.
Frank Ridlon, Wright Electric Eng. Co., Boston. Mass.
A. M. Robertson, general manager Minneapolis Brush Electric Company, Minneapolis, Minn.
B. J. Richardson, New York.
Thomas G. Roebuck, Insulite M'f'g Co, New York.
G. W Roberts, Boston, Mass.
J. C. Ryan, Gleason & Bailey M'f'g Co., Chicago, Ill.
T. S. Reed, Crescent Insulated Wire & Cable Company, Trenton, N. J.
Geo. H. Remington, Remington & Henthorn, Providence, R. I.
R. F. Ross, *Modern Light and Heat*, Boston, Mass.
C. L. Rodman, Cleveland, Ohio,
E. W. Rollins, president Electric Light Co., Denver, Col.
Walter Rodgers, Hope Valley, R. I.
D. R. Russell, St. Louis, Mo.
Fred W. Royce, Royce & Marean, Washington, D. C.
A. P. Seymour, Pass & Seymour, Syracuse, N. Y.
Frank J. Sprague, New York.
H. C. Spaulding, Boston, Mass.
A. O. Shepardson, Waterbury, Conn.
M. C. Sullivan, *Electrical Engineer*, New York.
F. H. Smith, New York.
W. G. Sellers, N. Y. Safety Insulated Wire Co., New York.
F. H. Smith, Thomson-Houston Motor Co., Boston, Mass
E. D Sharp, the Gould & Watson Co., Boston, Mass.
W. H. Spooner, Bristol, Conn.
C. E. Sanford, manager National Electric Protector Co., New York.
Jno. A. Seely, manager Complete Electrical Construction Co., New York.
C. E. Stump, business manager *Street Railway Journal*, New York.
H. M. Swetland, *Power-Steam*, New York.
H. L. Shippy, Jno. A. Roeblings' Sons Co., New York.
Ralph L. Shainwald, president Standard Paint Co., New York.
Col. J. H. Shay. Chas. Munson Belting Co, Chicago, Ill.
W. E. Stow, Standard Electric Supply Co., Boston, Mass.
J. A. J. Shultz, president Shultz Belting Co, St. Louis, Mo.
H. D. Stanley, secretary Bridgeport Electric Manufacturing Co., Bridgeport, Conn.
George B. Shaw, general manager National Electric Manufacturing Co., Eau Claire, Wis.
W. H. Sawyer, secretary American Electrical Works, Providence, R. I.
Gardiner C. Sims, Armington & Sims Engine Co., Providence, R. I.
H. S. Thornberry, Toronto, Canada.
C. L. Tolles, Jewell Belting Co., Hartford, Conn.
Prof. Elihu Thomson, Lynn, Mass.
F. C. Tyson, Kartavert Manufacturing Co., Wilmington, Del.
T. R. Taltavall, editor ELECTRICAL AGE, New York.
W. H. Temp'e, *Western Electrician*, New York.
F. S. Terry, manager the Electrical Supply Co., Chicago, Ill.
A. F. Talcott, Simplex Electrical Co., Boston, Mass.
C. R. Truex, Walker Electric Co., New York.
J. B. Taltavall, manager ELECTRICAL AGE, New York.
D. F. Urquhart, Thomson-Houston Carbon Co., Fremont, O.
C. S. Van Nuis, Ajax Switches, New York.
D. W. Vaughan, New York.
W. H. Vialle, with Washburn & Moen Manufacturing Co., Worcester, Mass.
C. Reginald Van Trump, Wilmington, Del.
Jos. Wetzler, editor *Electrical Engineer*, New York.
Benj. R. Western, Manufacturers' Advertising Bureau, New York.
Fred. H. Whipple, *Whipple's Reports*, New York.
G. W. Walker, president Walker Electric Co., New York.
Jean A. Wetmore, New York.
E. E. Wood, agent *Electrical Industries*, New York.
C H Wilmerding, superintendent Chicago Arc Light & Power Co., Chicago, Ill.
Chas Wirt, electrician The Electrical Supply Co, Chicago, Ill.
Howard Wheeler, Thomson-Houston Electric Co., Boston, Mass.
E. A. Willyoung, electrician Queen & Co. Phildelphia, Pa.
E. Y. Wightman, superintendent Electric & Gas Light Co., Danbury, Conn.
Louis Walsh, Crosby Electric Co., New York.
Louis E. Wilcox, manager L. E. Wilcox & Co., Meriden, Conn.
Edwin R Weeks, manager Kansas City Electric Light Co., Kansas City, Mo.
L. C. Whitney, New Britain Electric Light Co., New Britain, Conn.
Frank P. Wisner, Consolidated Fruit Jar Co., New Brunswick, N. J.
Schuyler S. Wheeler, Crocker Wheeler Electric Motor Co., New York.
G. L. Wiley, Standard Underground Cable Co., New York.
Louis R. Wallis, N. E. agent Buckeye Electric Co, Boston, Mass.
Ferdinand A. Wyman, Bridgewater Electric Light Co., Boston, Mass.
R. T. White, Boston, Mass.
J B. Wallace, The Electrical Supply Co., Ansonia.
Prof. J Elfreth Watkins, Washington, D. C.
Leroy S. White, Electric Appliance Co., Waterbury, Conn.
A. Ward Wilkins, Partrick & Carter Co., Philadelphia, Pa.
E. P. Young, Sewickley Electric Co., Pittsburgh, Pa
A M Young, Waterbury, Conn.
Prof. W. A. Anthony, Manchester, Conn.
M. W. Brown, Easton Elect. Supply and Construction Co., New York.
C. B. Burleigh, Thomson-Houston Elec. Co., Boston.
C. S. Bradley, Fort Wayne, Ind.
J. F. Brehert, Mather Elec. Co., Hartford, Conn.
M. J. Brayton, Utica Elec. Light Co., Utica, N. Y.
A. D. Claflin, Claflin & Kimball, Boston.
H. H. Cutler, Walworth Manufacturing Co., Boston.
L. Cofeen, Pittingell-Andrews Co., Boston.
F. E. Donohue, Sawyer-Mann Elec Co., Boston.
L. W. Dillon, Steam and Electric Co., North Attleboro, Mass.
H. M. Daggett, Jr., Steam and Electric Co., North Attleboro, Mass.
F A. Gilbert, president Boston Electric Light Co., Boston, Mass.
J. J. Gates, Perkins Electric Lamp Co., Hartford, Conn.
James F. Kelly, Edison General Electric Co., New York.
Geo. B. Prescott, Jr., Kerite Wire, New York.
O. S. Platt, New England Switch, Bridgeport, Conn.
C. G. Perkins, Perkins Lamp Co., Hartford, Conn.
H. C. Robinson, Camden Lighting & Heating Co., Camden, N. J.
L. S. Robinson, San Francisco, Cal.
A. Schawel, of Jas. Schawel & Co., New York.
N. O. Smith, Eastern Electric Supply & Construction Co., Boston, Mass.
S. F. Taylor, New York.
H. M. Trainer, Chas. M. Trainer & Co., Boston.
D. F. Urquhart, Thomson-Houston Carbon Co., Fremont, O.
F. H. Wilkins, Western Electric Co., New York.
L. J. Wing, Thomson-Houston Electric Co., Boston
Edward Weston, Weston Electric Inst. Co., Newark, N. J.

FORMAL OPENING OF THE EXHIBITION.

The exhibit of electric appliances commemorating the decennial of the commercial use of electricity held by the National Electric Light Association, was formally and successfully launched upon its three days' course Tuesday evening by the officers of the Association, with the assistance of ex-Gov. Ladd and the little daughter of Supt. Thomas of the Narragansett Electric Lighting Company, who took her part in a pretty ceremony with charming grace. Gen. C. H. Barney, Chairman of the Exhibition Committee and Mr. W. J. Hammer of the committee had been about the hall all day, and by 8 o'clock the last few touches were given, and all the exhibits were practically in order. At 8.05 Gen. Barney stepped to the front of the stage, and under an arch of vari-colored incandescent lamps rapped for order. The electric lamps had been turned off a quarter of an hour earlier, and the hall was lighted only by a few gas jets, which afforded a kind of twilight upon the main floor. The aisles were well filled with spectators, and on the platform were several of the ladies of the Convention. With the remark that it was fitting that an exhibition under the auspices of the National Electric Lighting Association should be opened by its President, he introduced President Marsden J. Perry.

President Perry, in behalf of the citizens, thanked the committee for the exhibit afforded, and in the name of the association for the arduous labors performed. He traced briefly the progress of lighting, from the flames of the fagot to the light of the torch, the floating wick, the candle, to gas, and, finally, to electricity, which has now come to illuminate us, and presented ex-Gov. Herbert W. Ladd to formally open the exhibition.

Gov. Ladd referred to the electricians as a bright and pushing company of men, "For all are young men," he said, "even your veterans are young. The science of electric lighting has had a rapid growth, but the profession stands to-day the peer of the oldest and highest of the sciences or arts. We are all much interested in electric lighting in this city. We believe we build the best engines for electric lighting here, have the model electric lighting station, and have some of the smartest men in the profession in this city, a fact you have proved by choosing one of them for your President." He welcomed the association and declared the exhibition open.

Gen. Barney said the science of electricity has been referred to as in its infancy. It was fitting, therefore, that the veritable act of directing the current which should illuminate the exhibition should be performed by one, who, by reason of her tender years, might typify the genius of electricity, and he presented Miss Bertha Leola Thomas, the five years old daughter of Van A. Thomas, Superintendent of the Narragansett Electric Lighting Company. Little Miss Thomas stood on a raw-hide trunk to enable her to reach the case in which was the plug which should start the lighting circuits. This was inclosed in a glass case fastened to one of the pillars supporting the arch of incandescent lamps, and the whole happy idea was due to the ingenuity of Mr. W. J. Hammer, who had charge of the Edison exhibit at the Paris exhibition. The device used was the plug which closed the circuit which lighted the first incandescent lamps ever run from a central station in the world. This was a station of 3,000 lights capacity at 57 Holborn Viaduct, London, and it was started January 12, 1882. Introduced into the circuit, and immediately beneath the descriptive placard, was a short piece of the first Atlantic cable, given to Mr. Hammer by Cyrus W. Field. The current used through the historic instrument for ringing the buzzer and gong which gave the signal for the actual work of throwing on the light and power currents from the Hirlimann "Champion" battery from the exhibit of the E. S. Greeley Company. The response was instantaneous; hundreds of incandescent lamps flashed into light, a smaller number of arc lamps flooded the hall with clear, white light and the motors gathered speed in a few seconds. Then a little Bedlam broke loose and every one who could get at a fish-horn or a gong blew or banged to suit the occasion. Little Miss Thomas was handed a fine bouquet as she stepped down, and to the music of Reeves's Orchestra the exhibition was under way.

Viewed from the gallery the scene was brilliant indeed. The great massing of incandescent lights attracted the most attention.

EXHIBITS AT THE CONVENTION.

Drake, Payson & Whittier, of Washington and Eddy streets, Providence, dealers in electric light, electric motor and general electric railway supplies, and State agents for Eddy motors, the Loomis system of incandescent lighting and the Hart snap switch, had an interesting exhibit consisting of two Eddy motors of ten horse power at 500 volts and one Loomis dynamo of 100 lights. The dynamo was run by one of the Eddy motors, and the current was used to light 100 Loomis incandescent lamps, which were distributed along the wall in festoons. This firm are the manufacturers of the Russell mast arms. These arms are made of any desired length. The exhibit also included a section of flexible conduit, manufactured by the American Circular Loom Co. of Boston.

The display of the well-known supply house of Alexander, Barney & Chapin was very conspicuous on a platform in the rear of the hall, and a very attractive one it was. On the arch over the front of the platform were 63 A. B. C. incandescent lamps running on the regular 50 volt Westinghouse alternating current. Under the arch were two finely finished Mosher arc lamps made in Chicago. The firm of A. B. C. are the Eastern agents for these lamps, which are designed to be used singly or in series on incandescent direct current circuits of 70 or 110 volts. One of the features of this exhibit was the great variety of the goods. The insulating material handled by this firm, including Fibrone, Alexite, Herculite and Plasticon, were shown to great advantage in frames and cases. Some new devices shown were the Richardson safety automatic cut-outs and double and single circuit cut-outs to be used on series circuits, and the Riser switch. The most interesting part of the exhibit, however, and one of the most notable in the whole hall, was the collection of relics, ancient lamps and fittings, loaned to the firm by Mr. Allen R. Foote, Secretary of the National Electric Light Association. In this exhibit was a lamp dated January, 1881. It has German silver clamps with screw or rivet holding the ends of the carbons, is set in a wooden stem with brass connections and screws into a brass-lined wooden socket, which is keyless. This class of lamps were extinguished by loosening them in the socket. Various other lamps of early form were shown, and this particular part of the exhibit showed in some degree the evolution of the incandescent lamp. The original switch key with which the current was turned on the lamps in the buildings Nos. 449 and 451 Water street, New York, January 15, 1881, was also shown as an historical curiosity; also safety plugs introduced December,

1881. The general exhibit of the firm attracted considerable attention and was very complete. It included lamps, keys, sockets and pretty much all of the easily portable goods handled by the firm. Mr. David Chalmers had charge of the exhibit.

Queen & Co. of Philadelphia occupied a large space on the stage. The firm was represented by Mr. E. G. Willyoung, and the exhibit was a most attractive one. It included resistance boxes of all grades, Siemen' selectric dynamometers, and Thompson's double coil reflecting galvanometers. There was also shown a magnetic vane ammeter, which instruments are made of any range by this firm. One is now being made for 1,500 ampere current and can be made to 2,500 amperes. Other instruments on exhibition were portable testing sets; chloride of silver batteries; reading telescopes for galvanometer work; a Sir William Thompson standard electric balance, direct reading; speed counters; Cardew volt meters and a large assortment of electric keys. There were many other instruments displayed, and the whole exhibit was a beautiful one, owing to the excellent appearance of the instruments, their finish being of the highest order.

The Narragansett Electric Lighting Co., of Providence, had an elaborate exhibit right in front of the main entrance of the Hall, in charge of Mr. L. W. Downs. The display consisted in its main features of the exhibit used by the Brush Company at Baltimore, at the recent Masonic Bazaar. It embraced incandescent lamps of all sizes, from 16 to 100 c.p., and of various colors; surmounting all was the Masonic Square and Compass designed with incandescent lamps, and under this were the letters N. E. L. C., made up of similar lamps. Under this, on a board, was a lamp design of a key-stone with large lamps grouped about it. A stage regulator was used to vary the light of the lamps in the key-stone, which were of a brilliant blue color. The principles of the transformer were practically illustrated, and were very interesting to the large crowds present. On a bracket on each side of the stall was a Tesla Alternating Current Motor, which attracted a good deal of attention. These machines, as is well known, run without commutation or brushes, and in this instance fans were driven by them.

The C. McIntire Co., Nos. 13 & 15 Franklin Street, Newark, N. J., was represented by Mr. C. McIntire. Mr. McIntire exhibited a line of their celebrated connectors, terminals and specialties. These connectors are well-known for their efficiency, and are made of the best lake copper. They have the full indorsement of the best electrical experts in this country and Canada, and their continued and increasing use on the leading electric light systems is the clearest evidence of their merit. From 50 per cent. to 100 per cent. less wire is required in making joints, and there is as much saving in time and labor. The joint is good for all time and is neat in its appearance. All joints on the long distance telephone lines are made with these connectors, which make the joint more enduring than the wire itself. A double pole switch and cut-out combined was also shown by this company. This is a new device just brought out.

The Bernstein Electric Company, of Boston, had a fine display on the platform or stage in the rear of the hall, of switches, series lamps and a new series socket, which presents several advantages over the old. A new potential indicator, direct reading, for continuous and alternating currents was also exhibited. Mr. George R. Lean, superintendent of the company and Mr. W. C. Fish had charge of this exhibit.

The Sperry Electric Company, 195 to 207 Canal street, Chicago, exhibited a fine line of goods. These included a magazine fuse with four fuses; single and double pole switches, circuit breakers, a 150 ampere railroad switch, electric lamp holder for gas fixtures, rosettes, etc. These goods were finished in antique copper and presented a very effective appearance. The same company also exhibited a Sperry automatic regulator for dynamos, which was finished in a fine manner; also an Ellis oil filter. A new arc lamp was also in operation, which burns as long as there is a current reaching it. It cannot be extinguished. The exhibit was in charge of Mr. C. E. Gregory.

The Russell Electric Company of 85 Water street, Boston, Mass., exhibited a number of their 10 and 24-hour single carbon arc lamps, in which the upper carbon takes the form of a disc four and a half inches in diameter. The feed of the rod carrying the disc is accomplished in the usual manner by the vibration of the armature, and by a rack and pinion arrangement. The upper electrode is made to revolve as it descends, and thus to burn evenly about the centre. The disc is claimed to present a much greater surface of contact than when two pencils are used and a stronger and more steady light is claimed from it. The representatives of this system said the disc could be burned down to the size of a half dollar. The lower pencil is from 9 to 15 inches long, according to the length of the lamp, and a saving of several inches of carbon resistance is claimed.

The Bryant Electric Company of Bridgeport, Conn., had a finely ornamented board fitted up with a variety of the Bryant double-pole switches from 15 to 50 amperes capacity. On their counter were a large number of the switches of smaller capacities, Bryant lamp sockets, porcelain rosettes and numerous other specialties manufactured by this company. Mr. W. C. Bryant had charge of the exhibit.

The Electric Engineering and Supply Company of Syracuse, N. Y., had an attractive exhibit of general supplies, including a large variety of lamp sockets and switches for any system, clocks for automatically putting out arc and incandescent lights at any designated hour, and numerous other useful devices of a like nature. Among the goods exhibited by this firm was a lamp socket the insulated parts of which consisted entirely of air-spaces and porcelain so tough that the other portions of socket could be riveted to it without even cracking the porcelain. The company had its initials formed of small glow lamps over its exhibit, giving the whole a very tasteful effect. The company was represented by Mr. F. H. Leonard, jr., manager; J. L. Hine, superintendent, and Percy A. Clisdell, salesman.

The Standard Electric Supply Company, of 180 Summer Street, Boston, represented by W. E. Stow, had a large exhibit of their own specialties as well as those of other firms for which they are agents. Their exhibit consisted of carefully calibrated electrical instruments, volt and ampere meters for central station and laboratory work. For the John A. Roebling's Sons Co., they exhibited a case of wire, ranging from the ordinary trolley wire to the heaviest cables. One of these was an all-copper cable built for a supplementary cable for the St. Paul and Minneapolis Electric Railway. They also exhibited a variety of switches made by the Star Electrix Company of Philadelphia, Pa., and O. S. Pratt of Bridgeport, Conn. They also displayed samples of the New England Switch, and "The Standard" electrical instruments, including voltmeters and ammeters. This company is also agent for Kerite wire.

Pass & Seymour, of Syracuse, N. Y., were well represented by Mr. A. P. Seymour in their neatly arranged table of chinaware for electric specialties, a class of goods claimed to be of as high a grade as any made. Mr. Seymour reports a very active demand for his goods, and has recently received one order from the Thomson-Houston Electric Company for 100,000 pieces.

The Gould and Watson Company of 35 Hartford street, Boston, Mass., had an extensive exhibit of their molded mica insulators which, are said to be formed while in a plastic condition and set by the agency of heat. Upon the top of the ornamental show board was a section of trolley line, with mica insulators of Sprague, Thomson-Houston and Gould & Watson pattern, all fitted with the firm's patent clip and yoke, which holds the wire firmly without the use of solder. For this material it is claimed that there is no sulphur in its composition, no oxidization is possible, it is not brittle and is practically unbreakable. Line hooks, which screw into pole arms, were shown, taking the place of rubber hooks, also keyless lamp sockets of the same molded mica. Washers and bushings are made of a different composition of mica, and these may be tapped, drilled and sawed like hard rubber. Screw-drivers with insulated handles were also shown; also pull-offs for trolley lines. These devices have important and valuable features. They are very strong and have excellent insulating properties, and are, moreover, unbreakable.

The Thomson-Houston Electric Company of Boston, Mass., had a number of their recording watt-meters for both direct and alternating currents and a variety of lamps on exhibition. Some of the meters were mounted in finished brass-framed cases, glazed plate glass, giving them a very handsome appearance. A number of these meters were in actual operation in other exhibits, including one on a C. & C. motor of 500 volts; an alternating current meter with Swarts & Gannett's exhibit, and a 500 volt meter with the Jenney motor exhibit.

The Jenney Electric Motor Company of Indianapolis exhibited a three horse power motor and a one horse power motor, each taking current at 500 volts, and a one and three-quarters horse power motor taking current at 110 volts. Sectional carbon brushes are used on all motors. The Jenney motors are reversible, that is, they may be used as dynamos as well. The exhibit was in charge of Mr. Charles D. Jenney, the developer of the Jenney systems.

The Jewell Belting Company of Hartford, Conn., represented by W. L. Graves, had a number of their leather belts on exhibition, among which was a 40-inch double belt, made for the Toledo, Ohio, Electric Street Railway, and a sample roll of railroad and dynamo belting. On one side of their exhibit was hung a leather belt showing the tanning and the quality of the leather, on which was marked off a cut for a belt five feet one inch in length.

L. E. Wilcox & Company of Meriden, Conn., exhibited their "Speed" electric wire stretcher, for which they have applied for a patent.

Albert and J. M. Anderson, of 21 Hamilton street, Boston, showed the Boston trolley arm as applied on the cars of the West End Street Railway. Besides this they exhibited supplies of all kinds for the electrical transmission of power by over-head wires. Over 1,500 Boston trolleys are now in use all over the country. The clip this firm use for the trolley wire requires no soldering.

The American Electrical Works of Providence, R. I., had an exhibit of wire of nearly every conceivable size, from the smallest magnet wire to the heaviest cables. The spools containing the insulated wires were arranged to get the most artistic effects from the colored insulation, giving a very harmonious appearance to the exhibit.

A. W. Harris Oil Co., 110 and 111 South Water street, Providence, manufacturers of valve oil for internal and engine oil for external lubrication, also dynamo and high speed machinery oils, had a full display of these goods. Their A. W. Harris valve and engine oils, as well as their dynamo oil, have been used by the Narragansett Electric Lighting Co. of Providence, R. I., since the inception of the company, and they have been so satisfied with these lubricants that they have renewed their contract for the coming year's supply. The American Electrical Works of Providence are using these lubricants, as well as the New England Butt Co., with excellent satisfaction. The Harris Co. is said to be the largest suppliers of oil for electric light plants. Their souvenir sample cases given away at the electrical exhibition have undoubtedly found their way into many electric plants, and should be followed by a trial order, which this company stands ready to send on approval and agree to pay transportation both ways if not satisfactory.

The Standard Underground Cable Company was represented by Mr. J. W. Marsh, Vice-President and general manager, Mr. George L. Wiley and T. F. O'Connor. An extensive exhibition of this company's celebrated cables and wires was given, including samples of their No. 4 cable for arc and alternating incandescent lighting, of which size there are 1,750,000 feet now in use. They also showed a sample of the Conner cable, which effects great economy in duct space. They consist of 10 No. 4 B & S. gauge conductors under one lead cover, with 7-32 inch insulation between them. The outside diameter of the cable is but 1 3-4 inches. Another notable sample was of an electric power cable with a cross section of the conductor of 846,000 circular square mils—or nearly an inch in diameter. The display included aerial wires of all sizes and styles of make up. There are 100,000 feet of the company's duplex No. 3 B. & S. gauge Waring electric light cables in use by electric light companies in New York City alone Plenty of literature was handy in testimony of the excellence of the Standard Underground Company's goods. The display attracted considerable attention. The New York office of the company is in the *Times* Building.

The Bryant Electric Company, of Bridgeport, Ct., was represented by Mr. W. C. Bryant, who had an excellent and artistically arranged display of the goods made and handled by his company. The well known Bryant "D. P." switches formed a feature of the display. There were also on exhibition Bryant sockets, rosettes, wall sockets and other specialties.

The Great Western Supply Co., of Chicago, was represented by Mr. Geo. Cutter, and had on exhibition samples of a few of the many goods handled by that company. Mr. Cutter had a line of trolley fixtures, shades, pole-tops, arc lamp hangers, and porcelain specialties. The Great Western Supply Co. are the Western agents for the Bryant switches.

The Eureka Tempered Company, of North East, Pa., had an excellent display of their meritorious goods, under the charge of Mr. A. L. Daniels. The exhibit included commutator segments, finished and unfinished, brushes and a soldering iron of special make, the copper being cast around the iron handle, making a firm joint. A case was exhibited containing various articles of copper, gotten up for the Franklin Institute of Philadelphia. Various samples were shown of parts that had been in actual use on dynamos showing the excellent property this Com-

pany's product possesses of resistance to wear. A tender-truck bearing was exhibited, which had been in actual use on a locomotive on the Pennsylvania R.R. The engine had run 155,000 miles and there was no perceptible wear on the copper bearing. The usual bearings of brass are worn out after a run of 47,000 miles. The Eureka Tempered Copper Company make castings of solid pure copper of any desired pattern, absolutely free from blow holes.

The Pettingell Andrews Company of No. 192–202 Summer street, Boston, had a large variety of supplies for electric lighting and electric railways on exhibition, under the charge of President F. E. Pettingell with Mr. T. G. Swift, as assistant. This firm as agents of the Okonite Company exhibited a large variety of Okonite specialties of that company, including a number of coils and sections of wires and cables; key and keyless sockets and receptacles; Okonite and Manson tape, branch and main cut-outs and many other goods in their line. This firm are exclusive agents in the East for the Okonite Co., the Electrical Supply Co., of Ansonia; Bryant Switches, Paiste Switches, P. and B. Compound; Universal Arc Lamp, Cutter's Specialties; Brennan Connectors, Novelty motors and are the sole manufacturers of "K. W." specialties.

The Washburn & Moen Manufacturing Company of Worcester, Mass., had an ornamentally arranged exhibit consisting of a large variety of bare and insulated iron and copper wires and cables.

The B. & S. Electrical Equipment Co., 115 Broadway, New York, exhibited a line of switches, rosettes, cut-outs and electric railway supplies. Mr. N. Bushnell represented the Company.

The Simplex Electrical Co., No. 620 Atlantic Avenue, Boston, had a display of wires of their own make of different sizes. Mr. Geo. F. Talcott looked after the company's interests.

In one of the large parlors at the Narragansett Hotel, Claflin & Kimball, No. 116 Bedford Street, Boston, had a very fine display of the goods dealt in by that firm. They are the New England agents for the Mather Electric Co:, Perkins Electric Co., and Perkins Electric Switch Manufacturing Co. The exhibit consisted of lamps of various candle powers and voltages. They make switches of six sizes, from 10 amperes up to 100; also lamp bases to fit all sockets. These switches are of 6 points, 3 points and 2 points. Several gentlemen connected with the firm were present, including Mr. A. D. Claflin and Mr. M. M. Kimball.

The New York Insulated Wire Co., No. 649 and 651 Broadway, New York, had a large and attractive display of insulated wires, cables and tapes, for which the company is celebrated. "The Nation's Choice," otherwise Grimshaw White Core, was conspicuously displayed. The company was represented by Mr. J. W. Godfrey, the general manager, who displayed considerable taste and ingenuity in the arrangement of his goods in the hall. The New York Insulated Wire Co., through Mr. Godfrey, will shortly offer to the trade a complete system of wire ducts for interior wiring of buildings. These tubes or ducts are to be known as "Vulcanoid Electrical Wire Ducts," and the material will be non-inflammable, water-proof, and a perfect non-conductor. It is not affected by extreme heat nor cold, is pliable, and is as smooth as glass. It is not affected in any manner by plaster. The compound is the invention of Mr. Geo. H. Meeker and the system of Mr. A. Noll, both gentlemen being connected with the company. It is reasonable to suppose that the demand for the "Vulcanoid Electric Wire Duct" will equal that for the celebrated Grimshaw white core wire, if the reputation of the company may be taken as a criterion, and no one questions that.

The Thermal Electric Company, of Gloucester, Mass., exhibited the Thermal Multiple Protector for telephone and telegraph circuits, which is manufactured by this company This protector opens the line permanently only on dangerous currents; it protects, but does not open the circuit in case of lightning; no ground wires are used: it protects as low as 2-10 of an ampere, and can be placed either in or outside of the building. Mr. L. B. Favor, mechanical expert and electrician of the company, had charge of the exhibit.

The Safety Insulated Wire & Cable Co., No. 234 West 29th St., New York, had a large display, in the charge of Mr. W. G. Sellers, of underground cables and wire. Over two million feet of this company's underground cable has been in use in New York for about two years, and no trouble whatever so far has been experienced. There are also eight million feet of this company's overhead wire in use at the present time.

The Phœnix Glass Co., of Pittsburgh, Pa., had one of the most elegant exhibits in the hall. under the charge of Mr. E. H. Peck. The New York office of this company is at No. 729 Broadway. The exhibit consisted of incandescent lamp shades of all kinds, crystal, etched, delicate tints and tinted tops; also a line of rich cut, flint and opalescent shades. The company are making a specialty of silver etching, which goods are attracting a great deal of attention. One of the features of the exhibit was a display of 35 "Stalactites" hung on the arch of the upper gallery, in front of the main display of the company. These "Stalactites" are shades of various colors and forms for incandescent lamps, much artistic skill being displayed in their design They were rich in color and etchings and some were of clear cut-glass. One of the most conspicuous parts of the exhibit was an 18 inch round ball of cut-glass, containing an electric incandescent lamp; the beauty and richness of these globes may be appreciated from the fact that they sell for $100 a piece, or $1200 a dozen.

Howard Bros. of Boston, the New England Agents for the C. and C. Motor, had a two horse power motor running on a 500 volt current with a Thomson-Houston meter in circuit. The exhibit was in the charge of Mr. H. A. Howard, of the firm.

Fairbanks, Brown & Co., of Boston, had a display of steam specialties in the charge of E. B. Williams, manager, and F. L. Patterson. Valves and packing in several varieties constituted the chief feature of the display.

The Shultz Belting Co., St. Louis, Mo., exhibited six raw-hide belts—three of them link belts and three flat belts. The construction of the link belt is well known. It is made up of small leather links, which are riveted together, not with metal rivets but rivets made of leather. A pulley covered with raw-hide leather was also shown, the leather being drawn tightly over the pulley's face by malleable iron clamps. The advantages of this covering are, ease of application; no rivets to tear the belting; no cement to loosen and release the cover from the pulley; exclusion of air from between pulley and cover; extreme durability; less wear and tear on dynamos and belting; oil consumption decreased, and increase of power transmission. Mr. J. A. J. Shultz, the head of the company, Mr. W. P. Mullen and Mr. R. F. Clark from the Boston office of the company, were in attendance at the exhibition. The New York office of the company is at No. 225 Pearl St., and the fact that this company's belts are so generally used is sufficient evidence of their valuable qualities. They are used very extensively and give the utmost satisfaction.

The Electrical Supply Co., of Chicago, was represented by Chas. Wirt, the electrical engineer of the company. Quite a large display was made of the electrical specialties handled by the company including the Sunbeam Incandescent Lamp, Habirshaw Rubber covered wire, Wirt Standard Volt Meter and Volt Indicator, the Bradner Adjustable Lamp Hanger, Wirt Lighting Arrester, Double Break Feeder Switch, Bassett Combination Portable Bracket fixtures for Incandescent Lamps, Ceiling Rosette and Switch, Arc Lamp Insulating Hanger, etc., etc. This house is sole agent for Hercules Trolley Wire for electrical railways and the Shield Brand of Moisture Proof Line Wire.

The Washington Electric Conduit Co., Washington, D. C., exhibited several sections of earthenware conduit for electrical conductors.

Russell A. Denison, President of the Denison Electrical Manufacturing Co., Providence, R. I., had an exhibit of underground conduits, cables and insulated wires.

The Standard Paint Co., of New York, displayed the well-known P. & B. electrical compound for insulating wire, insulating tapes, armature varnishes, water-proof paper for winding armatures and "Ruberoid," a new substance resembling rubber which will mix with rubber and may be used in liquid form for insulating purposes.

The E. S. Greeley Co., of Nos. 5 and 7 Dey street, New York, had a very attractive, and one of the finest and most artistic displays in the whole hall. It was under the general supervision of Mr. Frank A Magee, and the instruments exhibited were looked after by Mr. C. P. Frey, of the Greeley Electrical Laboratory, Albany, N. Y. The company had a full line of testing instruments of a most superior quality and fine finish. A board was hung up in the rear of the stall showing electrical specialties, and an easel supporting a case with samples of wire and conductors, was placed on the inside of the counter. On one counter was a large show case, containing various styles of measuring and other instruments, and a similar case was placed on a second counter. On one of the cases were placed two miniature Bartholdi statues, the torches of which were kept lighted by primary batteries under the counter. It is a noteworthy and interesting fact that the current which was used to sound the buzzer at the official opening of the exhibition, Tuesday night, and also to ring the official bell, was generated by a Hirlimann "Champion" Battery, which was supplied by the E. S. Greeley Co.

The Walker Electric Co., of No. 50 Broadway, New York, had an attractive exhibit of their recording ammeters and direct reading voltmeters and ampere meters, all of which were in actual operation. Samples of the photographic records made by these instruments were distributed. The exhibit was looked after by Mr. George W. Walker, vice-president and general manager of the company, and Mr. C. R. Truex.

Messrs. O. N. Bender & Co., 102 Orange street, Providence, exhibited some patent electric cable supporters, made in brass and zinc.

Green, Tweed & Co., of No. 83 Chambers street, New York, sole agents of the Western Carolina Mica Co., exhibited some samples of the mica produced by this concern. Mr. W. H. Platt, of the firm of Green, Tweed & Co., was in charge. Mr. Platt informs us that the mines of the Western Carolina Mica Co. have an area of 20,000 acres in North Carolina, and are very rich in mica deposit. Mr. George A. Blood, of New York, is president of the Western Carolina Mica Co.

Mr. H. T. Paiste, 12th and Market street, Philadelphia, had a neat exhibit of his celebrated Paiste Switches, sockets, decorated china switches and many other specialties in which he deals. Mr. Paiste himself and Mr. J. F. Chamberlain were in attendance. The Paiste specialties were tastily arranged on an easel.

Messrs. Chas. A Schieren & Co., the well-known manufacturers of oak leather belting and lace leather, No. 47 Ferry street, New York, had an exhibit which was in charge of Mr. Chas. A. Schieren, Jr., and E. P. Atkinson of New York, and George Hamblett of the Boston agency. The exhibit consisted of samples of perforated belting. They report a big run for their goods from electric railway people.

The American Oil Company, 66 and 67 South Water street, Providence, was represented by Mr. S. W. Davis, who exhibited some samples of the excellent goods manufactured by this company. They consisted of Crescent Oil, Dynamo Oil, Eagle Valve Oil, Special Cylinder Oil and Electric Engine Oil.

The Universal Arc Lamp Company, of 49 West 22 street, New York, had an exhibit of two Universal Arc Lamps on incandescent circuits. They were hung on Russell Mast Arms and attracted considerable attention by the beauty of the light they gave and its steadiness. This exhibit was successful in proving the practicability of using arc lamps on incandescent circuits. Mr. E. S. Mendels, the general manager of the company, was present in person and had charge of the exhibit.

A new Steam Turbine Motor, of which Mr. Howard P. Elwell, Providence, R. I., is general agent, was shown in the rear of the hall. This motor is specially adapted for running dynamos, and a 25 horse power machine weighs only 105 pounds. The steam pressure used is 100 pounds and the machine is very compact. The principle upon which it works is the same as that of the water motor, steam simply being substituted for water. These motors give great satisfaction in practice and have been used by the government for the propulsion of torpedoes. Mr. Dow, of Cleveland, Ohio, the inventor of the motor was also present.

The Crosby Electric Company had a fine exhibit on the platform in the rear of the hall, of their celebrated dry battery for open circuit work only, also of Hussey batteries. The exhibit was in charge of a colored man in uniform. His uniform was decorated with gold bands, brass buttons, etc., and the name of the company he represented was conspicuously worked in gold on his cap and on each coat sleeve. The uniformed colored man himself attracted a good share of attention, and the advertisement the company got through him was very great. The colored man and the exhibit were in the charge of Mr. Louis Walsh, who, with his activity and pleasing address, made many friends for himself and the company. The principal office of this company is Nos. 87 and 89 South 5th avenue, New York.

The Electric Construction and Supply Co., of No. 18 Cortland St., New York., was represented by Mr. R. B Corey, manager, and Mr. J. C. Knight. They had on exhibition some of their celebrated arc lamps; one of these lamps burning on an incandescent circuit of 110 volts taking 8 to 10 amperes. They may be run two in series. The Company also had on exhibition an Alternating Current Arc lamp, taking 8 amperes of the Westinghouse 50 volt secondary current. This lamp burns $\frac{7}{16}$ inch carbons, and will burn for 9 hours.

One of the most attractive exhibits was that of the New England Butt Co., and it was the only large piece of machinery in operation at the exhibition. It was the new machine for covering fine magnetic wire, and was devised by Mr. John McCahey who was in charge of it. This machine was run by a Thomson-Houston 1½ horse power motor. Three braiding machines for covering electric light wires were also on exhibition.

Mr. C. S. Van Nuis of 76 Cortland St., New York, was present, and had a very attractive display of his celebrated Ajax Switches of single, double and three poles, for 100 to 500 volt circuits and 100 to 600 amperes. He also showed for the first time his new Ajax lightning arrester. The arrester consists essentially of a revolving drum composed of insulating material, carrying eight fusable strips. These strips at one end are connected with the overhead line wire by the well-known means and at the other end is attached a carbon disc. These discs come directly under a carbon plate in succession as the fuses melt. This carbon plate is attached to a stationary arm and is made adjustable—in practice being set about $\frac{1}{64}$ of an inch from the discs on the rotating drum; this latter arm is part of the upper journal of the arrester, and is connected directly with the ground wire. When the fuse is melted proper mechanism is started and the drum revolves far enough to place the next fuse in position in the line automatically. This operation is repeated in the same manner until all the fuses are destroyed. The whole of Mr. Van Nuis' apparatus was effectively displayed on a board, having a background of black cloth. The instruments were screwed to the board, and the whole was hung up against the wall in a conspicuous place in the Hall.

The Weston Electrical Instrument Co., of Newark, N. J., had a beautiful display of their well-known instruments, in the charge of Mr. E. A. Colby. The exhibit comprised about 40 instruments of all varieties for measuring electric power of a capacity ranging from $\frac{1}{100000}$ of a volt to 6,000 volts and in amounts from $\frac{1}{10000}$ to 3,000 amperes. The needles of these instruments have jewel bearings and the readings are direct. As they are "dead beat," much time is saved in their use. The accuracy of these instruments is their most important feature, and they stand in the front rank of measuring instruments.

The Illinois Electric Material Co., 339-341 Rookery, Chicago, distributed catalogues of electric railway supplies and specialties, in which this company are large dealers.

Mr. W. D. Packard, Secretary and Treasurer of the New York and Ohio Company, Warren, Ohio, was in attendance. He had samples of the Packard High Grade Incandescent Lamp which this company manufactures. These Lamps have a guaranteed life of 1,200 hours, and the filaments are unbreakable. There is no blackening or discoloration of the bulb. The lamps are made in the Sawyer-Mann pattern, and the filaments are manufactured by a secret process.

The Standard Electric Time Co., of 739 Chapel Street, New Haven, Conn., exhibited the "Warner System" of electric time and Warner's patent electric gauge. The time system insures correct and uniform time. Warner's patent pocket electric gauge was also exhibited. This gauge is intended for testing the current strength of both open and closed circuit batteries, and is set to indicate the condition of single cells.

Mr. Arthur W. Denis exhibited an electric pin for insulators, invented by Wm. E. Joslin. This pin has many advantages of the old form. The old style breaks off at a force of 750 pounds, while the Joslin insulators have a strength of 1,150 pounds. This pin is so designed as to shed all moisture and water, which feature avoids the rotting usual in the old style.

Swarts & Gannett, of Providence, had a noteworthy exhibit, the prominent feature of which was the National Transformer, of the National Electric Light Company, of Eau Claire, Wis., for which concern Swarts & Gannett are the New England agents. This transformer is circular in shape, and has a detachable base, which permits the cutting out of both primary and secondary circuits for the purpose of replacing fuses. This exhibit included an Edison phonograph which reproduced music to the delight of the crowds present. On the ceiling, above the Swarts & Gannett exhibit was a gigantic fly with wrought iron head and wings and body of a ruby incandescent lamp. The lamp shone with great brilliancy, and the novelty attracted much attention. Among other things exhibited was a battery of accumulators and switches of the Electro-Dynamic Co. of Philadelphia, better known as the "Edco" system.

The American Circular Loom Company, No. 620 Atlantic avenue, Boston, Mass., exhibited samples of a Flexible Glass Electric Conduit, invented by Mr. Alexander P. Wright. The much desired qualities in a perfect conduit are flexibility, insulating properties and a tendency to resist fire. These have all been obtained to an eminent degree in this Flexible Conduit. It consists of a flexible glass tube, perfectly water-proof and practically fire-proof; it is enclosed in a strong woven jacket, giving it a high tensile strength and strong abrasion resistance, the conduit is then soaked in an insulating material making it thoroughly water proof.

Mr. Maybin W. Brown, president of the Eastern Electrical Supply and Construction Company, No. 65 Oliver street, Boston, Mass., was in attendance at the convention looking after business in a general way, as was also Mr. Albert Otis Smith, treasurer of the same company.

Howard Bros. managers for the New England office of the C. & C. Electric Motor Company, No. 63 Oliver street, Boston, Mass., were represented at the convention and expatiated on the excellence of the C. & C. Motors for driving ventilating apparatus, elevators, printing presses, sewing machines, organs, etc. These motors are superior to steam or gas engines by reason of their cheapness, efficiency, durability and cleanliness

The Audubon Machine Works, No. 31 and 41 Whitney Street, New Haven, Conn., manufacturers of Electric Motors, Incandescent Dynamos, etc., was represented by Mr. J. F. Denison, the electrician of the company. The Denison Automatic Electric Motor made by this company is a very compact and efficient machine, and possesses some very excellent qualities.

The Standard Paint Co., of No. 59 Maiden Lane, New York, had an exhibit of their paints and P. & B. electrical compounds, on the gallery in the front of the Hall, in charge of Mr. Frank R. DeRonde The P. & B. Compounds are well known for their excellent qualites for electrical work: they are water-proof, weather-proof and acid proof and are excellent insulators.

The National Electric Protector Co., of No. 18 Broadway, was represented by Mr. C. E. Sanford. These devices insure perfect protection against lightning and all excessive electrical currents. They automatically protect from ¼ ampere to 250 amperes.

The T. M. Foote Regulator Co., of 271 Franklin street, Boston, Mass., had a representative at the convention, and exhibited an intermediate speed regulator. This device is entirely novel, and will render the speed obtained from engines, water wheels, gas engines, etc., or any other irregular power perfectly uniform and even. It is as efficient as the best governed high speed engines. These regulators are especially recommended for use in electric light and power plants, where so much is dependent on the uniformity of speed. Another valuable feature of this regulator is that by its use water power is rendered equal to steam.

CONVENTION NOTES.

Lewisohn Bros., of Nos. 81 and 83 Fulton St., New York, distributed souvenirs in the shape of paper weights of copper.

The American Electrical Works of Providence, presented their friends with a novelty in the shape of a little box containing four small cubes resembling chocolate caramels. On taking the paper off, however, they were found to be two pieces of wood neatly dovetailed which, on being pulled apart expanded a strip of paper, accordeon fashion. On this paper were printed various observations concerning the American Electrical Works. Mr. E. F. Phillips, we understand, was responsible for this.

The Cleverly Electrical Works, of Philadelphia, showed their enterprise and good will toward their friends by the distribution of glass desk paper-weight calendars.

Mr. W. C. Smith, superintendent of Fire & Police Telegraph, New Haven, was present during the convention to learn all he could in the interest of the department he represents.

Mr. James F. Kelly was present in the interest of the Wire Department of the Edison General Electric Co., and kept a sharp eye open for business.

Mr. Charles E. Green, practical electrician, and dealer in general electrical supplies, Worcester, Mass., was present at the convention looking for new things.

Two C. & W. Electric Motors were exhibited in practical operation in the lobby of the Narragansett Hotel, and attracted considerable attention through their smooth and noiseless action. They were connected up with the new Crocker-Wheeler Speed Regulator.

Mr. F. A. Stone represented the Aluminium Brass & Bronze Co., of No. 53 Chambers Street. New York.

Mr. W. H. Dyer, formerly of Pawtucket, R. I., and at one time connected with James Davis and Sons, manufacturers of Belting, and Lace Leather, is now associated with the Schultz Belting Company, of St. Louis, Mo. Mr. Dyer has traveled all over the world selling belts.

The Providence Construction Company, 60 Weybosset, and 27 Pine Sts. distributed handbills calling attention to a motor and dynamo installation in a carpet house in Providence. It consisted of a 3 h. p. 500 volt motor made by the Connecticut Motor Co., driving one of their 30 light dynamos to furnish the current for the Germania Electric Manufacturing Co's incandescent lamps.

Joseph Ketchum & Co., of 46 & 48 Lexington Ave., Brooklyn, N. Y., were represented at the Providence Convention. This firm are manufacturers of D. D. insulating paint, insulatifig compound, D. D. and insulating tape. They also use the cold process of casing cables with lead.

Mr. J. R. Burdick represented the H. W. Johns Manufacturing Co. of 87 Maiden Lane, New York. This company are the well-known makers of Vulcabeston and asbestos goods. Electrical construction materia's are some of their specialties.

Mr. Thos. G. Roebuck, sole selling agent for the Insulite Manufacturing Co., of 35 Broadway, New York, was in attendance with an eye to business

The firm of Ahearn & Soper, Ottawa, Ont., had a representative at the convention. This firm deal in telegraph and electric light supplies.

Mr. J. Couillard, Electrical Inspector of the New England Insurance Exchange, 55 Kilby st., Boston, was in attendance in the interests of his company.

Mr. Chas. A. Price was at Providence during the convention, and his many friends were glad to meet him once more.

The Metropolitan Rubber Co., of New York, are manufacturing a hard rubber tubing, known as G. H. M. It is said to be something extraordinary.

Mr. C. A. Benton, manager of the railway department of the Detroit Electrical Works, Detroit, Mich., the Rae Electric Railway System, was present in the interest of his company. He succeeded in making many friends and made a good impression for the system he represented.

William Coupe & Sons, of South Attleboro, Mass., manufacturers of William Coupe's celebrated patent Excelsior raw-hide leather, also Coupe's Celebrated Excelsior Tanned Lace and Picker and the green hide Picker Leather had a representative at Providence. This firm is licensed to manufacture under the Schultz Patent.

George Bruce & Co., leather cleaners, of Bridgeport, Conn., was represented. This firm clean greasy belts by a process which does not destroy the leather, and the belt so operated on cannot be distinguished from a new one. They are having great success.

Mr. T. B. McCoubray, of the Okonite Co., was on deck with an eye open to the interests of the great concern he represented. Mr. McCoubray was at one time Secretary of the National Electric Light Association.

Mr. R. T. White, manufacturer of patented material for street railway road beds, etc., was present to set forth the advantages to be derived by using his goods. His place of business is No. 12 Pearl Street, Boston, Mass., rooms 6 & 7. His New York office is at No. 52 Wall Street, Room 41.

Mr. Jean Wetmore was around with the customary smile on his face, laying plans for future business.

The Western Electric Co., electric light department, was represented by Mr. I. George Kaelber. of Rochester, N. Y. Mr. Kaelber is a very enterprising representative of this well known concern.

Mr. E. Ward Wilkins represented the Partrick & Carter Co., No. 125 South Second St., Philadelphia, Pa. This company are well known manufacturers and dealers in electrical supplies, and have been long in the busines, the original house having been established in 1867.

Mr. F. J. Kuhne, manufacturer of Lubricating Oils for electric machines. No. 18 Front St., New York, was present.

Mr. A. P. Wisner represented the Consolidated Fruit Jar Company, of New Brunswick, N. J. Mr. Wisner was at the convention on business, and made a host of friends for his concern. The Company's office is at No. 49 Warren street, New York.

Mr. Frederick Burton looked after the interests at the convention, of the Ansonia Brass and Copper Company, Nos. 19 and 21 Cliff street, New York. This company are the sole manufacturers of the Cowles Patented Fire Proof and Weather Proof Line

Wire. They are also the makers of the celebrated A. B. C. line wire. Mr. Burton distributed beautiful souvenirs in the shape of an oblong pamphlet containing steel engravings of the various mills and factories of the company. The front cover was made of celluloid artistically inscribed.

Craig R. Arnold & Co., of Chester, Pa., manufacturers of arc and incandescent electric lighting apparatus, steam firictional dynamos for marine purposes, from 15 to 500 lights capacity, search lights to operate on incandescent circuits, steam heating and electric lighting plants for railway purposes, locomotive electric head-lights, train signaling lights, etc., were represented at the convention. This firm is doing a large business in their line.

The progamme of entertainment at the house warming of the American Electrical Works, Providence, R. I., on Thursday, February 19th, was gotten up in a most unique and artistic manner. The cover was made of olive colored chamois skin, and it will make an interesting souvenir of the occasion.

MR. PHILLIPS' RECEPTION.

The culminating event in the 13th annual Convention of the National Electric Light Association was the complimentary reception Thursday night by President Eugene F. Phillips of the American Electrical Works, at his manufactory on Stewart St., Providence. Owing to the increasing volume of business since the establishment of the concern, it has been found necessary to build a large addition to the five story structure, two floors of which were transformed into a brilliant hall for the guests of the occasion.

The ball room was brilliantly decorated and lighted for the occasion. The grand march was begun at 9 o'clock, and at midnight supper was had. The hall closed at two o'clock and every one was well pleased. The whole affair was a brilliant success.

Mr. Howard P. Elwell, the general agent for the steam turbine motor invented by Mr. Dow, was present at the Exhibition looking after the interests of the motor company. Mr. Elwell's headquarters are in Providence.

The Buckeye Electric Co., of Cleveland, Ohio, was represented by Louis R. Wallis, 85 Water St., Boston, the New England agent.

PRESIDENT PERRY'S RECEPTION.

The reception of President Marsden J. Perry at Spink's Hall, Wednesday night, was a brilliant success, and was attended by many distinguished persons, including Mayor Smith, ex-Gov. Ladd, Adj't-Gen. Dyer, President Watson of the Common Council, and many others. Music was furnished by the Hungarian band from New York, and the rooms were crowded to the utmost. The decorations for the occasion were very profuse and beautiful, and after refreshments dancing was indulged in.

DINNER TO MR. HENRY HINE.

On Friday, February 13th, thirteen gentlemen, associated for years in the electrical field with Mr. Henry Hine while that gentleman was district agent of the Westinghouse Electric Company, gave an elaborate dinner in his honor at "The Arena," 31st street, New York city.

By the side of each plate was an illuminated menu with the name of each one present embossed thereon.

After a number of remarks expressive of the high esteem in which he was held by all, and congratulations and good wishes on his acceptance of the position of general manager of the Stanley Electric Manufacturing Company, a beautiful horseshoe diamond pin was presented to him.

The thirteen gentlemen present were: C. A. Bragg, Herman W. Grannis, R. C. Carhart, Henry Hine, Will C. Hine, Alexander M. Moffatt, John N. Noble, B. B. Nostrand, George F. Porter, E. W. Seymour, E. N. Sanderson, Frank L. Townsend and A. Taylor.

Numerous congratulatory telegrams were received from different sources among which were a number from Mr. F. A. Cheney, of Elmira, N. Y., written in that gentleman's usual characteristic style, and to which replies of a like character were sent by the diners.

DEPARTMENT OF PUBLICITY AND PROMOTION.

A department of publicity and promotion has been established in connection with the World's Columbian Exposition, and Mr. Moses P. Handy has been appointed chief. As the work of preparation goes on, articles on the probable character of technical exhibits will be prepared by this department for circulation and publication through the journals devoted to special pursuits.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., Feb. 19, 1891.

Mr. Edward W. Grier, for several years connected with the North American Construction Company, has severed his connection with that company, and taken the position of superintendent of the Southern Electric Light Company of Philadelphia. Mr. Grier was assistant electrician in the construction of the plant in the Hoosac Tunnel; was electrician in the construction of Mr. Westinghouse's lighting plant at Lenox, Mass., and has been connected with the construction and equipment of a number of other leading plants and stations.

Mr. H. S. Winston, President of the Illinois Electric Material Co. of this city, returned Monday from a four weeks' trip through the States of Indiana, Tennessee and Kentucky. Mr. Winston reports the prospects of business in the electric line throughout this portion of the country as brightening, and he succeeded in securing considerable business while away.

The Continental Electric Construction Company has been organized at Chicago with a capital stock of $250,000, to equip, build and operate street railways, electric light and power, and heating plants. The incorporators are: William F. Orrell, Oren I. A. Heat, Leslie C. Orrell.

Commissioner Purdy has given an electric company permission to make a sixty days' trial of electric bridge turning motors on the Rush street bridge, with a view to the adoption of the system if it proves successful.

The Central Electric Company are having a large demand for their new ammeter and voltmeter, illustrated in our columns two weeks ago. Orders are coming in from every section of the country which shows that a reliable and moderate priced instrument of this kind has been needed.

The Central Electric Company report unprecedentedly large sales of Okonite and Improved Candee wires. From the nature of the orders that have already been received, during the month of February, the indications are that a very large amount of high class construction would be done as soon as the spring opens. They have just received the following letter:

"UNIVERSITY OF MICH., ANN ARBOR.
Physics and Electrical Engineering.
Feb. 12, 1891.

MR. F. W. CUSHING, Sec'y Central Electric Co.,
Chicago, Ill.

Dear Sir:—Some time in the latter part of 1887, the Central Electric Company sent me a coil of 1,000 feet No. 18 B. W. G. braided Okonite wire, to be used in measuring insulation resistance. For more than six months of the time since it has been under water in a tank its insulation resistance has increased rather than the reverse. At present it measures 16,100 megohms per mile at a temperature of 17° C. Mr. Patterson, instructor in physics in my laboratory has devised a new and improved method of measurement by which the percentage of error is much reduced. I can, therefore, give the above result with much more confidence than if the old methods had been used. The capacity of the 1,000 feet is 0.082 of a microfarad. Yours very truly,

H. S. CARHART."

The Sperry Electric Mining Machine Company of Chicago, which has made a specialty of furnishing electrical apparatus for mines, and is well known in this line, by reason of its extensive plants in the mining towns of several states, has, the beginning of the present year, added another department to those already organized. The manufacturing business of the Elmer A. Sperry Company, including the tools and equipment, was purchased and arrangements made for manufacturing in still larger quantities, the "Sperry Supplies and Specialties," which have met with such a ready sale in the hands of supply houses and construction men for some years past. These goods have been quietly perfected and manufactured under the watchful care of Mr. Sperry, their inventor, and now include a complete line of incandescent and arc supplies, with one or two recently patented specialties not offered by any other house.

Mr. Frank Ellis, of this city, has devised a new oil filter which has been tested in a very practical way and with very satisfactory results. It will probably be placed on the market at an early date and the public be given an opportunity of judging of its merits.

The Pumpelly Storage Battery Company have resumed business, their financial troubles having been straightened out and ample capital secured to attend to the increasing demands of the storage battery business. The office of the company has been removed to the factory at 205 Canal street, and Mr. E. H. Hill will retain the position of general manager. The Pumpelly company has done considerable business in the past in connection with the use of the phonograph, and their business has increased in this line. The company on its new basis, however, will give especial attention to storage batteries for traction work, as they believe they have the successful battery for that purpose. Some experiments were made some time ago in the line of traction work by this company and the success achieved seems to warrant the giving of especial attention to that line.

It is reported from Milwaukee that Henry Villard has purchased the interests of Messrs. Charles Ray, C. F. Illsley, J. H. Tweedy, Jr., and others in the Edison Illuminating Company of that city. The company will continue under its present organization and management for the present, but it is understood that a new company will soon be organized.

F. M. I.

PHILADELPHIA NOTES.

The new store and show room of Partrick & Carter Co., which is 120 feet long, presents a very attractive appearance. It is lighted by 3 arc lamps and is certainly one of the handsomest stores to be found anywhere in the electrical business. A full line of supplies for almost every branch of electrical industries is kept in stock and everything is arranged in the most systematic and orderly manner. A feature of this store is the lettering of all drawers, cupboards and bins, so that as one walks along the 120 feet of one side of the room he is reminded of "Calland Zincs," "Automatic Burners," "Giant Sounders," "Bronze Pushes," "K. W. Cut-outs," "Perkins Switches," etc., etc., and so on until he has read over a perfect catalogue of electrical supplies. Their factory facilities have been greatly increased by additional machinery and force and they are now turning out their various specialties of annunciators, bells, batteries, etc., in larger quantities than ever before.

The Crandell Manufacturing Company, in their new building No. 12 South Fourth street, are busily engaged in the manufacture of bell, gas lighting and electric light supplies. They will, in a short time, put on the market their "Must Get Up" electric alarm, which is destined to outdo for beauty and reliability anything in the shape of early riser's alarms. Full particulars of this apparatus will shortly appear in this paper. Among their other specialties they have after much experimentation produced a spark coil that gives a nice, big, fat spark. The coil is of extra annealed Swedish iron. Although little attention has heretofore been paid to this part of electric lighting apparatus, it is the most important, as without a good coil there is a great waste on account of the large battery necessary to produce a large enough spark.

Mr. H. T. Paiste, upon the close of the Electric Light Convention, took a trip through some of the New England States, partially on business and partially for pleasure. On his return he expects to jump into the harness at his old stand. While in Providence he got a good many new ideas which he proposes to put into practical form for the benefit of electrical people.

W. S. Griffith & Co., 114 South 15th street, are now constructing an electric light plant for the Tarpon Springs Developing Company, of Tarpon Springs, Fla. There will be about 1,500 lights installed throughout the town. They are also fitting a 40-ton ice machine and water-works for the same company. This firm has also just installed an electric motor for a dish-washing machine at the Colonnade Hotel, Philadelphia.

H. G. G.

AN EFFECTIVE WASTE-OIL FILTER.

We desire to call attention to an inexpensive yet effective Waste-Oil Filter, which is meeting with a very large distribution all over the United States. With this device all waste-oil from any part of the plant can be cleaned of all impurities and be made fit to use over again, and the manufacturers claim that it will return its entire cost in the saving of oil in a few months. Where the drippings from rods in which water is also collected the siphon will automatically carry off the water leaving the oil to be drawn off through the cock as may be needed. To those needing such a device we refer to Hine & Robertson, the manufacturers, No. 45 Cortlandt Street, New York.

LAMP GLOBES.—With alternating currents the lamp globes blacken more than with direct currents, and the lives of the filaments are shortened.

TRADE NOTES.

The Patent Posts for supporting electric light lamps manufactured by P. J. Dinn, of Boston, are such as are in use by the city of Boston, and as adopted by the United States Navy. They are also used in the Washington Navy Yard, as well as the one at San Francisco. They are the only posts which meet the requirements of the government in their advertisements as regards insulation, etc.

Mr. E. M. Carhart, it will be remembered by the trade and electric light and construction companies, invented and introduced some years ago the cable clip bearing his name. The successful introduction of these cable clips has made a demand for the numerous other electric lighting specialties introduced by Mr. Carhart, which will be found fully illustrated in one of the advertisement pages.

It will be pleasant to know that Mr. Fred Angel, well known among all the leading buyers of wire, &c., as well as old electrical manufacturing and supply houses throughout the country, is now representing E. M. Carhart and Co., 18 Custom House street, Providence, R. I., the popular manufacturers of electric lighting specialties. These goods will be found fully illustrated in one of our advertisement pages.

NEW YORK NOTES.

The Crocker-Wheeler Electric Motor Company has been fortunate in securing the services of Mr. William D. Palen as electrician in charge of the testing and inspection of their perfected apparatus in their large factory. Mr. Palen was formerly connected with the Edison Company and is known as a thoroughly capable electrician.

The Crocker-Wheeler Electric Motor Company has secured as sales agent Mr. George W. La Rue, who was long and successfully connected with the Sprague Electric Railway and Motor Company as Agent in the East. This appointment will result in extra large sales of the Crocker-Wheeler perfected motors.

The Providence convention took a great many electrical people away from New York last week. They all seemed to attach a great deal of importance to that particular convention and many of them succeeded in paving the way for a large future trade by attending.

The Standard Paint Co., of New York, are just putting into market some new compounds, possessing high insulating and many other special qualities. They are claimed to be absolutely moisture, acid, and alkali-resisting, will stand a heat of over 350 degrees, and a cold atmosphere of nearly zero, without in either case cracking or melting; in this respect being superior to rubber and other insulating materials. Beside, they have the elastic qualities to such an extent that the name by which the new insulating material will be known is "Ruberoid," in its solid form, and "Ruberine" in its liquid form; the materials can be made both solid and liquid. In its solid form it can be mixed with rubber, with which it readily amalgamates, and the material is likely to prove a very valuable substitute for rubber. The material was exhibited at the National Electric Light Convention, at Providence, and samples of it were furnished to parties for practical tests and demonstration. A great many tests have been already made with the material in various directions, and have been eminently satisfactory.

W. T. H.

FINANCIAL.

New York is without doubt the worst lighted city of any size in the United States with the possible exception of Brooklyn, and it is a matter of public interest to note that a road has been marked out by the Brush Electric Engineering Company in London which must some time be followed here. The Brush Electric Company of Cleveland was scarcely sufficiently advanced to fill an ordinary contract, but had the two masts illuminated in Union and Madison Squares as a big advertisement, with a few arc lamps on the leading streets near by, when Mr. Thomas J. Montgomery, one of the most successful promotors who ever crossed the Atlantic with an American patent to exploit, and to whom the city of London to-day is indebted, after over ten years of negotiating and experimenting for her public light, landed in England with a Brush plant and American skilled electrical labor to install it. He organized the parent company and the first year paid *one hundred* per cent. in dividends, placed a large sum in the reserve fund, paid for all the plant, gave each employé a gold watch and left the management to the English director. Litigation began at once, dividends ceased on the stock and a hard business struggle for financial existence has occupied their full attention up to about a year ago, when it was found commercially possible to resume dividends.

The year 1891 sees the city of London divided into three equal parts for electric lighting, two of them assigned to the Brush Company practically in perpetuity. The Lord Mayor cordially joined hands with the contracting elements and laid the first stone of the first manhole from which the conduit will extend with its electric conductors to every part of the city. That the company will have a monopoly is assumed from the fact that at the boundaries arrangements will be made for tapping either of the three central stations. The contracting party on behalf of the city is the Sewer Commission. It is claimed that London will be the best lighted city in Europe, and another solid electric investment security is added to the list in which Americans can invest if they wish. When will men's money and brains get together and solve this financial and economical problem for the cities of the United States to the profit of all locally concerned?

The Prospect Park and Flatbush Electric Railroad Company have passed a resolution to lease to the Coney Island and Brooklyn road, which runs from Fulton ferry via Smith street to the island. As soon as electricity is adopted on the latter route this will make still another and safe electric security.

At a meeting of the directors of the Westinghouse E. & M. Company held at Pittsburg on the 15th inst., Mr. Westinghouse reported that 37,000 of the 40,000 preferred shares had been subscribed for by the creditors and others, and it was concluded to extend the time to March 1st in consequence. Mr. Westinghouse further stated that the rumors of a consolidation with the Thomson-Houston Company were based on a patent useful to both companies. Preference stock can be had at 50 by all who desire to become interested in one of the largest electrical concerns in the world.

Brokers who during the exciting days of the Gold Board failed to learn that either the Union or Confederate bond *must at some early date* reach par, have had their second lesson and opportunity in the rise and fall of board trading in petroleum. It is no uncommon incident to-day for a whole session to pass without a single sale of oil certificates at the Consolidated Exchange, and the attempt to deal in it at the Stock Exchange never assumed proportions of any great magnitude. Even the use of it for fuel in place of coal, including electric generation, does not appear to create a demand of sufficient importance to retain it much longer on the list. Will some of the astute "I told you so's" inform me what the third lesson will be? I see no reason why electric securities should not supply the inevitable requirement. The legitimate field is more extensive and expansive than gold, silver, oil or mining. This year will see a thousand electric railway companies in operation and many thousand separate light, heat, power, construction and supply incorporations, whose securities as investments will be gilt-edged and over $500,000,000 in volume. It is a common remark that "there is always plenty of capital in New York for all worthy, feasible enterprises." Just now money is easy. If you have not sufficient of it to subsist satisfactorily on the interest paid by Government, one of your next surest is electrics.

Hello! Hello! Give me the ELECTRICAL AGE, Central. Hello! I want the Financial Editor at the phone —Mr. Editor. I notice by your articles, that there is plenty of money in New York for electric investment. I am in a hole and wish pou would help me out a little. My name is Electric Property. I own one-tenth of the capital stock of the Luminous Electric Light Co. We have a six year contract with the town council at a fair price; started the plant up four months ago, and the people are well pleased, pay their bills promptly and new orders are coming in about as fast as we can fill them, but it is of course too soon for dividends yet. I want to realize on part or all of my stock. I have also a contract just signed to light the town of darkness. The town is so situated that we can use either water or steam power, and want about $20,000 to construct the plant, or I will sell and assign the contract. The fact is I must have some money to introduce a complete electric light and power plant system, for which I own some 10 or 12 patents, including dynamos, lamps, "arc and incandescent," automatic regulator, meter, a contrivance showing time and place any lamp is out on the circuit, a cut-out, applicable to all electric circuits, a switchboard, a socketless incandescent lamp, very ornamental and novel, and a meter, which automatically records date, quantity of hours, the day of week, and can be applied to lamps, meters and nearly all electric circuits. Quite a number of these are being infringed, and the life of my patents go on. I understand the electric boom is on and I want a front seat. I have got a lot of stock in a number of electric companies, but although doing well they are not listed or quoted, and I cannot find a Loan and Trust Company which makes a specialty of this class of securities. The note brokers say I must find some personal friend to aid me, and generally recommend me to my partners or the treasurer. If you have clients with the will and ability to relieve me, I will forward full particulars by mail. I congratulate you on the great improvement in the ELECTRICAL AGE and place it at the head of the list of electrical publications. I count my best paying investment to be my half page advertisement in your columns. Good-bye.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE.

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Motor Co.			5.00
American Private Telephone (Parent)	50,000	100.00	98.00
American Telegraph and Cable			82.00
Anglo-American Electric M'f'g Co.			1.00
Averell Insulating Conduit	3,000,000	100.00	6.50
Asbury Park, L. & P.	50,000	10.00	
Ball Electric Light	2,000,000	100.00	
Bell Telephone			191.00
Boston Electric Light			105.00
Brooklyn Edison Electric Light	1,500,000	100.00	100.00
Brooklyn Citizens' Electric Light	500,000	10.00	*120
Brooklyn Municipal Light	500,000	100.00	122.00
Brush Illuminating (N. Y.)	1,000,000	100 00	75.00
Brush Swan E. L. Co. of N. E.	2,000,000	100.00	25.00
Brush Swan, (Ithaca)	50,000	10.00	
Bay Shore, Elec. Light (L. I.)	8,000	50.00	
Consolidated Electric Light			50.00
Complete Elec. Construction Co.	50,000	100.00	175.00
Daft	1,000,000	50,000	
Edison Elec. 5s			*99
Edison General			105.00
Edison Illuminating	4,500,000	100.00	95.00
East River Electric Light Co	1,000,000	100.00	80.00
Edison Elec. Light (N. J.)	1,600,000	100.00	
Essick Printing Tel.	5,000,000	100.00	75.00
Excelsior (N. J.)	500,000	100.00	
Fort Wayne Elec. Light Co	4,000,000	25.00	12.00
Hackettstown Elec. Light (N. J.)	25,000	20.00	25.00
Hudson Electric Light (N. J.)	100,000	100.00	
Harlem Electric Light Co	250,000	100.00	70.00
Hunt Engineering Co. (Brooklyn)	30,000	100.00	140.00
Interior Conduit			75.00
Int. Okonite, Limited	1,700,000	50.00	47-50
Jamaica Gas and Elec. Light (N. Y.)	1,000,000	100.00	95.00
Julien			
Law Telephone			
Long Branch Electric Light	50,000	100.00	75.00
Mount Morris 6s. (N. Y)			*95
Mount Morris Electric Light			90.00
Morristown, L. H. & P.	50,000	100.00	100.00
N. E. Telegraph and Telephone			51.00
N. Y. and N. J. Tel. and Tel 6s			*par.
N. Y. and N. J. Telephone Stock.		100.00	96.00
North American Phonograph			20.00
Newark, L. & P.	150,000	100.00	85.00
Newark, Elec. Light (Schuyler)	100,000	100.00	
Notrh New York, Lighting	150,000	100.00	60.00
Postal Telegraph	5,000,000	100.00	38.00
Postal Telegraph			
Passaic, Electric Light	15,000	100.00	92.00
Paterson, Electric Light	100,000	100.00	
Peoples, Elec. Light, (Trenton)	100,000	100.00	90.00
Plainfield, Electric Light	100,000	100.00	75.00
Port Richmond, (S. I.)	100,000	100.00	80.00
Russell Electric Lamp Co. (Boston)	300,000	100.00	.95
Rockaway Beach Elec. Light	50,000	100.00	80.00
Richmond L. H. & P. (S. I.)	150,000	100.00	75.00
Saratoga Gas and Elec Light 6s			*86
Swan Incandescent	800,000	100.00	2.00
Thomson-Houston Electric Co.			47.00
Thomson-Houston, Pref.			25.00
United Elec. Traction Co			2.50
United States Electric Co			40.00
United States Illuminating	1,000,000	100.00	70.00
United E. L. & P.	5,000,000	100.00	
Western Union	86,188,852	100.00	81.00
Westinghouse Electric Co.	5,000,000	50.00	25.00
Westinghouse Elec. Co. Pref.			50.00
West End, L. (Boston)			22.00
Yonkers, L. & P.	50,000	100.00	92.00

As very few electrical securities are dealt in on the Stock Exchange the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

* Per cent.

OAKLAND, CAL., NOTES.

Oakland will soon boast of being the first city on the Pacific Coast to make electric railroading a success. Two roads are now under construction, and several other companies have made applications for franchises.

The Oakland and Berkeley Rapid Transit, the first electric road, is fast nearing completion, and cars will soon be put on the road, which runs from the water front of Oakland to Berkeley, a distance of about eight miles.

A third road has obtained a franchise to run on various streets of East Oakland.

There is also some talk of the S. P. Co. operating their "Seventh Street" local line by electricity.

The Bargion Compound Rail Company recently brought out the most useful inventions in railroad construction. This is a rail composed of two parts, which when laid, forms a continuous rail. The web of the upper rail lacks an inch from touching the bottom of the space between the flanges of the lower rail. Their patents cover a telegram system, by which a cable of four wires can be run through this space, with attachments for connection with the instruments; or a wire connected with a galvanometer in a dispatcher's office to indicate the location of a derailment or a broken rail.

J. E. Morris, who is secretary of the Company, and also manager of the Western Union Telegraph Company in Oakland, is now in the East in the interest of the new rail.

ELECTRICAL PATENTS.

ISSUED TUESDAY, FEBRUARY 17TH, 1891.

446,417. Conduit Electric Railway. Edward M. Bentley, New York, N. Y. Original application filed Oct. 13, 1887. Divided and this application filed May 18, 1888.

446,418. Electric Line Switch. Edward M. Bentley, Boston. Mass. Filed Feb. 15, 1890.

446,419. Electric-Railway Conduit. Edward M. Bentley, Boston, Mass. Filed Apr. 9, 1890.

446,420 Contact Device for Electric Railways. Edward M. Bentley, Boston, Mass. Filed July 11, 1890.

446,424. Telegraphy. Robert G. Brown, Brooklyn, assignor to the Standard Multiplex Telegraph Company, New York, N.Y. Filed Mar. 6, 1886.

446,425. Telegraphy. Robert G. Brown, Brooklyn, assignor to the Standard Multiplex Telegraph Company, New York, N. Y. Filed Mar. 6, 1886.

446,428. Contact-Trolley for Electric Railways. James B. Cahoon and Isaac F. Baker, Lynn, Mass., assignors to the Thomson-Houston Electric Company, of Connecticut. Filed July 3, 1890.

446,459. Electric-Arc Lamp. John A. Mosher, Abilene, Kans., assignor to the Mosher Arc Lamp Company, same place. Filed July 8, 189c.

446,475. Electric Railway. Nicholas Seibert, Malden, Mass. Filed May 5, 1890.

446,477. Moisture-Protection Hood for Lamps. Andrew Shillinglaw, Chicago, Ill. Filed May 22, 1890.

446,483. Electric-Railway Conductor. Elihu Thomson, Lynn, Mass. Filed May 22, 1890.

446,489. Electrical Measuring-Instrument. Edward Weston, Newark, N. J., assignor to the Weston Electrical Instrument Company, same place. Filed Mar. 17, 1888.

446,490. Rheostat. Edward Weston, Newark, N. J. Filed Feb. 28, 1889.

446,491. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed May 12, 1890.

446,492. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed July 1, 1890.

446,493. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Oct. 14, 1890.

446,494. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Oct. 16, 1890.

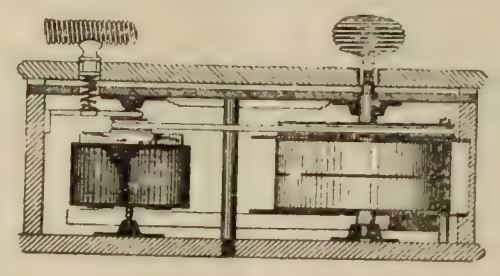
446,509. Electric Lock. Edward J. Colby, Chicago, Ill. Filed May 6, 1890.

446,515. Electro-Magnetic Cut-Out. Ludwig Gutmann, Pittsburg, Pa. Filed Feb. 4, 1890.

446,527. Secondary Battery. Arthur M. F. Laurent-Cely, Paris, France, and Illius A. Timmis, London, England. Filed Apr. 8, 1890.

446,536. Commutator and Brush. Horace F. Parshall, Baltimore, Md., assignor to the Wenstrom Consolidated Dynamo and Motor Company of Baltimore City, same place. Filed July 30, 1890.

446,544. Battery Compound. William Wright, New York, N. Y., assignor to the Wright's Denver



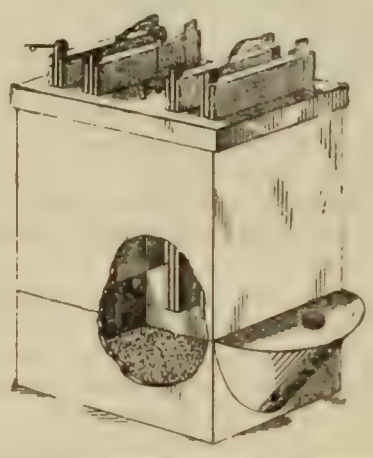
446,661.—MAGNETO-ELECTRIC MACHINE.

and San Francisco Electric Light Company, of Colorado. Filed May 12, 1890.

446,546. Electric Railway-Signal. William S. Cook and Moses C. Cook, South Omaha, Nebr. Filed Nov, 15, 1889.

446,549 Disk-Carbon Holder for Electric Lamps. Edwin C. Russell. Boston, Mass. Filed May 14 1890.

446,613. Controlling Switch for Electric Railways. Frank B. Rae, Detroit, Mich., assignor to the Detroit Electrical Works, same place. Filed Aug. 22, 1890.



446,727.—PYRO-CHEMICAL BATTERY.

446,614. Telephone-Call. David H. Rice, Lowell, Mass., assignor to the Currier Telephone Bell Company, of Massachusetts. Filed October 15 1881.

446,623. Electric Switch George R. Lean, Boston, Mass., assignor to the Bernstein Electric Company, Portland, Me. Filed May 12, 1890.

446,641. Annunciator. John H. Elfering, New Haven, Conn., assignor of one-third to S. Harrison Wagner, same place. Filed Apr. 24, 1890.

446,655. Electric-Conductor Connection. Heinrich Arld, Nuremberg, Germany. Filed Sept. 15, 1890. Patented in Germany, France, Belgium, Austria-Hungary, Italy and Switzerland.

446,660. Carbon for Electric Lamps. William H. Burns, Los Angeles, Cal. Filed July 26, 1890.

446,661. Magneto Electric Machine. George P. Clarke, New York, N. Y. Filed Aug. 23, 1890.

446,666. System of Electric Lighting. Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed June 26, 1882. Patented in England.

446,667. Locomotive for Electric Railways. Thos. A. Edison, Menlo Park, N. J. Filed Aug 7, 1882.

446,668. Electric-Arc Light. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Aug. 7, 1882. Patented in England, Belgium, Italy and France.

446,669. Manufacture of Filaments for Incandescent Electric Lamps. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Mar. 16, 1883.

446,684. Electric Music-Box. Charles A. Hussey, New York, N. Y., assignor to M. J. Paillard & Co., same place. Filed Dec. 29, 1888. Renewed Nov. 25, 1890

446,703. Electric Fire-Engine. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed July 7, 1890.

446,704. Magnetic Pulp-Separator. William C. Edwards, Holyoke, Mass, assignor, by direct and mesne assignments, of one-half to Roswell M. Fairfield, same place, and Oscar S. Greenleaf, Springfield, Mass. Filed Sept. 29, 1890.

446,706. Amalgamating Apparatus. Thomas Gemmell, London, England. Filed Dec. 12, 1889.

446,727. Pyro-Chemical Battery. John Blair, North Orillia, and Alexander G. Hunter, Dundalk, Ontario, Canada. Filed June 25, 1890.

446,730 Induction-Coil. Fred H. Brown, Chicago, Ill. Filed July 21, 1890.

446,732. System of Electric Calls. Jacob B. Currier and David H. Rice, Lowell, Mass. Filed Nov. 13, 1882.

446,767. Magnetic Ore-Separator. Charles G. Buchanan, New York, N. Y. Filed Feb. 25, 1890.

446,801. Electric Regulating-Clock. Désiré Van de Plancke and Gustave Van de Plancke, Courtrai, Belgium. Filed May 21, 1889. Patented in Belgium, Germany, France and England.

446,817. Electrically-Propelled Car. Rudolph M. Hunter, Philadelphia, Pa. Filed Mar. 14, 1889.

446,821. Electric Locomotive. Eben M. Boynton, West Newbury, Mass. Filed Oct. 17, 1890.

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NEW YORK, MARCH 7, 1891.

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THE OVERHEAD WIRE QUESTION IN NEW YORK.

It looks now as if the war on overhead electric lines would be renewed in this city after June 1st next if the wires now run overhead in certain prescribed limits are not placed under ground before that date.

On Friday, Feb. 27th, the Board of Electrical Control adopted resolutions directing the subway company to continue the work of building subways in the streets that are to be repaved, and order all the electrical companies whose wires now run over house-tops to put them in the subways as far as possible.

One resolution authorizes the Mayor to direct the Commissioner of Public Works to remove all poles carrying electric wires of any class within the district bounded by Third and Eighth avenues, and Eighth and 59th streets, including the avenues.

This is a large territory to cover in one sweep, and three months would seem to be a rather small allowance of time in which to complete the work of building subways in so vast an area. If the subway company acts in good faith, and does its best to prepare sufficient subway facilities before the day of destruction comes, doubtless the object of the resolutions will be carried out peacefully, but if the subway company fails to do its part the property of the electrical companies operating the lines involved should be protected. These companies are quite at the mercy of the subway company, and should not be made to suffer for the sins and lapses of the latter concern. The electric companies are willing that their wires should go under ground, but they very naturally and properly consider that they have some rights to be protected. They will meet the subway company half way, but they should have, and are entitled to, fair play and proper consideration.

ELECTRIC HEATING.

Many enthusiasts talk of the possibility and the probability of heating our homes and places of business by electricity. There is no doubt whatever that it can now be done to a limited extent, but it is far from being an economical method of artificial heating.

Prof. Elihu Thomson in the course of his paper on "Memorial Day" read before the recent National Electric Light Convention in Providence, touched on this subject, and gave some exceedingly interesting and instructive facts in this connection.

In answer to the question whether it will ever be possible to heat our houses by electricity, Professor Thomson says: "It is not at all likely that we will ever heat extensively by electricity, unless we can find some way of converting the energy of coal into electricity far more directly and less wastefully than is done in steam engines of the present day."

This is the very point that advocates and promoters of electric heating lose sight of in making claims for the advantages of this system of heating. The fact is, such a method of heating costs nine times as much as it does in the ordinary way. The same fact stated in another way is that to heat by electricity it would be necessary to burn nine pounds of coal to get the heating effect of one pound. This is explained by the fact that under the best conditions, with the best engines made, we realize in electricity about one-tenth of the energy of the coal consumed, "and when we turn that 10 per cent. of electricity into heat," continues Prof. Thomson, 'we simply get nothing more than 10 per cent." It is evident, therefore, to get electric heat equivalent to the heat in one pound of coal it is necessary to burn ten pounds of that mineral.

Electric heating is undoubtedly convenient and the ideal method of artificially warming our places of habitation, but Prof. Thomson has stated the facts in plain terms when he says that it will never be economical until we can transform the heat in the coal directly into electricity without the intervention of boilers and engines.

The practical solution of this problem is one of the things for future development, and he who succeeds in finding out how to do this will be immortalized. Here is a rare chance for some young inventor to reach the zenith of fame.

INSULATION FOR SWITCHBOARD WIRES.

The use of wires with india rubber insulation on electric light station switchboards is discouraged by Mr. T. Carpenter Smith in his able paper on "The Distribution and Care of Alternating Currents," read before the recent Convention at Providence, of the National Electric Light Association, His reason for this is that rubber is too inflammable for use at this particular portion of a plant. On incandescent boards fuses are liable to blow at any moment and draw a heavy arc with them. Under these conditions the use of rubber insulation, while excellent insulation, becomes a factor of danger. A fire once started in this way might lead to very serious consequences. An insulating material, non-inflammable in its nature, or rendered so by proper treatment, is therefore best suited for switchboard uses. The removal of this element of danger would be a great gain in any station, and Mr. Smith's suggestions in this direction are worth serious consideration.

EARLY EXPERIENCE IN ELECTRIC RAILROADING.

A paper of great historical value was that read by Mr. Frank J. Sprague, at the National Electric Light Convention, on the reverses and discouragements experienced in the introduction of electricity as the motive power on the Richmond, Va., street railroad. This road, it is well known, is the pioneer electric railway in this country, and the difficulties that beset Mr. Sprague and his associates in this particular undertaking were, indeed, enough to discourage most men. But Mr. Sprague is a man of undaunted spirit, and lucky it was for the electric railroad that he possessed the quality of perseverance to such an eminent degree. If he had yielded to the difficulties encountered during his Richmond experience the development of the electric railroad would certainly have received a serious set-back. But it is a wise provision of nature that the right man is produced at the right time to undertake a task of momentous importance. Mr. Sprague came forth at the right time to accomplish a task, the contemplation of which would have made most men quail, and he succeeded. What splendid results have followed his victory over what seemed to be impossibilities! The electric railroad as it is to-day, in its splendid equipment and appointments, owes much to the invincible spirit of Mr. Sprague, and his story of his doubts and trials at Richmond will be read with extreme interest.

Had this story been told at the time those things happened, it would have had a serious effect on the development of the electric railway, and instead of the electric railroad being the matured reality that it is to-day, it would have been a stunted and sickly affair. The difficulties experienced, however, were kept secret in the hearts of those directly concerned until the proper time should arrive, when all danger was past and they could divulge their secret. Mr. Sprague chose the Providence meeting as the proper place and time to tell his story, and those who are now successfully operating electric railroads may appreciate how much of their success in this direction is due to Mr. Sprague's indomitable will and enterprise.

IN TEN YEARS.—The address of President Perry at the opening of the National Electric Light Convention was a masterpiece and is of extreme interest to the electrician. It contains much historical data which will be of great value and worth careful preservation. Touching on the growth of electrical industries, Mr. Perry says: "Ten years ago the only electric currents in use were the feeble currents of the telegraph and telephone. There was then not a lineman nor a workman of any kind who had ever heard of the high tension currents we are using to-day for the services of light and power. No man had ever handled conductors carrying such currents, nor manufactured apparatus for operating them excepting in an experimental way. There was not an educational institution giving a course of technical training in electrical engineering. Consider this; then behold what has been accomplished in the first decade of electric lighting." The record of development in this direction during the past ten years is truly wonderful, and who dares to predict what will be accomplished in the next ten years?

THE PROVIDENCE ELECTRICAL EXHIBITION.

The accompanying illustration is of the main exhibition at Union Hall, in connection with the recent ElectricLight Convention at Providence. It is made from a photograph, and is an excellent representation of the exhibits on the floor of the Hall.

On the right are seen two rows of Loomis incandescent lamps, and in the foreground, at the right, is a Russel mast arm, to which hangs a Universal arc lamp.

The names of Queen & Company, Alexander, Barney & Chapin, and Bernstein Electric Company are conspicuous in the rear of the hall. These exhibits were on the stage or platform, and were fully described in our last issue. "The Nation's Choice" *i. e.* Grimshaw White Core Wires, are displayed underneath the name of Alexander, Barney & Chapin. The letters N. E. L. Co., and the Masonic emblems displayed at the left of the illustration were included in the exhibit of the Narragansett Electric Lighting Company, of which we gave a description in connection with the report of the convention in last week's issue.

The exhibition was very largely attended by those present at the convention and outsiders. The hall was crowded at times and it was difficult to move about. The large number of visitors not in any way connected with the business of electric lighting, is evidence that electricity is growing in popularity.

We are indebted to our esteemed contemporary of Chicago, the *Western Electrician*, for the accompanying illustration.

THE WORCESTER EXHIBITION.

On Monday evening, Febuary 23d, an electrical and industrial exhibition was opened at the rink in Worcester, Mass., amid great enthusiasm. Quite a large crowd of distinguished persons were present at the opening exercises. The Mayor of the city, after the speech-making was over, pressed a button which started the machinery of the exhibition in operation. The lighting of the building is done by electricity and the current is supplied by a Loomis Compound-wound dynamo, which was put in under the direction of J. F. McCartney and H. Larned of the Eureka Electric Company, No. 18 Broadway, New York. They also did the wiring of the building. The power is supplied by two Daft motors, aggregating 110 horse power. The Worcester Power Company are agents for these motors. Three 10 horse power Daft motors are employed to run the sewing machines, looms, carpet beaters, planers and all the other machinery run from the shafting. The current for these motors is supplied by a Loomis dynamo.

Among the exhibits is an electric car in practical operation, using Wheeler's double trolley system.

Waters & Glover, of Worcester, Mass., dealers in electrical goods, have an exhibit, as have also the Washburn & Moen Manufacturing Company, of Worcester.

Many other electrical exhibits will be displayed as soon as they can be placed, many of them coming from the Providence Exhibition.

Mr. H. H. Bigelow is the gentlemen who planned and carried the exhibition into effect. In his formal address at the opening exercises, he stated he would offer a prize of $100 for the best motors, to be used on a proposed electric railroad between Worcester and Lake Quinsigamond and for the boats to be used on the Lake.

LOWELL'S NEW ELECTRIC LIGHT PLANT.

The new electric light plant for the city of Lowell, which will soon be in active operation, is one of the largest in New England. It is located but a short distance from the heart of the city and is designed for 3,000 horse power, 1,200 of which is already installed.

The building covers an area of 20,000 square feet, is oblong in shape and two stories high. One fourth of the length and the whole depth is the boiler room, with accommodation for 16 boilers 72 inches in diameter and 17 feet long. The boilers were manufactured by Scannell & Wholley, of Worcester, and set by the Jarvis Engineering Company, of Boston.

The height of the stack is 175 feet and it has a seven-foot flue which runs within 50 feet of the cap.

The remainder of the building is divided lengthwise and consists of three rooms. The engine room contains one 250 H. P. cross-compound Harris-Corliss engine, a 500 H. P. tandem compound Harris-Corliss and a 300 H. P. cross-compound condensing engine. The fly-wheel for the large engine is 22 feet in diameter, with a 53 inch face ; was built in 10 sections and weighs 50,000 pounds. Space is left for a 1,000 H. P. tandem Corliss engine and a 500 H. P. engine, both of which are being built. It is interesting to note that this company organized in 1881 with a capital of $10,000, and started business with two Weston dynamos supplied with power from a saw mill.



VIEW OF THE ELECTRICAL EXHIBITION AT PROVIDENCE, R. I.

AN INGENIOUS WIRE INSULATING MACHINE.

One of the most perfect machines designed for covering bare electric wires with a coating of insulating material, is the "Six Spindle Flyer Winder" that we illustrate below.

This machine is manufactured by the New England Butt Company, of Providence, R. I., who specially constructed it to do accurate work at the highest possible speed.

Either silk or cotton insulation can be used and changes are made from one spool, when emptied, to a fresh source of supply without cutting the wire.

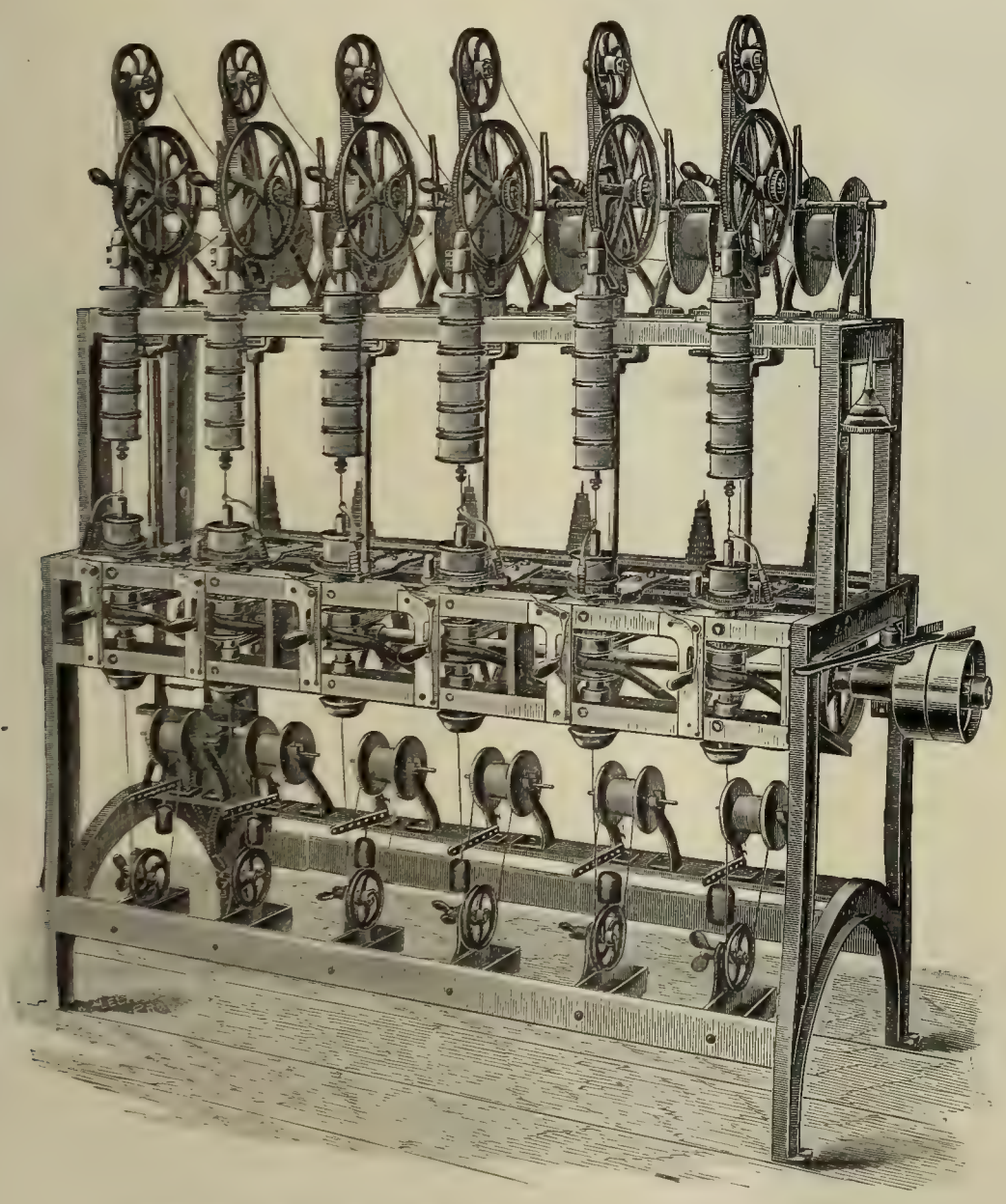
The bare wire on the commercial spool or on a reel is placed on the standards under the machine, a tension regulated by the adjustment of a small weight being applied; it then passes around the small sheave wheel, which is so arranged that it can be lowered down into a pan for holding a solution, if used, and to raise it out of the solution when the machine is not in operation. It then passes up through a spindle, which has a dead centre and protection against oil. The spindle is driven by a quarter-turn belt on to a tight and loose pulley, the loose pulley being chambered and filled with wool to retain the oil for lubricating. The wire then passes up through the disc on which the flyer is fastened, with a counterbalance opposite. The spool is placed on the spindle and the thread carried from it to the flyer and under the drop-wire of stop-motion, then up through the eye of flyer to the winding point, where it is fastened to the wire coming up through the spindle, in the top of which is the grooved guide and support for the wire when being wound. The guide can be finely adjusted for more or less tension and for the lay of the thread. The revolutions of the spindle which carries the spool and the flyer around the wire at a high speed, covers it uniformly and with the smallest fraction of insulation.

Hanging over the thread and in the bottom of the flyer is a drop-wire which when the thread breaks or a spool runs out drops, and extending through the disc, in its revolutions comes in contact with a latch holding up the starting lever, releasing it when it falls, changing the belt to the loose pulley and stopping the spindle; each spindle being independent that one only stops. The spool is slotted, and when it runs out of thread, is raised just above the spindle and taken off sidewise, the wire passing through the slot, a full spool is taken down from the spool-holder above and placed on the spindle and threaded up, when the spindle is ready to go on again.

The wire passing up through the tube or spool-holder, passes around the feed-wheel and over the sheave down on to the reel. The feed-wheel is driven by connections of shaft and gearing with the spindle, making it positive; a variety of changes of speed being obtained by change gears, which is made by a simple and quick arrangement, the hand-nut at the left of the feed-wheel being loosened the wheel is raised up throwing gears out of mesh and the change made, dropping the wheel back to mesh of gears.

The hand-nut on the right of feed-wheel when loosened releases the wheel from the gear and allows it to turn back to repair the wire or to mend a break. The wire is traversed on to the reel by a traverse motion. The machine is driven by a tight and loose pulley, 7 inch diameter, 2 3-8 inch face, and should run 725 revolutions. The machine weighs 500 pounds and occupies a floor space of 5 feet 6 inches by 2 feet 6 inches.

We also give an illustration of the exhibit of the New England Butt Company, at the Providence Exhibition. The winding and insulating machine shown on the left was run by a Thomson-Houston electric motor, which is shown in the picture. At the right hand side of the illustration is shown a cable covering machine of this company's make.

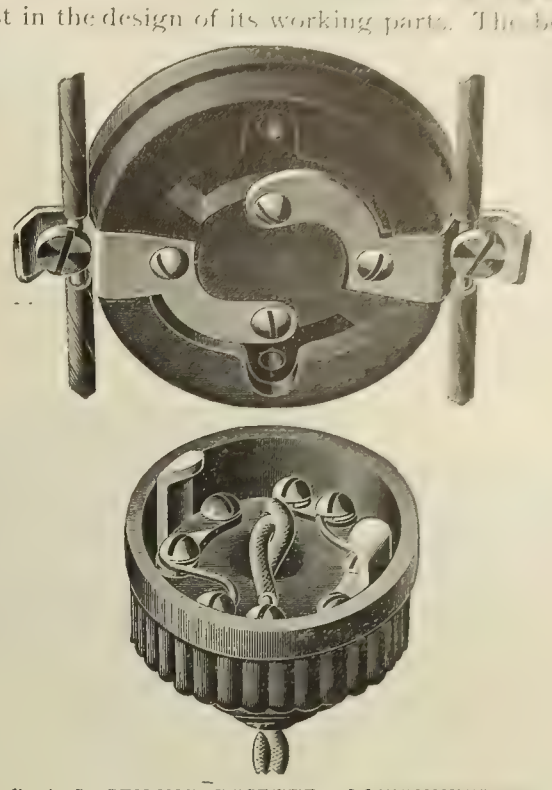


NEW ENGLAND BUTT COMPANY'S SIX SPINDLE FLYER WINDER.

THE B. & S. CEILING ROSETTE.

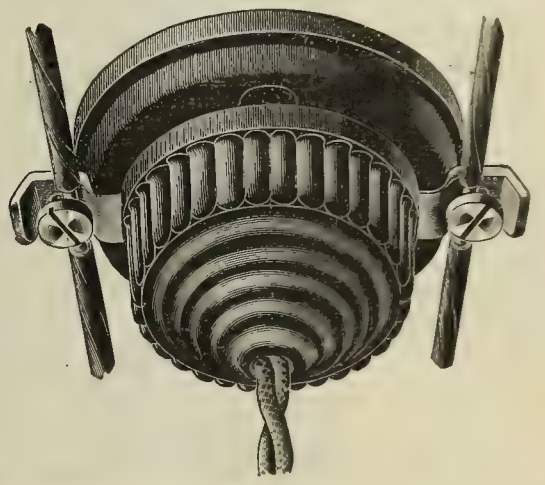
The accompanying cuts represent a new double pole rosette cutout recently brought out by the B. & S. Electric Equipment Co., of 115 Broadway, New York.

This rosette is everywhere acknowledged to be the handsomest on the market, as well as the simplest in the design of its working parts. The body



B. & S. CEILING ROSETTE—DISCONNECTED.

is black in color, perfectly resembling ebony or hard rubber, but upon special orders it will be furnished in any color desired. It is made of a fire and water-proof moulded material which admits



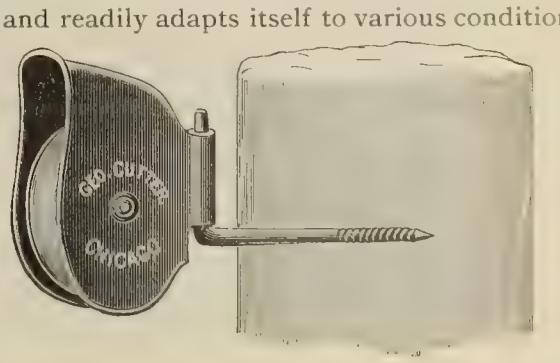
B. & S. ROSETTE—COMPLETE.

of a perfection of finish and accuracy of fitting which cannot be obtained in porcelain. The movable part is heavily ribbed in order to give the wireman a good hold to turn it. The cutouts are large enough for the largest incandescent lamp, as the connecting brasses have two surfaces in contact when the rosette is closed. There are no holes or screw heads showing and the screws for holding it to the ceiling are the only ones that go through the back.

The cuts render further explanation unnecessary.

THE MORRIS SWIVEL POLE PULLEY

Most of the arc lamps now used for outdoor lighting are hung from pulleys suspended over the centre of the street. This method is a simple one and readily adapts itself to various conditions.



MORRIS SWIVEL POLE PULLEY.

The cord for lowering the lamp usually passes over a pulley secured to the pole, and then down to a cleat or windlass. In practice it is found next to impossible to fasten the pulley securely to the pole and yet have it in line with the cord. So the cord scrapes against the edge of the pulley and wears away until the safety of the lamp demands a new cord.

THE NEW PRESIDENT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Mr. Charles R. Huntley, of Buffalo, N. Y., the new President of the National Electric Light Association, is one of the most esteemed gentlemen connected with that organization. We give herewith his portrait, and his many friends who have not had the pleasure of meeting him personally, may henceforth known him when they see him. Our illustration is an excellent one of the gentleman.

Mr. Huntley at present holds the position of Secretary and General Manager of the Brush Electric Light Company, of Buffalo, N. Y., and under his management the company has made material progress and been very successful. He is a very active member of the Electric Light Association, and has done much for the promotion of the objects and interests of that society.



CHARLES R. HUNTLEY, PRESIDENT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Mr. Huntley was born at Winfield, Herkimer county, N. Y., October 12th, 1854. He received a good education in Utica, N. Y., and his first business venture was with the Remington Arms Company. After three years service there, he became interested in the oil business, and in 1883 was agent for the United Pipe Line. In 1888 he went to Buffalo and assumed the position which he still holds.

The election of Mr. Huntley, as President of the Association, gives very general satisfaction, and it is announced that his policy will be a liberal one. It is said that he intends to make the Montreal convention next August a memorable event in the history of the Association.

Our hearty congratulations to Mr. Huntley.

The above picture of Mr. Huntley is taken from the *Western Electrician*, and is an excellent one of that gentleman.

RATIO OF PATENTS ISSUED TO POPULATION.

In the annual report of the Commissioner of Patents for the year ending December 31st, 1890, a table is given showing the number of patents issued to citizens of the United States, with a ratio of population to each patent granted. The figures are quite interesting and instructive. Connecticut stands at the head of the list with one patent to every 796 inhabitants; the District of Columbia next with 980. Mississippi represents the opposite extreme with one to every 23,447; North Carolina is next to Mississippi, having 21,864. Massachusetts stands third at the head of the list, with one patent to every 1,068; Rhode Island comes next, then New Jersey, New York, California and Pennsylvania, in the order named

THE SHULTZ BELTING COMPANY'S EXHIBIT.

We give herewith an excellent illustration of the exhibit of the Shultz Belting Company, of St. Louis, Mo. This illustration was made from a photograph taken by our special artist, and shows several samples of belting, three of which are of the well-known link make. The pulley shown is a sample of the method of covering pulleys with leather. Heretofore it has been customary to drill holes in the face at each edge of the pulley and rivet the leather to it. The objections to this was the difficulty in keeping the air out from between the face of the pulley and the belt. This tended to break the rivets and render the pulley unserviceable.

Another objection to this method, was the fact that so many rivets prevent the proper adhesion of the power belt to the pulley and they also cut the belt. The Shultz covering, however, overcomes all these objections. The covering being wider than the pulley face, its edges are brought over those of the rim of the pulley and fastened by malleable iron clamps. The clamps are placed on the pulley under the rim and drawn together by a bolt which draws the leather tight over the face and edges of the pulley. The well-known link belts of the company are made up of leather links, fastened together with leather rivets. This renders the belt most flexible and durable. It is claimed that the absence of metal rivets prolongs the life of the belt very materially. One important feature in the use of this belt is that the load may be greatly varied; while there is no slipping whatever of the belt, and there is no wavering. When a severe strain occurs, the tight side yields for the moment and the slack side becomes a little slacker and lies this way without any slipping until the load returns to its normal strain. The belt than gradually recovers its uniform position, which is a great deal slacker than any flat belt can be run under the same conditions.



SHULTZ BELTING COMPANY'S EXHIBIT AT THE PROVIDENCE CONVENTION.

ELECTRICAL ENGINEERING AT CORNELL.

A number of instructive lectures have been delivered before the Cornell Electrical Association recently. Prof. E. L. Nichols occupied an hour pleasantly in speaking of his "Experience in Edison's Laboratory at Menlo Park."

At the meeting following, Prof. R. H. Thurston talked in his usual interesting manner upon "High Speed Engines for Electric Lighting Purposes." Prof. Thurston is the author of a work of the above title and his knowledge of the subject is thorough and complete. His lecture was fully illustrated by lantern slides. Professors Moler and Ryan also each occupied an hour, the first upon "Storage Batteries" and the latter upon "Drum Armature Winding." Both were highly appreciated.

The lectures for the next few weeks will be by non-resident speakers. The interest taken in the association has been greatly increased by the inauguration of this course of lectures, and its meetings are largely attended.

Professor Ryan requires of every senior as part of his regular work, the design of a complete electric lighting plant and station for some specified town or city, the date to be based upon the actual requirements of the case.

The performance of the horizontal slit photometer is being tested in connection with the regular senior laboratory work, under the direction of Mr. Genung. Professor Nichols will present the results before the American Institute of Electrical Engineers

The undulatory effect of the current producing the "humming" of alternate current arc lamps is the subject of an investigation by Mr. G. F. Meyers and Mr J. C. McMynn. They employ photographic methods of observing the arc, which is reflected in a revolving mirror.

D. G. Hulett, '89, is at Sodus, N. Y., engaged in electric railway work.

Mr. Calvin Humphreys, R. G. has accepted a position as superintendent of the Englewood Electric Plant, and has resigned his position with the Westinghouse Co.

EXHIBIT OF BRYANT SWITCHES AND WALKER ELECTRIC METERS.

The illustration given herewith is of the display of the Bryant Electric Company, of Bridgeport, Conn., at the exhibition at Providence during the Electric Light Convention.

This company are the manufacturers of the "Bryant" Standard Switches, both single pole and double pole; "Bryant" Rosettes, Orford Rosette Pendants, sockets of all kinds, etc., etc. The double pole "Bryant" Standard Switches are mounted on wood or porcelain bases, and made with extra heavy contacts and wide break; they are finished with nickel-plated caps, and enameled knob. Brass or bronze caps can be had if desired. The company carries a full line of main and branch cut out blocks. The Bryant" Rosette made by this company is of porcelain, double pole, and has a detachable cap containing the fuse. These rosettes are also made in Alexite. The Orford Rosette Pendants are designed to avoid the objectionable features arising from the use of silk cord for suspending incandescent lamps. They are a neat, flexible fixture, easily put up, and possess the advantage of being permanent,

At the right of our illustration is shown the exhibit of the Walker Electric Company, No. 50 Broadway. A row of their well-known direct reading voltmeters and ammeters, are shown above the rest of the exhibit, which consisted of Recording Ammeters, all of which were in actual operation. The Recording Ammeter made by this company was described in our issue of a few weeks ago. The meter consists of an ammeter coil or solenoid, in which an iron wire, in the shape of a nearly complete circle is placed as a core to the same, to which the circle or coil of the ammeter is attached. There is also fixed a light aluminum sector, provided with a fine vertical slot, and immediately behind this sector is a box which encloses the roll of sensitized photographic paper. The screen placed between the sector and the box has a horizontal slot, before which the sensitized roll is made to pass. The vertical slit in the sector is so arranged as to come immediately in front of the horizontal slit in the screen; so in whatever position it may be, it will allow the ray of light to pass from the lamp conveniently placed, on to the sensitized roll. This roll, after a certain time, is taken from the box and developed so as to fix the light impression, and can then be measured up in the same way as an indicator card, and the current consumed calculated at once.

These instruments attracted a great deal of attention among those interested, and they were generally conceded to be most ingenious and reliable instruments.

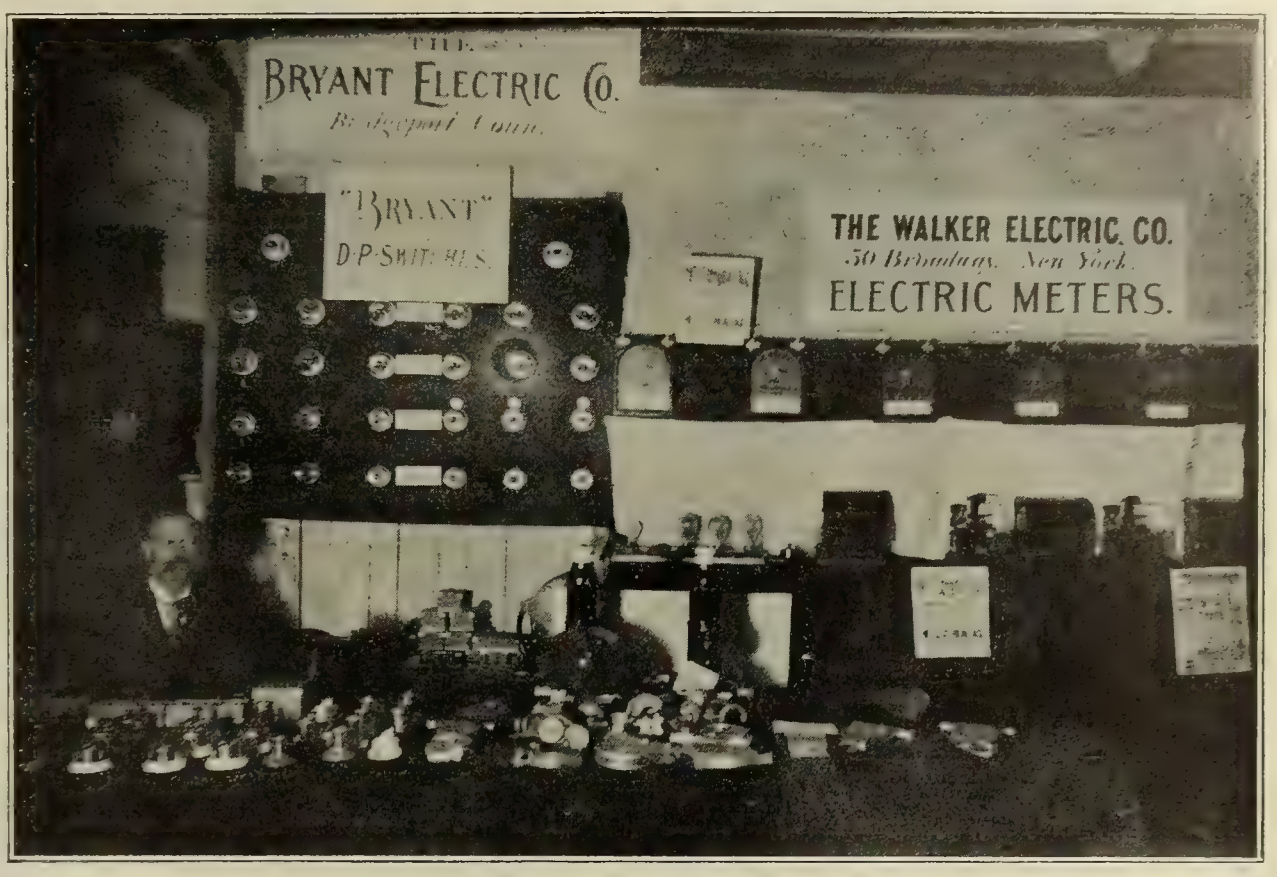
The voltage required to sustain an arc, with large or small currents, ranges from 45 to 50 volts, and the larger the current passing in the arc, the less its electrical resistance.

On each of the two counters formed by the angle of the corner was an elegant show case, containing a full line of first-class and highly finished testing instruments. The workmanship displayed on these instruments was excellent, and their elegant finish attracted a great deal of attention. As is well known, the instruments manufactured by this company are extremely accurate and well made.

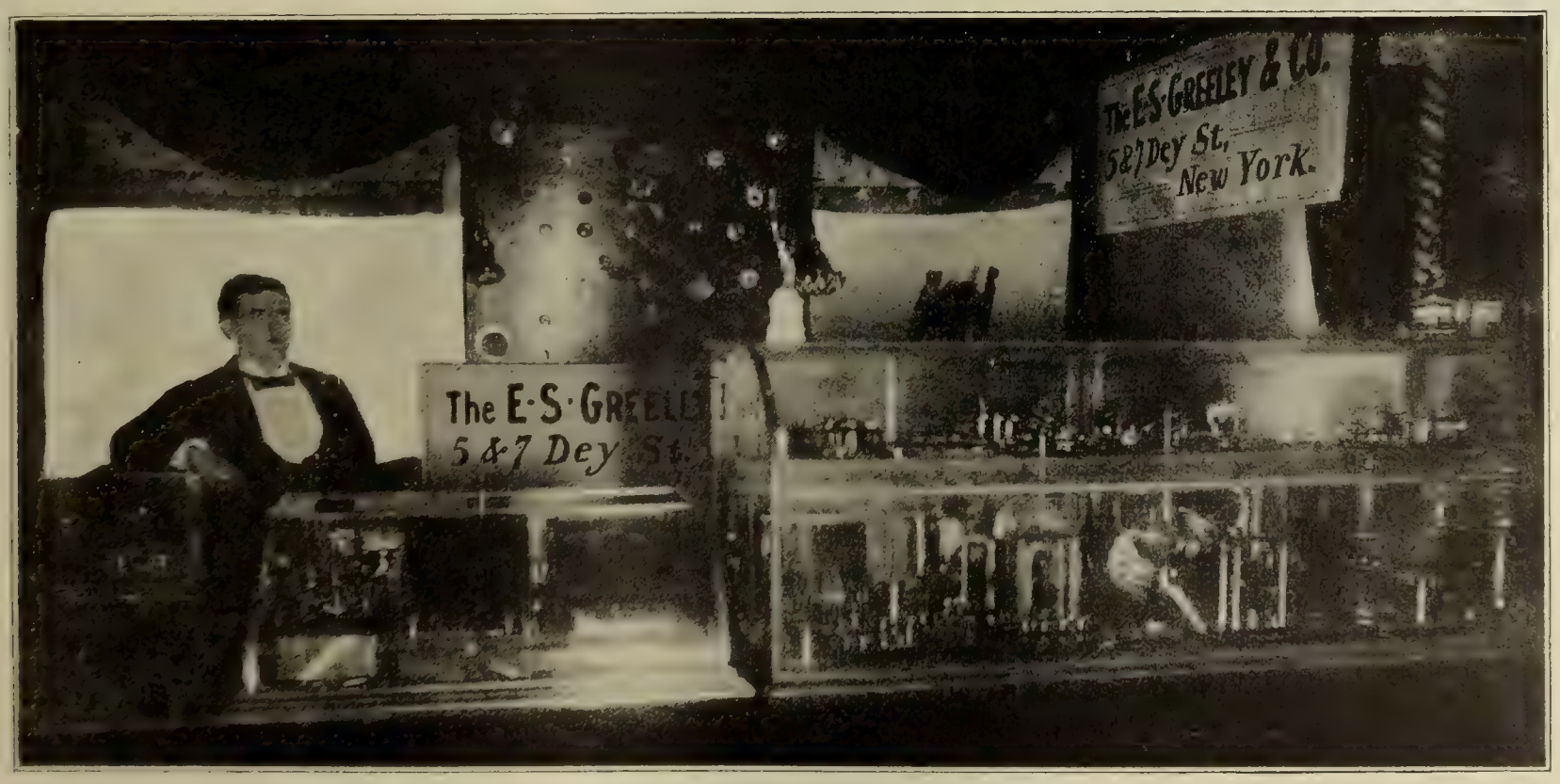
An illustration of this exhibit is given herewith which shows the large showcase on the main aisle. In the rear of the space is a board to which are attached cut-outs, lamps, etc., pertaining to incandescent electric lighting.

Mr. C. P. Frey, of the Greeley Electrical Laboratory, Albany, N. Y., was in attendance at the exhibit most of the time, explaining the features of the various instruments under his charge.

Mr. Frank A. Magee, whose picture is included in the illustration, had general charge of the Greeley interests at the convention. He exhibited considerable ingenuity and taste in the arrangement of his goods and no doubt the result of his labors will be of material benefit to his company. Mr. Magee is well known for enterprise and has a fertile brain for novelties.



TWO OF THE EXHIBITS AT THE PROVIDENCE CONVENTION.



THE EXHIBIT OF THE E. S. GREELEY & CO. AT THE PROVIDENCE CONVENTION.

THE E. S. GREELEY & CO'S EXHIBIT AT PROVIDENCE.

At the electrical exhibition at Providence, during the recent Electric Light Convention, one of the most attractive and noteworthy exhibits was that of the E. S. Greeley & Co., of Nos. 5 and 7 Dey St., New York. Their space was on the corner of the left hand aisle, and that across the hall at the rear. On the showcase seen in the front of our picture, is a miniature Statue of Liberty, the torch of which was a small incandescent lamp, fed by primary batteries placed under the counter.

THE GENIUS OF ELECTRICITY.

We give below the photograph of little Miss Bertha Leola Thomas, who turned on the current for the electric lighting circuits at the formal opening of the electrical exhibition at the Providence Convention of the National Electric Light Association. This little Miss is the daughter of Mr. Van



MISS BERTHA LEOLA THOMAS.

A. Thomas, Superintendent of the Narragansett Electric Lighting Company, and is five years of age She was selected by General Barney to perform this interesting duty as typifying the genius of electricity. When she turned the switch hundreds of lights blazed forth in all their glory, and the occasion was one long to be remembered.

ELECTRIC LIGHTING SPECIALTIES.

The recent convention in Providence revealed the fact to many that there is a wonderful stock of ingenuity and enterprise in that city in the electric field. Mr. Van A. Thomas, the superintendent of the Narragansett Electric Lighting Company, of Providence, may justly claim a prominent place at the head of the long list of inventors scattered throughout the country.

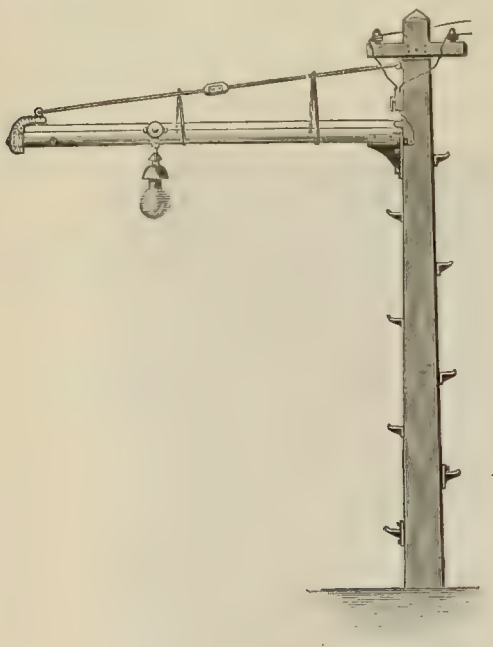


FIG. 1.—MAST ARM.

The superb plant of the Narragansett Electric Lighting Company was the admiration of all in attendance at the convention, and its excellent condition is undoubtedly due, to some degree, to the close attention to the little things.

Mr. Thomas is the inventor of many devices for use in electric lighting operations, a few of which we herewith illustrate.

Fig. 1 is a mast arm of this gentleman's invention. It is simple, strong and durable and is made of two pieces of L iron, which are used as conductors as well as for the track to carry the lamp out over the street. These tracks, with the supporting brace, are insulated from the pole, dispensing with the cable, which has always been a source of annoyance, as well as incurring continual expense. A switch is placed on the pole to switch out the lamp circuit while the lamp is being trimmed. Fig. 2 shows a section of the arm. An ingenious contrivance is shown in Fig. 3. It is a tree insulator by the use of which the line is kept in a normal position while the tree is allowed to sway in the wind, thus relieving the wire of all strain.

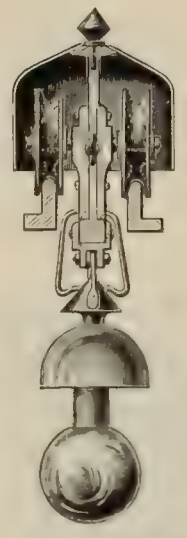


FIG. 2.—MAST ARM.

Nothing so mars the appearance of a shapely pole as the insertion of spikes to be used as a ladder for linemen to climb. These are bad enough, but when the pole is hacked to pieces and perforated by the spurs ordinarily used by linemen, it is a great deal worse. To overcome these objections Mr. Thomas has invented a device which is shown in Figs. 4 and 5. These are detachable steps for the use of trimmers, and they do away with the necessity of the trimmer carrying a ladder in addition to his load of carbons. A socket is fastened to each side of the pole, and the trimmer taking two small steps places one in each socket, goes up the pole, trims the lamps, comes down, takes out the steps, replaces them in his pocket and goes to the next lamp post, and so on, thus accomplishing a greater amount of work. Fig. 4 shows the pole with the steps being placed ; Figs. 5 shows them in place.

All of these specialties are made by E. M. Carhart & Co., No. 18 Custom House street, Providence, R. I.



FIG. 3.—TREE INSULATOR.

PUBLIC USE AND SALE OF INVENTIONS.

It is very generally understood that, in order to avoid the operation of laws relating to public use of a device for which application for a patent is made, inventors must regulate their movements with profound care and secrecy. This is an error. The law, as now defined, allows the public use and sale of inventions for nearly two years prior to the application. If, however, during the time of such public use any party besides the inventor shall have made and used the same device, the law will protect him in the prior use which he has had, but not in any further manufacture after the date of the inventor's patent.

SECOND CENTURY OF THE AMERICAN PATENT SYSTEM.

Under the auspices and supervision of the President and Vice-President of the United States, the Secretary of the Interior, Commissioner and Assistant-Commissioner of Patents, the ex-Commissioners of Patents, Congressional Committees of Patents, U. S. Senators and Representatives,



FIG. 4.—POLE STEP BEING PLACED.

prominent Public Officials and Representative Inventors and Manufacturers throughout the country, all of whom have given their adhesion thereto, and from whom active participation and support are assured, there will be held in Washington, D. C., on the 8th, 9th and 10th of April, 1891, a National Convention, celebrating the beginning of the Second Century of the American Patent System. This will be an essentially national affair, and cannot fail to result in great good to inventors, manufacturers, and the whole business of the country.

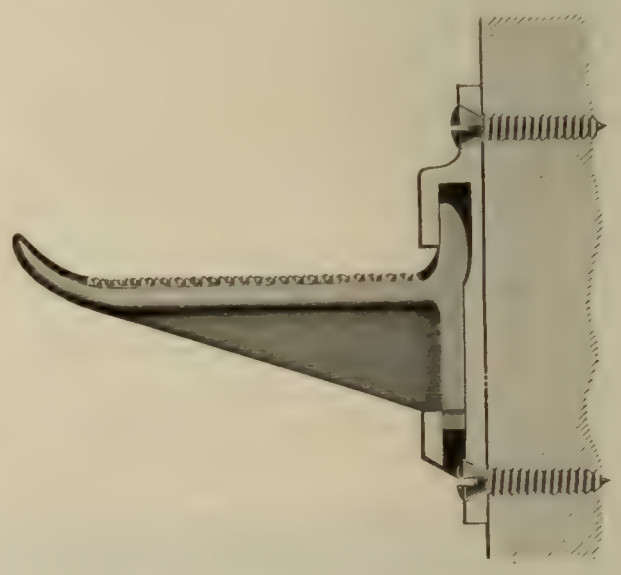


FIG. 5.—POLE STEP IN PLACE.

The objects of this convention are, among others, to organize a National Association for the mutual benefit of inventors and manufacturers; to secure a proper recognition of the rights of inventors; to operate to secure the perfection of the patent system; improvement in the practice of granting patents; increasing the protection afforded inventors and the owners of patents; removing existing obstacles in the way of a more thorough administration of the Patent Bureau; obtaining a more thorough knowledge of and improving the great advantages already derived from the patent system by all the varied industries of the country.

LAMPS IN PARALLEL.—If arc lamps are connected in parallel, as on low potential incandescent mains, special devices are required to keep the current supplied to each lamp at the right amount.

ALTERNATING CURRENT DYNAMOS.—Alternating current dynamos are easiest run separately and not in multiple arc.

INSULATION.—Keep dynamos well insulated, but put collectors to lead off static electricity from the bolts.

SWITCHBOARDS.—Have your switchboards so that circuits and dynamos can be easily and quickly charged. It is a great mistake to crowd switchboards too closely.

THE PRACTICAL APPLICATION OF ACCUMULATORS.

STORAGE BATTERIES FOR TESTING.

BY E. V. BAILLARD.

At the factory of the Okonite Co., at Passaic N. J., the Accumulator Company of New York installed a small but very interesting plant of accumulators for use in testing cables and wires.

The plant consists of 74 cells of the 5S type accumulators, the smallest size made, having a capacity of 6 ampere hours each, and a rate of discharge of 2 to 3 amperes, at an E .M. F. of 148 volts.

Special attention was given to the installing of these cells so as to insure a very high insulation, and for this purpose the battery rack shown in the accompanying illustration was erected.

It consists of vertical boards carefully coated with shellac, and supporting iron rods run through vulcanized rubber washers and covered with Okonite tubing. The accumulators are placed between



ACCUMULATORS AT OKONITE FACTORY, PASSAIC, N. J.

these, about one inch apart, and are suspended thereon by the projection on each side of the cell due to the peculiar construction of these accumulators when it is sought to reduce the space required to a minimum.

The terminal wires are brought to a switchboard shown at the left of the engraving. This switchboard is mounted on hard rubber rods which in turn are fastened to a shellaced board held against the wall.

The cells shown at the lower part are 5 of the 23 M type accumulators, having capacity of 150 ampere hours, and are used for lighting small incandescent lamps for the reflecting galvanometers. The "Spot" obtained is so clean and bright that it excites the admiration of every one seeing it.

All these batteries are charged from the lighting circuit. As the voltage of the lamp circuit is only 105, which would not be sufficient to charge the 74 cells, there is mounted on the switchboard a switch wherewith at one movement the cells are thrown from one series of 74 cells connected to the testing-room wires to two series of 37 cells each connected in multiple to the lamp circuit for charging. As the pressure then required for charging is only 70 or 75 volts, two 34-volt incandescent lamps shown at the top of the switchboard are included in the charging circuit of each half.

In the charging circuit of the 5S's and of the 23 M's are two automatic break switches which automatically cut the cells out of circuit when the dynamo is stopped. The current for the 23 M's is regulated by the rheostat shown at the bottom of the engraving.

The ammeter shown in the centre of the switchboard can be inserted at will by the aid of a flexible cord and plug switches, either in the circuit to the lamps, or in the circuit of the 23 M's, or in that of the 5 S's, either in multiple or in series, so the current in all parts of the circuit can be ascertained at any time.

In the engraving the ammeter is shown inserted in the main charging circuit.

The insulation of the entire plant tests very high, being 60,000 megohms.

Mr. Varley, electrician of the Company, whom I had the pleasure of seeing some time ago, speaks in the highest terms of the performance of the battery; in fact he would not for anything be without it. He tells me that by a contrivance of his own design a fault which brings the insulation down to 2 megohms per mile (which they consider a serious fault and which sometimes only amounts to a microscopical piece of some foreign material in the insulator) can not only be detected but located in 25 seconds. Only those who know of the enormous number of wires and cables tested daily at this establishment can form any idea of the immense benefit accruing from this system of testing.

The accumulators have been in successful operation for nearly two years.

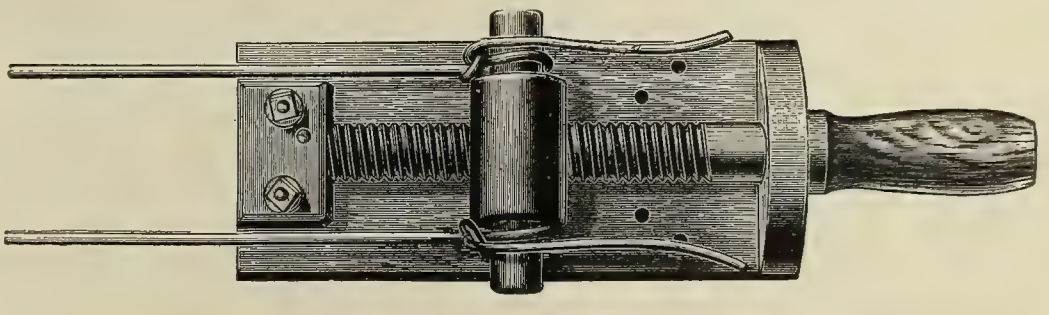
Comparing this plant with the central station plant described in the ELECTRICAL AGE of February 21st, the wide range of the uses of accumulators is readily apparent.

I would like here to mention that in the beginning of the article describing the plant at the Waterloo central station, (page 101) it should have read "an accumulator installation consisting of two series of 63 cells each of the 15 L type;" not simply of 63 cells, etc.

A PATENT WIRE STRETCHER.

Wiremen and all parties engaged in running wires for electrical purposes cannot fail to appreciate this innovation in the line of construction tools, recently placed upon the market by L. E. Wilcox & Co., of Meriden, Conn. It is claimed that by its use one wireman can do the work ordinarily requiring two. The work is done with great neatness and facility, and is not an eyesore, as by old methods.

To use the stretcher it is only necessary to fasten it to the ceiling at one end of the line by means of screws, then, after fastening the wires at the other end of the line by means of cleats or porcelains, the ends of the wires are passed around the ends of the wooden nut and the wires are stretched by turning the screw until the wire is perfectly taut and all kinks have disappeared. Cleats and rosettes are then put in place, and the stretcher may be taken down. The next span is proceeded with in like manner.



WILCOX'S PATENT WIRE STRETCHER.

A NEW FLEXIBLE CONDUIT.

Among the many electrical appliances invented in recent years, few have found a more ready market than the many systems of conduits or tubes used for the insertion of the electric conductors conveying electric currents in buildings.

So greatly do they facilitate the handling of wires that architects and electrical engineers have seized upon the idea and few new buildings of any importance have been erected of late years without a complete system of interior conduits.

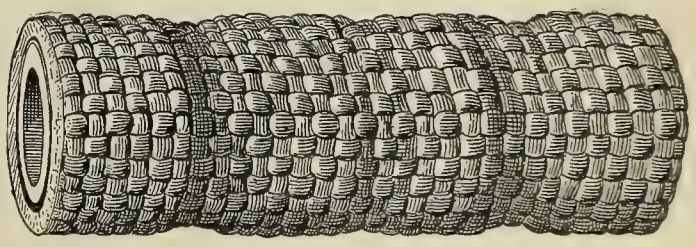
To be of much practical use they must have good insulating and fire resisting properties, and the more flexible they are, so much less is the expense and labor involved in an installation of this kind. In fact, flexibility has a direct bearing on the cost, as it does away with innumerable joints; but besides this, the placing of interior conduits in *old buildings* is possible without cutting the walls for the whole surface, it only being necessary to cut the mop board on the floor and "fish" the conduit over the entire building.

The best insulator in use is glass; besides this, glass will resist the internal heat caused by the accidental short circuiting of the wires.

It follows from this that a *flexible glass conduit* would be as nearly perfect as anything we can conceive of, and this is exactly what Mr. Alex. P. Wright, a well-known electrical engineer, has invented. After much study, and a multitude of experiments, Mr. Wright has produced a flexible glass tube, perfectly waterproof, and practically fire-proof. It is enclosed in a particularly strong woven jacket, giving it great tensile strength, and strong abrasion resistance. The whole conduit is then soaked in an insulating material, making it thoroughly waterproof. We give a cut showing a piece of the conduit in a finished state.

The system of connections is as simple as any that can be devised, and the cost for a large building for this item will be quite small.

Mr. Wright, with a number of well-known manufacturers associated with him, will at once put this valuable invention on the market.



FLEXIBLE GLASS CONDUIT.

The American Circular Loom Company, 620 Atlantic avenue, Boston, have undertaken the manufacture of this new conduit.

ELECTRIC RAILWAY NOTES.

The Brooklyn City Railroad Company, has applied for permission to operate a surface railroad on the electric trolley system, between 39th street, Brooklyn, and Bensonhurst, in New Utrecht, L. I. The road will be six miles long, two miles being within the city limits. The posts will be of iron, 17 feet high and 6 inches in diameter, and will be placed on the inside of the curb line on each side of the street. If no legal obstacle is interposed the road, it is expected, will be in operation about the middle of June.

The plant and cars of the Danville Electric Street Car Company of Danville, Va., were destroyed by fire recently and the town was deprived of street car service. The loss on building, cars and machinery was estimated at $29,000.

The fall of resistance with the increase of current, has an important bearing on the construction of dynamos for arc lighting, and the running of lamps on constant potential or incandescent circuits.

DISTRIBUTION AND CARE OF ALTERNATING CURRENTS.

At the conclusion of the reading of the paper by T. Carpenter Smith on "The Distribution and Care of Alternating Currents," at the recent Electric Light Convention in Providence, R. I., the following discussion ensued, which will be read with interest:

DR. MASON.—You refer to the practice in Great Britain. I remember Mr. Musgrave told me he would not permit converters to be outside of the building.

MR. SMITH.—There is one reason for that. I was very much surprised in reading over some of the Board of Trade rules in England, that converters must be enclosed in a tight wooden case or tight iron case or something of that kind, and we now find that the English practice is not to put the converter as sold by the company in an iron shell. As regards the actual material of the Ferranti converter as Mr. Haskins has described it, it would appear that the laminated iron is exposed except when the converter is specially enclosed. Now all the converters I have seen of American manufacture have had that outside shell entirely separated from the laminated iron and forming no part of the electrical equipment of the converter, but simply a mechanical protection outside. They come to us from the manufacturer with the case provided. The water would very soon destroy the European converters without that outside case.

DR. MASON.—I would like to know from Mr. Haskins whether they have had any case of serious trouble with their method of installation in Great Britain; that is, putting the converters in buildings. I could not see that any special method was used as to placing them. I found them upstairs in the cupola, down stairs in the cellar, in entries, wherever it seemed most convenient to place them. But I know there is a great objection here. Almost everywhere, except in Philadelphia, it is forbidden that they should be inside any building. I would like to know if there has ever been any trouble resulting from the presence of a converter within a building.

MR. HASKINS.—To my knowledge there has been no trouble whatever with transformers in buildings. I think our practice was almost invariably to put the transformer in the cellar, which does not seem like a very favorable place. I have over there a number of photographs of transformers installed and in use. I have photographs of the transformers in Marlborough House, the Prince of Wales' residence, and in several other prominent houses, and I know of no one case where we have had any trouble with our tranformers. As Mr. Carpenter has said, the Ferranti transformer is not entirely enclosed. About two-thirds of the lamination is enclosed. But the internal insulation of the transformer is very perfect, and the wiring has to be done in the regulation manner inside.

DR. MASON.—I would like to ask Mr. Smith in regard to one point touching switchboards. I understood him distinctly to say that he had used none but stone or metal. Am I right?

MR. SMITH.—No, I did not say anything about the material of the switch. That is a question I would like a little light on myself. We have been accustomed for some years to regard slate as the best material, but within a short time I have had an annoying accident happen from the use of slate, owing to the presence of mineral in the slate itself. I came across a statement in one of the journals that marble should not be used on account of the presence of mineral; that slate was the only good material. But I find that the pure white Italian marble can be had in blocks without any mineral in it whatever, and it seems to me as though that would be the only substance that could be thoroughly depended on. But that will, of course, be quite expensive. For that reason I somewhat favor putting all switches and cut-outs and work of that kind on marble or porcelain bases, but making the switchboard itself of wood and allowing no wires to be clamped directly to it, keeping everything off the switchboard two or three inches. An air space of three or four inches will protect your board pretty thoroughly against fire. With a board of that kind if there was danger of catching fire, I would not hesitate to turn the hose on it.

DR. MASON.—Did I understand Mr. Smith to say that on a switchboard he would use none but an absolute waterproof insulation.

MR. SMITH.—No, sir; I said nothing about that. I want an insulation that will not carry fire. Underwriters' has been very good for switchboard for that reason, and it has been reasonably safe for men, because the switchboard is generally in the driest part of the station. The underwriters' wire, however, is not by any means what we ought to have. It is purely a makeshift. But we do want for switchboards some wire which will not carry flame, which cannot be set on fire either by the heat of the copper in it or by flames striking it from the outside.

DR. MASON.—There seems to be no substance which can be put on for the insulation, nothing that is practical, that is absolutely waterproof, excepting rubber or gutta percha. I think that can be taken as a settled thing.

MR. SMITH.—For that reason I say I do not lay so much stress on the wire being absolutely waterproof on the switchboard, because a wire is generally thoroughly dry. What I want is a wire that will not carry flame and which will be reasonably safe for the men working about the switchboard. On a live switchboard you have got to go in among the wires, and to take some risks. We want to make those risks as small as we can.

DR. MASON.—Do you not see an advantage in having an absolutely waterproof wire?

MR. SMITH.—It would be an advantage, but I do not see an advantage of having a waterproof wire if offset by the danger of fire.

DR. MASON.—Any gentleman who has trouble with his switchboard, if he has an absolutely waterproof line and has any sort of a cotton covering over it, and will soak it with a solution of tungstate of soda, he cannot burn it if he tried.

LEGAL.

The Massachusetts Supreme Judicial Court in Equity has rendered a decision in the case of the Chemical Electric Light and Power Co., *vs.* James H. Howard.

This was a bill asking the Court to reform a written contract under seal, whereby the plaintiff agreed to sell, and the defendant to buy, a patent of one Jarriant covering the use of bi-chromate of soda in galvanic batteries, and to pay a certain sum for the same, provided it should be found that said patent was "in full force and effect."

The same case has been before the Court as an action at law, and has been twice before the Supreme Court, who have construed these words "in full force and effect" as equivalent to a warranty of validity of the patent. At the trial, the jury found that the patent was invalid for lack of novelty, the same invention having been disclosed in a prior patent granted in 1872 to Harry Highton in England. Prof. A. E. Dolbear, of Tufts College, and W. L. Puffer, of the Institute of Technology, were the expert witnesses for the defendant, and Thomas D. Lockwood, of the American Bell Telephone Co., testified as an expert for the plaintiff. Mr. Lockwood had previously given to the plaintiff company a lengthy, well-paid-for written report, in which he stated that he had examined, etc., (see note A.) and that there was nothing to be found anticipating Jarriant's patent, and advising the purchase thereof. In this report he made no mention of or reference to the Highton patent of 1872. In his testimony on behalf of the plaintiff he stated that this omission was by accident, and probably due to the fact that he "must have turned over two leaves at once." And therefore the jury found for the defendant. After this, the plaintiff moved for a new trial, which was refused, and then attempted to get the Supreme Court to revise its opinion as to the meaning of the words, "in full force and effect," and failing in that, asked leave to change its action at law into a bill in equity to enable it to have the contract there reformed. The Court refused this, and final judgment was entered for the defendant. Thereupon the plaintiff brought this bill in equity in this Court, to which the defendant demurred on the ground that every question of law and fact herein involved had already been adjudicated upon in the first suit and decided in the defendant's favor. The demurrer was argued in December last before Judge Knowlton who has now sustained the demurrer, and an entry has finally been made dismissing the plaintiff's bill, thus ending a hotly contested litigation lasting over four years.

Note A. "I have been for twenty-three years engaged in the study of electricity, theoretical and applied. Since 1879 I have been engaged especially in the application of the electric telephone and its uses and believe myself to be regarded as an authority in that branch. It is part of my duty to acquaint myself with all electric applications and I have endeavored to do so both by study and by practice. I have written many papers upon electrical subjects, and am an author of three treatises on electricity, electrical measurement, and upon the practical operation of the telephone. I am also familiar with patent office practice and have prepared probably one hundred and fifty or more applications for patents upon electrical inventions. I have heretofore testified as an expert in cases involving the subject of electricity."

B. In the first sentence of your report you say: "I have made, perhaps, a more searching investigation than the subject will ever again undergo. I have examined the British Electrical Patents from the invention of the Voltaic pile to the present time; I have examined all the United States patents on the battery and kindred subjects; I have examined the accessible French patents; and all the text books and manuals upon electricity published in the United States, France, Great Britain and Germany, which relate even in the remotest degree to batteries, battery fluids, and the subject of depolarization.

"I have also examined the two patents under which you work, Nos. 328,687 and 328,948, issued October 20th and 27th, 1885, to Theodore L. Kauffer, both bearing the title of Electric Battery."

Now, as to the literature of the subject: I have examined all the books that approach this theme, and while all refer to Poggendorff's bi-chromate of potash solution and the changes which have been wrung thereon, not one has a word to say about bi-chromate of soda.

Sprague goes so far as to give a list of thirty-one substances adapted for use in batteries, but sodic bi-chromate is not one.

In 1874 the Count Du Moncel prepared an elaborate report on "Bi-Chromate of Potash Batteries," in which the use of sodic bi-chromate is not even hinted at.

See Brit. *Telegraph Journal* 1874, pp. 41 and 60.

In conclusion, the only reference outside of patents which I have been able to find, is that of the New York *Electrician*, August, 1885, p. 286, with which you are already well acquainted.

Yours truly,

[Signed] THOMAS D. LOCKWOOD.

THE CHEMISTRY OF THE PRIMARY BATTERY.

BY FRANK K. IRVING, E.E.

Something like a century has passed since the discoveries of Galvani, Volta and others, which opened the road to a new and wonderful era in the generation of electrical energy from chemical combination. Yet, strange to say, up to the present time there are few who thoroughly understand the chemical reactions that take place in the transformation of chemical to electrical energy. It has always seemed strange to me why so few electricians and chemists have taken any interest or active part in the study of this subject. We want to commence at the beginning in studying this subject, and take it step by step, weighing each result obtained by experiment carefully and drawing the conclusions and the reasons thereof to the best of our present knowledge. Now let us start with the most simple cell, that of amalgamated zinc-copper and acidulated water, and for the sake of simplicity we will first suppose the liquid in the cell to be pure water, neglecting, for the present, the sulphuric acid which it contains. Now, water is composed of two gases—oxygen and hydrogen—which, having a certain strong liking, or, as we say, chemical affinity for each other, and so long as they are not too powerfully affected by external circumstances, they remain firmly united together to form this well-known liquid. Now, as with every other kind of matter, whether solid, liquid or gaseous, the physicist believes water to be made up of a vast number of extremely minute particles, which he calls molecules or little masses, each of these molecules being so extremely small that by no mere physical process can it be subdivided. Nevertheless, small as it is, to all intents and purposes it is water, just the same as the largest body of that fluid which it is possible to imagine. Here the physicist stops. This molecule which he defines as the smallest particle of a substance which can be or exist in a separate state, he takes as the unit which he employs in all his theories and calculations. Now the chemist comes in. He takes the molecule and by chemical decomposition splits it up into its component atoms, defining an atom as the smallest particle of an elementary substance that can be moved in the molecule or from one molecule to the other. This atom is the unit of the chemist.

Now if I have made the above clear it will be understood by the reader that the molecule is the smallest particle of a substance, whether simple or compound, which can be obtained by mere physical division, while the atom is the smallest particle of a simple substance or element which can be obtained from the chemical decomposition of a molecule. Using the above definitions, we would now say that each molecule of water is made up of three atoms—two atoms of hydrogen and one atom of oxygen—which is written in the chemical shorthand, or symbol, OH_2 or H_2O. Now when our plates are united in the battery, a disturbance of the chemical equilibrium of the water takes place. Strong as is the affinity of oxygen for hydrogen, it has a much greater liking for zinc, thus the molecules of water are decomposed, the oxygen uniting with the zinc to form an oxide of zinc; the hydrogen being given off at the copper pole. In the explanation of the cell as above, we have assumed the liquid to be pure water, although dilute sulphuric acid is most always used, for the reason that the oxide of zinc formed does not readily dissolve in the water, but tends to cling to the zinc, thus impeding the further generation of a current. The chemical action when sulphuric acid is used, is precisely similar to that just given for water. The molecule of sulphuric acid consists of one atom of sulphur, two atoms of hydrogen and four atoms of oxygen, a fact which is expressed by the chemical symbol H_2SO_4. From this compound molecule the hydrogen is displaced and the SO_4, or sulphion, unites with the zinc and forms a sulphate of zinc $Zn\ SO_4$, which is freely soluble in the liquid. Upon such an assumption as this, it is, of course, easy to understand the production of a current in an ordinary cell and to discover the causes of its diminution, which are these: The positively charged hydrogen turns towards the negative, copper plate, while the negative oxygen goes to the positive, zinc, the oxygen uniting with the zinc and the product of the combination being dissolved in the solution. Thus the positive plate is kept clean and always ready for a fresh attack of oxygen, but with the copper plate it is different. There no combination of hydrogen takes place, consequently the negative plate soon becomes coated with a film of hydrogen gas which acts injuriously in two ways: First, gases being almost impenetrable by low tension current acts as a non-conductor; secondly, hydrogen being positive, we have virtually two positive plates in the cell, which of course tends to prevent any generation of current. As, moreover, the hydrogen film is more positive than the zinc it tends to give rise in the liquid to a counter E. M. F. from the copper to the zinc, thus equalizing the current which should be produced, and producing a slight reverse current in some cases. We also find another reason for the deterioration of the current in the production of a super-saturated solution of zinc sulphate ($Zn\ SO_4$), which occurs from the uniting of the sulphion (SO_4) with the zinc (Zn), thus preventing the dissolving of any further salt of zinc and practically stopping the *chemical* action on the zinc plate.

Now that we have finished a brief analysis of the zinc-copper element let us take up a few of the well-known batteries now in use, commencing with the one nearest in construction to the one we have just described, which is the Smee. In this battery we have two zinc plates and a plate of platinum or platinized silver. In this form of cell the hydrogen is prevented from accumulation by the rough deposit of platinum, and we have just the same action as in our first described cell, the zinc oxidizing and becoming a sulphate from the SO_4 in solution, and the hydrogen freed by the rough surface of the platinum or platinized silver. The next nearest battery to this construction is the Walker. In this battery gas carbon is substituted for the platinum, but there being no surface as in the Smee to free the hydrogen, and there being no combination made between the carbon and hydrogen, this battery soon polarizes or becomes coated with the hydrogen film first mentioned. But on the other hand if we mix a little powdered bi-chromate of potash ($K\ Cr_2O_3$) with the dilute acid solution, we find that not only is the hydrogen taken up but that the E. M. F. is increased to 1.89 and the internal resistance decreased to about .45 of an ohm. Now let us see what chemical action takes place to produce this result. The sulphuric acid goes to the oxidizing zinc and forms a sulphate. The hydrogen goes to the carbon but encounters on its way, the chromic acid (Cr_2O_3) which has been liberated from the bi-chromate of potash ($K\ Cr_2O_3$) the potash having gone to the sulphuric acid to form chrome alum and sulphate of potash ($K\ SO_4$). This chromic acid as we see from the chemical symbol Cr_2O_3 is very rich in oxygen, containing three equivalents. Now the hydrogen having a great affinity for oxygen takes one atom of oxygen from the chromic acid and becomes water. (We have already shown that two atoms of hydrogen and one atom of oxygen form water) The chromic acid now having lost one atom of its oxygen becomes the green oxide, or protoxide of chromium (Cr_2O_2). This statement can be easily verified, as we will see on examination, that the red color of the solution will soon change to green. This battery is considered one of the strongest cells, having a high E. M. F. and a small internal resistance, but it has a great many faults, some of which we will look into. When the cell is not in use, the chromic acid being very easily decomposed, the zinc oxidizes at the expense of the chromic acid, reducing it to the green oxide or protoxide of chromium (Cr_2O_2) without the generation of any current; also when the battery is in use the zinc becomes coated with the chromic oxide and assumes a polarity similar to the carbon. Then the sulphuric acid having a chemical affinity for potash a compound is formed known as chrome alum. This compound clings to the carbon and reduces the conductivity, also increasing the internal resistance. This statement can also be very easily verified by mixing the bi-chromate of potash, acid and water together, the water being hot. Let the mixture stand 36 hours and decant and we will find the sulphate of potash ($K\ SO_4$) in crystals at the bottom, leaving free chromic acid in solution. If this compound is used in the battery we will not be troubled with the chrome alum deposit and we will also have much better results on account of the solution being mixed and cooled before use.

We now come to a class of batteries using two or more separate solutions—one solution, usually the dilute acid and zinc in the jar, and the depolarizer and carbon, or other material, in a porous earthenware cup or cell. The simplest and most constant of these is the Daniell. In this battery we have a copper plate with a solution of sulphate of copper ($Cu\ SO_4$) in the glass jar, and a solution of sulphuric acid and water 1 to 16, with the zinc in the porous cup. Now, as in the original form we first examined, the dilute acid unites with the oxide of zinc (formed by the union of the oxygen evolved at the zinc pole, with the zinc) and forms a sulphate of zinc. The disengaged hydrogen of the molecule of sulphuric acid next to the zinc plate reacts upon the next molecule and displaces its hydrogen; this hydrogen displaced from this second molecule of sulphuric acid reacts in a like manner upon the next molecule, and so on, until the porous cup is reached. Here the "nascent" (or active as it is called when in this state) hydrogen meets with the sulphate of copper ($Cu\ SO_4$) and displaces from its nearest molecule the copper forming with its other atoms, sulphuric acid, and this copper reacting upon the copper of the next molecule, displaces its copper, and so on, until the molecule next to the copper plate deposits its copper upon the plate. By this it will be seen that sulphuric acid is formed in the outer cell, which tends to replace that used with the zinc, while the copper plate is increased in weight by the deposit of metallic copper, resulting from the decomposition of the sulphate of copper by the hydrogen. The amount of sulphuric acid liberated in the outer cell is regular and is proportional to the acid used in the porous cup. This battery has its faults also, one of the greatest of which is, that just as much zinc is consumed on an open circuit as when the cell is doing work; also the formation on the zinc of the black oxide of copper ($Cu\ O$) which is caused by the sulphate solution dialyizing through the porous cup and oxidyzing at the expense of the zinc. This battery is good only for constant work on a high external resistance. The constants are E.M.F. 1.098, or 6 ohms. The next well-known form of porous cup battery type is the Grove. Here, as in the Daniell, we use dilute sulphuric acid with the zinc, but in the porous cup we use strong nitric acid (NO_5) with a plate of platinum. As in the other cells, we also have the sulphate of zinc formed and hydrogen set free. At the porous cup the hydrogen meets, not with sulphate of copper, but nitric acid. From this nitric acid (NO_5) the hydrogen takes one atom of its oxygen, with which it forms water, leaving nitrous acid (NO_4) and thus liberating hypo-nitric acid fumes. In this battery we have the nitrate of zinc, Zn_2NO_3, formed, as well as the sulphate;

also the red oxide of mercury, Hg. O. This is due to the nitric acid dialyzing through the porous cup and attracting the zinc and mercury used to amalgamate the zinc. These hypo-nitric vapors may be prevented by the addition to the nitric acid of any compound rich in oxygen and held together by a weak chemical affinity. (See patent 436,001 to F. K. Irving). Suppose we use bichromate of soda ($Na\ Cr_2\ O_3$). Now, as soon as the hypo-nitric acid is liberated it takes up one atom of oxygen from the soda and becomes nitric acid again. We also have a nitrate of soda (Na_2NO_3) formed, but this does not affect the working of the battery in any way. The constants of the plain nitric acid battery are E.M.F. 1.93, r. .025; when chromic acid is added E.M.F 2.02, r. .023.

Thus we see from the several experiments we have examined that the difficulties which sometimes appear great are small when studied out; also, that the vast domain of chemistry opens numerous ways for the perfection of the primary battery if they are carefully studied.

UNITED STATES PATENTS AS AFFECTED BY FOREIGN PATENTS.

BOSTON, February 20, 1891.

EDITOR THE ELECTRICAL AGE:

With regard to certain statements and letters which have appeared in your valuable journal recently, concerning the bearing which a foreign patent may have upon the life of a United States patent for the same thing, there seems something still left to say.

Nobody need fail to understand the statute, provided the said statute be fully and correctly stated.

Mr. Kintner in his able letter, printed on page 69 of your issue of February 7, 1891, does state it fully and correctly.

But there is still something to be said; referring to English patents, whenever a specific case comes up, it becomes necessary to inquire: When is an invention patented in England?

Judge Shipman has given the country his answer to this question in the case of Gold and Stock Company *vs.* Commercial Telegram Company, 23 Fed. R. 340, (1885.)

Calahan was the American inventor and patentee. His English patent was dated March 16, 1868, the day when his provisional specification was filed, but it was actually sealed August 21, 1868.

The United States patent was granted April 21, 1868, a month after the date of the English patent, but four months before the *sealing* of that patent. The English patent was issued under Act 1852, 15 and 16 Vict.

The Court, Shipman, J., thus announced its decision: "In this case the English patent was sealed five months after the patent in suit was issued; and although the English patent was, when published, dated March 16, 1868, I do not suppose that such date has an effect upon the life of the subsequently issued United States patent."

See also "Am. Diamond Rock-boring Company *vs.* Sheldon, 17 Blatch., 303.

We can readily see why this should be so. Simply because until a British patent is sealed not only does it not exist, but no one knows whether it ever will exist.

It thus appears that whenever it is desired to apply the foreign limitation clause to a United States patent, the British patent for the same thing having died of old age, one of the first things to do is to find out when the said British patent was sealed; not merely when it was dated, for though the date determines the duration of the British term, it does not often have anything to do with the United States term.

Very truly yours,
THOS. D. LOCKWOOD.

ELECTRIC LIGHT WIRING INSTALLATIONS FROM A MECHANICAL STANDPOINT.

BY AUGUSTUS NOLL.

Read before the National Electric Light Association, Providence, R. I., Feb. 19, 1891.

The question is frequently asked by architects and owners of buildings, "Can electric lights be installed with safety from fire, and will the installation give results that are satisfactory and permanent?"

The improvements made recently, in materials and methods admit of answering in the affirmative.

Nearly all the trouble in electric lighting plants has been caused by defective wiring, and on that part of the lighting system, more than on any other, depends the success of future service.

It may not be amiss to compare the early date of the art of electric light wiring with the present, and the probable future advancement in the methods of installation.

In the early days of electric lighting a wire covered with cotton, and saturated with paraffine, was used; this in a short time was replaced by a wire covered with cotton and white lead, known as "Underwriters' Wire;" the insulation was supposed to be fire-proof, and, on that account, decreased the chances of fire; while the insulation was non-inflammable, it also readily absorbed moisture which caused excessive leakage and some incipient fire; a few carefully conducted tests and experiments proved that "protection against moisture was prevention of fire," and henceforth a moisture-proof wire was demanded, and the manufacturers in that line now offer us such high-grade insulations as "Grimshaw White Core," "Okonite," and others.

Improvements in the method of installing the wires were also made. Formerly buildings in the course of erection were equipped with the fire-proof insulated wire encased in wood mouldings, or inserted in zinc or lead tubes, but with the appearance of the moisture-proof insulated wire, the former insulation was discarded for the latter, and instead of inserting the wire in zinc and lead tubes, it was fastened directly to the side walls and ceilings, and covered by plaster. The cut-outs and switches are now mounted on porcelain and slate, instead of wood as formerly. More attention was given to the equalization of electrical pressure on conductors.

While these changes helped to improve the work, it was still a matter of chance that wires placed in a new buildings, and embedded in plaster, gave satisfactory results. Conditions that could not be controlled increased the difficulties. A cut from the plasterer's trowel, or a blow from a hammer on the insulation, destroyed its utility; and though the wires may be tested, the fault in some cases would not appear till the building was completed, when, to remedy the defect, it was necessary to cut the plaster to obtain access to the wires, or, discard the faulty circuits and re-wire on the surface of the plaster; in either case disfiguring the walls and causing extreme annoyance. Again, should change be contemplated in the wiring, such as any increase of lights on different outlets, or a change to a lighting system where lamps of a lower voltage are used, we are once more confronted by work that is totally inaccessible, and, to make the changes required, are forced to have resource to the same expedients as stated before, and with the same results.

Although wiring installations gave better results than formerly, there was yet a large field for improvement. Access to the conductors became absolutely necessary for controlling the system, making changes and rectifying defects which may occur after the work is finished and the building completed, and to do so without cutting or defacing the walls or interfering with the other portion of the lighting system.

It is evident that as long as the conductors are inaccessible, just so long will the results be uncertain; and as it is our aim to eliminate the objectionable features and secure a wiring system that possesses accessibility and freedom from fire and leakage, the question is, "What is necessary?" To which I reply: A high-grade moisture-proof insulated wire, together with a system of "raceways" or conduits, and a complete line of "fishing" or junction boxes.

The conduits should be of ample size, with smooth inner surface, so that wires can be easily inserted or withdrawn; they should be constructed of materials that will not stain nor exude through plaster or paint, and should be non-combustible and moisture-proof; the action of lime or cement, or extreme variations of temperature, should have no effect.

The "fishing" or junction boxes should be equipped with shoulders or sockets for the entrance of the tubes, thereby making them a part of the conduit system, and preserving the continuity which is so essential in a system of this kind and also enabling us to make the joints moisture-proof.

All cut-outs when single or in groups, should be located in the junction boxes.

The conduits should be installed in a workmanlike manner; they should not be run or looped from one outlet to another, but branches should lead to each outlet from the main conduit, carrying the wire for that circuit, and at right angles with same; at the intersection of the branch and main conduits a "fishing" box should be placed; the main conduits may be located in the cornice near the ceiling or behind the base-board at the floor, with the cover of the junction box flush with the surface, thus keeping them out of sight and at the same time easy of access. The location of the conduits should be uniform on the different floors throughout the building.

An extra covering of metal should be placed on the conduits at the outlets to keep them securely fastened to the wall, protect the ends, and take off the strain when inserting or withdrawing wires.

With a proper conduit and a complete system of junction boxes it becomes unnecessary to insert a single wire (with the exception of the main feeders) until after the installation of conduits is complete, and the building finished. The insertion of strings or drawing lines is equally unnecessary, for, should the string or wire break near the middle of its length, that circuit would be as inaccessible as though it was embedded directly in the plaster.

The main wires can be inserted in the conduits at the time of installing the same, and placed in recesses in the walls, the cover of the recess to be detachable.

In hotels, apartment houses, office buildings, and other structures used for similar purposes, the largest part of the wires and conduits, together with the cut-outs and junction boxes, can be located in the halls so that in case of alterations or additions being required the occupants of the rooms will not be annoyed.

Considering the advantages a wiring system of this kind possesses over previous methods, a comparison in cost will be favorable to the conduit system.

The indefinite manner in which electric light wires are sometimes installed, has often placed the owner of a building, who contemplates changes, at the mercy of the company or contractors under whose supervision the work was installed. They in turn delegate the foreman, who had charge of the work in that particular building, to attend to the changes required, and he usually tries to obtain the services of some of the wiremen who worked on the installation, because "they know where the wires lay."

It is apparent that the employment of a com-

plete conduit system obviates these troubles, and also that instead of equipping a building with a wiring system suitable only for a special company's system of lighting, it can be fitted with conduits for electric lighting regardless of system, and in fact similar to piping the buildings for gas; and should a change in the system be desired in the future where lamps of a lower voltage are used, the change can be made without cutting or defacing the walls, and at a nominal cost; whereas, should this change be required in a building where the wires are embedded in plaster, it would practically necessitate the rewiring of the entire plant, and at a cost at least equal to that of the original work.

While a conduit of good insulation is necessary it should not be regarded as extra insulation or protection to an extent where the insulation directly on the wire is decreased. It should only be treated as a medium to accessibility.

"Prevention is better than cure," and for that reason should only one wire be placed in a conduit. Although the fusible metal cut-out will usually break the circuit in case of a "cross," still, it is safer to guard against any formation of this nature, by placing each wire in a separate tube than to invite it by insufficiently insulated wire, or inserting wires of different polarity in the same tube.

Only the best is good enough, and will in the end be the cheapest for all branches of electric lighting.

The co-operation of architects is not only desirable but necessary for the future advancement of electric light installation work, and to their credit be it said that they are ever ready to extend their help. Already have their suggestions been of value to us, and should the necessity of securing separate recesses be explained, they will, without doubt, make provision for the work similar to that made for gas, steam, and water pipes.

THE FORT WAYNE ELECTRIC COMPANY.

The Fort Wayne Electric Co., of Fort Wayne, Ind., are doing a thriving business in and about Philadelphia. Mr. G. A. Wilbur is the representative of the company, and his office is at No. 907 Filbert street.

The following list shows some of the principal plants Mr. Wilbur has lately sold in Philadelphia, not to mention others in the surrounding territory:

Merchants' Electric Light Co., of North Front street: 300 "Wood" arcs, and 1,000 "Slattery" incandescents.

Frankford Avenue Electric Light Co., Kensington: 180 "Wood" arcs.

Columbia Electric Light Co., 20th and Jefferson streets: 2,000 "Slattery" incandescents.

Electric Power Company, 13th and Market streets: 120 "Wood" arcs.

Powelton Electric Company, West Philadelphia, 180 "Wood" arcs and 2,600 "Slattery" incandescents.

Suburban Electric Company, Tacony, ; 240 "Wood" arcs and 3,000 "Slattery" incandescents.

Girard College, Philadelphia; 60 "Wood" arcs.

Philadelphia Hospital, Philadelphia; 30 "Wood" arcs.

Alex Crow & Son, Philadelphia; 40 "Wood" arcs.

There are now six local Electric Light Companies in Philadelphia operating the Fort Wayne systems, and all these plants are giving good satisfaction.

The principal features of the "Wood" arc system are the close automatic regulation of the dynamo, the steadiness and whiteness of the light produced, and the simplicity of the entire system. The "Slattery" Induction system is well known, and is in use in all the principal cities of North America.

The ventilated armature used in their alternating machine, the low internal resistance of the same, the absence of heat, and the many new mechanical features of the system makes it one of the most desirable alternating systems in the market.

Several additional local companies are about to embark in the electric light business in Philadelphia, and nearly all of them will be likely to adopt the Fort Wayne systems, as the apparatus in use has given such good results.

The Fort Wayne Company is to be congratulated upon having such live business men to represent it, and to make the public acquainted with the advantages they claim for their systems.

MORE STORAGE BATTERIES FOR DUBUQUE.

The Dubuque Street Railway Company is so well pleased with the running of the experimental storage battery car operated on the Edco system, and which has been running in regular daily service since last August, that it has concluded to order from the Accumulator Company three additional cars of the same kind, work on which we are advised has already been started; delivery to be made in April.

This will make nine Edco cars in all which the Dubuque Company will have in operation, the first six of which are about ready for delivery, and will be installed in March.

We are informed also that the Accumulator Company has arranged with the Eckington & Soldiers' Home Railway Company to rent them two Edco cars, which are about ready for delivery, and which are to be operated by the Eckington & Soldiers' Home Railway Company upon the G street branch of that road, between the Treasury Department and the Pension Office, thence to the corner of New York avenue and Fifth street, pending the delivery of the six new Edco cars recently contracted for, which will not be ready for delivery till about May or June.

ST. LOUIS NOTES.

The Bell Telephone Company are about to occupy their large and beautiful building, just erected, on the corner of Tenth and Olive streets.

The Missouri and Kansas Telephone Company is engaged in making a survey of the lower part of Kansas City, Mo., with a view to putting their wires underground in the business section. The company is also intending to build a new exchange located as centrally as possible. When that is done the burying of the wires will be actively pushed.

A bill is now before the General Assembly of Missouri requiring that all electric wires, excepting electric railway wires, shall go underground.

A big deal in electric lighting was consummated in this city February 19th. The Laclede Gas Company has acquired the absolute control of the lighting of St. Louis by gas and electricity. This company has purchased the plants, property and franchises of the Missouri Electric Light and Power Company and Municipal Electric Light and Power Company, at an aggregate cost of three millions of dollars. It is stated that the purpose of the consolidation was not so much to build up a monopoly as to place all the companies under one management, reduce expenses, and get a profit on the invested capital. The electric lighting companies had been making great inroads on the business of the gas company, and the deal was vitally necessary to the latter concern. It is conceded that it will be an advantage to have lighting controlled by one company, as the public will have but one corporation to deal with. The president of the new company maintains that there will be no advance in the cost of light to the consumer.

The Lindell Electric Street Railway Company has almost completed its loop in Forest Park, and by spring the entire extension will be ready for use.

The Columbia Incandescent Lamp Company have increased their manufacturing facilities to about three times its former capacity, and are going to further enlarge it by adding a 500-light alternating dynamo, for lighting the lamps on the pumps. It is claimed by the officers of this company that they will then have one of the most complete plants of the kind in the country.

TRADE NOTES.

The Union Glass Company, manufacturers of flint, opal and silver glassware, Somerville, Mass., has just issued a card bearing photographic illustrations of incandescent shades and electric light globes manufactured by that company. The factory of the company is in Somerville, and the Boston salesrooms are at No. 36 India street.

The business of the North West Electric Supply and Construction Company, No. 711 Third street, Seattle, Washington, has been disposed of to the Edison General Electric Company. Mr. N. W. Huggins was manager of the former company.

Messrs. Pass & Seymour, of Syracuse, N. Y., manufacturers of china and porcelain specialties, cut-outs, etc., are doing a very large business at their new factory which was especially fitted out for this class of work. Their switch bases, lamp collars, etc., are in great demand and giving excellent satisfaction. The company is furnishing large quantities of these goods to the Schuyler Electric Company, and many others. At the company's factory special tools and machinery are used for making dies of any pattern. The china goods manufactured by this company are well known for their strength, and it is possible, and quite common now, to rivet brass work to the china. This is abundant evidence of the strength of the material. They color their goods to match woodwork or any other decoration.

FACTS ABOUT BELTS AND THEIR CARE.

The following are a few of the results of experiments made by some of the largest and best manufacturers and mechanics in the country.

Belts should always be run grain or hair-side to the pulley. A belt made of thick, firm leather, cut from the back or centre of the hide, run grain to the pulley, will draw 34 per cent. more than flesh-side to the pulley; 48 per cent. more than rubber; 121 per cent. more than gutta percha or canvas.

A pulley covered with leather, and belt grain-side to pulley, will sustain fifty per cent. more resistance than without the pulley so covered.

The strain allowed for all widths of belting, single, light double and heavy double—is in direct proportion to the thickness of the belt, firmness of the leather being the same in all cases.

Belts should be protected from dampness.

Many people use resin to keep a belt from slipping; this is about the worst thing that can be done. If a belt slips, the probabilities are that the pulley has become dirty or foul, and that the belt, consequently, does not adhere properly to the pulley. In such cases, clean all the dirt from the pulley and from the belt; rub the pulley surface of the belt with warm tallow; if the belt then slips, you can be certain that you are overtaxing it, and you need a wider belt or larger pulley.

To apply the tallow, use a soft woolen rag and rub over the surface of the belt evenly. Warm tallow is the best and about the only thing that will soften and at the same time preserve a belt; it should then be used sparingly.

Too much oil loosens the fiber and injures the belt. Never try to put a belt on when it is in motion. Many a person has lost his life or a limb by so doing.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., Feb. 27, 1891.

Mr. W. R. Mason, general manager of the Electric Merchandise Company, returned from Providence in excellent spirits over the success of the convention and, incidentally, of his own business efforts. While East, Mr. Mason secured for his company the general agency for the Tramway Rail Company, of Pittsburg, manufacturers of steel rails, chairs, etc., whose wares are well known throughout the country.

The new catalogue of the Illinois Electric Material Company is a very neat publication, well arranged, carefully illustrated and convenient for use. It contains, in addition to descriptions and illustrations of the handsome line of railway and light supplies which this company carries, a series of wiring tables for handy reference.

A number of new specialties are being placed on the market this week by the Central Electric Company. Special mention may be made of the Paiste-Edison socket, of which they are general Western agents; and a new form of the microphone carbon battery made expressly for their use. The chief features of this latter article are the making of the carbon cylinder much larger than in the old style, and making the glass jar square instead of round, thus permitting of the use of more fluid. The cylinder, being larger, fits tightly at the neck of the jar, making an almost air-tight union. They claim much for this battery in connection with gas lighting and bell work.

A cunningly devised circular bearing a fac-simile of a "Fragment of a Latin Inscription Excavated Recently near New York" issues from the press of the Illinois Electric Material Company; whether it is the intention of the Illinois Company to claim for their wires the playing of a material part in an ancient but departed civilization is not known, but an inspection of the "fragment" certainly shows that the Bishop is "in it." We await the next flight of the versatile young artist who evolves these bursts of humor for which the Illinois Electric Material Company is becoming famous.

The Central Electric Company are placing on the market the Max Stadt safety cut-out for the protection of telegraph and telephone circuits. These cutouts fuse at one-half ampere, and have been adopted by several of the large telephone companies, as also by the Western Union Telegraph Company.

NEW COMPANIES.—The Lincoln Electric Street Railway Company, Lincoln, Ill. Capital stock, $65,000; incorporators, E. D. Blinn, A. Quisenberry, and John F. Mundy.

The Continental Electric Construction Company at Chicago; capital stock, $250,000; to build, equip and operate street railways, electric light, power and heating plants, and to do a general electric manufacturing business; incorporators, William F. Orrell, Oren I. Wheat and Leslie C. Orrell.

Day Railway Construction Company at Chicago; capital stock, $10,000,000; to construct and contract surface and elevated railways, intermural and subterranean, rolling stock, motive power and appliances; incorporators, St. John V. Day, Edwin F. Getchell, Willard J. Block.

Standard Electric Company at Chicago; capital stock, $100,000; to manufacture electric light, motor and other machinery, cars and appliances, establish and operate electric light and power; incorporators, William A. Conover, Francis E. Charnley, Frederick M. Clocke.

F. M. I.

NEW YORK NOTES.

The Prentiss Tool and Supply Company, No. 115 Liberty street, have bought the entire plant of the Love Manufacturing Company, comprising 99 machines, including special tools and fixtures, all in good condition, and well adapted for the manufacture of electrical apparatus, sewing machines, typewriters, guns, etc. Included in the machines are engine lathes, planers, friction shapers, crank-shapers, punching and shearing machines, boring machines, mortising machines, etc., etc. All those interested in work of this class should communicate with the company.

The Clark Electric Company, No. 192 Broadway, New York, are distributing a card with a beautifully embossed representation of their new arc lamp. The lamp is mounted in one of the company's ornamental chandeliers for interior lighting. The softness of the illumination and the absolute steadiness and silence of these lights render them unequaled for this purpose. These fixtures are artistic in design, handsome in finish and in every way novel in the field of electric lighting. The lamps can be operated from either arc or incandescent current, and coupled with the new fixtures it indeed makes a beautiful and ornamental light.

Frederick Pearce, successor to Pearce & Jones, 79 John street, the manufacturer of electrical and mechanical apparatus of all kinds for the trade, inventors, etc., is producing some of the leading specialties in this market. He has every facility in machinery and tools, as well as the best mechanics and draughtsmen that can be secured. The Iske Automatic Fire and Heat Alarm is of his production, and they are having a good sale. Mr. Pearce is also making, in addition to the numerous electrical specialties for the trade and public in general, duplex and single motor turn tables for displaying wares of all kinds, which will hold from 50 to 250 pounds of goods.

The Star Head Light Company, of Rochester, N. Y., has recently equipped some cars on the Albany Street Railway, the Bangor, (Me.) Street Railway and the Pittsburg and New Orleans Street Railways, with head lights, for the manufacture of which the company is celebrated. Mr. E. C. Glazier fills the dual position of president and superintendant of the company. The Star Head Light Company manufacture railroad signals, head lights, etc., and is making a specialty of its electric head light for use on electric street cars.

Mr. Robert Keasbey, general manager of the New York branch of the Magnesia Sectional Pipe and Boiler Covering Company, No. 58 Warren street, reports an excellent business. Particular attention is paid to the covering of electric light and electric power plant boilers and pipes. Among the recent contracts in this line he has just completed the covering of all the steam pipes of the new electric light plant at the New York entrance of the Brooklyn Bridge. He has also recently applied his goods to the steam plant of the Rapid Transit Street Railway in Newark, N. J., and is now covering all the boilers pipes, etc., in the new Pulitzer Building.

Mr. C. J. Hirlimann, No. 91 Green street, New York, manufacturer of the celebrated Hirlimann "Champion" batteries, reports an excellent demand for his goods. Mr. Hirlimann is the original maker of the Leclanche batteries in the United States, and knows as much about batteries as anybody in the country, having had many years' experience in this line. The "Champion" battery, of which he is the patentee, is remarkable for its efficiency. A corrugated zinc is used, which gives a largely increased surface. Mr. Gorges D'Infreville, electrical engineer and expert, of No. 110 Liberty street, in a letter to Mr. Hirlimann, stated after he had made a test of a Champion cell, that the efficiency of this particular style of battery is unequaled.

Messrs. Hine & Robertson, engineer specialties, etc., No 45 Cortlandt street, are doing a very satisfactory business in their line. The Arc Indicator, described in our columns a few weeks ago, is giving great satisfaction to all users, and the demand for the device is constantly increasing. The Centrifugal Exhaust Pipe Head is also giving the best of satisfaction for the reason that it entraps all oil, grease and water, and prevents roofs of buildings from being coated with oily filth. The Centrifugal Steam Separator handled by this company separates the water and delivers to the engine and pump clean dry steam. These specialties are of great value in the operation of steam plants.

Messrs. Himmer & Anderson, No. 20 Vesey street, manufacturers of dry galvanic cells, electric clocks and novelties, are meeting with great, success in the sale of their goods. Their electric cigar lighter is very artistic and useful and is meeting with a large sale. The dry battery made by this company is the only restorable cell in the market. This firm have the reputation of making goods of the highest standard of excellence. Mr. Vitalis Himmer is the electrician and Dr. Anderson the chemist of the company.

E. T. Copeland & Co., No. 106 Liberty street, No. 110 Trinity Place and 111 Cedar street, merchants', contractors' and factors' selling agents, have a very attractive exhibition establishment in full operation. They represent the J. T. Case Engine Company, of New Britain, Conn. The Case engine can be used in direct connection with the dynamo or other high speed duty, and driven at any speed, from 150 to 1,000 revolutions per minute, as desired. They are made in various forms and sizes and range from 2 to 15 horse power. They are of the vertical and pedestal type, and are designed to meet the requirements of small manufacturing industries of any kind. The Ball Engine Company, of Erie, Pa., is also represented by this company. The Ball engine is renowned for its high efficiency. It is made in all sizes, from 15 to 300 horse power, single high pressure, tandem compound, cross compound, and vertical compound. The Leffel Water Wheel and Engine Company, of Springfield, Ohio, Hodge & Co., of East Boston, manufacturers of stationary and marine boilers, stand pipes, oil and ship tanks, etc., and the Worthington Boiler Company of New York, are also represented by this firm. Any one desiring purchasing agents in the line of power appliances would do well to communicate with this firm. Mr. Copeland has had thirty years' experience in the trade, as buyer for large manufacturing houses, and the very best satisfaction may be depended upon when dealing with his company. They have the largest and finest machinery store in the city, 3,000 feet of floor space being devoted to the exposition of first-class sample machinery in motion, all of which is interesting and instructive.

The E. P. Gleason Manufacturing Company, 181 to 189 Mercer street, was represented at the Electric Light Convention, Providence, by Mr. E. F. Gennert, the superintendent of manufactures, New York. Through Mr. Gennert's efforts and artistic taste, this firm is producing some of the finest cut-outs, holders, fittings, globes and shade reflectors, and general appliances for arc and incandescent electric lighting to be found anywhere. At the head of the stairs on entering the salesroom for metal goods and electric combination fixtures, etc., is noticed a set of resolutions suitably framed. These resolutions were drawn up for the employees of the firm and engrossed by Mr. Gennert and presented to Mr. E. P. Gleason some years ago. It is an excellent piece of work. In this department of the company Mr. Gennert may always be found ready to receive his friends most heartily and he always has a good word for everyone.

Mr. A. Livingston Bogart, expert electrician, and son of A. L. Bogart, No. 22 Union Square, the well-known manufacturer of multiple and automatic gas lighting specialties, has recently been retained by one of the large electric light companies as expert and electrician. His services as electrician to the business of his father, has been the means of developing many improvements in automatic, multiple and electric gas lighting, as well as numerous others in annunciators, burglar alarms, etc. Mr. A. Livingston Bogart has applied himself so closely to business of late as to break down his health. This has necessitated a trip for recuperation and he is now on his way to Bermuda with that object in view. Many of the largest electrical supply manufacturers and others in kindred lines are much indebted to Mr. Bogart for the valuable services he has rendered them in the past, and they, with ourselves, wish him a *bon voyage*.

The National Manufacturing Company, Nos. 14 and 16 Vesey street, New York, make everything in the line of electrical supplies, from a push button to a 400-number messenger system. They have the most complete method of showing samples of the articles they make. These are exhibited on an immense board which is hung in a conspicuous place, and is readily seen on entering, or the goods may be seen in a case or on a large counter. Their Splitdorf insulated wires of all sizes are having a big sale. Every supply house and dealer in electrical goods cannot have a complete stock without this wire.

The firm of Pierce & Thomas, No. 42 Cortlandt street, engineers and contractors for electric railroads and lighting plants, are working hard on a number of light and railway installations. Their work is celebrated for its completeness and workmanship and they have an excellent reputation in the trade. They handle the McIntosh & Seymour engine, both single and compound, water tube and return tubular boilers. Steam power plants are installed complete by this enterprising firm and they furnish specifications and designs for everything that comes within their line.

Stanley & Hall, the well-known electrical house furnishing manufacturers, Nos. 32 and 34 Frankfort street, are doing a rushing business. They are constantly getting up novelties, and every one needing goods in the electrical house furnishing line should see Stanley & Hall first; satisfaction can be had here if it can be had anywhere.

The Goodyear Hard Rubber Company, Nos. 9, 11 and 13 Mercer street, are the oldest manufacturers of hard rubber goods in the world, being the owners and sole manufacturers under the patents of Charles Goodyear during their existence. The company make a specialty of articles for electrical purposes, particular attention being given to those requiring great exactitude, high finish and superior quality, for which they have a world wide reputation. They have a storage battery which is reputed to be of excellent merit.

Mr. Frank P. Wisner, of the Consolidated Fruit Jar Company, 49 Murray street, is a hustler and is having big success for the firm. He seems to have the faculty of getting orders from electric light, railway, supply, battery and other companies for the metal goods manufactured by his concern. His company manufactures a large variety of metal goods for the electrical trade.

Among the concerns represented by exhibits in the salesrooms and offices of E. T. Copeland & Co., 126 Liberty street, are the A. A. Griffing Iron Company, of Jersey City, manufacturers of the Bundy Steam and Hot Water Radiators, and the Hine Eliminator Company, 40 Cortland street. The A. A. Griffing Iron Company is represented by Mr. Leroy B. Sherman, manager. The Hine Eliminator is attached to the exhaust pipe of the engine or pump and automatically eliminates the oil from exhaust steam so that the water condensed is purified and can be used either in the boilers or for any other purpose desired. There are now 460 of these machines in successful operation, and they are made for all sizes of steam pipes and for both horizontal and vertical connections.

Mr. J. A. Gram, who lately took the management of the Eastern office of the Munson Belting Company, No. 44 Dey street, is meeting with excellent success. Mr. Gram was assistant to the former manager until his accession to his present position, when he took the reins to command the trade in the East.

An Edison plant has been installed in the New Haven *Register* Office, New Haven, Conn. It consists of 90 lights, and is run by one 10 horse power Case pedestal engine. J. Gibbs, Smith & Co., of New Haven Conn., have put into their establishment an Edison 130-light plant, run by a No. 5 Case engine of the pedestal type. The Forsyth Laundry Machinery Company have also installed an Edison 125-light plant, run by a Case engine. These engines are handled exclusively on the American continent by E. T. Copeland & Co., No 106 Liberty street. Mr. W. G. Bushnell, the Connecticut agent of the Edison General Electric Company, installed all of these plants.

The Edson new steam pressure recording gauge is meeting with large sales, and is giving excellent satisfaction. Mr. Jarvis B. Edson, of No 87 Liberty street, New York, has recently introduced some improvements in the construction of this well-known recorder, which make it a highly efficient instrument. Those who are using this apparatus thoroughly appreciate its value.

Mr. A. E. Rich, of the Hunt Engineering Company, 238 Washington street, Brooklyn, has just returned from an extended trip throughout the West. He met with general success in the sale of their specialties, taking orders for thousands of their H. E. and Westinghouse lamp sockets. He also received large orders for their new switches, etc.

The Hunt Engineering Company, 238 Washington street, Brooklyn, are arranging an extensive exhibit in the Arcade, corner of Tillary and Fulton streets, in conjunction with the Brooklyn Institute, who have arranged to make an extensive exhibit during March and April. They are also arranging for a Brooklyn agency of the Crocker-Wheeler motors in Brooklyn, and will have a large exhibit of these motors in the Arcade exhibition during March and April. This firm is extensively engaged in construction work, and have every facility for drawing up plans and specifications for central station and isolated electric light plants; also electrical railway construction work, as well as all detail household and office specialties. Mr. W. M. Fay has been appointed their Western agent at Elgin, Ill.

W. T. H.

FINANCIAL.

The *Investor's Guardian*, of London, which for over a quarter of a century has alone faithfully recorded the birth, life and death of all British Public Companies, reaches us this week with the sequel of the contract to electrically light the city of London, in the shape of the incorporation of the City of London Electric Lighting (Pioneer) Company, Limited, registered on the 5th of February, 1891, with a capital of £100,000 in £50 shares, to adopt the agreements with the Brush Electric Engineering Company, and the Laing, Wharton and Down Construction Syndicate, to take steps towards the formation of the permanent company, and to carry on in London the business of an Electric Lighting Company. The subscribers who only sign for one share each are, Joseph Savory, Lord Mayor—Marlborough, Blenheim, Woodstock—Suffolk and Berkshire, Charlton, Malmsbury—Alan Chantres, 23 St. James Place—J. B. Braithwait, 27 Austin Friars—J. C. Bull, Surbiton, and Cecil Braithwait, 27 Austin Friars. The solicitors are our old friends, Ashurst, Morris, Crisp & Company. One more step: the floating of the consolidated company, about which there is no doubt, will close the circuit. Without fear or favor, I advise every man who can to invest in that stock. You can buy it in New York and it will be a safe investment for yourselves and your family for a generation at least. Under similar circumstances and time, Paris is to be illuminated by the Woodhouse & Rawson United Company, with a capital of £300,000, ordinary (£5) shares and £250,000 Preference 8 per cent. (£5) shares. The ordinary shares have paid 15 per cent. semi-annually for three half years. No doubt the Paris plant in full working order will increase it. New York is practically divided up. Surely the day is not far off when by consolidation one, or at most two corporations will light Manhattan Island, and the holders of those bonds and shares will be made exceedingly happy by large and ever increasing dividends. The Laclede Gas Company have just purchased the control of all the electric light companies having contracts with the city of St. Louis. A great saving in managerial expenses is certain to follow, with a positively improved service to the public, and correspondingly increased returns to those investing in the company's securities.

Once again comes the rumor that the members of the Exchange who are not of the 400 recognize that the New York Stock Exchange represents directly or indirectly the vast majority of the cash capital of the United States, but finding their governing rules do not permit them to educate investors or speculators beyond personal contact, and offer common facilities to all, are about to inaugurate a new departure, a sort of modern improvement, and establish agencies at each local financial centre. It should have been done long ago. We have outgrown the ancient methods; middlemen have abandoned the traditional missionary dollar for the greater, because double commission rendered it possible between client and broker who are beyond speaking distance, and is as necessary to those who hold or desire bonds and stocks as a distributing office is to the Post Office, or a receiver of public money is to the Treasury Department.

In the early days of California we miners all looked on gold as the standard of value and, almost regardless of the amount of alloy it contained, accepted it at the rate of $16 an ounce. To-day, thanks to the immense number of incandescent electric lamps, manufactured platinum takes the lead, the price having raised from $7.50 to $20 an ounce, and still going higher. Meantime incandescent lamps are being reduced in cost by improved construction, with greater quantities, leaving dividends undisturbed. Aluminum, now quoted at $2 a pound, will take its place in the list before the year is out and many companies will be producing it. I want full particulars for quotation as soon as you are incorporated. The readers of the ELECTRICAL AGE want their interest before the canal is opened; are waiting at the door now with their money all ready to invest. Send in your terms with your subscriptions, and let them join in pushing aluminum to the front and reap their reward. February was a good month to have floated your company in; electric stocks began strong and in the first half gained from six to ten points, and are fairly holding their own yet, as will be seen by looking over your file. The market has been active; inquiry for both bonds and shares is increasing; dividends are being paid and in a short time I will publish a list of them in this column.

PERSONAL.—Mr. Frank A. Magee, M. E., graduate of Stevens Institute of Technology, and a member of the American Society of Mechanical Engineers, was for two years connected with the engineering department of the Edison Electric Light Co., and six years as salesman of electric light and engine supplies.

The winter of 1890–'91 will be memorable in the history of electric companies on account of the damage to overhead wires by storm, sleet, wind, etc,

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Motor Co.			$ 5 00
American Private Tp'hone (Parent)	50,000	100 00	98 00
American Telegraph and Cable			82 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	*60
Averell Insulating Conduit	3,000,000	100 00	4 00
Asbury Park L. & P.	50,000	10 00	
Bell Electric Light	2,000,000	100 00	
Bell Telephone	12,500,000	100 00	183 00
Boston Electric Light			105 00
Brooklyn Edison Electric Light	1,500,000	100 00	100 00
Brooklyn Citizens' Electric Light	500,000	10 00	13 00
Brooklyn Municipal Light	500,000	100 00	122 00
Brooklyn City R.R.	6,000,000	10 00	18 00
Brush Illuminating (N. Y.)	1 000,000	100 00	75 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Consolidated Electric Light			50 00
Complete Elec. Con. Co, N. Y	50,000	100 00	175 00
Daft	1,000,000	50 00	
Edison Elec. 5s			par
Edison General			104 00
Edison Illuminating	4,500,000	100 00	80 00
East River Electric Light Co.	1,000,000	100 00	80 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Erie Telephone			47 00
Essick Printing Tel.	5,000,000	100 00	75 00
Excelsior	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Fort Wayne Elec. Co.	4,000,000	25 00	13 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	25 00
Hudson Electric Light (N. J.)	100,000	100 00	
Harlem Electric Light Co.	250,000	100 00	70 00
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit			75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Julien			
Laclede Gas Co.			17 00
Laclede Gas Firsts			*50
Law Telephone			
Long Branch Electric Light	50,000	100 00	75 00
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light			90 00
Morristown L. H. & P.	50,000	100 00	100 00
N. E. Telegraph and Telephone			51 00
N. Y. and N. J. Tel. and Tel 6s			par
N. Y. and N. J. Telephone Stock		100 00	96 00
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North New York, Lighting	150,000	100 00	60 00
Postal Telegraph	5,000,000	100 00	38 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Plainfield, Electric Light	100,000	100 00	75 00
Port Richmond (S. I.)	100,000	100 00	80 00
Russell Electric Lamp Co. (Boston)	300,000	100 00	*95
Rockaway Beach Elec. Light	50,000	100 00	80 00
Richmond L. H. & P. (S. I.)	150,000	100 00	75 00
Saratoga Gas and Elec. Light 6s			*86
Shaver Corporation	100 000	1 00	3 00
Swan Incandescent	800,000	100 00	2 00
Thomson-Houston Electric Co.	10,000,000	25 00	47 00
Thomson-Houston Pref.	5,000,000	25 00	25 00
United Elec. Light and Power	3,000,000	100 00	
United Elec. Traction Co.			2 50
United States Elec. Co			40 00
United States Illuminating	1,250,000	100 00	50 00
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co.	5,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.			50 00
West End, L. (Boston)			22 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

NEW CATALOGUES.

The Electric Merchandise Company, No. 11 Adams street, Chicago, Ill., have just issued a catalogue of electrical railway supplies, which is as complete as it seems possible to make a work of this kind. It is a volume of nearly 150 pages, and is replete with illustrations and information of all kinds relating to electric railways. The firm must have devoted a great deal of time and thought in compiling this work. For the electric engineer who is about to build a road, or for the manager of an electrical road who requires repairs, this catalogue is so complete that they will be able to make out their complete lists without any trouble. Owing to this company's long and practical experience in the electric railway field, and to the fact that they devote all their time to this branch of the electrical business exclusively, they thoroughly understand the wants and requirements of electric railway companies.

HANDBOOK.—We hereby acknowledge the receipt of a copy of that excellent pocket handbook, gotten out by the Standard Underground Cable Company, Pittsburg, Pa., to which we referred a few issues ago. This handbook contains a great deal of useful information to the electrician, and also price lists, telegraph codes, etc., relating to the lead covered electric cable insulated wires manufactured by that company. This valuable work was written and compiled by Mr. Joseph W. Marsh, vice-president and general manager of the company.

A NEW SUPPLY COMPANY.

The Engineering Equipment Company, organized early in February, have located temporarily at 73 Cortlandt street, New York. After April 1st they will be in the new Central Building, Liberty, West and Washington streets.

The following gentlemen, and others, are actively interested in this new and promising enterprise: F. A. Magee, M. E., Engineer; F. L. Perine, General Manager; A. L. Tinker, Secretary and Treasurer. The company are contractors for steam and electric equipment materials. They represent the Underwood Manufacturing Company, of Tolland, Conn., makers of cotton-leather belts, and other specialties in the belting line, and are sole agents for the patent indurated fibre pipe used in electrical subway work and for other purposes. The Engineering Equipment Company are also manufacturers representatives of Corliss and High Speed engines, horizontal and vertical boilers, wooden and iron poles, line materials, wire and cables, underground conduits, cars and trucks, iron roofs, cranes, etc.

It is the purpose of this company to furnish equipment materials of the best class at figures which will be attractive to intending purchasers, especially to those who desire to place large orders in safe, reliable hands and under conditions that will insure the exercise of sound judgment by experienced engineers.

IMPROVEMENTS IN THE MASON BATTERY.

Mr. J. H. Mason, Nos. 118 and 120 Park Ave., Brooklyn, who has made a special study of primary batteries for many years, is constantly making improvements in his well-known battery. His latest is now ready to be placed on the market, and it puts all former ones in the shade. A test was recently made of his new solution, which gives very remarkable results. One No. 9 cell 7 x 5 in. was charged at 11 A.M. one day with one pint of his new solution, and started to work at 1:30 P.M., from which time readings were taken until 5:14 P.M. To begin with, the cell delivered a current of 18 amperes. It ran up as high as 19.6, and varied between that and 10 amperes up to 4:30 P.M. At 5:14 when the last reading was taken 8.1 amperes were being delivered. The battery was on a short circuit during the whole time.

One of the most important improvements Mr. Mason has recently made, is the new amalgamating compound. By adding a teaspoonful of this compound to every two pints of solution in which the zincs are immersed, they will be preserved and never require amalgamating. Solution thus prepared can be used through several charges without any addition of compound. The saving of zinc is enormous, and the surface of the same will always keep clean and bright. Unamalgamated zinc can be used with this compound; thus the saving in first cost is considerable. When thus prepared zinc solution should not be thrown away, as it is only necessary to add the sulphuric acid as per instructions, adding enough water to allow for evaporation only.

THE FRANKLIN INSTITUTE.

The stated meeting of the electrical section of the Franklin Institute, Philadelphia, was held Tuesday, February 24th. The following communications were presented: Some Dangers Connected with Electric Lighting, by William McDevitt; A New Standard Cell, by Mr. Carl Hering; A New Accumulator, by Mr. C. W. Pike; The Effect of Atmospheric Pressure on Batteries, by Prof. Herman Hering; A Suggestion in Arc Lighting, by Prof. C. Hanford Henderson; A New Form of Megohm Resistance, by Mr. R. W. Davids; A Résumé of Recent Development in the Manufacture of Aluminum, by Dr. William H. Wahl.

THE NEW YORK ELECTRICAL SOCIETY.

The next meeting of this society will be given at Columbia College School of Mines, on the evening of Friday, March 6th.

Charles E. Emery, Ph. D., the well known engineer, will deliver a lecture on the subject of "The Utilization of the Forces of Nature."

PERSONAL NOTES.

Mr. M. D. Law, late of Denver, Colo., has been appointed manager of the arc lamp department of the Edison General Electric Company, with headquarters at Schenectady.

Mr. William J. Maiden has been appointed Assistant Superintendent for Ohio of the Central Union Telephone Company, to date from March 1st, 1891. Mr. Maiden's office will be in Columbus, Ohio.

Mr. M. J. Carney has been appointed Superintendent for Ohio of the Central Union Telephone Company, and his office will be in Columbus, Ohio. Mr. Carney's jurisdiction has been extended, and his appointment took effect on February 25th.

PHILADELPHIA NOTES.

J. W. Parker, Electric and Mechanical Engineer, No. 38 South Fourth street, Philadelphia, is furnishing and building several steam power plants for electric light purposes. One has just been completed at Lewistown, Pa., and is working very successfully. The plant carries a one thousand light alternator of the T.-H. system. A new plant at Lockhaven, Pa., which Mr. Parker is erecting, is about ready to start, and will have a T.-H. one thousand light alternator and 35 two thousand candle power arc lamps. At Mt. Carmel, Pa., Mr. Parker is installing a plant which will carry a pair of Edison direct current machines. This new station is in a more favorable location than was the old. The old one was one of the first Edison three-wire central stations ever built. Mr. Parker reports many inquiries for engines for electric lighting and electric railway use. He has just received an order from Washington from the Rock Creek Railway Company for a 150 horse power tandem-compound Ball engine, and expects to close orders for several more.

Messrs. Walker & Kepler, No. 431 Chestnut street, Philadelphia, have lately installed several lighting plants. One of these is in Grace Baptist Church, corner of Broad and Berks streets, with 540 lights. It includes one Beck automatic high speed engine and two Babcock & Wilcox boilers. This plant has the distinction of being the only church installation in Philadelphia, and one of the few in the United States that have their own isolated plant for lighting. The firm have recently added another 500-light dynamo to the Franklin Sugar Refinery plant, making a total capacity of 4,500 lights. This firm has been awarded the contract for installing an Edison electric light plant in the new Girard Avenue Theatre, Girard avenue and Marshall street, now in course of construction; also, one of 600 lights for the Athletic Club of the Schuylkill Navy, No. 1626 Arch street.

Partrick & Carter of this city will, on March 1st, issue an entirely new catalogue in book form which they will be pleased to mail to any address in the U. S. and Canada. This book will be important to dealers in electrical goods and should be eagerly sought for.

The Brush Electric Light Company during 1890 secured from the city the contract for lighting the district embracing the *bon ton* end of Spruce street, and as a result erected their poles to cover the

ground named in the contract. For the year 1891 the Electric Power Company secured the contract covering the territory named, but the former company declined to dispose of its poles to the latter, hence the Power Company was obliged to erect their own poles. Select Councils appointed a committee to have the unsightly poles removed from Spruce street, and at a meeting of the Electrical Bureau yesterday a representative of the Power Company stated that his company would give the city its poles, providing they could use them for public and private lighting, as they had not been able to secure a lease of the conduits in the section referred to. Mr. Camp for the Brush Company said he was not in authority to grant the concessions named by the Power Company's agent, as his company expected to again secure the contract for lighting Spruce street next year. As the erection of the Brush Company's poles was under an ordinance of City Councils, Chairman Etting of the committee, said he would endeavor to have the ordinance revoked if the two electric companies failed to arrive at a satisfactory understanding between themselves.

J. W. Parker, of 38 South Fourth street, agent for the C. & C. Motor, has sold to H. K. Reber, of Reading, Pa., one 25 horse power C. & C. motor, and informs us that his business is showing quite an increase for the month of March.

Mr. Townsend, representing Partrick & Carter Co., will start early in March on an extended trip in the interest of that firm, during which he will go South, Southwest and West. He will have many new goods to offer and at prices that will get the trade. "Tom" is very popular with his friends in the trade everywhere and is always a welcome visitor.

The Langhorne, Pa., Electric Light and Power Company have had their steam plant duplicated by one 15x16 Ball engine and one 60x16 boiler; the erection of the above was under the supervision of Mr. J. W. Parker, an able and efficient gentleman in his line of business.

H. G. G.

THE ELECTRICAL AGE'S ALUMINUM MEDAL.

Our esteemed contemporary, the *Electrical Engineer*, in its issue of Feb. 25, refers as follows to our aluminum medals which were distributed at the Providence convention:

"THE ELECTRICAL AGE" was well represented by its entire New York staff, and made *the* success of the convention in the souvenir line with its "Aluminum Age" medal. The medal is a very neatly executed one, the size of a dollar; and as they were bored and had a ribbon attached, everybody wore one. In fact, the good people of Providence got the idea that the medal was the Association badge and treated every wearer accordingly with due honors. It is also said that a great many were paid out as good current coin by waggish and festive "night owls," and were presented later on at the Hotel for redemption. Be this as it may, it is certain that a Convention souvenir was never more of an instantaneous and pleasing success than this, and that the ELECTRICAL AGE deserves a gold medal for its enterprise and originality. The souvenir was, moreover, extremely appropriate, seeing that it is to progress in the electrical arts that aluminum now owes its position as a useful and readily obtainable metal.

A MODEL RAILROAD.—The Philadelphia and Reading Railroad controls over 1,057 miles of roadway, which is laid with 90 pound steel rails, and for the most part stone ballast. Its total trackage, including main lines, branches, laterals and sidings, is 2,180 miles. The line between New York, Philadelphia and Washington cannot be surpassed for equipment, fast time, comfort and picturesqueness of scenery. In this latter particular it is especially notable.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, Mass., Feb. 28, 1891.

The Gould & Watson Company are experimenting with a new storage battery.

Drake, Payson & Whittier were exhibitors at the electrical convention at Worcester.

E. M. Carhart & Co. of Providence, have just finished the installation of a Holtzer-Cabot watchman's clock in a large brewery of that city.

Maybin W. Brown, of the Eastern Electrical Supply and Construction Company, contemplates taking a trip to Cuba about March 1st. It is supposed that business is combined with the pleasure of the trip.

A. E. Bliss, manager of the Malden Electric Company, is dangerously ill with a fever.

Sherman L. Whipple has been elected treasurer of the Redding Electric Company, *vice* Harvey Redding, resigned.

Bird & Sloane are receiving large orders for their "Diamond S" open circuit battery.

The Shultz Belting Company sold six link belts yesterday from eight to sixteen inches wide, as a result of their splendid exhibit at the convention at Providence.

Mr. Henry F. Kellogg has just been appointed manager of the light and power department of the Eastern Electrical Supply and Construction Company.

Pettingell & Andrews are having quite a run on their K. W. goods.

It is understood that Mr. Charles B. Burleigh has discovered a device to stop Frank Ridlon's horse. Mr. Burleigh will test the practicability of this latest electrical invention on the horse he expects to draw in Chelsea as being the most popular superintendent. Electricians should call on Mr. Burleigh and see his invention.

The Page Belting Company, of Concord, N. H., manufacture, in their extensive works, all the staple grades of leather belting, making specialties of wide main belts, particularly for electric plants, and also of a special grade of single belting, which they call their Crown Extra. During the past year they have added to their specialties for electric work their Acme link belt, of which they have sold a large number with the very best results, some of them being put into very hard work and running at a high rate of speed (considerably more than a mile per minute) with the very best of service. They also report large and increasing sales in their dynamo double flat belt for driving dynamos. This establishment now has stores in New York, Boston, Chicago and San Francisco, having recently opened at No. 16 Dey street, New York, where they have a complete stock of staple and special grades of belting, including lace leather, both raw hide and tanned. Among the establishments recently fitted up by them with belting are the following: Ducey & Backus Lumber Company, Brandon, N. Y.; Star Thread Company, Athens, Ga.; Eagle Lock Company, Terryville, Conn.; Lebanon Building and Power Company, Lebanon, N. H., and have also shipped: 26 in. to Geo. G. Page Box Company, Cambridgeport, Mass.; 20 in. to Sanford Mills, Sanford, Me.; 26 in. to Amesbury Electric Light and Power Company, Amesbury, Mass.; 17 in. to W. F. Swords Lumber Company, Bridgeport, Conn.; 20 in. to S. O. Cummings, Bellaire, Ohio. They have also shipped Acme Link Belts to the Warren Electric Light Company, Warren, Pa.; the Wheeling Steel Works, Wheeling, W. Va., and many others.

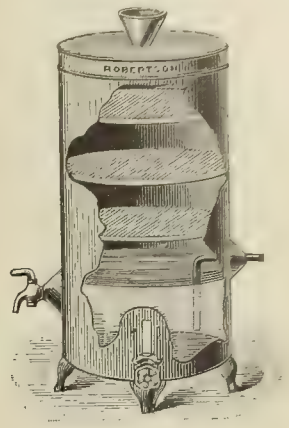
F. E. B.

The larger proportion of electric arc lights in operation is run on circuits of constant current, the lights being in series.

SHORT ARCS.—In "short arc" systems the carbons are burned much nearer together than in the "long arc" systems.

ROBERTSON'S WASTE OIL FILTER.

Economy in the running of steam plants being a necessity, steam users will no doubt examine with interest the waste oil filter we illustrate. It is manufactured by Hine & Robertson, 45 Cortlandt street, who claim that it combines common sense principles and simplicity in construction, and will return its cost in a very short time wherever any quantity of oil is used. Composed of three movable trays in which suitable filtering cloths are placed, the waste oil and water is poured in at the top and



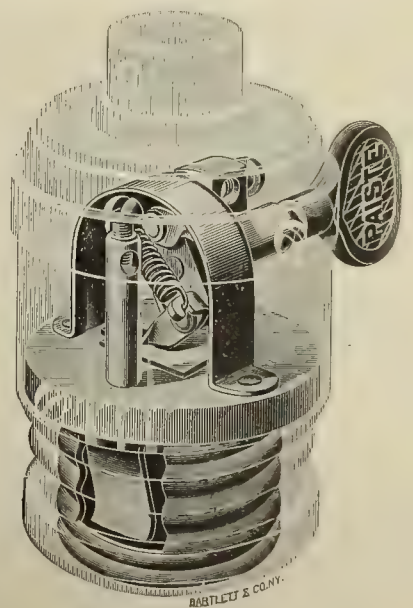
WASTE OIL FILTER.

passing through these filtering cloths, drops to the bottom chamber thoroughly cleansed of all grit and foreign matter, and in a condition to use over again. This process can be repeated from time to time with the same results. Suitable water gauges and cocks are provided for drawing off the oil and a siphon for carrying off automatically any water poured in with the waste oil.

The lid and trays being loose, make it a very easy matter to clean. Durably made and attractively japanned, it is an ornament, and its low price places it in the reach of every one.

PAISTE-EDISON SOCKET.

The illustration given below is of a Paiste-Edison Socket, for which the Central Electric Company, of Chicago, are general Western agents. As will be noticed, it is a combination of the celebrated



PAISTE-EDISON SOCKET.

Paiste switch and the Edison incandescent lamp socket. The capacity of the Paiste switch in the socket is 5 amperes, and the whole thing is no larger than the ordinary Edison socket. The advantages claimed for this combination are compactness and superior electrical connections.

SPARKING.—If an attempt be made to separate any part of a circuit in which the current is maintained by a sufficient potential and the separated ends are moved quickly, we get a flash or spark of varying length, which becomes a flame of great heating effect if the current be of large rate of flow.

ENERGY OF THE ARC.—The real energy used in an electric arc is not expended in overcoming flame resistance, but chiefly in vaporizing carbon in the positive crater.

ELECTRICAL HORSE POWER.—An arc consuming 90 to 100 watts, means, of course, about 7 or 8 to the electrical horse power.

ELECTRICAL PATENTS.

ISSUED TUESDAY, FEBRUARY 24th, 1891.

446,846. Thermostat. Adolph M. Barron, Kansas City, Mo. Filed Sept. 19, 1890.

446,864. Electric Motor. Ludwig Gutmann, Pittsburg, Pa. Filed Sept. 18, 1890.

446,871. Binding Post. Charles A. Lieb, New York, N. Y. Filed Sept. 19, 1890.

446,902. Automatic Cut-out. Jacob P. Tirrell, Boston, Mass., assignor to Horace A. Pinkham, Philadelphia, Pa. Filed June 4, 1888.

446,917. Electric Railway Signal. Earl T. Harvey, Chicago, Ill. Filed Nov. 6, 1888.

446,931. Trolley for Electric Railways. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Nov. 12, 1890.

446,966. Cut-out. Stephen D. Field, Stockbridge, Mass., assignor of one-half to Phoebus H. Alexander, New York, N. Y. Filed May 28, 1890.

446,967. Electric Time-Lock. Malon I. Flowers, Springfield, Mo., assignor of two-thirds to James E. Jones and C. W. Price, both of Oklahoma City, Oklahoma. Filed May 5, 1890.

446,974. Method of and Apparatus for Electric Welding. Hermann Lemp and Louis M. Schmidt, Lynn, Mass., assignors to the Thomson Electric Welding Company, of Maine. Filed July 23, 1890.

446,985. Trolley-Wire Hanger. Charles H. Macloskie and William E. Baker, Boston, Mass. Filed Nov. 18, 1890.

446,995. Socket for Incandescent Electric Lamps. John M. Orford, Bridgeport, Conn. Filed Nov. 18, 1890.

447,016. Galvanic Battery. Martin W. Robinson, Medford, Mass., assignor to the Vulcan Electric Company, Kittery, Me. Filed June 6, 1890.

447,023. Electro-Heating Apparatus. Charles E. Carpenter, Minneapolis, Minn. Filed Sept. 27, 1890.

447,045. Magneto-Electric Signal Device. Noel B. Ginochio, New York, N. Y., assignor of one-half to Elias M. Greene, same place. Filed May 9, 1890.

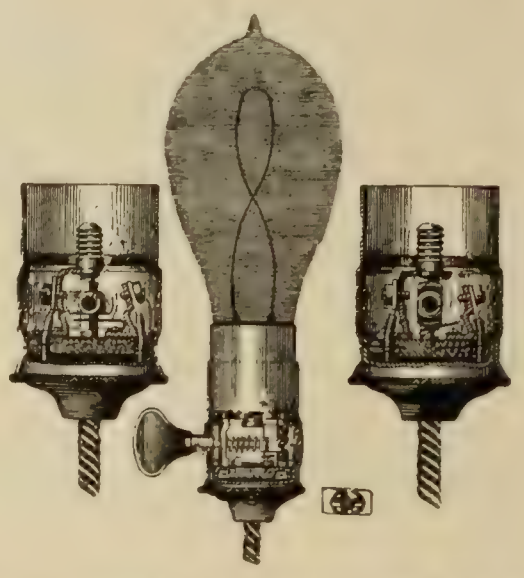
447,058. Police Signaling Apparatus. Bernice J. Noyes, Boston, Mass. Filed July 28, 1887.

447,059. Police Signaling Apparatus. Bernice J. Noyes, Boston, Mass. Filed July 28, 1887.

447,060. Municipal Signal Apparatus. Bernice J. Noyes, Boston, Mass. Filed Sept. 14, 1888.

447,061. Municipal Signal Apparatus. Bernice J. Noyes, Boston, Mass. Filed Sept. 14, 1888.

447,062. Signal Box. Bernice J. Noyes, Boston, Mass. Filed Sept. 11, 1888. Renewed Dec. 5, 1890.



446,995. SOCKET FOR INCANDESCENT ELECTRIC LAMPS.

447,074. Non-Interference Fire-Alarm Signal-Box. William H. Kirnan, Brooklyn, assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed Mar. 1, 1889.

447,104. Electric Welding Apparatus. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed Nov. 1, 1890.

447,105. Independent Electric Clock. Walter J. Dudley, Everett, Mass. Filed October 18, 1890.

447,127. Vacuum Core for Electrical Heating Devices. Henry R. Butterfield, Waterville, Me. Filed June 25, 1890.

447,143. Electric Heater. John I. Ashbaugh, Chattanooga, Tenn., assignor of one-half to David G. Curtis, same place. Filed Mar. 15, 1890.

447,166. Telegraph-Transmitter. Samuel W. Smith, New York, N. Y. Filed Nov. 13, 1890.

447,177. Regulator for Electric Circuits. Thos. M. Edwards, New London, Conn., assignor to Thomas W. Williams, same place. Filed Nov. 5, 1890.

447,194. Telephone. Ernest J. P. Mercadier, Paris, France. Filed May 26, 1890. Patented in France, England, Germany and Belgium.

447,195. Annunciator and Indicator System. John E. A. Miller, San Francisco, Cal. Filed Sept. 5, 1890.

447,198. Telegraph Apparatus. Josiah A. Parker, St. Louis, Mo. Filed Feb. 28, 1890.

447,208. Cross-Over for Trolley-Lines. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Oct. 22, 1890.

447,215. Electric Railway System. Charles J. Van Depoele, Lynn., Mass. Original application filed Mar. 7, 1889, Divided and this application filed Nov. 8, 1890.

447,220. Transmitter-Circuit. Anthony C. White, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed July 24, 1890.

447,230. Current-Controlling Device for Electric-Railway Cars. Jacob C. Chamberlain, New York, N. Y. Filed Sept. 9, 1889.

447,255. Electric Motor Mechanism. Samuel E. Mower, New Haven, Conn., assignor to Henry G. Thompson & Sons, same place. Filed May 31, 1890.

447,256. Apparatus for Flashing and Exhausting Incandescent Electric Lamps. William E. Nickerson, Cambridge, and Adolph Berrenberg, Somerville, Mass., assignors to the Beacon Vacuum Pump and Electrical Company, Portland, Me. Filed June 20, 1890.

447,279. Secondary Battery. Stanley C. Currie, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed Nov. 18, 1890.

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NEW YORK, MARCH 14, 1891.

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TRANSLATED INTO JAPANESE.

It will be well remembered that during last year we published a series of articles entitled "Electric Lighting for Beginners," which attracted a great deal of attention and elicited much favorable comment.

Our correspondent in Tokio, Japan, informs us that the articles were greatly appreciated by those interested in electricity in that country who could read English and that they were translated into the Japanese language for the benefit of native electricians who had no knowledge of the English language. They have been published in a native paper in Tokio.

THE MONTREAL CONVENTION.

Already there are indications among electrical people of a hearty disposition to make the Montreal Convention the most successful of any yet held by the National Electric Light Association. In the electrical trades calculations are being made with reference to the exhibits, and there is an evident disposition to make this feature of the meeting next August more successful than any of its predecessors.

THE NEW WESTINGHOUSE MOTOR.

We give in this issue a very full description of the new Westinghouse electric railway low speed motor.

This new motor possesses many valuable features, both in its mechanical and electrical construction. It is claimed to be of high electrical efficiency, for the following reasons: There being no external magnetism, there is consequently small loss in the lines of force, the air gap is reduced to a minimum, low resistance of the field coils and armature, and the utilization of all the wire on the armature owing to special winding. All else being equal, a motor of this character should be an extremely efficient one, and the Westinghouse Company show great enterprise in producing a machine of this class so well designed for the work for which it is intended.

SUITS AGAINST THE CITY.

The sequel to the crusade against the electric wires in this city in 1889 materalized on March 5th in the shape of suits against the city for damages. The plaintiffs are the Brush Electric Lighting Company and the United States Electric Lighting Company. The former company sues for damages in the amount of $525,000, and the latter to the extent of $550,000. The companies aver that the interference with their business caused by the attack on the poles and the breaking of the currents which supplied private patrons with light was disastrous and that for several weeks they were practically prevented from doing business by the city's attack on their poles.

The city will claim in defence that it has the right to regulate structures in the public thoroughfares which affect the life and health of the public, and that the plaintiffs had wrongfully neglected and refused to remove the poles.

The trial of these cases will add an interesting chapter to the story of this remarkable fight.

OUR SPECIAL ILLUSTRATIONS.

In our last issue we gave three illustrations made from photographs of exhibits at the recent convention in Providence of the National Electric Light Association, and in this issue we present others. That our enterprise has been appreciated is evident from the number of complimentary letters received from all quarters.

Photography has become a most important adjunct to a well conducted paper and we believe the ELECTRICAL AGE is the first electrical journal to make extensive use of the camera for the purpose of illustrating descriptive matter in its columns.

We have on our staff a gentleman who is expert in the use of the camera, and it is through his efforts that we are enabled to present these excellent illustrations of the various exhibits. At Providence the pictures were obtained under the most difficult circumstances and at night time, when the lightning-like flash of the magnesium had to be depended upon to make an impression on the sensitized plates. How well he succeeded our readers may judge for themselves.

HIGH SPEED ELECTRIC RAILWAY WORK.

The first authentic and detailed account of the remarkable experiments made four years ago at Laurel, Md., near Baltimore, in high-speed electric railway work is published in this issue. The facts were given by Mr. O. T. Crosby, in a paper read before the American Institute of Electrical Engineers on February 24.

It will be remembered that the experiments were conducted under Mr. Crosby's direction, and the results were, indeed, marvelous.

Mr. David G. Weems, of Baltimore, conceived the idea of constructing an automatic electric railway service from city to city, the cars to be smaller than would be necessary for placing a man, and it was for the purpose of demonstrating the practicability of the idea that these tests were made.

The experiments demonstrated the fact that, all conditions being favorable, very high speeds can be attained. Indeed, a speed of 120 miles an hour was actually reached on the occasion of the last test, and had it not been for the fact that the motor was derailed owing to inherent defects in the roadbed itself, still higher speed would have been shown.

Mr. Crosby discusses the subject at great length, and even goes so far as to consider a line from New York to Chicago in its commercial aspect. The figures he gives in this connection are endorsed by high scentific authorities, who conclude their opinion with these words:

"Should it be demonstrated by an actual test that passenger trains can be run safely and economically at a speed over 100 miles per hour from here to Chicago, the financial aspects of the case would certainly be improved. We are of the opinion that the chances are in favor of this being accomplished by the present scheme."

The paper thoughout, from beginning to end, is an extremely interesting one, and considered in a reflective mood, its most striking feature is the boldness displayed in the undertaking of the enterprise.

In this age of progress man does not stop at anything. Scientific knowledge helps him out of every difficulty, and there is hardly any obstacle that cannot be surmounted by its aid. Electricity has done more to help him in the accomplishment of his daring designs than any other available power, and there is no doubt that greater wonders are yet to be accomplished through its agency.

OBITUARY.

THOMAS P. CONANT.

Mr. Thomas P. Conant, electrical engineer for the eastern district of the Edison General Electric Co., died on February 24th last, and his funeral was held at the house of his grandfather, the Rev. Dr. T. J. Conant, in Brooklyn, February 27th.

Mr. Conant's death was quite a surprise to electrical engineers here and elsewhere, and caused profound regret. Mr. Conant was born in Paris, June, 1860, and he was educated at the Columbia School of Mines in this city, from which he was graduated in 1882. He then became secretary to Mr. Thomas A. Edison, and made rapid advances in electrical engineering. He was for a time connected with the Accumulator Co. of this city, and was a member of the Electric Club, the American Institute of Electrical Engineers and numerous other electrical and engineering societies. The cause of his death was rheumatism of the heart.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The fifty-fifth meeting of the American Institute of Electrical Engineers will be held at the House, No. 12 West Thirty-first street, on Tuesday evening, March 17th, when a paper will be read by Mr. J. J. Carty, electrician of the Metropolitan Telephone and Telegraph Co., on "Inductive Disturbances in Telephone Circuits."

NIAGARA'S POWER.—A report from Lockport, N. Y., says that Niagara Falls is to furnish power for an electric railway for which Rochester capitalists are endeavoring to obtain the right of way. The proposed road will be more than 80 miles long.

NEW WESTINGHOUSE LOW SPEED RAILWAY MOTOR.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., have just brought out a new slow-speed motor known as motor No. 3, which embodies some new and valuable features. A full description of this new motor, with illustrations, follow.

In Fig. 3 is presented a perspective view of the Westinghouse four-pole or single reduction motor, while Fig. 4 shows another view, bringing out more prominently the gear casing. The construction of the motor can be more readily comprehended by referring to Fig. 1. Here are shown the castings of the motor complete, consisting of only three parts, the frame and the two semi-cylinders, the two latter being practically one. The size of the frame is such that it can readily be placed upon a bogie truck, being equally as well adapted for an eight-wheel as for a four-wheel car. The width of the motor is such that it can be used on an ordinary 3′ 6″ gauge, and by slight changes, on a 3′ gauge. In the sides of the two semi-cylinders are seen the holes where the plates are secured which serve as a protection to the sides of the machine.

drical form the maximum strength is obtained with the minimum amount of material. All corners and sharp edges which mean unnecessary weight, and at the same time having a tendency to reduce the efficiency, are eliminated in this machine.

The fields are completely enclosed and protected, not merely externally by the surrounding cylindrical shell, but also internally by the heavy brass cap covering it completely.

The cast-iron frame on which the motor is mounted, also forms a distinguishing feature of the Westinghouse motor. This frame is rectangular, in one casting, and made especially strong at points subjected to the greatest strains. The frames, and, in fact, all parts of the motor, are interchangeable. By means of this frame the armature and car axle are maintained in perfect alignment, and consequently perfect meshing of the gears is obtained, which experience has proved to be of vast importance. The gearing is mounted closely to the frame so as to eliminate the objectionable buckling and tendency to loosen parts. This method gives a strong mounting and perfect rigidity between the parts of the motor. Moreover, by extending this frame completely around the motor and suspending it at both corners, the strains are distributed which

semi-cylinder. The armature is then ready to be taken out, and by removing the bushing-cap and placing a sling about the armature, it can be lowered into the pit without obstruction or danger of injuring the armature.

The armature is what is known as the drum type, which experience has demonstrated is superior to other types for street railway work. The armature core is built up of laminated grooved iron plates, so that the completed core has slots to receive the wires. In the completed armature, the wires are completely imbedded in iron, hence they cannot be injured from ordinary external causes. Since the surface of the armature is iron, the air-space, that is, the distance between the iron and the armature and pole-pieces, is reduced to a minimum, thus greatly increasing the efficiency of the motor.

The armature shaft is manufactured from the best grade of forged steel, especially prepared for this purpose. The end of the shaft is tapered to receive the pinion, the holes of which are also tapered so as to fit the shaft perfectly. By this means, the pinion always fits the shaft perfectly, and moreover, can be easily removed. The construction of the shaft and armature is such as to make it exceedingly strong, and

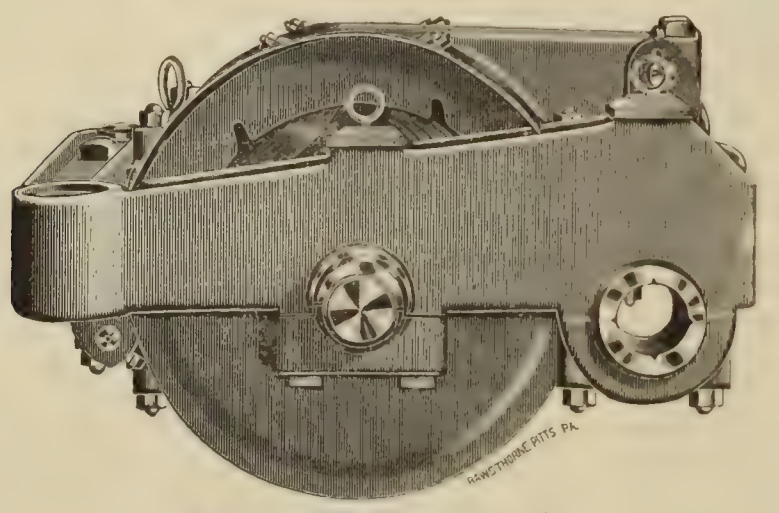


FIG. 1.—SIDE VIEW OF MOTOR.

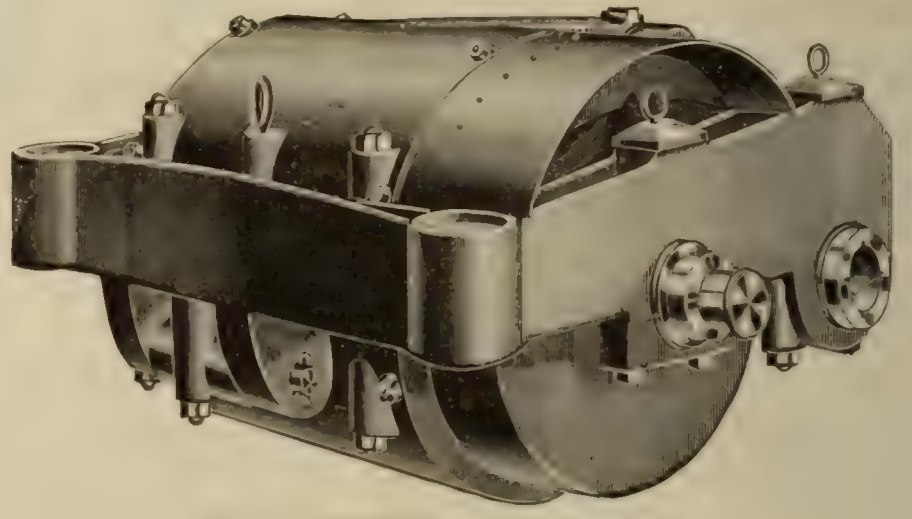


FIG. 3.—PERSPECTIVE VIEW OF MOTOR.

If necessary, the machine can be completely shut in, so as to make it thoroughly iron-clad. It was formerly believed that a motor could not be shut in, since it needed ventilation; but experience with Westinghouse high speed motors, and that of manufacturers in England, has fully demonstrated that if a motor is correctly designed, electrically and mechanically, and properly constructed, there is no difficulty whatever in enclosing it. At the same time if, in some cases, it be deemed advisable to allow a small opening for ventilation, the plates can be constructed accordingly.

The method of enclosing the motor completely is exceedingly convenient in snow and rain storms, and especially where the cars pass over trestles which expose the motor to the full force of the storm. Heretofore, considerable trouble has been experienced from water dripping on the motors from the car floor; in this new motor, as is obvious, such troubles are completely eliminated.

Again, the objections of the motor being exposed to water, dirt and dust, can be fully appreciated when it is remembered that a large number of engineers favor some method of mounting the motors on the car floor. The above objections are completely overcome by making the motor iron-clad.

By again referring to the cut, there will be seen the four internal poles, hence, it is what is called a four-pole motor. Some of the advantages of four-pole over two-pole machines are slower speed, greater simplicity, better symmetry, and most important of all, greater radiating surface for the field coils. In case a two-pole motor is used, and the same amount of wire is wound about these two poles, the radiating surface certainly is far less than where there are four poles. An ideal machine would have one layer of wires around the pole, but this, of course, would not give the best economy.

Another important feature to be noticed is the form of the motor proper, namely, circular. It is a well-known law in mechanics that the strongest form is the arch; consequently, by this cylin-

prevents the abnormal wearing of the bearings so characteristic of single centre suspension.

In Fig. 2 is shown the method of hinging the field castings. These, as will be noticed, can readily be swung back, thus giving easy access to the fields and armature. It will be noticed that the poles protrude radially from the interior of the

capable of withstanding the severe strains sometimes brought upon it. It will be noticed that the oil receptacles are sunk into the frame. These oil cups are thus disposed of, so that there is no liability of injuring them. The oil boxes are very large and the method of oiling is the same as that of the high speed.

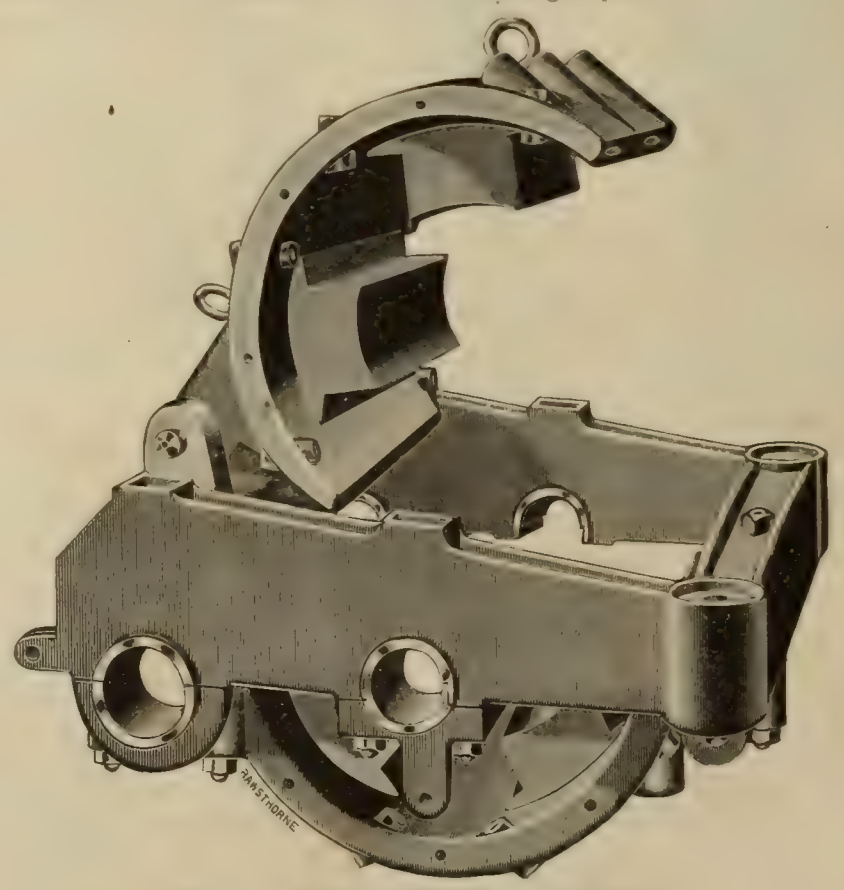


FIG. 2.—FRAME AND FIELD CASTINGS.

cylindrical shell. The field coils shown in Fig. 9, are slipped over these poles and held in position, and at the same time, thoroughly protected from the interior by a brass cap. Any field can be removed without disturbing any other part of the motor, and this can be accomplished in little time and with the greatest ease. The lower field can be removed similarly by swinging back the lower

In Fig. 8 is shown a view of the field coils. These are wound with wire having exceedingly large carrying capacity, and they are wound with great care.

The arrangement adopted for the brush holder has also been very neatly worked out. It consists of a square oak holder attached to the side of the frame and carrying the brush holders proper, which

are clamped so that they can readily be adjusted. The carbon brushes are placed in a sliding frame and pressed against the commutator by a pair of springs which can be released by a pressure of the finger and the carbon slipped out for replacement when worn.

The casting supporting the brush-holder is fastened at the bottom of the motor so that the brushes rest on the upper part of the commutator, the greater part of which is exposed above so that the commutator can readily be cleaned from the inside, as well as from the outside of the car.

The superior mechanical advantages of the Westinghouse Slow Speed Street Railway Motor are:

1. Simplicity.—As is shown by the fact that the body of the motor consists of only three parts; the frame, and the two semi-cylinders, which are practically one. This is the simplest combination possible. Constructions or devices tending to complicate the motor have been carefully avoided, since great simplicity and few parts are so essential to the success of any machine.

2. Strength.—It has been proportioned so as to be capable of withstanding the severest strains to which it will be subjected in practical operation. The gears, shafts, in fact all details, are designed and made especially strong at points called upon to resist the maximum strain. In fact the first impression received from the motor is its substantiality.

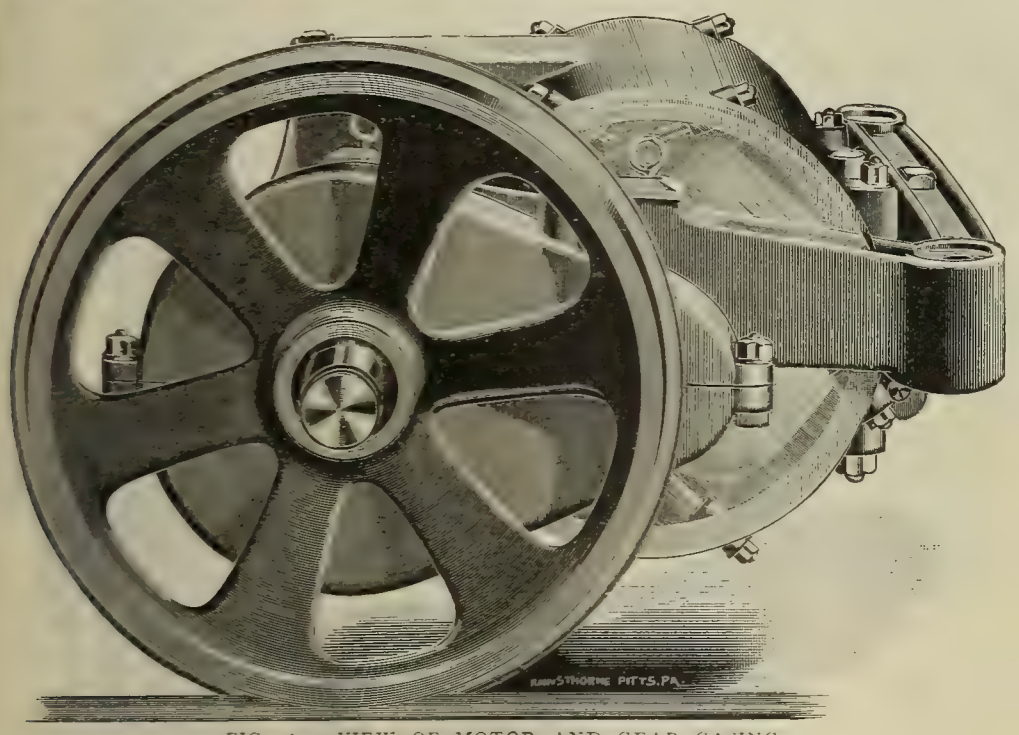


FIG. 4.—VIEW OF MOTOR AND GEAR CASING.

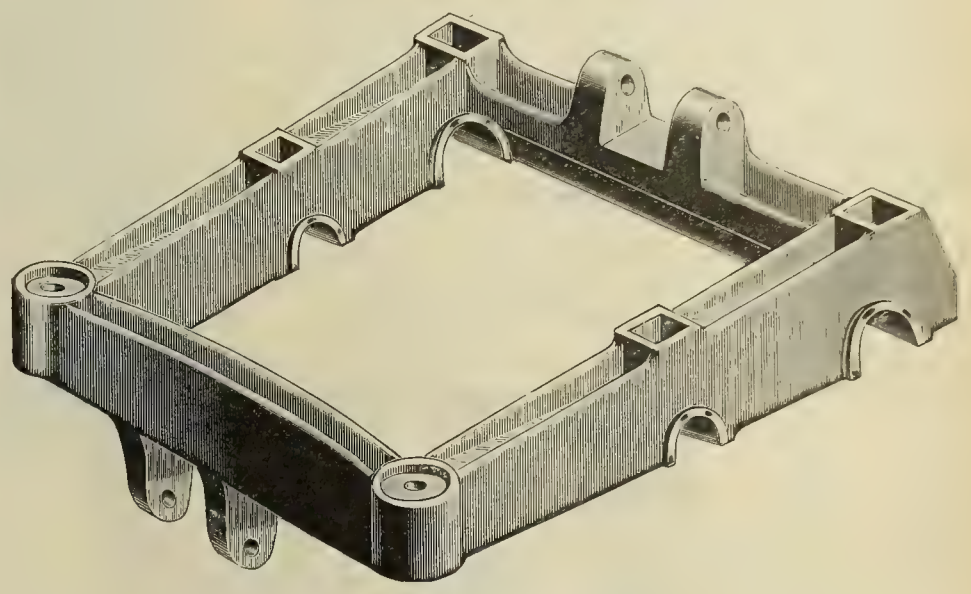
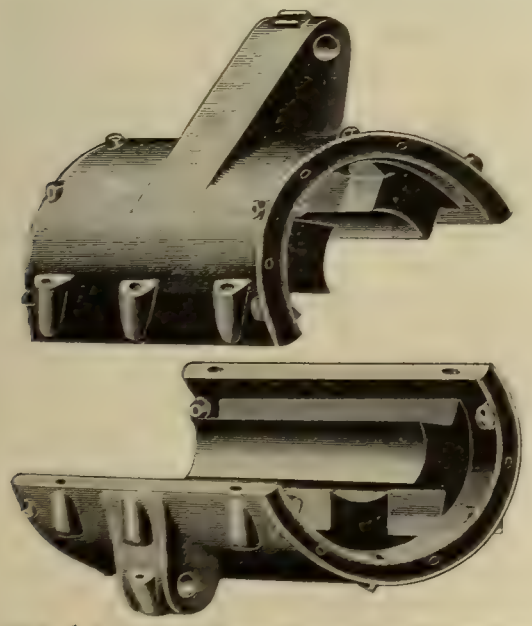


FIG. 5.—MOTOR FRAME.



FIGS. 6 AND 7.—UPPER AND LOWER HALVES OF CYLINDER.

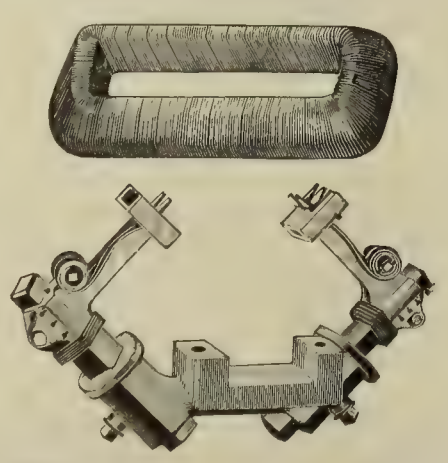
3. Durability.—This essential and desirable feature is obtained by thoroughly and completely protecting the running and wearing parts of the motor from dirt and dust, and from the very fact that the motor was designed with this special object in view. The material and workmanship are thoroughly first-class, hence a durable motor.

4. Noiseless.—The method of encasing the gears with a cast iron box prevents the objectionable noise so common to other systems. The slow speed of the armature produces no noise whatever from the brushes pressing against the commutator.

5. Efficiency.—The great mechanical efficiency of the motor will be evident when it is taken into consideration that there is only one pinion and gear, these running in lubrication and protected from dirt and dust. Owing to the peculiar design of this motor a very high electrical efficiency is obtained. Some of the facts contributing to this high efficiency are, that the wires are placed in slots so that the air-space between the armature and pole-piece is reduced to a minimum; and also that the wires on the fields and armature have a large carrying capacity, thus consuming little energy in themselves.

6. Slow Speed.—An often quoted principle of mechanics is, that the wear of a machine is proportional to the speed. Now remembering that the speed of this motor armature is only one-fourth that of the high speed type, it will be evident that this is a most desirable feature. Of course the speed of the car itself remains the same as heretofore, or it can be made any speed desired within certain limits. Owing to the slow speed of the armature, a comparatively large armature pinion can be used, and consequently the efficiency of the gearing is greatly increased. The wear of gears, bearings, shafts, commutator and brushes is enormously reduced.

7. Iron Frame.—One point of great superiority of the Westinghouse motor, is the iron frame on which the motor is placed. No other street railway motor has a frame similar to this. The advantages of this frame will be apparent; it keeps the axles in perfect alignment, always giving a perfect meshing of the gears, preventing any twisting or torsional action between the different parts of the motor and also prevents any buckling of axle or any back lash in the gears.



FIGS. 8 AND 9.—FIELD COIL AND BRUSH HOLDER.

8. Cylindrical Form.—This cylindrical iron form of the motor is the strongest and simplest possible to construct with the same amount of iron, making use as it does of the maximum amount of material in the minimum amount of space. It also thoroughly protects the armature and field coils from external injury; in short, it produces an ironclad motor.

9. No External Magnetism.—In most other machines, there is considerable external magnetism, thus dissipating energy and creating a tendency to draw pieces of iron into the revolving armature, which are liable to injure the armature and field coils. The cylindrical iron form of this machine absolutely prevents any external magnetism.

10. Well Protected.—The motor is thoroughly and completely protected; in fact, it is almost entirely surrounded by iron. The field coils are not merely protected from the outside, but also on the inside by a heavy brass cap. The motor can be completely shut in by fastening plates on the side, thus protecting it thoroughly from rain or snow. Also, there is not merely a complete protection of the field coils and armature, but also of the commutator. The upper part of the motor is also completely protected from water leaking through the car floor or platform. All pans, sheet-iron coverings and similar devices for protecting the motor are unnecessary.

11. Armature Winding.—The wires of the armature are thoroughly protected from injury by being placed into slots in the core. This prevents any lateral motion of the wire. They are also protected above by the strips so that they cannot be injured, even though a neglected bushing be worn so that the armature will come in contact with the pole.

12. Field Coils.—The greatest possible care is taken in the winding of these coils. The size of the wire is also much larger than that in any street railway motor of the same size.

13. Special Commutator.—The commutator is one of the most interesting features of this motor. It is designed wholly for street-car work and so constructed that heating, should any occur, produces no unequal expansion, thus preventing the commutator bars from ever becoming loose from this cause. Each segment has underneath its entire length a bearing surface, making it impossible, even with a hammer, to bend down or move out of place any segment. The commutator is so protected that it is impossible for foreign substances to lodge between the segments.

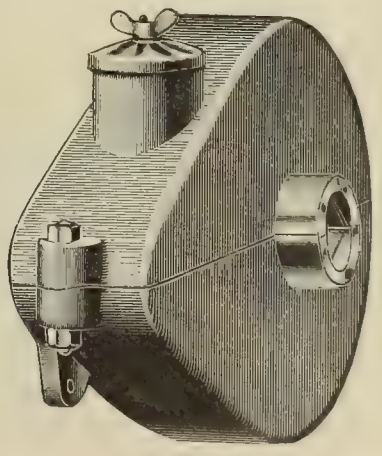


FIG. 10.—GEAR CASE.

14. Material.—Nothing but the best material is used throughout the entire construction of the motor The shaft and pinions are of the best forged steel especially prepared for this work. The cast iron employed for the magnetic circuit, is of a special soft grade, having excellent magnetic properties, and the copper and insulation are of the very best.

15. Taper Shafts.—The end of the armature shaft is tapered for the mounting of the pinion, the hole of which is also tapered. The armature pinion is fas-

tened by means of a special tightening device. The great advantage of this construction is that when the pinion heats, and consequently expands, the pinion is forced along the shaft, thus always giving a tight fit; and also the ease with which this pinion can be removed or put back in its place.

16. Gear Casing.—The gears are encased in a cast iron casing partially filled with grease. The advantages of this, are that it prevents any dust or dirt from getting at the gears, increases the efficiency of the gearing and deadens completely the noise produced by them. This increases the life of the gears enormously.

17. Hinging Construction.—The motor is so constructed that the lower and upper half of the cylindrical shell can be swung back, giving easy access to any part of the motor. The armature can be removed with the greatest ease without danger of injuring or bruising it. Another important advantage is the fact that it is never necessary to remove the iron castings or body of the motor from the car truck, since the armature, field coils and bushings can all be removed without disturbing these.

18. Method of Suspension.—The motor is suspended at both corners of the frame, thus relieving all parts from any twisting action or severe strains liable to occur when the motor is merely suspended at the centre; in addition to this, distributing the strains on all parts of the machine and also relieving the bushings from any abnormal wear.

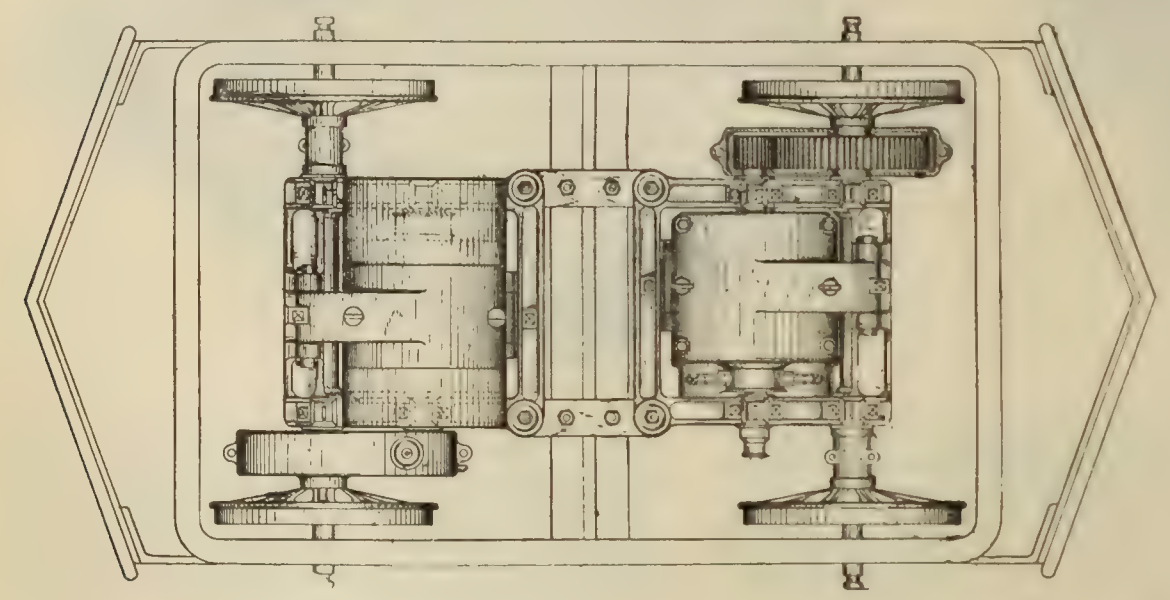


FIG. 11.—PLAN AND ELEVATION OF MOTORS ON TRUCKS.

19. Gear Pitch.—Small ratio of gear reduction which is only 3.3 to 1. As is well known, the larger this ratio up to a certain limit, the more inefficient the gearing.

20. Armature Speed.—When the car is running at the rate of ten miles per hour, the armature makes less revolutions per minute than any other slow speed motor of equal capacity. The peripheral speed is also very low; while the car moves 1,000 feet, the armature wire moves only 1,250.

21. Binding Wires.—There is practically no strain on the bands, as it is transmitted directly to the armature core.

The following superior electrical advantages are claimed for Westinghouse slow speed motors:

1. High Efficiency.—Very high efficiency, due to the following:

(*a*) No external magnetism; consequently very small loss in the lines of force—the loss being only one-third of what it would be with two-poles.

(*b*) High efficiency; due to the fact that the air-gap is reduced to a minimum; that is, the distance between the iron of the armature and of the fields being made so very small.

(*c*) Low resistance of the field coils and armature.

(*d*) High efficiency due to utilizing all the wire on the armature, owing to special winding.

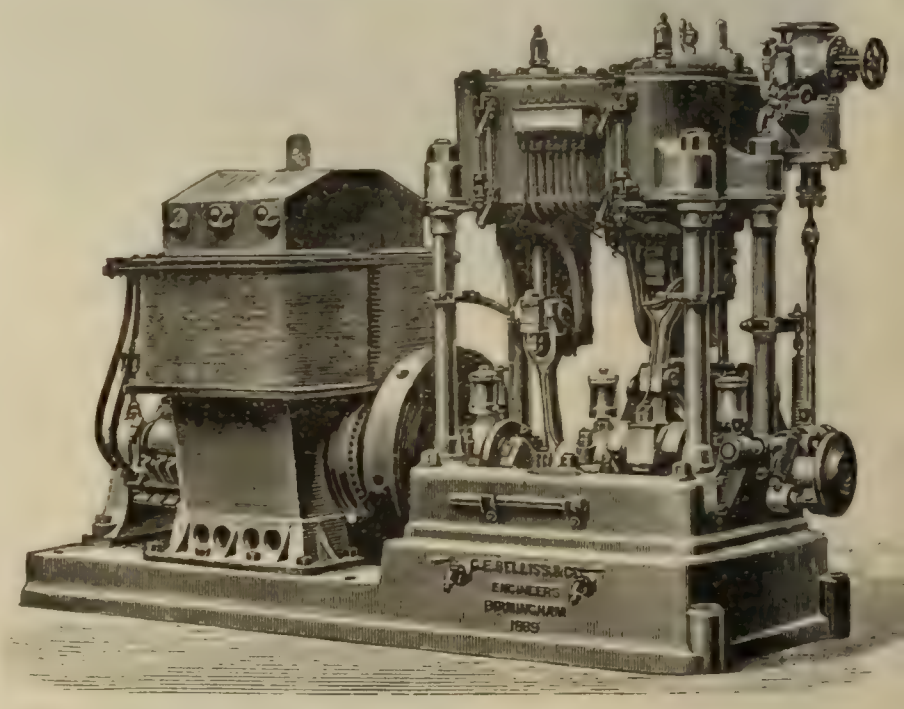
2. Armature Winding.—The size of the wire on the armature is large and the number of turns small; the smaller the number of turns, the less de-magnetizing effect on the field: hence much less sparking at the brushes and controlling switch. The larger the wire, the lower the resistance and the greater the capacity and the efficiency.

3. Cylindrical Form.—This gives the most symmetrical form; and the more symmetrical the field the less tendency to sparking in any motor.

4. Narrow Pole Faces.—The narrower the poles, the smaller the reaction or de-magnetizing effect of the armature on the field, and consequently, the more constant the lead. This simply means no sparking at the commutator. Moreover, since the field coils are placed over these narrow poles, the proper demagnetization with the least length of wire is obtained, and therefore the least resistance, hence higher efficiency.

OPEN COMPOUND ENGINE FOR SHIP LIGHTING.

The English Admiralty have recently abolished the use of the closed type of engine, formerly used almost exclusively in the Navy for electric light machinery, and have substituted therefor open engines of the compound type, an illustration of one of which we give herewith. These engines are made by a Birmingham firm for the new ships of the British Navy, and trials at Portsmouth have given complete satisfaction. The engine is well balanced, the cranks being opposite, and the valve arranged to give the amount of pressure required for economical and quick running.



OPEN COMPOUND ENGINE.

In the construction of these engines, it was aimed to produce a machine capable of running for long periods without requiring adjustment, and with such simplicity of parts as shall render liability to damage as small as possible, and give the utmost facility for adjustment or repairs. The engine and dynamo are carried upon a combination base plate.

The illustration shows the engine in combination with a Siemens dynamo, but the dynamos of any other design may be used.

It is said that the forthcoming Naval exhibition in England will include electric light machinery, and an interesting display will likely be made.

HYSTERESIS.—The effect of successive reversals of magnetism in iron causes it to heat, and this phenomenon is termed hysteresis.

ELECTRO-MAGNETISM.

Whenever the poles of a battery are connected by a conductor, or series of conductors, so as to form a circuit, a current of electricity is assumed to flow from the negative to the positive pole, through the battery itself, and from the positive to the negative pole, through the conductor.

If the conducting wire is covered with an insulator, such as silk or cotton, so as to compel the current to traverse the entire length, and is wound into a spiral or coil, surrounding a magnetic needle, the needle will be deflected from its natural position, and will tend to take up a position at right angles to the direction of the current. If the current is passed in the opposite direction through the wire, the deflection of the needle will also take place in the opposite direction. The Galvanometer, an extremely useful instrument for the purpose of indicating the presence, direction and strength of a voltaic current, is constructed upon this principle.

If the conducting wire, covered as above, be wound upon a bar of soft iron, the iron becomes magnetic as long as the current continues to flow, and possesses the property of attracting other pieces of iron in its vicinity. This arrangement is called an electro-magnet.

If the iron is very soft and pure it loses its magnetism instantly upon the cessation of the current, but if impure, or if hardened by hammering or turning, it retains a certain amount of residuary magnetism, especially after it has been acted upon by a powerful current. It is, therefore, necessary that the iron cores, as they are termed, of electro-magnets, should be annealed with great care.

FOREIGN NOTES OF INTEREST.

A decided sensation has been produced by the establishment of an electric light plant in a flour mill in Jerusalem. The building is near to the supposed site of Calvary, and close to the Damascus Gate. The proprietors of this enterprise are Germans. The Arabs and Jews are much puzzled to account for the light in a lamp in which there is no oil, and they have kept at a respectful distance.

The steamship "State of California," recently launched in Glasgow, has an electric light plant with all the latest improvements. It consists of about 330 incandescent lamps, each of 16 c. p. There is a duplicate set of machinery.

The Liverpool overhead electric railway is expected to be completed by the end of the present year. It extends along the dock for nearly seven miles.

According to official returns, the public electric lighting of Paris comprises 297 arc lamps and 115 incandescent lamps.

The French Government have decorated Prof. Helmholtz with the Grand Cross of the Legion of Honor.

Six telephone trunk lines are to be laid between Madrid and some of the most distant provincial capitals. It is also intended to connect all towns, including even the small ones, by telephone with the nearest telegraph station.

AN INTERESTING EXHIBIT.

Mr. C. S. Van Nuis had an exhibit of his Ajax switches at the recent Providence Convention, which was attractively located in the rear of the Hall, and was quite a conspicuous display. It consisted of single, double and three-pole switches for 100 to 500 volt circuits of from 100 to 600 amperes.

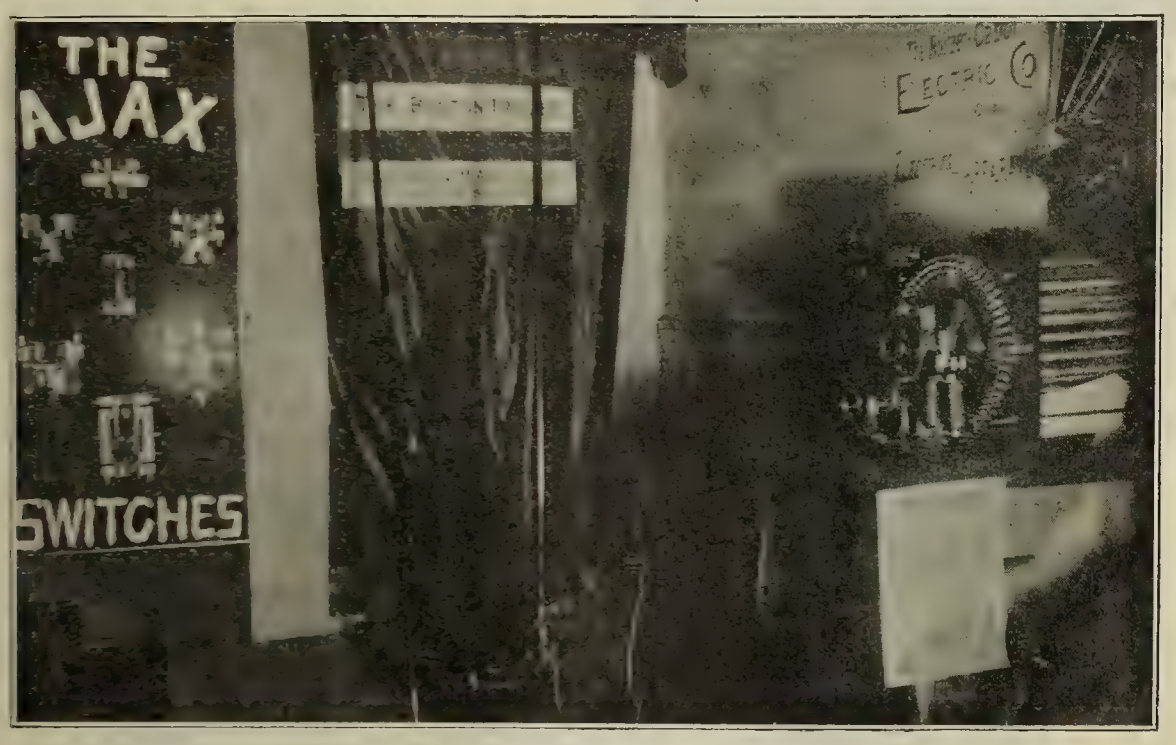


EXHIBIT OF SWITCHES, ETC. AT THE PROVIDENCE CONVENTION.

Mr. Van Nuis is the inventor of a new lightning arrester, which takes the same name of his switches, Ajax. He showed these arresters on this occasion for the first time. In our last issue we described this piece of apparatus briefly. It contains a magazine of fuses, and is so constructed that when one fuse is melted another one is immediately connected into circuit automatically.

Our illustration shows, on the left, the display of these instruments.

In the centre of the picture are shown two Boston trolley arms, made by Albert and J. M. Anderson, of No. 21 Hampton street, Boston. Over 1,500 of these trolleys are now used throughout the country, and the clip used by this firm for trolley wires requires no soldering.

At the right of the picture is shown an automatic pressure controller, made by the Holtzer-Cabot Company, No. 11 Arch street, Boston. This pressure controller is an automatic device, which can be used in connection with the indicator made by the same company and operated by it. It automatically throws in and out resistance so as to bring back the pressure to normal, thus keeping the pressure constant on long feeders.

This device is also used in controlling the E. M. F. of the dynamo, or the pressure at the lamps when run from a storage battery.

LECTURES.

Mr. Robert S. Dobbie, of the Edison General Electric Co., delivered a lecture on "Arc Lighting," before the department of electricity of the Brooklyn Institute, on March 6th. The lecture was illustrated by arc lights and lantern views.

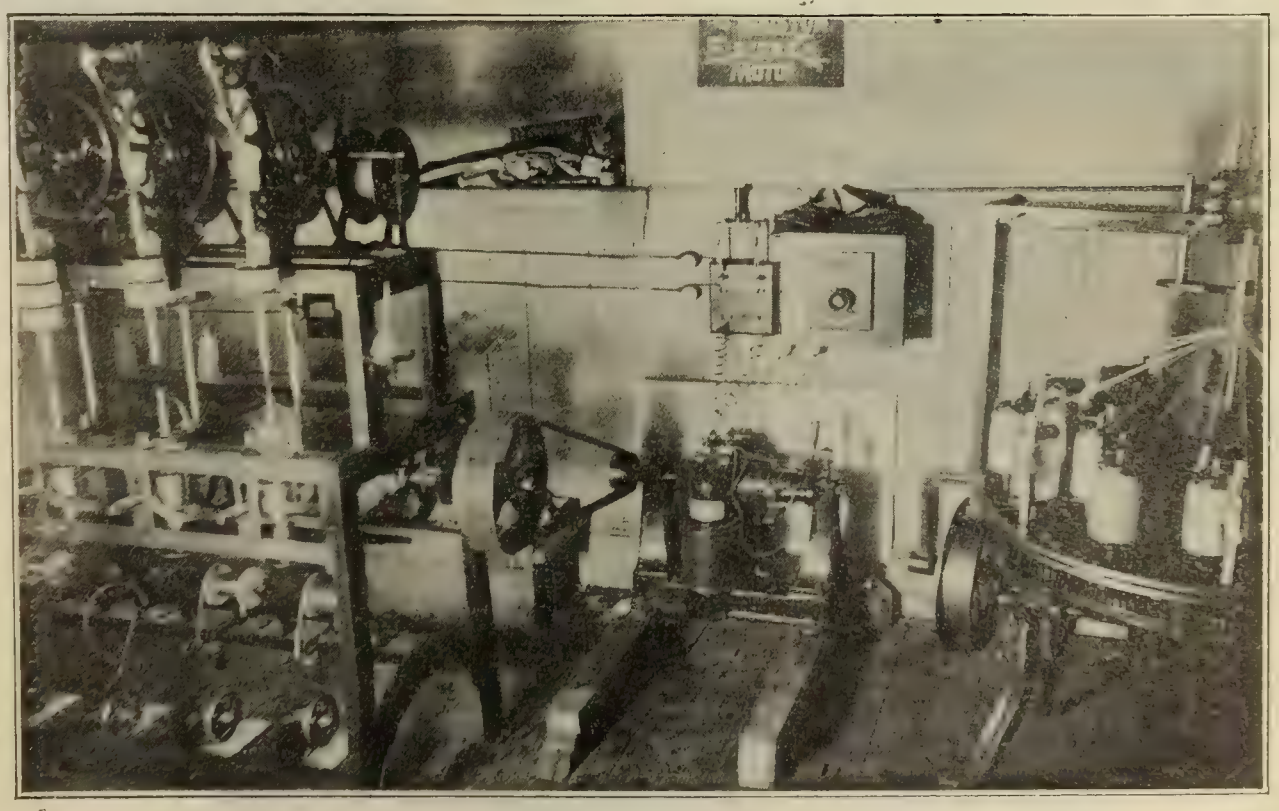
On March 20th, Mr. E. H. Cutler, general manager of the Elektron Manufacturing Co., Brooklyn, will lecture before the same society. His subject will be "Electric Motors and their Construction," illustrated by examples of the laminated type. The lecture will be in the Y. M. C. A. Building.

WINDING AND INSULATING MACHINES.

The exhibit of the New England Butt Co., at the Providence Electric Light Convention attracted a great deal of attention. A winding and insulating machine was in operation, and the process of winding wire was watched with considerable interest. The machine was driven by a Thomson-Houston motor. Both these are shown in the accompanying illustration, which was made from a photograph of the exhibit.

The winding and insulating machine was particularly described in our last issue. The machine shown on the right of the illustration is a braider, by the use of which wires are covered with braiding. The number of strands of the covering material varies according to the size of the machine.

The process of braiding is an extremely interesting one, and the New England Butt Co. are to be congratulated on the success of their efforts to enlighten the public as to how this work is accomplished.



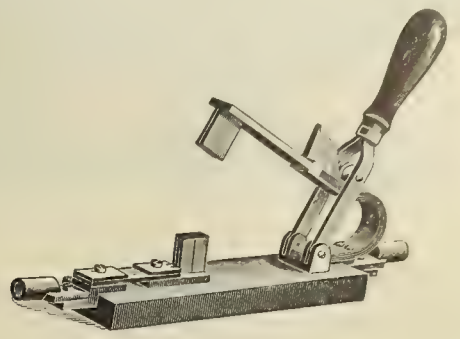
THE NEW ENGLAND BUTT CO.'S EXHIBIT AT PROVIDENCE.

A NEW SWITCH.

The accompanying illustration represents a new switch upon which patents are pending, recently designed by Thomas J. Fay, the well-known electrician of the Hunt Engineering Company, of 238 Washington street, Brooklyn, N. Y.

From the illustration it will readily be seen that this switch is not only ingenious, but it is also a new departure in the switch line. Spiral springs, and other cumbersome attachments usually necessary to a quick make and break, are in this switch conspicuous by their absence.

The circuit is completed between electrodes by means of a heavy strap metal set of springs, on the upper side of which is mounted a guide of peculiar shape upon which a roller is traversed between two forked metal pieces, at one end of which the handle is mounted, the same acting as a lever.



NEW SWITCH.

It can readily be seen from the illustration, that by throwing the lever backward, and *vice versa*, the circuit will be opened or closed, as the case may be, with great rapidity.

These switches will be manufactured by the Hunt Engineering Company, either single or double pole, in 200 and 400 ampere sizes, with length of break to suit any voltage from 1,000 down.

They are also provided with fusible cut-out attachments, making them very complete and desirable for electric light, power and railway work.

Mr. Fay and the Hunt Engineering Company are to be congratulated on their successful efforts to fill a long felt want.

THE MONTREAL CONVENTION.—The Montreal *Star* and the *Witness* of the same city, in their issue of February 28th, published a paragraph with reference to the next summer convention of the National Electric Light Association, which is to be held in Montreal. Mr. A. J. Corriveau therein expresses the opinion that the Montreal Convention and Electrical Exhibition will be larger and more interesting than the one just held in Providence. Both papers express the hope that everything will be arranged satisfactorily to the exhibitors, in the matter of entry of the exhibits through the Custom House.

ENGINEERING DIFFICULTIES.—The chief difficulties which beset the electrical engineer are internal and invisible and they can only be effectually guarded against by testing with special apparatus and electric currents. They arise from leakage and from bad connections and joints, which lead to waste of energy and the production of heat.

STEAM TURBINE DYNAMO.

It will be seen by the illustrations given herewith that our English friends are devoting as much time and attention to the improvement of the mechanical part of electric lighting, as we are in this country.

The illustrations are of steam turbine dynamos,

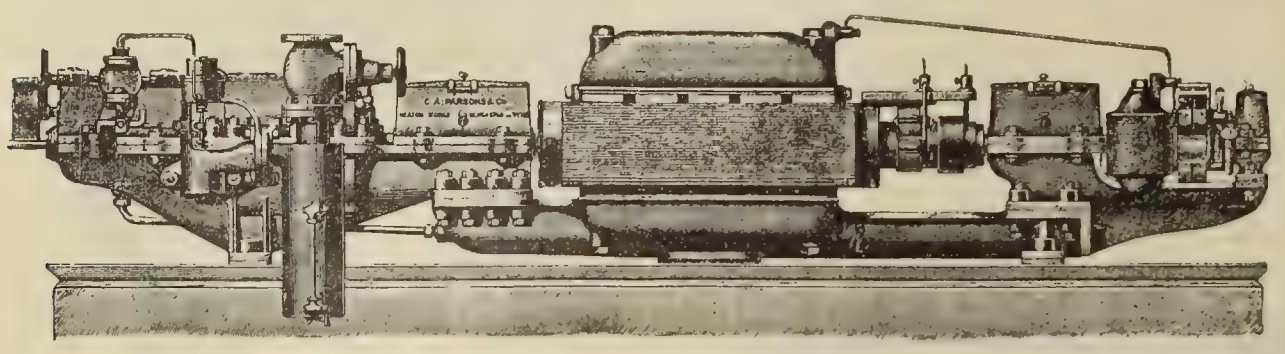


FIG. 1.—35-UNIT STEAM TURBINE DYNAMO.

invented by Charles A. Parsons, a member of a well-known engineering firm in England.

Mr. Parsons is the inventor of the turbo-electric generator, which is giving excellent service in the lighting of Newcastle, England. The chief characteristics of this machine are that the motor part of the combination consists of a parallel flow compound steam turbine revolving at an extremely high rate of speed, and coupled directly to a dynamo of special construction. The speed was so high that special bearings and means of lubrication had to be employed in order to obtain a satisfactory result.

Fig. 1 represents a 35-unit steam turbine dynamo, whose speed is 4,500 revolutions per minute, which is intermediate between that of the ordinary dynamo and the turbo-electric generator, it will be seen that the automatic lubrication is replaced by ordinary lubricators of large size, and that the dynamo is of ordinary construction, with a Gramme-wound armature; the speed is sufficient to enable the dynamo to develop an unusually large output for its size, etc. The whole plant is extremely light and compact.

Fig. 2 shows a 75-unit steam turbine alternator; the speed of which is 5,000 revolutions per minute, generating an alternating current of 83.3 periods per second. Four turbo alternators of 75 units each have been generating the current of the Newcastle and District Electric Lighting Company for the last twelve months, during which time there has been no hitch or stoppage, and the service has been exceptionally steady.

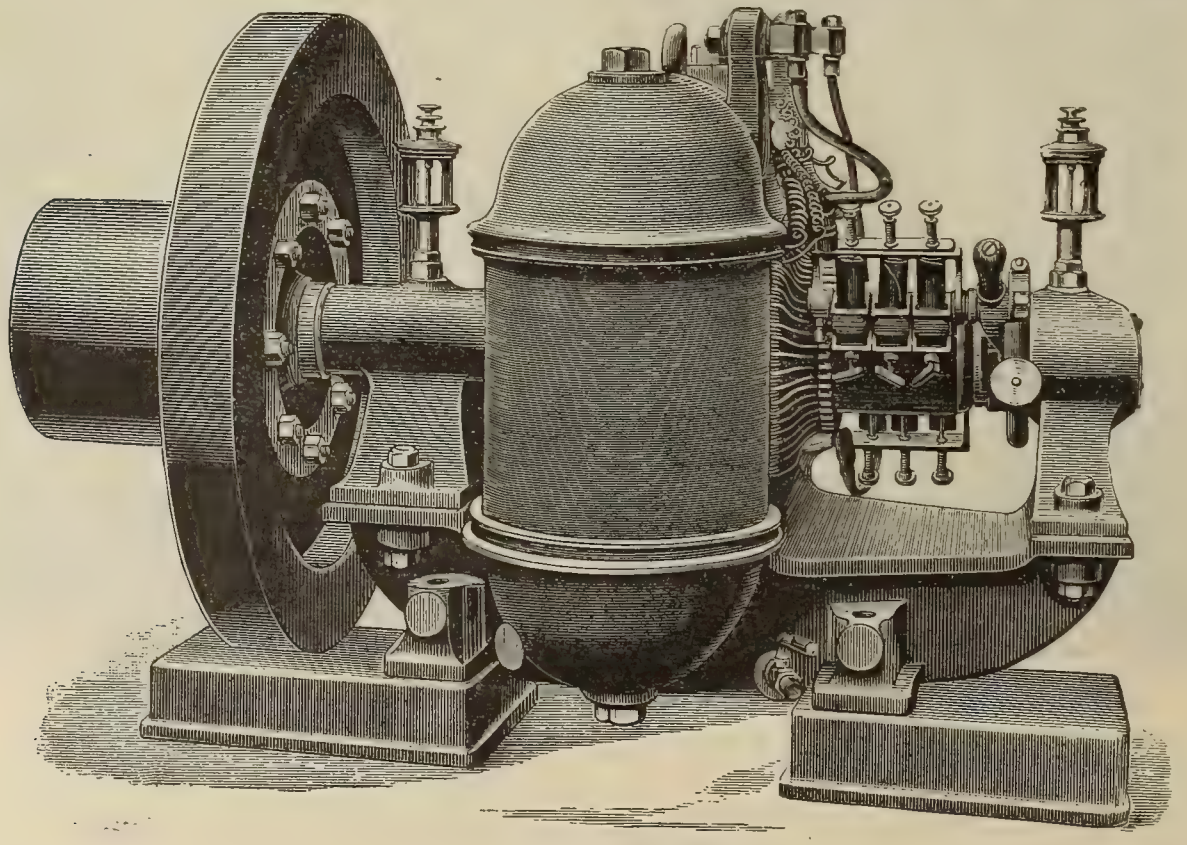


FIG. 2.—75-UNIT STEAM TURBINE ALTERNATOR.

TRANSFORMERS.—Transformers generally produce a buzzing sound when current is passing through their coils.

JENNEY ELECTRIC MOTORS.

Among the many attractive exhibits at the recent Providence meeting of the National Electric Light Association, was that of the Jenney Electric Motor Co., of Indianapolis, Ind. While the engraving below gives a general idea of the Jenney Motor, a brief description will not be out of place.



JENNEY MOTOR CO.'S EXHIBIT AT PROVIDENCE.

This machine is extremely simple, compact and well proportioned. There is but a single magnetic circuit, and the one field magnet is of large size, and is composed of the best wrought iron. This extends through the bottom of the pole-pieces, which are bored to the same diameter. Clamping bolts hold these parts firmly together, and in this way is secured a joint with large surface and a closer contact than can be secured in any other way. The frame of the machine is practically of one piece, and a large part of it is composed of wrought iron. The pole-pieces are of ample section and nearly envelop the armature. In this way is secured a field of very low magnetic resistance and one that is economical to maintain.

The armature is carefully designed and free from the troublesome reactions experienced with many other makes. It is carefully insulated, balanced and protected from external injury.

Self-oiling bearings are used which require attention only at long intervals. A new design of brush holder for carbon brushes is used, and gives excellent results, even on circuits of low voltage. They allow a large variation in lead without necessity of shifting, and the wear upon the commutator is reduced to a minimum. These brushes require no trimming, and the direction of rotation in the armature may be reversed—a very important consideration in certain classes of service. These features just described are of great practical value, as they do away with most of the trouble heretofore experienced with electric motors, namely, proper lubrication and the care of commutator and brushes.

In connection with the motor shown above is seen a very neat and efficient rheostat for starting and stopping. This is built of porcelain and iron and is thoroughly fire-proof.

The company show in this exhibit a three-quarter horse-power 110 volt motor, one three horse-power 500 volt motor, and a one horse-power 500 volt motor. The last two were running during the time the exhibition was open, and attracted much attention for their quiet performance, as well as for the fine finish and workmanship. The motors shown are standard machines and not finished up especially for exhibition purposes.

This company is building much larger machines which are said to be giving the best of satisfaction as dynamos for incandescent lighting. This type of machine was formerly built by the Jenney Electric Company, of Indianapolis, who installed many of them in various parts of the country.

The simplicity and efficiency of this motor-dynamo, adapts it especially to the uses of electroplating and electrotyping. The company have sold machines which are now doing hard and continual service of this nature in a most satisfactory manner.

REPORT OF HIGH SPEED ELECTRIC RAILWAY WORK.*

BY O. T. CROSBY.

The experiments here reported were the first serious efforts ever made to at once double railway speeds, and as such should, I think, be systematically recorded. They were made for the Electro-Automatic Railway Company, of Baltimore, Md. This company was organized about four years ago by Mr. David G. Weems, who, though not an engineer, was convinced that the electric motor would give very high speeds for the transportation of parcels. His persevering enthusiasm resulted in inspiring a number of gentlemen to subscribe money for the venture.

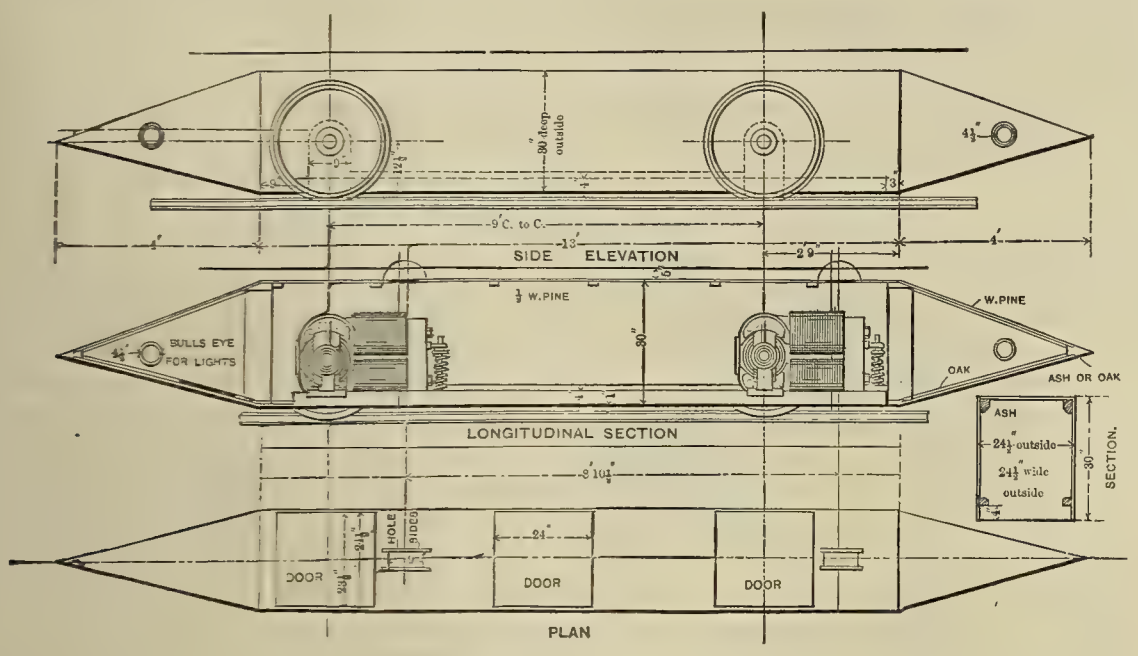


FIG. 1—OUTLINE OF MOTOR.

Mr. Weems first contemplated having an entirely automatic service from city to city, the cars to be smaller than would be necessary for placing a man.

For purpose of demonstration, a circular track nearly two miles in circumference was laid at Laurel, Md.; gauge 28 in.; weight of rail 16 lbs.; shape T; cross-ties 3 x 4 in. square, 16 ins. apart. Wooden stringers 3 x 4 ins. were laid outside each rail, serving as guards. Mud-sills 3 x 4 ins. were laid under the ties, and to the ties was built up a vertical frame-work on both sides of the track, this carrying from cross-pieces 2x6 in. wooden stringer, suspended above the middle of the track, while to the lower surface of the stringer was attached a small T rail, head down. This upper rail was intended to serve as an electric conductor, and also, in connection with upward pressing wheels, as a guide. The latter function was not successfully performed, the lateral oscillation of the car, on so slight a track, being too great. Part of the track was on trestle work crossing a swamp, the overflow of which caused frequent wash-outs.

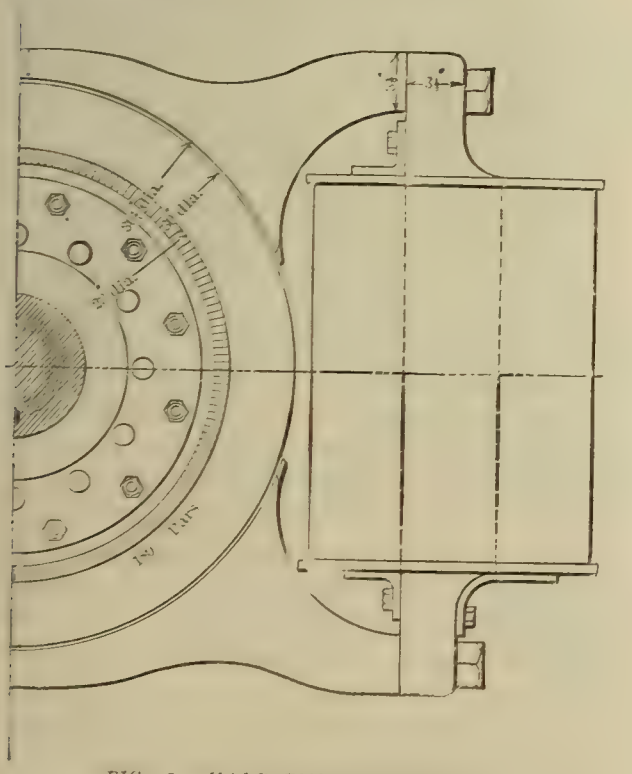


FIG. 2—HALF END ELEVATION.

The locomotive was very simple. Three axles carried 28 in. wheels; on these were hung a steel box 16 feet long x 24 ins. high x 30 ins. wide. A slight vertical play of the box was provided for by springs, but, horizontally, the three axles were in rigid connection. On each of these axles it was designed to place a motor. The head was pyramidal; the weight of the car with three motors was about three tons. A second similar box of steel was made to be drawn by the motor-car, the two to be connected by a ball-and-socket arrangement, the interval between cars to be flanged over so that only one surface should be presented to meet atmospheric resistance. The tail was pyramidal. The second car was not in use more than once.

The track-work and cars were completed as above outlined when the matter was brought to the Sprague Electric Railway & Motor Company, with the request that they design motors of which the armatures should be placed directly on the three driving axles of the car, the construction of which was already nearly finished. It was further conditioned that the motors should do 25 horse power of work, each, at a normal speed of about 3,000 revolutions per minute. This corresponds to a car-speed of about 250 miles per hour. Needless to say, that on so light a track, none of which was straight, and with a car weighing three tons, and with only 60 horse power available for work, no such speed was attained. The motors were carefully designed by Mr. H. F. Parshall of the Sprague Company, for a normal impressed E. M. F. of 500 volts, and thoroughly filled the specifications. They were to be connected in multiple across the 500-volt circuit supplied with current from a dynamo made by the Edison Machine Works. When the motors were finally mounted and ready for action, it was found almost impossible to start the car, due probably to stiff bearings, and when several trials of speed had been made, the results were disappointing.

Up to this time the electrical work had received only such engineering attention as could from time to time be given by employees of the Sprague Company, much occupied in other ways. It became evident to the Baltimore Company that any satisfactory accomplishment could be had only through the continuous attention of some one having had electrical experience.

As Superintendent of the Sprague Company, I had been familiar with the manufacture of the motors, and had, moreover, visited the plant; hence in October, 1889, it was arranged that further experiments should be under my direction Throughout the work Mr. B. J. Dashiell, Jr. M. E., and Mr. H. F. Purdy of the Sprague Electric Company were of constant assistance, both in conception and execution of all that was done.

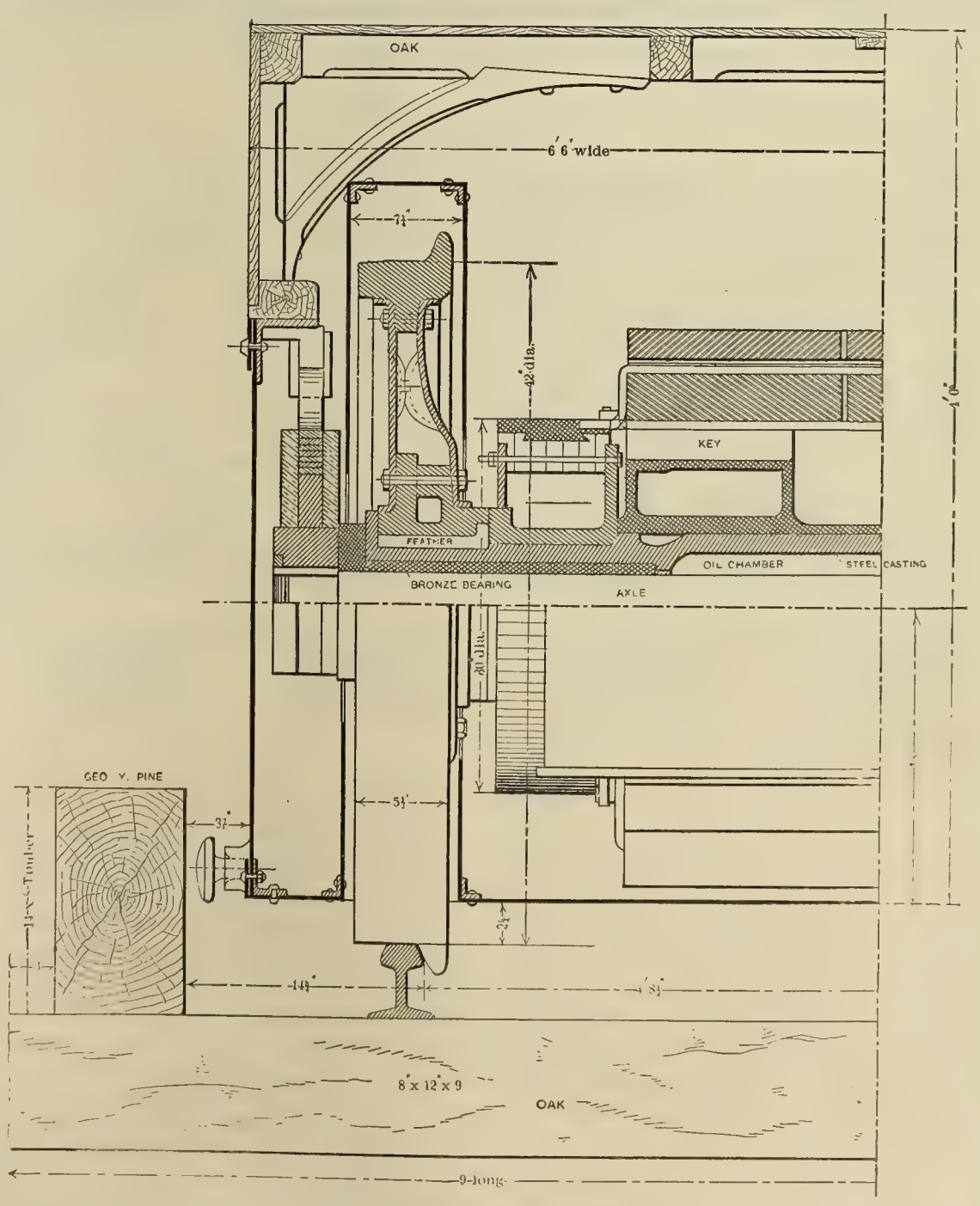


FIG. 3—HALF CROSS SECTION.

Work having been resumed, it was soon found

*A paper read before the American Institute of Electrical Engineers, New York, February 24th, 1891.

that a given speed could be attained with less current if two motors were in service than with three, and consequently the motor on the middle axle was removed. It seems probable that, when running, this middle motor was largely occupied in skidding the wheels driven by it, since the two outer axles, on a yielding track, would doubtless support the greater part of the weight. In any case, the two motors were able to produce a greater speed than the track could stand. These machines were of the U type. The armature was wound with 100 sections of No. 12 B. W. G. wire, each section of two turns. This armature, with its commutator was rigidly mounted on the axle. The pole-pieces were attached to brackets centered on the axle, the keeper was spring-supported on a cross-piece carried by the steel casing. Bearings were of phosphor-bronze and lubrication by oil from an ordinary cup. No trouble on this score was experienced. Each magnet core was wound

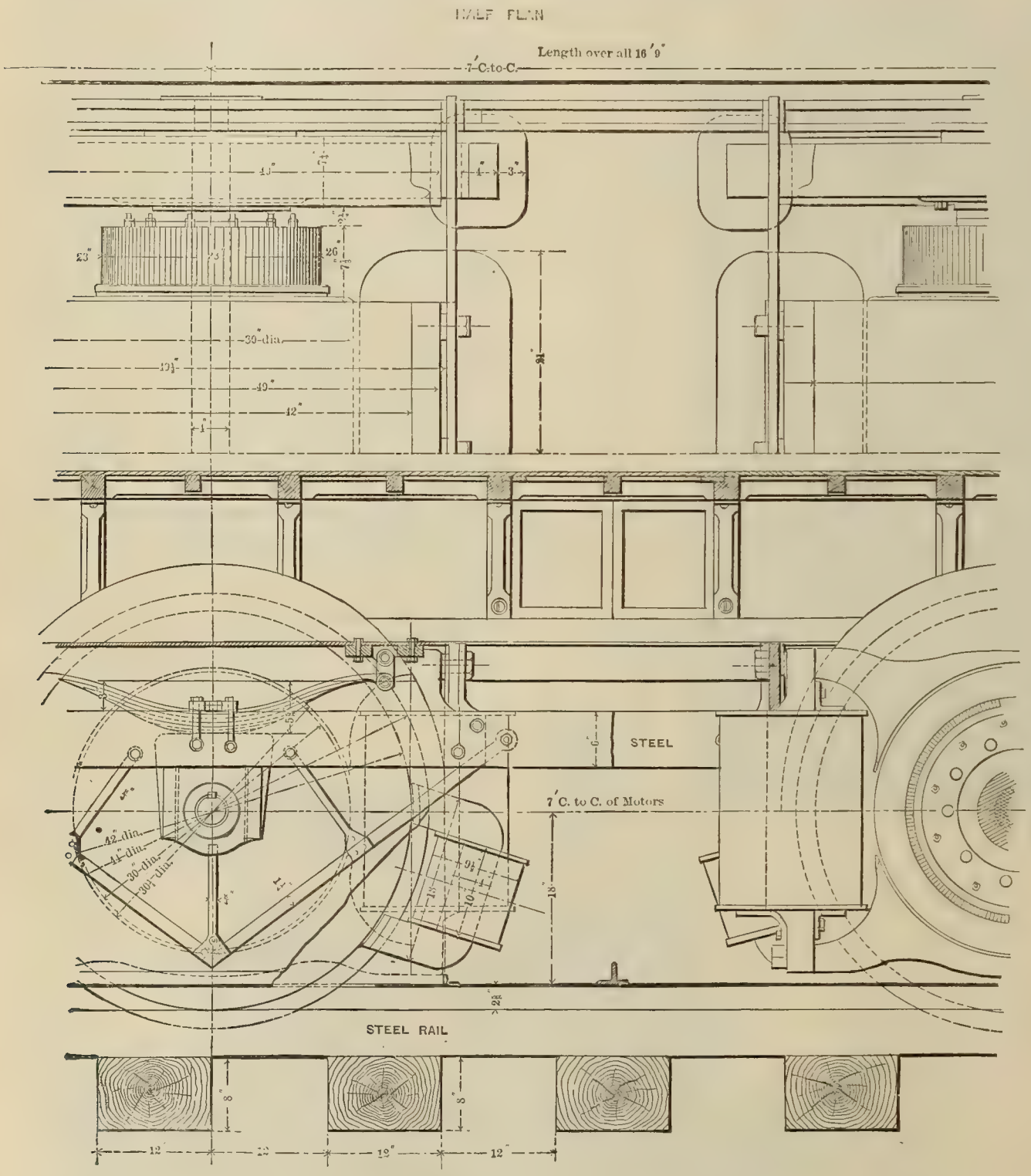


FIG. 4.—LONGITUDINAL SECTION.

with 120 turns of No. 4 B. W. G. wire. At 30 amperes the armature induction was about 80,000 lines per square inch. Outline of the motor is shown in Fig. 1. These motors, since wound, according to specification, for the 500 volt circuit, were originally connected in multiple arc. This connection was changed, they being placed in series, thus diminishing the potential control required at the station, by reason of the fact that the machines were run at a speed so much below that for which they had been calculated.

To supply the current, contact was made between the upper rail and brushes of sheet copper set against the rail by springs. These served their purpose well. The return circuit was through the wheels and rails, the steel casing being insulated from the axle by fibre plates and washers at joints and bolts. Rail bonds (covering joints in upper and lower rails) were used throughout; the resistance of the external circuit from the feeder junction to a point diametrically opposite was about 0.25 ohm.

The station was placed inside the circle, about 200 feet from the track. The generator was a 70 horse power Edison machine, not compounded originally, and was driven by a 90 horse power high speed Ball engine. At first a wire resistance of about 12 ohms was used to lower the potential on the line, as it was not convenient to run the dynamos at less than 400 volts. Later, a whiskey barrel was filled with water, an iron plate, 8 inches square was placed in the bottom, a similar plate was fixed to the end of an iron rod and this rod attached to the pulley, permitting easy lifting or dropping of the plate through the water. These plates being connected in the main circuit, a very serviceable liquid rheostat resulted, which, when "taken with a grain of salt," answered excellently the purpose of regulating currents, which often went as high as 150 amperes.

The usual course of a run was this. Speed-observers, as many as could be had, up to five or six, were stationed around the circle, distance apart being known. Watches of these observers and of recorders who read current and potential were compared. Potential readings were taken at station and at one or two points on the line, permitting easy reduction to horse power. Mr. Dashiell, my assistant, then took the engine and I managed the dynamo. A current of from 20 to 40 amperes usually started the car. The size of the armature wires limited to about 90 amperes—45 in each machine,—the current permissible for any length of time. This value was usually attained in the first half mile of run, a considerable part of the external resistance having been cut out. When the car had attained a speed of 75 to 100 miles per hour, the line potential was in the neighborhood of 450 volts, the iron plates in the barrel being in contact, having been slowly approached as the counter E. M. F. increased. The time limitation of the runs, was invariably caused by failure of the track to serve its purpose. On three occasions the car left the track: once at 45 miles per hour, once at 80 miles per hour, and once, the last time, at about 115 miles per hour. Curiously enough, on the two former occasions the derailment was to the inside of the circle, super-elevation being about four inches.

It was easy to tell in the station when a derailment was imminent, as the ammeter was most violently agitated by the make and break of the circuit caused by the particularly bad spots in the track. The agitation increased with each trip round the circle and ended in a run-off, or, after some experience had been gained, in a cessation of the trial. As the track limited the length of run in time, so also it limited the speed obtainable. Each trial—the longest being about twenty-two minutes consecutive running—was followed by an overhauling of the track, requiring from a few hours' to a weeks' work by four or five men.

Could the experiments have been made on a road bed and track, deemed even second-class according to steam railway standards of rail weight, etc., there can be no question that without any other change, the car could have maintained for several hours a speed of 120 miles per hour. Indeed, I know of no time limitation that would have arisen save that from a limited oil supply.

The speed obtained in the first round—that is in the first 9,240 feet—varied from 30 to 75 miles per hour; this determined by the management of the rheostat. The *rate* of acceleration from point to point in going round the circle was irregular, due to the grades, which, going in the direction usually followed, varied from 2.0 to 2.5 per cent.

The fact that the track—always bad—went rapidly from bad to worse during each run, made it difficult to analyze the records with a view to determining the true coefficient of traction. Moreover, the coefficient for such a track, even in its best condition, would be greater than for the track that would necessarily be built for actual service. The figures obtained were of little worth as far as fixing absolute values at very high speed, but at least served to show the error of many train resistance formulæ found in the text books. Some of these formulæ give good enough results when used for the low speeds on which they are based, but their algebraic form is such as to give rise to great error when higher speeds—say 80 to 120 M. P. H.—enter. This whole matter of train resistance has been more fully treated in a paper, "Limitations of Steam and Electricity," read by me before this Institute on May 21, 1890. The particular element of atmospheric resistance, for which special experiments were made at Laurel, was fully treated in a paper read by me before the West Point Branch of the Military Service Institute, and published in London Engineering, issues of May 31 to June 13, 1890.

Mr. Crosby then analyzed the various test runs made with cars with differently shaped heads.

Referring to the last test, he says: The maximum speed—that of final derailment—could not be absolutely determined, since the car left the track at some distance from the last two observers, whose time records gave the speed attained between the points of observation. It was clear, however, that final speed was between 110 and 120 miles per hour. A length of 1,000 ft. of track was injured, about 300 ft. of the upper framework wrecked, and the car itself was landed about 30 ft. from the track, having finally jumped the guard rails while going over a fill four or five feet high. It seemed clear that the Laurel plant

had passed its days of usefulness. Nothing further of value could be done without practical rebuilding. It was then time to make new plans, and this work was at once begun by Mr. Dashiell and myself. At the outset I felt that—if for no other than commercial reasons—we should plan for the carrying of passengers as well as parcels. This meant an increase in the size of cars and a change from an attempt at automatic control, to control by human intelligence on the locomotive.

For purposes of demonstration I proposed to the company that they should build a track about four miles (not less) in circumference, and should run thereon a train of two or three cars drawn by one locomotive. Calculations were based on the following data:

(1) A speed 150 miles per hour on a level was to be aimed at.

(2) Cross-section of car should be a minimum consistent with the seating of passengers. This was taken at 6x5 ft., 30 sq. ft. (crowning higher along middle of car.)

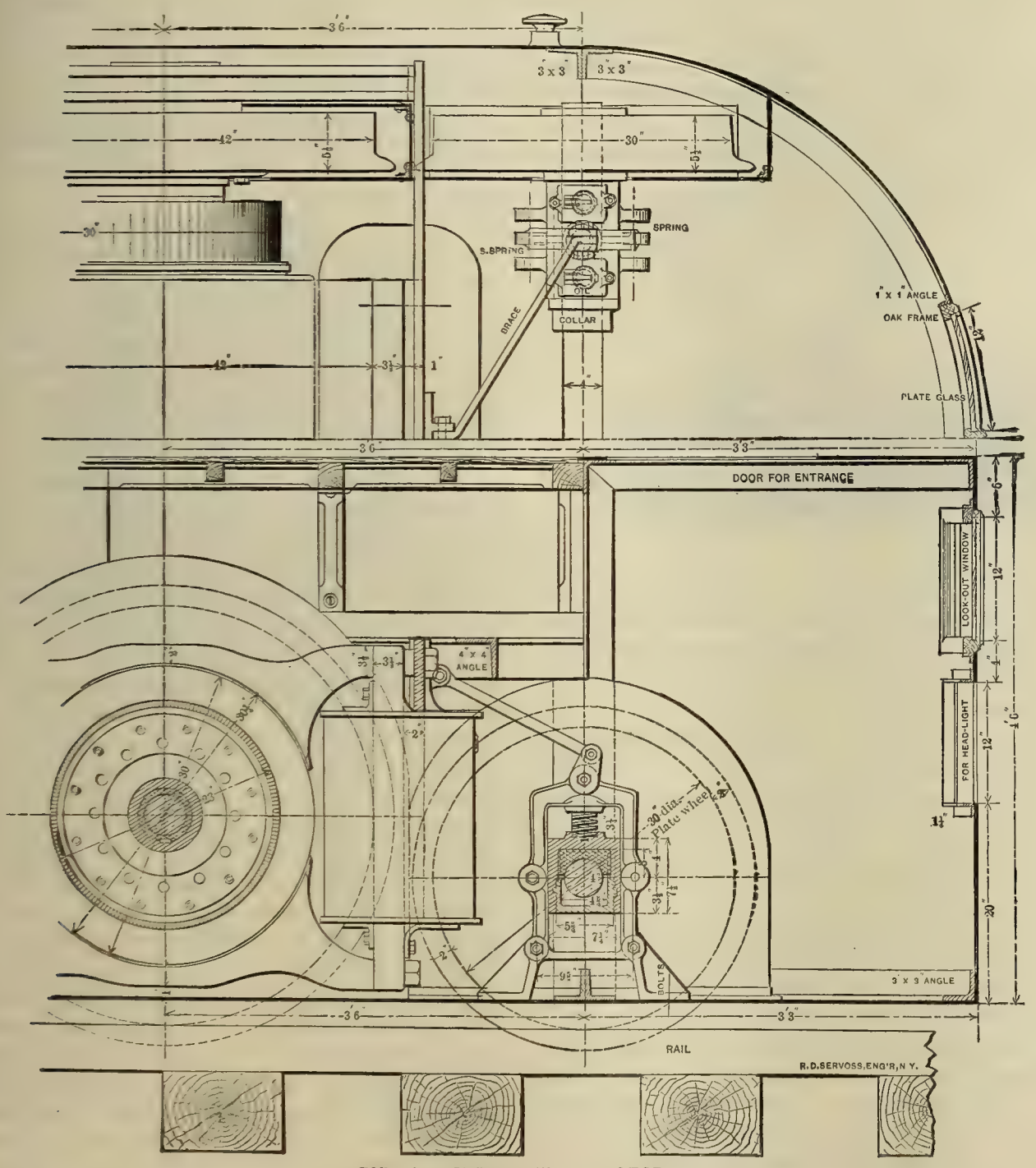


FIG. 5.—END VIEW OF MOTOR.

(3) Gauge of track should be standard—4'—8.5"

(4) Character of track should be simply the best that art could contrive, rails to be from 65 to 90 lbs.

(5) Electromotive force should be as high as the art of insulation would permit.

(6) Whatever might be the number of cars in a train, all were to be so connected as to present a continuous exterior, thus presenting only one cross-section to the atmosphere.

(7) Atmospheric resistance at 150 miles per hour would be taken at 15 lbs. per square foot of cross-section, a wedge or parabolic locomotive head being used. This value is 50 per cent. in excess of that indicated by our experiments.

(8) Traction coefficient, exclusive of air resistance, would be taken, at 150 miles per hour, to be 25 lbs. per ton—this for reasons set forth in previous papers.

From the two resistance coefficients just given, it followed that for every square foot of cross-section, regardless of weight, six horse power would be required, and for every ton of weight, regardless of cross-section, 10 horse power must be supplied.

For a locomotive of about 600 horse power having 30 ft. cross-section the dead weight was calculated to be about 18 tons. Steel cars of equal cross-section were designed, weighing, empty, about five tons, with carrying capacity of about five tons.

The important question as to power required could then be thus tabulated :

	150 M. P. H.	120 M. P. H.
Locomotive alone.....	360 H. P.	288 H. P.
Locomotive and one car loaded.....	460 "	369 "
Locomotive and two cars loaded.....	560 "	446 "
Locomotive and three cars loaded....	660 "	528 "

To perform the work here indicated two motors were provided, one armature directly on each of the two axles of the locomotive car. These motors, outlined in Figs. 2, and 3 were of the Manchester type. They were supposed to be at first connected in arc across a 1,500-volt circuit, each taking about 130 to 150 amperes, and delivering about 250 to 300 horse power. Should it be desired to experiment with higher line potential, the motors in series would permit 3,000 volts to be easily tried. The armatures of the Gramme type are 30 in. outside, 23 in. inside diameter. The armature conductors were to be of about 40,000 circular mils cross-section, or from 500 to 600 cm. per ampere. Many successful machines, designed to work indoors, go as low as this figure, and since the dissipation of heat must in such case proceed more slowly than in the case here considered, the figure seemed very safe. Moreover, it was intended to introduce a blast of air from the car front which should continuously flow through the open centre of the armature (Gramme type). How far the rate of dissipation would be carried by such means can not now be known, but all recent evidence (see experiments of Mr. Kennelly) goes to show that the heat capacity would be much increased.

The cross-section of core in the armature was 3.5" x 40" = 140 square inches gross, or, deducting 15 per cent. for paper insulation between discs and 8 per cent. for conductor slots cut in periphery, 110 square inches net. Through this armature it was desired to force 22,000,000 lines (C. G. S. units) or 100,000 per square inch = 15,200 per square centimeter.

The hysteresis loss in such an armature revolving at 1,200 R. P. M. (equivalent with 42 inch wheel to 150 M. P. H.) was calculated to be about 3,000 watts—following the curve published by Esson. The C^2 R. loss (C = 135 amperes, R = 0.26 ohm when T = 75° C) = 4,740 watts—or about 8,000 watts for the two losses. I found it difficult to obtain such coefficient as would give reliable values for loss due to Foucault currents. With very thin plates it would not be large. From what precedes, it followed that the number of armature conductors should be 340. These were divided into 170 sections, wound in one layer, each conductor to lie in a slot ; both slot and conductor were planned to be rectangular, or nearly so, with the reservation that experience in manufacturing would soon show the proper detail.

The magnets have a cross-section of 164 square inches through which 14,300,000 lines of force must pass, the increase from the number in the armature being determined by a leakage coefficient 1.3.

The magnet coils of the two armatures were calculated to be in series with each other, but in shunt with respect to the two armatures. This variation from present street car practice I thought to be justified by the following considerations: First, no system of commutation could obviate the need of a considerable external resistance, which then could be easily made sufficient, within itself, for speed control; second, the maximum torque for a given armature current is always desirable and can be best obtained by permanent saturation; third, this constant and maximum magnetization would tend to diminish sparking—an evil to be specially avoided in long distance work, involving continuous runs of several hours.

While it was thus intended to use shunt coils at first, I felt that a little experience would soon positively demonstrate that the advantage lay with this or the series winding.

The commutator, Fig. 4, was designed to be twenty-three inches in diameter, which would, of course, give rise to a very high speed relative to the brushes. I believed it better to face the mechanical trouble that might be connected with great circumferential speed rather than to diminish the diameter by decrease of sections, since this in turn might produce sparking.

Without going into the mechanical detail of the commutator, I may add that a single bar could be taken out or replaced, without removal from the shaft.

The rheostat for the armature circuit was designed to be of iron wire, with the expectation, however, of experimenting also with liquid or carbon resistance. The resistance and heat capacity of this main line rheostat were determined with reference, first, to current necessary for starting, second, to currents needed for maintaining low speeds. The starting current on practically level track was calculated to be from 300 to 400 amperes, the load being 80,000 lbs. (or locomotive and three loaded cars). For continuous running at thirty miles per hour, a current of forty amperes would be required, the counter E. M. F. of each of the 1,500-volt motors being, at this speed, only 320 volts. The line-potential being 3,000 volts, it would be necessary to have in the

armature circuit an external resistance of $\frac{3000-640}{40}$ = 59.0 ohms. The wires are calculated to stand 40 amperes continuously, and the various sections are proportioned to stand various currents for such time as would serve to bring the train up to speed. It was, of course, known that a considerable reduction in the size of resistance box could be effected by winding the motors for the regular line potential, thus normally working them in arc, but putting the armatures in series where a great reduction in speed might be required.

A small rheostat and a condenser were designed to be placed in the circuit of the magnet coils, and a rheostat also in the lamp-circuit, these resistances giving delicate control.

The problem of retardation for a mass of say 40 tons running at 150 miles per hour is a serious one. It was found that a brake pressure of about 5,000 lbs. should be applied to each wheel. This was designed to be produced by magnetic brakes similar to those used by Mr. Daft on a New York elevated railway. The form and approximate dimensions of those brakes are shown in Fig. 5.

A mass of 80,000 lbs. moving at 150 miles per hour represents 64.000,000 foot-pounds of energy. Average resistance due to brakes=0.1 x 60,000=6,000 lbs. Average resistance from track and atmosphere for average speed of 75 miles=400 lbs.

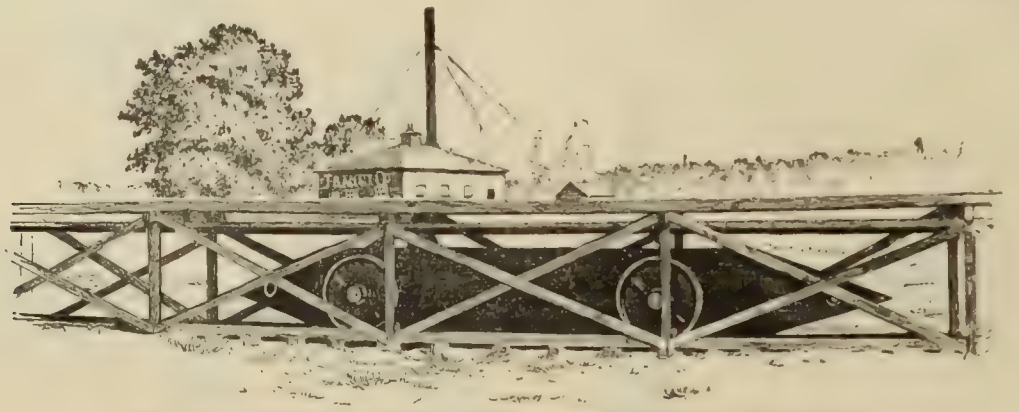


FIG. 6—GENERAL VIEW HIGH SPEED ELECTRIC RAILROAD.

In addition, the motors may be required to generate a current which shall be wasted over the rheostat. Since the field circuit in the case of shunt motors is independent, magnetization may remain constant, and average E. M. F. of 1,500-volt motors (*i. e.*, motors generating 1,500 volts E. M. F. at 1,100 R. P. M. or with 42 wheels at 150 E. M. F.) would be, while the train was coming to rest, 750 volts. Make the external resistance such, that the two armatures being in series, an average current of 200 amperes shall flow. Then average dynamo resistance, in lbs. =2,000. Total retarding effort =6,000+400+2,000=8,400 lbs. Dividing 64,000,000 by this last quantity we have 7,620 ft. as the length of run to come to a stop, and the time of stopping about 100 seconds.

For the mechanical construction of the locomotive, two plans were contemplated. One has a 12 foot rigid wheel base and no pilot wheels; the other has a 7 foot wheel base for the drivers and a pony axle in front, free to move laterally over a certain distance, dragging the drivers in the same direction. This is the general principle of pilot wheels, so largely used on high speed engines. This second arrangement is preferred. In it nearly all the weight goes on the drivers. In this particular case, total weight of locomotive is about 18 tons, each motor being six tons. Of the total, 15 tons rest on the drivers. If then the adhesion-co-efficient, while running, be taken at only 0.1, a circumferential effort of 3,000 lbs. may be exerted without slipping the wheels. This is safe, since if 600 H. P. of work be required at 150 miles per hour=13,200 F. P. M. the horizontal effort $=\frac{600 \times 33,000}{13,200}=1,500$ lbs. For starting the load, adhesion-co-efficient may be taken at .25, giving 7,500 lbs. possible pull, this being much in excess of the value required.

The locomotive construction is such as to put the entire weight of the armature directly on the axle. In designing this, I did not overlook the fact that the armature must thus be subjected to much jarring. But I believe the difficulty should be met by excellent mechanical construction, rather than that spring movement should in any way be attempted.

The weight of the magnets and pole pieces goes also directly on the axles, save for the intervention of rubber plates having a maximum play of 1-16 of an inch. By the use of motors of the U type, part of the weight might be spring-supported, but on the other hand it is not as easy with that type as with the Manchester, to obtain a perfectly sparkless motor. Moreover, the weight going dead on the axles in the case considered, is not greatly in excess of that due to 8 foot drivers and other attachments of large steam locomotives. Further, the need of any spring movement decreases with increasing perfection of track work; as in ideally perfect track, car springs would not, save on curves, come into play.

In the first design of locomotive cars, the operator is to sit between the two motors, where also would be placed the controlling devices. In the second design, the operator would be placed over the pony axle, the devices being chiefly in the cylindrical or parabolic head.

As to the supply of current, it is proposed to use the double metallic system. This departure from the ground return, now so commonly employed in street railway work, seems justified by the following considerations:

1st. For a given voltage it diminishes the cost of insulation *per se.*

2d. It diminishes the danger of accident within the motors.

3d. It diminishes danger of accident to workmen.

4th. By being thus more easily handled it is probable that a higher voltage will be found practicable than with the ground return; hence in fact even first cost might not be greater.

As designed, the conductors will be placed in an inverted wooden trough, attached to posts placed at 12-foot intervals on each side of the track. The trough to be about 5.5 feet above the ground. The conductors for each side of the circuit to be two—one insulated and continuous; the other a bare, flat strip, broken into sections, these being normally out of circuit; the locomotive trolley-arm operating a switch which shall throw out the rear section and throw into circuit the section ahead. Such a switch was designed in detail.

As to what the line voltage should be, progress in the art of insulation can alone determine. It would of course not be necessary, on a roadway for long distance travel, to consider the death producing voltage as a limitation.

In the important matter of limiting curvatures, calculations were made in the ordinary way, using the particular values for weight and height of centre of gravity. A safe speed was then tabulated as that which is just one-half the speed that causes the resultant of weight and centrifugal force to pass through the outer rail of a curve. The beneficial effect of superelevation, neglected in the calculation, would, of course, practically increase the factor of safety.

Of course, naught save practical trial could determine whether the assumed factor of safety, which is quite large enough at present speeds, would in fact, be right for higher speeds aimed at.

Mr. Crosby then discusses the commercial aspect of the enterprise and continues: To demonstrate all or nearly all that has been outlined in this paper will cost about $300,000, covering the construction and operation for a reasonable time, of the four-mile circular line proposed above. Last year the Baltimore company met unexpected difficulty in efforts to raise the needed money; their operations were suspended and my connection with them ceased just at the time when plans were completed—even to working drawings. I have been much pleased to learn, within the last few days, that far from being discouraged, they are now confidently hoping that they may push on, in the near future, the great work to which they have laid their hands.

Unfamiliar as is the project, you will perhaps be the more ready to share the confidence of its promoters, on hearing the words from Prof. Henry A. Rowland and Dr. Louis Duncan, of Johns Hopkins, to whom were submitted, last spring, full details of the plans partially described in this paper. After reviewing the figures for power required, they say:

"We believe from the data obtained that the values given are not too low, and that the horse power which Mr. Crosby calculates is *not less than the amount required.* While we have investigated carefully and considered all the data obtainable, yet the existing experiments are not sufficient to accurately fix a limit to the train resistance. *We believe, however, that the value assumed by Mr. Crosby is safe.*"

"The motors, the calculations and drawings for which are in the appended statement, will develop the horse power for which they are designed, namely 500 horse power. We point out some modifications which will be beneficial. *We believe that they will drive the train,* (locomotive and two cars, O. T. C.) *at the required speed.*" (Italics here and elsewhere are mine, speed then considered 120 on a level, O. T. C.)

"The possibility of a train being derailed by an obstruction on the track increases with the speed. At speeds up to 90 miles, however, there seems no increase in the number of derailments. In the case in question, the centre of gravity of the cars is very low and *it would be difficult to derail them on straight parts of the track.* The radius of the curves should of course be great, but not so great as would be required for an ordinary train going at these high speeds. *The question of safety is, however, almost wholly a question of track construction.* Considering the form of the proposed train, its comparatively light weight, making a less demand on the track, it is certain that with a carefully constructed road, it could attain with safety, speeds which would be impossible with trains as at present constructed. As these latter have several times made 86 miles, and often 80 miles, *it would seem that a speed of 120 miles or even more, with the electric cars, would not be outside the limits of safety.*"

"The plan for supplying current to the motors is feasible."

"The design of the motors is discussed in the detailed report. It is generally good."

"Should it be demonstrated by an actual test that passenger trains can be run safely and economically at a speed over 100 miles per hour from here to Chicago, the financial aspects of the case would certainly be improved. *We are of the opinion that the chances are in favor of this being accomplished by the present scheme.*"

These words, though guarded and accompanied by criticism of the detail, are yet a substantial approval of what was submitted. To me, they were very encouraging.

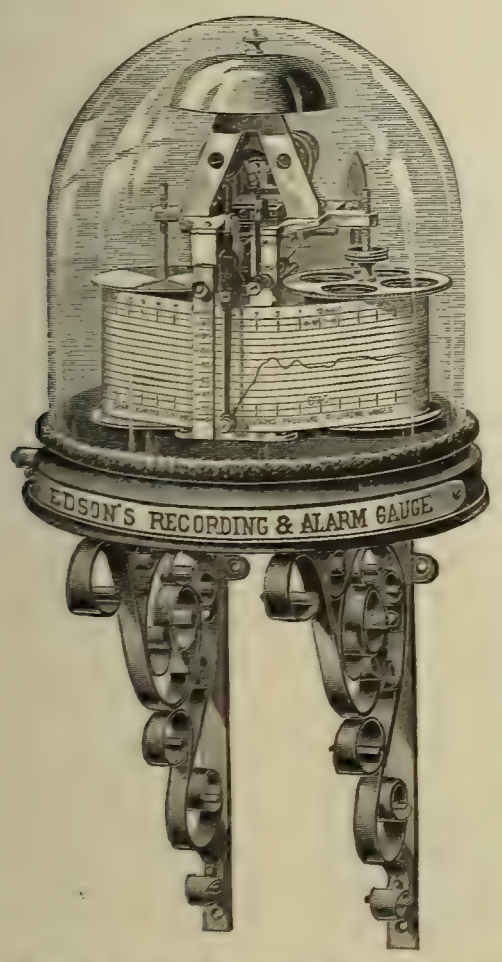
EDSON STEAM PRESSURE GAUGE.

Mr. Jarvis B. Edson, of No. 87 Liberty street, New York, has recently made some improvements in the construction of the Steam Pressure Recording Gauge manufactured by him. The accompanying illustration is that of one of these gauges, known as style No. 1.

Mr. Edson, as is well-known, has been a persistent advocate of the necessity of uniform steam pressure in plants where speed of extreme regularity is essential, such as in electric light stations.

In the old style of gauge there was an indicating hand and dial. These have been dispensed with, records being made in the new instrument on the vertical scale only.

An electric bell is operated by an adjustable circuit closer, shown near the vertical scale, and enables an alarm to be sounded either on the instrument or at a distant point, when any limit of pressure at which the circuit closes has been set is reached. The modification of the arrangement provides a low circuit closer, in addition to the above, operated from the same battery, so that while the recording chart below in recording continuously the pressure carried, acts as a constant check, or reminder, upon the man in the fire-room, the electric bell device undertakes to call attention to the dereliction, and enables an immediate



EDSON'S NEW STEAM PRESSURE RECORDING GAUGE.

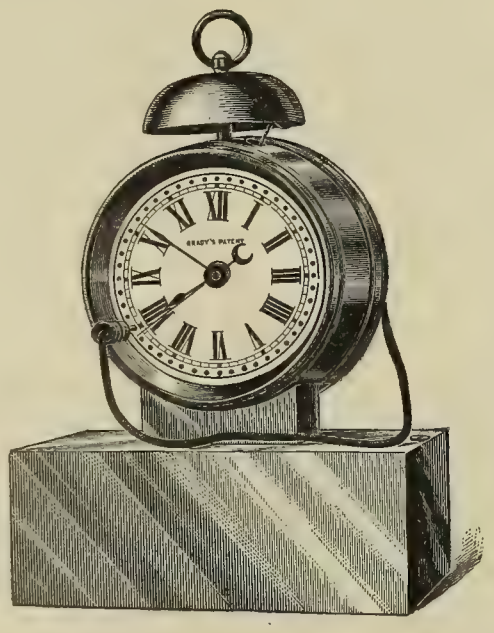
remedy; whereas, without the alarm, the pressure might be either above or below normal for a considerable period without being noticed. The mechanical construction of this new style of instrument is a vast improvement over the older one, inasmuch as lost motion and wear is provided against, and its simplity has admitted of a reduction in price. This style is provided with metallic paper ruled to the particular travel of the diaphragm, and spaced off in hours and half hours. The marking lead has been dispensed with and silver wire substituted, the whole being surmounted upon an ornamental black iron bracket.

In order to conduct a steam plant economically, intelligence must be used, and the engineer or manager of the plant needs some accurate method of recording the pressure of steam at all times, particularly if he should be absent temporarily. Neglected or over-fed fires are ruinous to perfect combustion, and in the absence of any reliable record of the same it is difficult to place the responsibility where it belongs. A good pressure recording gauge, therefore, cannot be too highly recommended.

THE GRADY ELECTRIC ALARM CLOCK.

A reliable time-piece and time alarm is as necessary in every household these days, as any other piece of furniture or apparatus. That there is a demand for such devices is evident from the fact that so many have been placed upon the market within a short period. In this line one of the neatest electric alarm clocks is illustrated herewith. It is a new invention and is claimed to be the most complete, economical and trustworthy of its kind.

The electric bell, battery and movement are all enclosed in a finely finished nickel-plated case, making it as compact and portable as the ordinary mechanical alarm clock. For any one who is inclined to over-sleep in the morning, or has some specific duty to perform at a certain time, and must get up promptly on time, an alarm clock of this character is quite indispensable. It helps along wonderfully to enable one to catch an early train.



THE GRADY ALARM CLOCK.

An ordinary alarm clock rings for half a minute, and then stops of itself. A person is then liable to go to sleep again. This particular clock, however, rings until the person gets up and stops it.

The use of this valuable little device will enable a person to obtain more sleep than he would otherwise get, as he may rest assured that he will be thoroughly awakened at the time set,

One of the valuable features of this Electric Alarm Clock is its adaptability to business purposes; for instance, a business man may make an appointment and can set the clock to ring the alarm at the proper time to enable him to fulfil his engagement. When the time arrives the alarm is sounded and he is reminded that the time is up to keep his appointment.

T. H. Grady & Co., No. 263 Fulton street, Brooklyn, N. Y., are the sole manufacturers of this clock.

AN IMPORTANT INDUSTRY.

The factory in Glenwood Yonkers-on-the-Hudson, bought by the India Rubber and Gutta Percha Insulating Company, of 315 Madison avenue, cor. 42d street, formerly of No. 159 Front street, has been remodeled and refitted by the company for the manufacture of insulated cables and wires for submarine and underground purposes. This company also manufacture vulcanized india rubber, pure rubber and special goods to order for electric lighting and all other electrical work, house wires, flexible cords of any capacity, etc., and everything in the wire line. The new factory in Yonkers is fitted up in a most approved manner. Dr. M. M. Habirshaw, F. R. S., general manager of the company, has given personal supervision in the remodeling of the factory, and it is through his exertions and experience that the company's goods have been brought to the high standard which they now have. The fact that they have become so popular necessitated the enlargement of the works, and with the new facilities the company will be enabled to fill all orders more promptly, and carry in stock a larger quantity of their goods. The site of the new factory is an extremely convenient one. Shipments of goods can be made by water or rail with great facility. It is said that this new factory when completed will be the largest and most complete in the country for manufacturing insulated wires and cables. Recently large orders have been received for assorted sizes of vulcanized india rubber wires for general electrical purposes. The United States Government is also a large user of this company's wire, having placed large orders for marine core wire to be used on United States Cruisers. The Buffalo Underground System contains large quantities of this company's wire for electric railway use. The manufacture of all the products of the India Rubber and Gutta Percha Insulating Company, is under the charge of Mr. William Habirshaw. This company has recently moved to elegant new offices and salesrooms, corner of Forty-second street and Madison avenue, where they will be pleased to receive all their friends. Mr. C. R. Field, the manager, is a gentleman liked by every one who has the pleasure of his acquaintance.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE.
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, Mass., March 6, 1891.

F. E. Alexander, son of P. H. Alexander of New York, formerly with the Westinghouse Electric Company and a young man well and favorably known in electric circles, has entered the employ of the Eastern Electric Supply and Construction Company. He will look after the interests of the company in Central lighting stations.

The upper section of the huge iron chimney of the Essex electric light station at Haverhill fell February 27th, caused by the rotting of the iron, and a heavy wind blowing at the time forced it over in spite of the guy ropes. Nobody was injured.

The American Waltham Watch Company have just purchased a 30 horse power gas engine from Messrs. Day & Bishop, of Boston. This engine is to furnish light for the watchmen and sweepers after the shops are closed and their regular electric light power of 400 horse power is stopped for the night.

The Belt Line Street Railway Company of Lynn will pay a dividend of five per cent. to all stockholders July 1st, 1891.

Judging from orders received by the Electric Gas Lighting Company from Col. Burnham who went into the Southwest recently in search of health it would appear that he had found the right climate.

The Shaver Corporation have just finished incorporating the states of Maine and New Hampshire by counties with their telephones, and are now going into Connecticut. They recently finished the installation of an exchange with one hundred subscribers at Charlottesville, Va.

The Electric Gas Lighting Company have made arrangements with the Star Electrix Company of Philadelphia, to handle their electric light specialties.

F. E. B.

RESISTANCE.—The ordinary methods of measuring the resistance of leads, has no value for alternating currents, since they set up a spurious resistance which varies with the number of alternations per second.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., March 6, 1891.

Mr. L. W. Collins is now representing the *Electrical Review* in this section, in the place of Mr. Dean, who recently resigned and took a position with the Electrical Merchandise Company. Mr. Collins was formerly manager of the Chicago Electric Club, and in that capacity made many friends among the members of the electrical fraternity. He has had considerable experience in the journalistic line, having been connectcd with one of our leading dailies. Mr. Collins was also, some time since, on the staff of the *Western Electrician.*

The Mount Sterling Light and Power Company has been formed at Sterling, Ill., with capital stock of $10,000; incorporators, F. W. Rottger, A. Bailey, E. Schonen, H. Stark, W. Brockman, W. L. Carey and S. T. Ranney.

Plans have been completed for the erection of a plant by Frazer & Chalmers, manufacturers of mining machinery, on the twelve acre tract lying between Fillmore and Twelfth streets, and Rockwell street and Fairfield avenue. The total cost of the plant will probably be $1,000,000.

The Charlston Thomson-Houston Electric Company has been formed at Charlston, Ill., with capital stock of $40,000; incorporators: J. C. Brooks, A. M. Searles and F. A. Brooks.

A small strike at the the Pullman Car Works in this city, this week, was settled by the company securing new men in the places of those striking, without much difficulty. F. M. I.

SOUTHERN NOTES.

The Brookside Cotton Mills, Knoxville, Tenn., has an isolated plant of 25 lamps, and the Knoxville Woolen Mills, has just installed a 1,000 light plant and two 500 volt Edison dynamos.

The electric street railway in Knoxville, Tenn., has about four miles of track, and is operated on the overhead trolley Thomson-Houston system. Each car has two 15 horse power motors, and the generators consist of two 500 volt T.-H. dynamos connected in multiple.

The Knoxville City Flour Mills is installed with an isolated plant of the Westinghouse alternating system.

The University of Tennessee, located at Knoxville, has an isolated plant on the Edison incandescent system.

PHILADELPHIA NOTES.

The Hale & Kilburn Manufacturing Company are just issuing a new catalogue of Street Car Seating, including all styles of upholstered seats, with and without springs, and covered in plush, carpet and rattan, as well as their patent "Elastic Slat Spring Seating." This is the first catalogue ever issued devoted exclusively to Street Car Seating. The recent remarkable development in both electric and cable street car lines has created a demand for something better in the way of seating. This company is just about to begin on the work of putting up their new buildings adjoining their present works on Sixth street below Arch, made necessary by the great increase in their business during the last year or two.

Mr. H. T. Paiste, of this city, will leave here on Sunday next for an extensive trip through the West and Southwest, taking in all of the principal cities in his travels, combining pleasure with business. Mr. Paiste will carefully go over the site of the 1893 Exhibition ground while in Chicago, and undoubtedly bring home a Buffalo head from Denver, Colo.

J. W. Queen & Co. have received from Prof. C. S. Hastings, of the Yale University, New Haven, Conn., a $4,000 order for electric and scientific appliances. This enterprising firm is certainly destined to be classed No. 1 in the manufacture of scientific instruments.

O. D. Pierce, No. 808 Walnut street, agent for the Perkin's Electric Lamp Company, of Manchester Conn., has accounted for 8,000 of these lamps sold, during February, 1891. This is the result of the removal into a more central location, with a gentlemanly attendant always on hand.

The De Kosenko & Hetherington Manufacturing Company, of this city, formerly of Thirteenth and Hamilton streets, have recently taken more spacious quarters in the Times Annex building, Eighth and Sanson streets. Their specialty in the manufacturing of chandeliers and bracket fixtures for electric lighting has a world-wide reputation. This company designs their own work, principally, or will execute architects' designs to the letter. Many prominent buildings in this city, New York, Washington, Pittsburg, Baltimore, Kansas City, Mo., and many other large cities in the United States bear evidence of the artistic skill and fine workmanship displayed by the above company. A full description of the new building and business will appear in one of our later issues.

H. G. G.

NEW YORK NOTES.

A one horse power, slow speed Crocker-Wheeler motor was wired up in the U. S. District Court, Post Office building, recently to run a Lynotype to show its workings in a patent suit. The motor elicited much favorable comment, and was handled by the judges.

The following resolution adopted and promulgated by the Board of Fire Commissioners speaks for itself: *Resolved*, That the Board of Fire Commissioners hereby directs the entry in the minutes of its high appreciation of the excellent judgment and tireless energy displayed by Chief of Department, Hugh Bonner, and by Superintendent of Telegraph, J. Elliot Smith, in promptly and successfully meeting the serious emergency which arose from the destructive storm of January 25th, 1891.

Alexander, Barney & Chapin have just imported a novel electrical trumpet that can be used for a great variety of purposes. It consists of a trumpet-shaped tube made of brass or any light metal that will give a large amount of vibration, mounted on a raised iron base having three legs for fastening, by means of screws, to the place where it is to be used. In the base of the brass tube is a ferrotype disc with a soft iron armature in its centre which is attracted by means of a pair of small magnets inside the tube. The contact points are on the bottom of the ferrotype disc and operate on the same principle as an ordinary electric buzzer or bell. They are made in different sizes to give different pitches, the smaller sounding very much similar to a piccolo, while the largest will drown the noise of a fog-horn. The electrical trumpet has a handsome appearance and the smaller sizes would be very ornamental where used in the place of bells, buzzers, or window-tappers. Several of these novelties were placed over the door and put into operation a few days ago and the noise attracted a great crowd of people in front of the store.

The Boynton Bicycle Railway Company, whose system is now in operation on Coney Island, near the boulevard, are talking of adopting some electric motor system. The offices of this company are at No. 32 Nassau street, New York. There is an excellent opportunity for the development of some good motor in connection with this system, as it is being introduced all over the United States, and numbers of contracts are under way. As run at present, the wheels of the engine or locomotive and passenger cars are in the centre, the same as in a bicycle, and there is a single track overhead to support the engine and cars. Any ordinary railroad can adopt this system, and utilize the two tracks or rails for trains running in either direction.

The Eureka Electric Company, 18 Broadway, are introducing the Loomis system of electric lighting, both arc and incandescent, very successfully throughout the United States. Their plant, at 40 Wall street, New York, of 800 incandescent lamps is giving most satisfactory service. They have lately completed a 2,500 light plant in the new Tampa Bay Hotel, Tampa, Fla., and have several others under way.

The National Electrical Construction Company, No. 50 Broadway, New York, Z. Latshaw, Vice-President and General Manager, are constructing and completing many large plants on the system of the National Electric Manufacturing Company, of Eau Claire, Wis. They have lately rebuilt and reconstructed the plant at Dover, N. J., and have there installed one of their latest improved 1,000 light incandescent dynamos for general lighting. This Company is extending the plant lately installed by them at Jamaica, L. I., to Dunston, L. I., where they are constructing lines for 300 lights, the current to be furnished from the Jamaica plant. They are using in this plant for power one 105 H. P. Rice engine.

The Riker Motor Company, of Brooklyn, N. Y., are preparing a new catalogue, which will be ready for distribution in a couple of weeks. Send in your name and get a copy early.

Mr. George B. Durfee, manager of the Carr Metal Company, inventor and manufacturer of an alloy of zinc and mercury for battery purposes, Fall River, Mass., called at this office this week, and speaks in high terms of the success his company is having with their celebrated battery zincs. These zincs, having an alloy of ten per cent. mercury, are said to be far superior to anything ever put on the market. They avoid the necessity of amalgamation, so very troublesome among battery manufacturers and users. Every supply house ought to be stocked with them.

Mr. Frank A. Magee, M. E., is now representing the Engineering Equipment Company, of No. 73 Cortlandt street, contractors for steam and electrical equipment. Mr. Magee is a graduate of Stevens Institute of Technology and a member of the American Society of Mechanical Engineers. He has had large experience as a salesman of electric specialties, electric light, railway and other supplies.

The Porter Teletype Company, No. 177 Broadway, are bringing out a new motor. Mr. M. D. Porter is the electrician of this company.

The Nassau Electric Company have moved to larger and more handsome quarters at 112 and 114 White street, near Centre. They have about 5,000 square feet of floor space in their new offices and factory. which is now being fitted up with every facility to supply the large demand for their specialties.

Mr. Charles H. Hinds, manufacturer of static electric machines and electric gas lighting burners, Trio Building, 13th and Hudson streets, is well-known in this section for his integrity of purpose. Some years ago he invented one of the most practical static electric machines for multiple electric gas-lighting, for which there has been a large demand. He also makes a line of first-class and serviceable electric gas-lighting burners. The trade and buyers generally will do well to call upon him at his new address, as he has additional manufacturing facilities.

All inventors should consult Mr. John Henry Hull, room 165, Times Building, New York, when ready to apply for a patent. Mr. Hull is an experienced patent attorney, and those who have dealings with him may rest assured that their interests will receive the best of care and attention. Mr. Hull has long had experience in this line, which fact is of great interest and importance to patentees. An inventor naturally feels, when he gets ready to apply for a patent, that his success will depend largely upon the experience and ability of his attorney. To these it may be said that Mr. Hull has attained an eminent position in his practice, and he is one of the most successful practitioners in his line. All parties securing a patent through Mr. Hull will receive a free notice and description of the same in the ELECTRICAL AGE. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
American Motor Co.			$ 5 00
American Private Telephone (Parent)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Amsterdam Electric St. R.R. N.Y.	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	*60
Averell Insulating Conduit	3,000,000	100 00	4 00
Asbury Park L. & P.	50,000	10 00	
Bell Electric Light	2,000,000	100 00	
Bell Telephone	12,500,000	100 00	183 00
Boston Electric Light			105 00
Brooklyn Edison Electric Light	1,500,000	100 00	100 00
Brooklyn Citizens' Electric Light	500,000	10 00	13 00
Brooklyn Municipal Light	500,000	100 00	122 00
Brooklyn City R.R.	6,000,000	10 00	18 00
Brush Illuminating (N. Y.)	1,000,000	100 00	75 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Consolidated Electric Light	1,929,400	100 00	50 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Daft	1,000,000	50 00	
Edison Elec. 5s	2,000,000		*99
Edison Illuminating	4,500,000	100 00	78 00
Edison General	14,000,000	100 00	106 00
East River Electric Light Co.	1,000,000	100 00	80 00
Edison Elec. Light N. J.	1,600,000	100 00	
Erie Telephone			47 00
Essex Printing Tel.	5,000,000	100 00	75 00
Excelsior	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Fort Wayne Elec. Co.	4,000,000	25 00	13 00
Hoboken-town Elec. Light N. J.	25,000	20 00	25 00
Hudson Electric Light (N. J.)	100,000	100 00	
Harlem Electric Light Co.	250,000	100 00	70 00
Home Engineering Co. (Brooklyn	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Ins. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Laclede Gas Co.	7,500,000	100 00	17 00
Laclede Gas, pref	2,500,000	100 00	55 00
Laclede Gas Firsts			*50
Law Telephone			
Long Branch Electric Light	50,000	100 00	75 00
Mount Morris 6s (N.Y.)			*95
Mount Morris Electric Light			90 00
Morristown L. H. & P.	50,000	100 00	100 00
N. E. Telegraph and Telephone			51 00
N. Y. and N. J. Tel. and Tel 6s			par
N. Y. and N. J. Telephone Stock		100 00	96 00
Natl. Elec. Co., Wash., D. C.	250,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North New York, Lighting	150,000	100 00	60 00
Postal Telegraph	5,000,000	100 00	38 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light Trenton	100,000	100 00	90 00
Plainfield, Electric Light	100,000	100 00	75 00
Port Richmond (S. I.)	100,000	100 00	80 00
Rawson Electric Lamp Co. (Boston)	300,000	100 00	90
Rockaway Beach Elec. Light	50,000	100 00	80 00
Richmond L. H. & P. (S. I.)	150,000	100 00	75 00
Saratoga Gas and Elec. Light 6s			*86
Shaver Corporation	100,000	1 00	3 00
Swan Incandescent	800,000	100 00	2 00
Thomson-Houston Electric Co.	10,000,000	25 00	47 00
Thomson-Houston Pref.	5,000,000	25 00	25 00
United Elec. Light and Power	3,000,000	100 00	
United Elec. Traction Co.			2 50
United States Elec. Co			40 00
United States Illuminating	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co.	5,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.			50 00
West End. L. (Boston)			22 00
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

Hello! Hello!! Give me Electric Property, Central, if you please—Hello?—Yes. I have mentioned your communication and situation to several investors who, if assured of the intrinsic value of your securities, desire to come to your rescue; but I can find no public record of your companies. Remember I don't question their value. From a cold, calculating business standpoint you really appear to be hiding your arc and incandescent lights under a bushel, or at least got a fence around your territory so high that no ordinary investor can get any satisfaction as to its revenue. Change places for a moment. If you had a few thousands saved up and wanted it to earn more than "bank interest on deposits," would you put it into a business of which the possessors withheld all information and gave no account to the general public, their customers, except in confidential whispers behind closed doors to the favored few? Would you? You have got your contract signed, your company incorporated, your plant installed; then why not publish for the benefit of investors your financial condition and prospects? Capital will come to you in the still watches, more than sufficient. Now, as to your patents: the Government has granted them to you for seventeen years and demands that you exploit them. You are safe in their possession and you alone are the pecuniary sufferer by withholding them from the world, you say they are prior fundamental patents; have been granted several years; no doubt some of them are being infringed and the property rightfully yours enriching others. Who is to blame for this? Not I, surely. Look at the front page of the ELECTRICAL AGE; does E. S. Greeley hide his patents or business? Meander on to the last page; does the Okonite Company miss an opportunity to flash its patents or business on the public? Notwithstanding their publicity they can get all the money they require at current rates. Why don't you take the blanket off and air your securities? I will willingly assist you all I can. Send on your report to enable our readers to ascertain how much they want to invest with you. The ELECTRICAL AGE is read everywhere, and a quotation in our list will make a market in your own village. Good-bye.

The shareholders in the Brooklyn City Railroad (as well as all others interested in electric corporations collecting quick small sums from the public) are notified that counterfeit money coming into the company's office must be retained and delivered to the Government.

If the United States Illuminating Company gain their suit for damages to poles and wires from the city the shares will increase in value to the extent of $550,000, which is $25,000 more than stockholders in the Brush Illuminating Company ask for.

Mr. Wise made a prophetic remark the other day to the Railway Commissioners at the Chamber of Commerce, when he stated that "there are hundreds of able electrical scientists devoting their entire attention to the perfection of a commercially practical storage battery, and the first who discovers it will (or can) be so rich that he may look down on the wealth of Astor or Vanderbilt, and shake money at Aladdin till he makes him sick." Financially, the trolley system is just now shaking down the dividends to those who have had the nerve to advance money to introduce it. Take an active interest in your local trolley companies; send me your corporate name, amount of capital stock, par value per share, and a price at which you are willing to sell, for quotation, with periodical reports of your condition for publication in the ELECTRICAL AGE, and when improvements are found desirable, you will have no difficulty in raising all the money you require in New York at current rates.

Electric stockholders in New York State are personally interested in the bill introduced by the Hon. W. G. Byrne, compelling all tunnels over a specified length through which trains pass to be lighted and ventilated. Of course the lighting will be done by electricity; ventilation with any other illuminant is simply a delusion and a snare.

Investors who have become wealthy from the immense increase in electric securities, have just lost one of their most arduous assistants, in the person of John H. Bowley, an efficient aid to Prof. Morse and later to Cyrus W. Field in laying the Atlantic cable, also in erecting our net work of wires, and finally the subways, whose life current was grounded in Jersey City on the first of March. What an opportunity with his knowledge of the certain success of electric appliances to have grown rich early and increased with the art; it is open to every reader of the ELECTRICAL AGE. Act on it.

Comparisons are odious, nevertheless when dividends to the amount of about $90,000,000 are paid in the early days of January in New York, and only $12,000,000 in Boston, $10,000,000 in Philadelphia, $8,000,000 in Chicago, $6,000,000 in St. Louis and so on down the line, you who desire the greatest number of securities to choose from, even if of the same class, should remember that here the capital of the country is sent to meet the industry of the nation, and one thing you may hold me responsible for which is, that the market requires as much developing as the mine.

NOTES FROM JAPAN.

The building in which the Japanese National Assembly, or Diet, meets, was burned to the ground early in the morning of January 21st, last. It was lighted by electricity on the Edison three-wire system, using therefor about a thousand incandescent lamps. The building was of wood and a temporary one. It was first reported that the fire was started by electric light wires, but the indications are that it started from some other cause.

Mr. S. Katogi delivered a lecture before the Tokio Electrical Society on January 30th, last, taking as his subject "Electric Fires." He took as a basis for his paper the one read by Mr. S. E. Barton in Boston May 21st of last year, on the subject of "Fire Insurance and Electrical Interests." He illustrated his lecture with various experiments, showing cut-outs under various conditions, and the different kinds of insulated wire used in electric lighting.

Statistics pertaining to the city of Tokio show that in 1889 there were in use 7,078 electric lights, both arc and incandescent. In 1888 there were 3,599 and in 1887, 1,447. The fire statistics for the same periods do not mention fires started by elctric light wires at all, which leads to the conclusion that there were none. Out of the 742 fires in 1889, 69 were started by petroleum lamps, 39 by smokers, 206 by furnaces and fire boxes, and incendiaries started 223. It may be stated that fire boxes in Japan are their heating apparatus in winter time.

Mr. Katogi has translated into the Japanese language, the articles published in the ELECTRICAL AGE last year on "Electric Lighting for Beginners." Great interest was taken in these papers, and their translation was necessary for the dissemination of the information among the young electricians in Japan.

TOKIO, Japan, Feb 10, 1891. S. KATOGI.

ASSOCIATES.—The following gentlemen were elected associate members of the American Institute of Electrical Engineers on February 24th: Watson G. Anthony, Assistant Electrican of the Okonite Company, Newark, N. J.; Reginald Gordon, Assistant in Physics, Columbia College, New York, and Louis H. Landy, Assistant in Applied Chemistry, School of Mines, Columbia College, New York.

The transactions of the special meeting of the American Institute of Electrical Engineers, November 18, 1890, have just been issued by the Society in its regular form.

Volume eight of the transactions of the American Institute of Electrical Engineers, embracing the special meetings of December 16th, 1890 and January 20th, 1891, is now being distributed.

ELECTRICAL PATENTS.

ISSUED TUESDAY, MARCH 3D, 1891.

447,291. Electric Dental Motor. Harry H. Blades, Detroit, Mich., assignor to the Detroit Motor Company, same place. Filed March 23, 1888.

447,315. Incandescent Lamp Socket. Harry J. Gutman, Des Moines, Iowa. Filed Sept. 29, 1890.

447,318. Railway Signal. William P. Hall, Greenwich, Conn., assignor to the Hall Signal Company, Portland, Me. Filed Oct. 16, 1890.

447,321. Electric Matrix-Making Machine. Thomas C. Hargrave, Minneapolis, Minn., assignor of one-half to John W. Cobb, same place. Filed Dec. 26, 1889.

447,332. Electric Railway. Walter H. Knight, New York, N. Y. Filed Mar. 13, 1886.

447,338. Conduit for Underground Trolley-Wires. Horace J. Medbery, Ballston, N. Y. Filed Nov. 21, 1890.

447,350. Electrical Subway. John C. Reilly, Brooklyn, N. Y. Filed May 20, 1890.

447,352. Commutator Brush. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 28, 1890.

447,353. Electric Heater. Charles C. Rich, Mount Vernon, N. Y. Filed Sept. 15, 1890.



447,353—ELECTRIC HEATER.

447,383. Electric Arc Lamp. Elihu Thomson, New Britain, Conn., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 16, 1884.

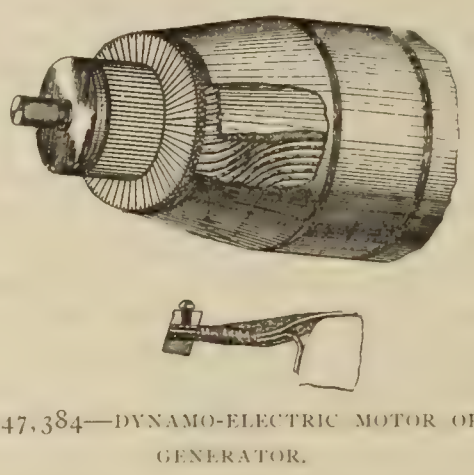
447,384. Dynamo-Electric Motor or Generator. Elihu Thomson, Swampscott, Mass. Filed Oct. 20, 1890.

447,409. Electric Time Lock. Joseph H. Kaiser and Andrew B. Ledwith, Brownsville, Pa. Filed May 15, 1890.

447,426. Telephone Switch System. Claude C. Gould, Batavia, assignor to the Eastern Electrical Manufacturing Company, Wheatfield, N. Y. Filed Oct. 10, 1887.

447,469. Commutator Brush. William Main, Brooklyn, N. Y. Filed Dec. 23, 1889.

447,482. Electric Lighting System. Barton B. Ward, New York, N. Y., assignor to the Electric Construction and Supply Company, same place. Filed May 5, 1890.



447,384—DYNAMO-ELECTRIC MOTOR OR GENERATOR.

447,485. Telephone Exchange Apparatus. Franklin G. Beach, Chicago, Ill., assignor to the American Bell Telephone Company, Boston, Mass. Filed Feb. 4, 1888.

447,486. Universal Joint for Incandescent Lamp Brackets. Edwin C. Bennett and Elisha C. Freeze, Chicago, Ill. Filed Apr. 4, 1890.

447,494. Rheostat. Jeremiah O'Meara, New York, N. Y. Filed Nov. 15, 1890.

447,495. Turn-out and Crossing for Line Conductors. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Apr. 12, 1890.

447,529. Electro-Magnetic Cut Out. Giles Taintor, Worcester, Mass. Filed Aug. 16, 1890.

447,558. Electrical Annunciator. William E. Cram, Cambridge, assignor of one-half to Edwin S. Beckford, Quincy, Mass. Filed May 23, 1890.

447,569. Electrical Transformer. Rankin Kennedy, Glasgow, Scotland, assignor of one-half to Robert Dick, same place. Filed Dec. 29, 1886.

447,632. Trolley for Electric Railways. William J. Cavert, Albany, and William P. Wiswall, West Troy, N. Y. Filed Aug. 27, 1890.

447,676. Electric Cut-out. George C. Gammon, Pawtucket, R. I. Filed July 2, 1889.

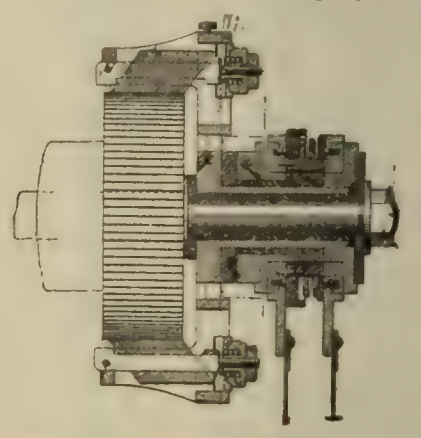
447,702. Electrode for Electric Arc Lamps. Albert C. Seibold, Mount Vernon, N. Y. Filed Oct. 30, 1890.

447,704. Electric Motor. Robert W. Traylor, Richmond, Va., assignor to the Traylor Electric Company, same place. Filed May 21, 1890.

447,728. Electric Snap Switch. Gerald W. Hart, Kansas City, Mo., assignor of one-half to George S. Hegeman, same place. Filed Aug. 21, 1890.

447,734. Electric Motor. Emil B. Meyrowitz, Ridgefield, N. J., and Ferdinand Buchhop, New York, N. Y.; said Buchhop assignor to said Meyrowitz. Filed May 24, 1890.

447,746. Electric Arc Lamp. Luther H. Buchanan, Passadena, assignor of one-half to J. De Barth Shorb, San Gabriel, Cal. Filed July 8, 1890.



447,469—COMMUTATOR BRUSH.

447,748. Electrical Door Bell Pull. Lewis W. Cleveland, Portland, Me., assignor of three-fourths to Clarence L. Marston, Lewis A. Barker and Dennis A. Meaher, all of same place. Filed Dec. 1, 1890.

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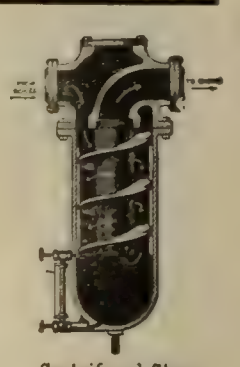
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NEW YORK, MARCH 21, 1891.

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THE MAYOR DOES NOT CARE FOR LAW POINTS.

The Subway Commissioners reported at their meeting on March 11th, that both sides of Lincoln ave., from 132d to 141st street, were occupied by poles owned by the Western Union and Postal Telegraph Companies, and that failure had resulted in the efforts to induce these companies to unite and use only one side of the street, in accordance with the resolution recently passed by the subway Commissioners. Mayor Grant, however, would not accept this as an excuse, and insisted that if the resolution is not complied with in this instance within a week, the poles would be chopped down. Counsel for the Subway Commissioners suggested that there were several law points in the way which should be considered. "I don't care anything about law points," retorted the Mayor, "If the poles are not down within a week I will have them cut down."

President Lauterbach of the Subway Company reports that over 66 miles of subways were built last year, and that less than five miles of these are now in use. Several representatives of electric companies explained that they could not make connections with the subways, on account of the refusal of the Commissioner of Public Works to permit the streets to be torn up in winter.

LINE MATERIALS.

In the building of telephone and telegraph lines it is essential to use none but the best materials if it is intended that the lines should give the best possible satisfaction for as long time as possible.

In the past a few lines have been built for speculative purposes with as little care being bestowed upon them as possible, the cheapest and poorest materials being used. These days, however, no such lines are put up, and experience has taught the existing companies that the very best material must be used for the equipment of the lines in order to get the best service out of them.

First-class material for electric lines, of course, costs a little more than the cheaper grades, but the ultimate saving is far greater in proportion.

The vicissitudes of the weather soon tell on a line that is not properly built. Any structure that is exposed to the weather at all times, summer and winter, rain or shine, as an electric wire line is, manifestly should be built of material that is capable of withstanding the detrimental effect of the constant atmospheric changes as much as possible.

An anomalous condition of things very generally exists in lines as usually built. The point where most of the strain is exerted is frequently the weakest. That point is at the insulator. Insulator pins do not receive the attention that they should. They should be of the toughest wood obtainable, as they are called upon to bear very great strains.

Electric companies are already beginning to realize the necessity for exercising great care in the selection of insulator pins. This has led manufacturers to look around for better and more serviceable wood for this purpose, and one of the results is the choice of locust as one of the best woods known for insulator pins.

On another page we give an interesting article, which throws a good deal of light upon this somewhat neglected but important subject.

It should be read by all contractors.

WATER POWER.

As an illustration of the simplicity of the application of water power for the operation of dynamos, etc., we refer our readers to the article in this issue on the Bangor electric light plant. One of the accompanying illustrations shows the water-wheel and the manner of its connection with the machinery of the station. Excellent results are obtained, and the plant is a model of its kind.

There is much power running to waste in streams all over the country. The day will come, however, when it will be more extensively harnessed than it is at the present time.

THE INVENTOR OF THE ELECTRIC MOTOR.

The story told by Mr. Frank L. Pope before the American Institute of Electrical Engineers, about Thomas L. Davenport and his invention of the electric motor, is an extremely interesting one. We print it in full on another page, and there seems to be no doubt that Mr. Davenport is entitled to all the honor of being the inventor of this most valuable and important machine.

Mr. Pope's patient research in this matter is commendable. He has placed the honor where it justly belongs, and Mr. Davenport's name will take a place in the front rank of American inventors. In this instance, as in many others in the past, the inventor himself did not live to see the day when he should enjoy the fruits of fame. His name, however, will be imperishable, and Mr. Pope deserves the thanks of every lover of justice and right for the splendid results of his investigations.

THE WESTINGHOUSE TROUBLES.

Man's ingratitude is something astounding sometimes.

It was with deep regret that the friends of Mr. George Westinghouse learned of the efforts being made to oust that gentleman from the presidency of the Westinghouse Company, and this is being done, according to our information, by men who owe their position in the business world and their wealth to Mr. George Westinghouse. Now they turn upon Mr. Westinghouse in the time of his adversity and try to crush him. Justice and right would demand that Mr. Westinghouse be not deprived of his interests in the splendid business he has built up, but man's cupidity frequently renders him blind to justice, right, and everything else when a fellow-man is in trouble. Every man is a splendid fellow when he is prosperous, but when adversity overtakes him his friends ignore him and he receives the cold shoulder.

Mr. Westinghouse's friends will heartily sympathize with him in his present troubles, and we hope that he will conquer his enemies.

ARC LAMPS ON INCANDESCENT CIRCUITS.

The demand for an arc lamp that would give satisfactory results when connected to an incandescent circuit has led to the design of many lamps of this class.

The first ones did not give very gratifying results, but they have been so much improved that it may be said now that such a lamp is an actual thing and a practical success.

The advantages of using an arc lamp on an incandescent circuit are obvious. Larger spaces can be lighted by their use than by those of the incandescent type in proportion to the current used, and there is a great pecuniary saving in not having to run an arc circuit to the point where it is desired to use the arc lamp. This latter fact in itself is an important one, and introduces a permanent factor of safety. The dangers of high tension currents are entirely obviated, and the service is fully as satisfactory as that rendered on regular arc circuits.

We describe in a general way a lamp of this class on another page, and the lamp is highly spoken of as an efficient one.

Electrical Formulæ.—We print on another page some valuable formulæ compiled by Mr. Thomas J. Fay, of Brooklyn. These formulæ will be found very useful to the electrical engineer, whose duties frequently require calculations, the rules for which may have been partially or entirely forgotten. To locate these in books may consume considerable valuable time, as it is necessary, usually, to look over a good deal of matter before we find what we want, if we find it at all. If these formulæ were segregated from the various works containing them, and set apart by themselves for handy reference, they would find more frequent use and greatly lessen the labors of electricians, besides saving much time. This very thing Mr. Fay has accomplished in the publication in this issue, for the first time, of several formulæ which he has collected from books and deduced from practical experience.

He gives examples of the application of these formulæ; and he very generously dedicates the result of his investigations and study to his fellow-electricians, with the hope that their labors may thus be lightened.

The Montreal Convention.—The date of the next meeting of the National Electric Light Association, which is to be held in Montreal, has been fixed as August 25th, 26th and 27th.

THE NEW BAXTER ELECTRIC RAILWAY MOTOR.

The new street railway motor of the Baxter Electric Motor Company, of Baltimore, Md., possesses many interesting features. The motor has eight poles and a Gramme ring armature which revolves at a speed of 420 revolutions per minute, when the car is going at the rate of ten miles an hour. The low speed of these motors obviates all necessity of expert attendance, as there is no liability of accident and the wear and tear is materially reduced. The reduction in speed is accomplished by the use of the multipolar field and Gramme ring construction. The intermediate shaft is done away with entirely, which results in the gain of at least ten per cent. in power on the axle, otherwise lost in friction.

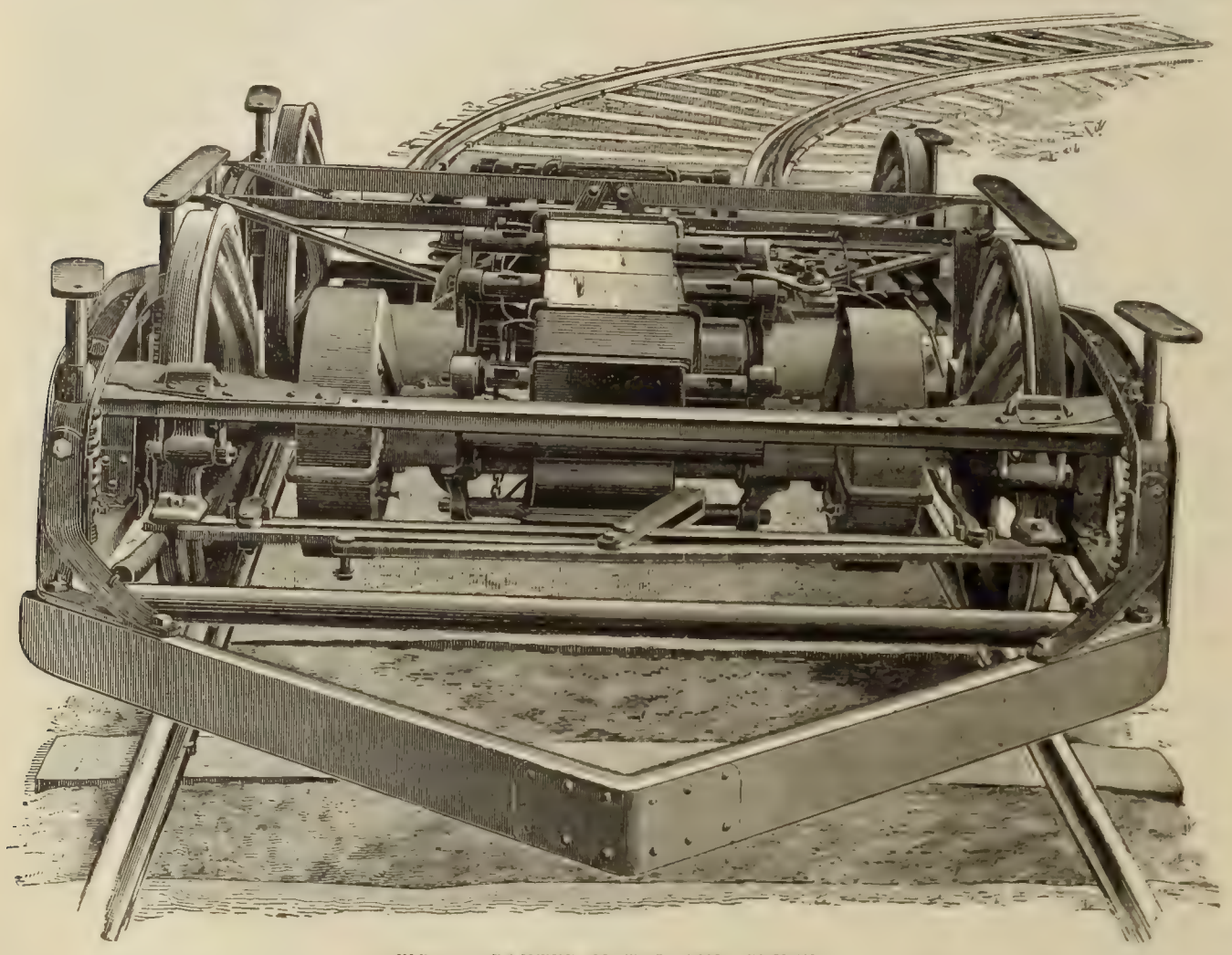


FIG. 1—BAXTER MOTOR AND TRUCK.

Fig. 4 is an illustration of a 100 horse power Baxter Electric Railway Generator. The generators are multipolar and wound for a potential of 500 volts, which is kept constant, regardless of variation of load, by means of a separate exciter.

The multipolar field construction, united with the gramme ring armature, allows of slow speed, which reduces wear and tear on the commutator, brushes, bearings, belting and shafting to a minimum. By the special construction of the brush holders, they are regulated automatically and all sparking is eliminated.

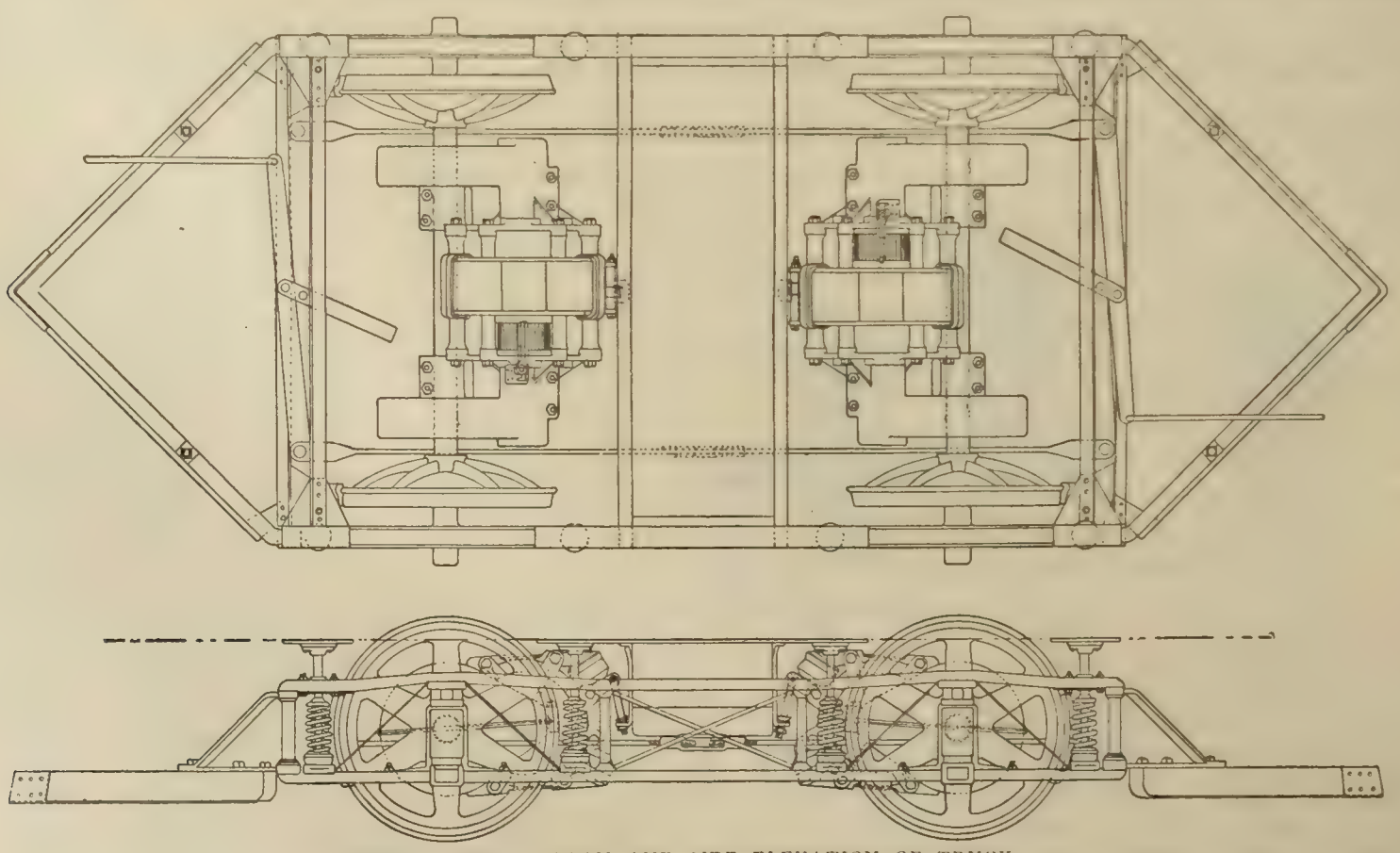
The special feature of this generator is the mounting of the pulley between the bearings, thus relieving the machine from all torsional strain, and giving it great stability. These machines are built in different sizes, from 50 horse power up.

Referring to the motor, it would be of interest to state that both of the brushes are placed at the top of the commutator, rendering them of easy access through the trap in the floor of the car.

The motors are suspended upon a universal joint, in order to prevent any binding on the bearings while going around curves. The whole mechanism of the truck is exceedingly compact, which is a very valuable feature of the system.

The trucks are constructed on the bridge truss method, which gives the greatest possible strength for weight. It is so adapted as to give access to all parts of the machine, and allow of the removal of the motors with the greatest ease. The length of the support is calculated to reduce all rocking of the car body to a minimum, thus eliminating the danger of derailment when running at a high speed or when towing a car.

Fig. 5 shows the works of the Baxter Electric Motor Company, which are bounded by Chase, Biddle and Chester streets and Collington avenue, Baltimore. The company manufacture electric railway and power equipments, build motors and generators for all purposes, and their electric railway system is said to be a most efficient one.



FIGS. 2 AND 3—PLAN AND SIDE ELEVATION OF TRUCK.

Fig. 1 shows a car truck already equipped with one of these slow speed motors. The gears and pinions are in an air-tight casing that is partially filled with oil, which reduces the wear to a minimum and practically renders it noiseless, and at the same time affords perfect lubrication, not only to the gears but to all bearings. This casing is virtually the frame of the motor, and adds little

THE DETERMINATION OF NITRIC ACID BY ELECTROLYSIS.*

When solutions of nitrates are acted upon electrolytically, the nitric acid which they contain in a combined state is reduced to ammonia. It has recently occurred to a German chemist, G. Volkmann, to make use of this observation and to determine the conditions under which this electrolytic decomposition or transformation is best effected. The investigation has been so far successful that it has resulted in the discovery of a quantitative method, by means of which nitric acid may be conveniently estimated.

Volkmann's work may be consulted *in extenso* in the current issue of the *Berichté de Deutschen Chemischen Gesellschaft*, (Vol. xxiii., p. 2,798–2,801). Briefly we may thus describe it:

On passing a galvanic current through dilute acid or through a solution of the nitrate of an alkali (*e. g.* $K NO_3$) that has been previously acidified with sulphuric acid, no ammonia is formed; if, however, a metallic salt be present whose acidified solution is decomposed by the current with deposition of the metal, then reduction of the nitric acid, whether free or combined, readily takes place.

Complete reduction of the nitric acid to ammonia takes place in the presence of salts of mercury or of

*Electrical Review, London.

platinum, but Volkmann finds that the result is obtained best when a copper salt is present. When zinc salts are used the reduction to ammonia does not take place with the same degree of certainty.

The essential features of this method of determining nitric acid are as follows: A sufficient quantity of pure copper sulphate is added to a solution of the nitrate contained in a platinum dish, and the mixture after being acidified with sulphuric acid is electrolyzed. As soon as all the copper is deposited the solution is evaporated to a small bulk, and the ammonia is distilled as usual.

The strength of current used in this operation is one that would yield from 1.0 to 2.0 cc. of electrolytic gas (oxygen and hydrogen) per minute.

The amount of copper sulphate used is guided by the approximate amount of nitric acid present in the salt that is to be analyzed. For instance, suppose it were required to determine the nitric acid in potassium nitrate, it would be necessary to take half as much crystalized copper sulphate; if less be used the rate of deposition must not be so fast.

The following experiment is described as illustrating a modification of the above method which may be used in cases where a neutral salt is under consideration, or when other salts are present, which undergo no permanent decomposition: To a solution of potassium nitrate dissolved in water is added a measured quantity of sulphuric acid containing a known strength of acid. The positive electrode is coppered and the current of electricity is then passed until all the copper has been transferred to the negative electrode. The excess of sulphuric acid is then determined by titration against an alkali, but in this particular instance it must be noticed that some of the titrated acid is taken up by the potassium. This is expressed in the equation

$$KNO_3+4\,H_2+H_2SO_4=K(NH_4)SO_4+3\,H_2O.$$

This, of course, must be taken into account in the calculation.

Volkmann states that the method is delicate, rapid and reliable; it is without doubt extremely interesting and might with advantage be added to the laboratory notebooks of our readers.

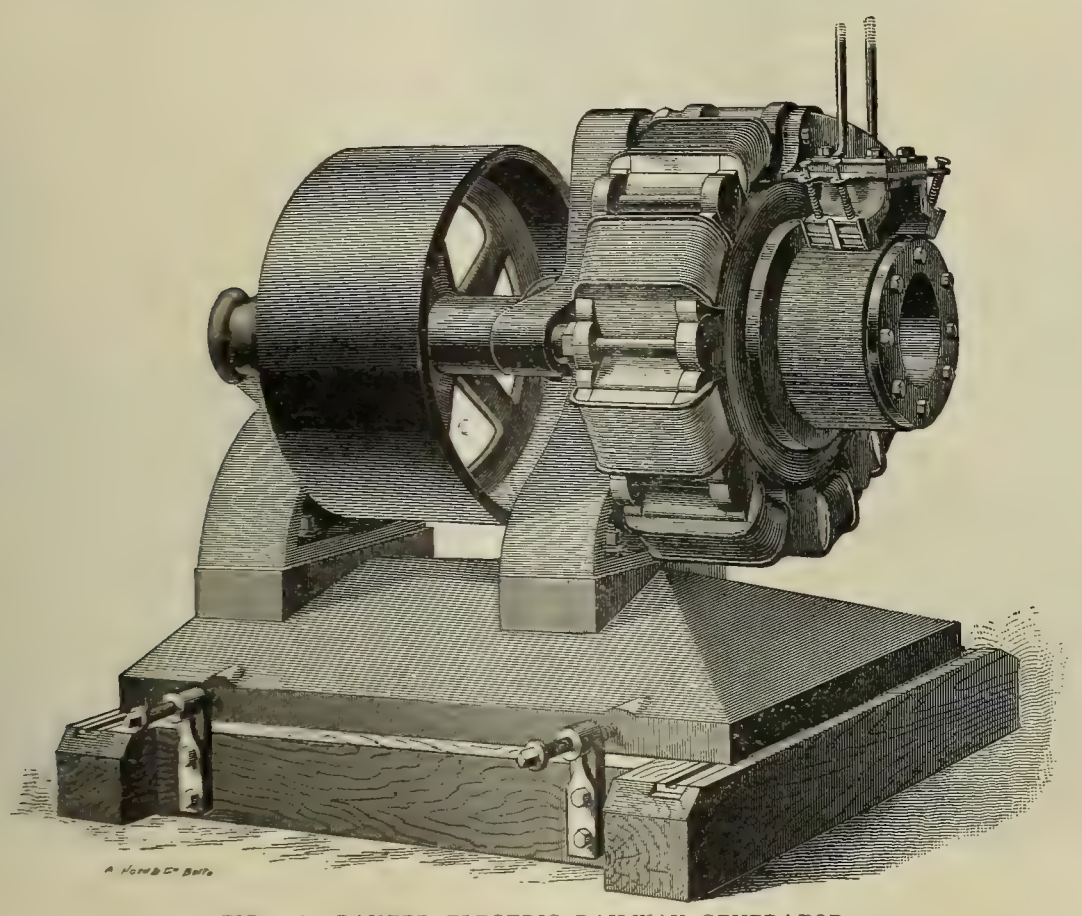


FIG. 4—BAXTER ELECTRIC RAILWAY GENERATOR.



FIG. 5—BAXTER ELECTRIC MOTOR CO.'S WORKS.

ELECTRICAL FORMULÆ.

BY THOMAS J. FAY.

Few are gifted with a memory so retentive as not to require the aid of written formulæ in working out the numerous calculations constantly necessary in the mathematics appertaining to electrical problems, and there are but few books or articles dealing with the subject, so that one can refer to them for the various and rapid calculations so constantly needed in practice. From time to time books and articles have been written and placed at the disposal of the profession, but these manuals, however generally useful and admirable, are not sufficiently comprehensive for practical purposes. I, myself, have ofttimes experienced the want of such formulæ, which necessitated patient search in various sources of information, only to find that what I needed was frequently either mixed up with extraneous matter or arranged in impractical form, and sometimes clothed in mathematical terms so abstruse as to render it almost valueless.

This experience has led me to compile and note, for my own use, many formulæ and memoranda, some of which, after careful revision, I give below, with the hope that other electrical engineers will find them as useful as they have been to me. Many of the formulæ, though appearing in new form, are not original, but merely simplified by myself so as to give the same result with less labor and complication. Some are inserted unchanged; others I have deduced from practical experience.

FORMULÆ:

Where C=current in amperes.
E=Electromotive force in volts.
R=Resistance in ohms.
W=Power in watts.
H.P.=Electrical horse power.
d^2=Area in circular mils=diameter squared.
%=Percentage of energy wasted.
l=Mean length of a conductor=distance from source to delivery.
L=Total length of wire in a conductor.
K=Constant for voltage employed.

Then:

(1) $C=\frac{E}{R}=\frac{W}{E}=\frac{746\times H.P.}{E}=\frac{d^2\times\%}{l\times K}$

(2) $E=C\times R=\frac{W}{C}=\frac{746\times H.P.}{C}$

(3) $R=\frac{E}{C}=\frac{10.79\times l}{d^2}$

(4) $W=E\times C=C^2\times R=\frac{E^2}{R}$

(5) $H.P.=\frac{W}{746}=\frac{C^2\times R}{746}=C^2\times R\times .00134$

(6) $d^2=\frac{C\times l\times K}{\%}$

(7) $\%=\frac{C\times l\times K}{d^2}$

(8) $l=\frac{d^2\times\%}{K\times C}=\frac{L}{2}$

(9) $L=l\times 2$

(10) $K=\frac{21.58\times 100}{E}=\frac{L}{2}$

APPLICATION:

(1) In a circuit whose resistance (R) is 2 ohms with an electromotive force of 100 volts, what is the value of C?

$$C=\frac{E}{R}=\frac{100}{2}=50 \text{ amperes.}$$

In a circuit delivering 10 electrical horse power (H.P.) with a pressure of 100 volts, (E), what is the value of C?

$$C=\frac{746\times H.P.}{E}=\frac{746\times 10}{100}=74.6 \text{ amperes.}$$

In a lamp running with an expenditure of 70 watts, (W), at a pressure of 100 volts, (E), what is the value of C?

$$C=\frac{W}{E}=\frac{70}{100}=.7 \text{ amperes.}$$

In a circuit whose area in circular mils is equal to 42,000 (d^2), and there is known to be a loss of 5 per cent. (%), the distance (l) being 90 feet, the constant (K) 10, what will be the value of C?

$$C=\frac{d^2\times\%}{l\times K}=\frac{42000\times 5}{90\times 10}=233\tfrac{1}{3} \text{ amperes.}$$

Find the current (C) running a motor at 10 horse power (H.P.) when the difference of potential at its terminals is 220 volts (E).

$$C=\frac{746\times H.P.}{E}=\frac{746\times 10}{220}=33.9 \text{ amperes nearly.}$$

(2) In a battery whose resistance (R) is equal to .4 ohms (R), what will be the value of (E) if .025 ampere is flowing?

$$E=C\times R=.025\times .4=.01 \text{ volts.}$$

In a lamp consuming 70 watts (W) when one ampere (C) is flowing, what will be the value of (E)?

$$E=\frac{W}{C}=\frac{70}{1}=70 \text{ volts.}$$

(3) Find the E.M.F. in volts (E) at the terminals of a motor, when delivering 10 horse power, (H.P.), under a constant current of 10 amperes (C).

$$E=\frac{746\times H.P.}{C}=\frac{746\times 10}{10}=746 \text{ volts.}$$

(4) In a rheostat through which 10 amperes (C) are flowing under a pressure of 60 volts (E), what is the resistance (R)?

$$R=\frac{E}{C}=\frac{60}{10}=6 \text{ ohms.}$$

In a conductor whose length (L) is 1,000 feet, and whose sectional area (d^2) is 20,000, what is the resistance of R?

$$R=\frac{10.79\times L}{d^2}=\frac{10.79\times 1000}{20000}=.5395 \text{ ohms.}$$

(5) In a lamp through which 1 ampere (C) is passing with a pressure of 60 volts (E), what is the power in watts (W) consumed?

$$W=E\times C=60\times 1=60 \text{ watts.}$$

In a circuit whose resistance is 4 ohms (R) and through which 100 amperes (C) are flowing, what will be the power in watts (W) consumed?

$$W=C^2\times R=100\times 100\times 4=40000 \text{ Watts.}$$

In a dynamo whose voltage (E) equals 100, and internal resistance is .04 ohms (R), what will be the watts (W) wasted.

$$W=\frac{E^2}{R}=\frac{100\times 100}{.04}=25.00 \text{ watts.}$$

(6) What is the electrical horse power (H.P.) of a dynamo which delivers 25,000 watts (W)?

$$H.P.=\frac{W}{746}=\frac{25000}{746}=33.512 \text{ horse power nearly.}$$

In a conductor carrying 600 amperes (C) whose resistance (R) is .001 ohm, what is the horse power (H.P.) wasted?

$$H.P.=\frac{C^2\times R}{746}=\frac{600\times 600\times .001}{746}=.469 \text{ H.P. nearly.}$$

In a battery whose out-put is 50 amperes (C) and internal resistance (R) is .02 ohms. what is the horse power (H. P.) wasted?

$$H.P.=C^2\times R\times .00134=50\times 50\times .02\times .00134$$
$$=.067 \text{ horse power nearly.}$$

(7) Find the sectional area in circular mils (d^2) of a conductor, carrying 100 amperes (C) 1,000 feet (l) at 200 volts (E) and 10 per cent. (%) waste.

$$d^2=\frac{C\times l\times K}{\%}=\frac{100\times 1000\times 10.79}{10}=107900$$

(8) Find the percentage of energy wasted (%) in a conductor carrying 100 amperes (C) 1,000 feet (l) at 200 volts (E) and 10 per cent. (%) waste.

$$\%=\frac{C\times l\times K}{d^2}=\frac{100\times 1000\times 10.79}{107900}=10 \text{ per cent.}$$

(9) Find the distance that a conductor 107,900 circular mils in sectional area (d^2) will carry 100 amperes (C) at 200 volts (E) and 10 per cent (%) waste.

$$l=\frac{d^2\times \%}{K\times C}=\frac{107900\times 10}{10.79\times 100}=1000 \text{ feet.}$$

(10) To find the total length (L) of wire in a conductor, multiply l by 2.

(11) Find the constant (K) for 200 volts (E).

$$K=\frac{21.58\times 100}{E}=\frac{21.58\times 100}{200}=10.79$$

Note.—In Formulæ where (K) is a factor, it must be pre-determined.

TABLE OF CONSTANTS FOR DIFFERENT VOLTAGES.

VOLTAGE	CONSTANT	VOLTAGE	CONSTANT
55	39.236	500	4 316
75	28.773	600	3.596
110	19.618	700	3.082
220	9.536	800	2.697
330	6.539	900	2.486
440	4.904	1000	2.015

Compiled from Equation (11).

THE AMERICAN STREET RAILROAD ASSOCIATION.—Among the committees to report at the tenth annual meeting of the American Street Railroad Association, to be held in Pittsburg, Pa., October 21, 1891, are the following: A Perfect Electric Motor, H. A. Everett, Secretary of the East Cleveland Railroad Co., Cleveland, Ohio; the Dependent—Overhead or Underground—System of Electric Motor Power, George W. Mansfield, Attleboro and Wrentham Street Railway Co., Attleboro, Mass.; the Independent—Storage or Primary Battery—System of Electric Motor Power, Knight Neftel, electrician of the Lancaster City Railroad Co., Lancaster, Pa.

THE electric arc is composed of a stream of vapor arising from the actual boiling or vaporization of the solid or fused ends of the separated conductors.

THE BANGOR ELECTRIC LIGHT PLANT.

With this issue we give three excellent cuts of the city of Bangor (Me.) Electric Company's lighting plant, which is located in the same building as the city's water works.

The plant was installed June 19, 1889, by the Brush Electric Company, and consists of three Brush arc dynamos, one 150 H. P. Armington & Sims engine and one 150 H. P. boiler.

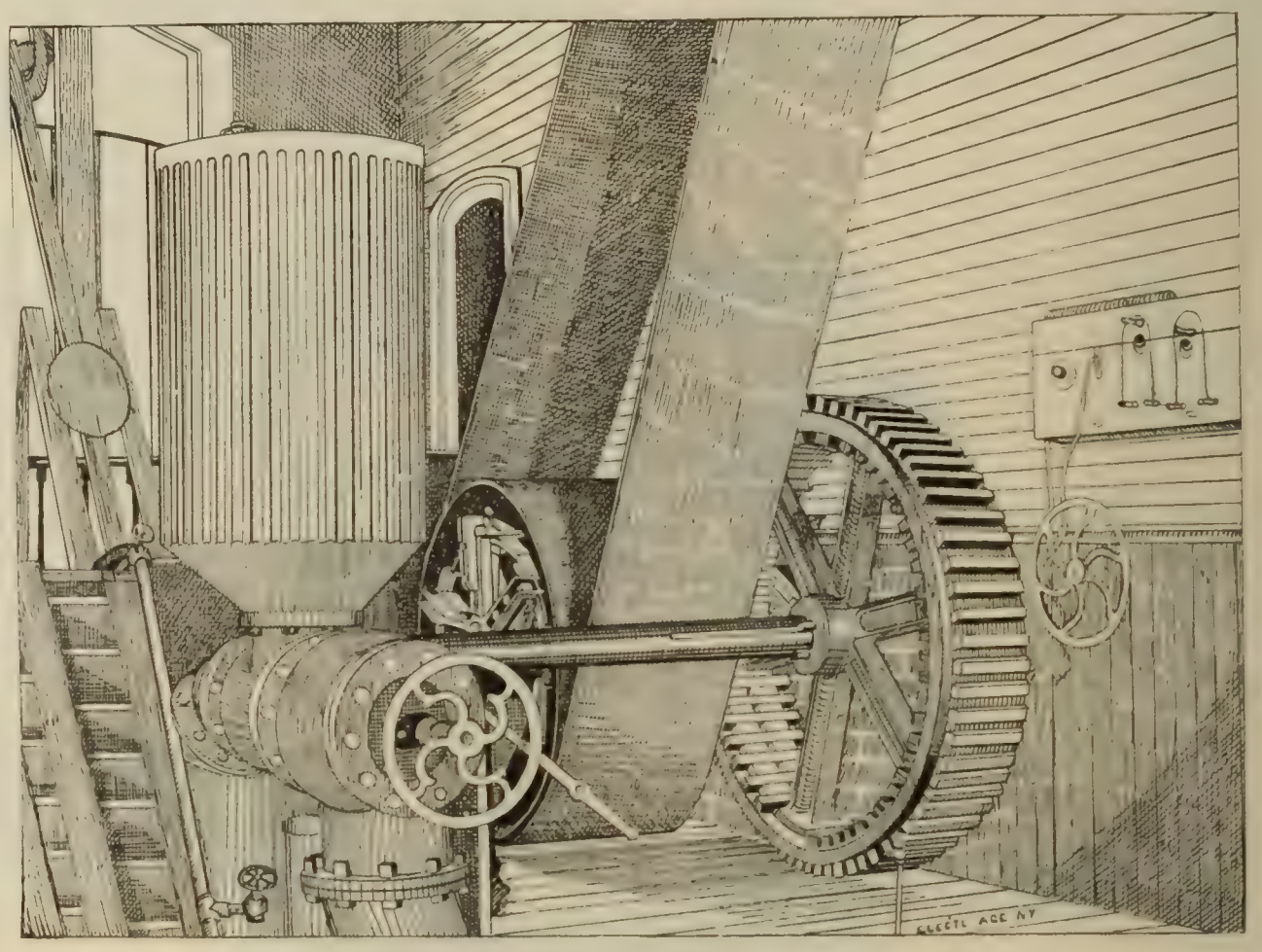


FIG. 1—WATER-WHEEL OF THE BANGOR ELECTRIC LIGHT PLANT.

The city had two sets of American water-wheels for their water works, but as one was ample for their water supply for years to come, they set about devising ways and means of utilizing the idle wheel, with the result of contracting with the Brush Electric Company for the present electric light plant. The shafting of the wheels is arranged so that if one gives out the other can be used, the Armington & Sims engine being reserved to run the light plant in such emergencies, or at any other time that it is found necessary to stop one of the wheels for any purpose. One of these wheels is shown in Fig. 1, which also shows the main belt, a 32-inch perforated belt made by Charles A. Schieren & Co., of 45 and 51 Ferry street, New York. There are also four other belts of the same type and make used, one of 32 inches, and three of 12 inches.

The countershafting was placed against the ceiling of the building, as there was not sufficient room on the floor for the purpose. The main shafts are fitted with patent clutch pulleys, a large 68-inch friction clutch pulley having a 36 inch face being used for the main belt.

The Armington & Sims standard 150 H. P. high speed engine is shown in Fig. 2.

The three dynamos shown in Fig. 3 are the regular commercial Brush arc dynamos having open coil armatures. Two have capacities of 65 and the other fifty 2,000 c. p. arc lights. The dynamos are set on solid brick foundations laid in cement.

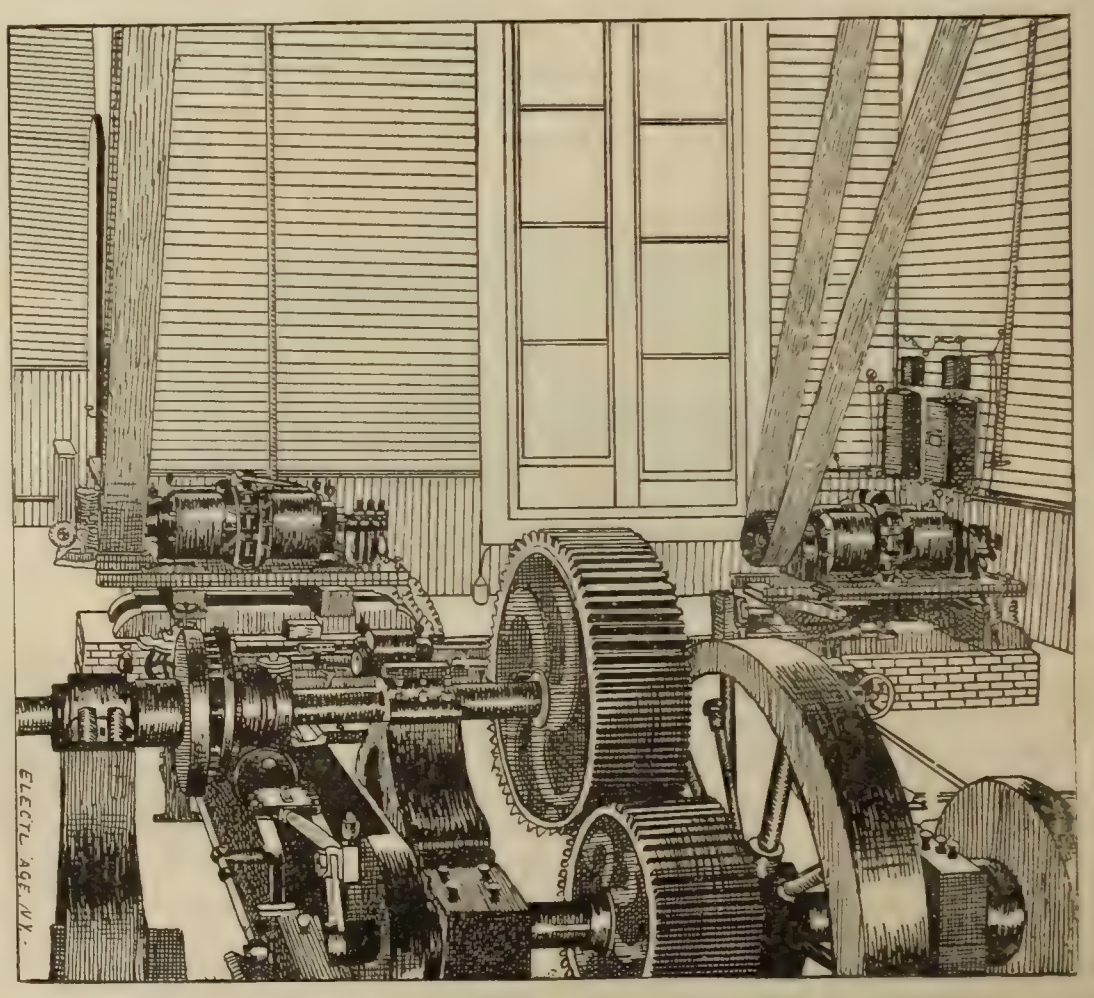


FIG. 2—ARMINGTON & SIMS ENGINE, BANGOR ELECTRIC LIGHT PLANT.

The light circuits, of which there are three, are so laid out that the lights in the central and busi-

ness portion of the city are on one circuit, so that in case of accident arising from any cause a small amount of power only will be required to operate them. There are 148 2,000 c. p. double carbon lamps in use at present.

Thirty-six miles of Nos. 4 and 6 wire were used in the construction of the plant. The poles are 25 feet and 35 feet in height and are placed 100 feet apart. On the poles are iron mast arms 16 feet and 25 feet in length which hold the lamps over the middle of the street where very little shadow is cast by trees or buildings.

The switchboard of the station is a very artistic piece of work, being composed of alternate strips of walnut and ash. The switch plugs are of the usual hook pattern. Over the switchboard is a gallery for visitors.

Automatic switches are used to cut the lights on and off. The whole plant was constructed in a painstaking and substantial manner, and it is claimed that the city is better lighted than any other city in the country. The poles were supplied by Nealey & Company, and the engine and boiler by the Hinckley & Egerly Iron Company, of Bangor.

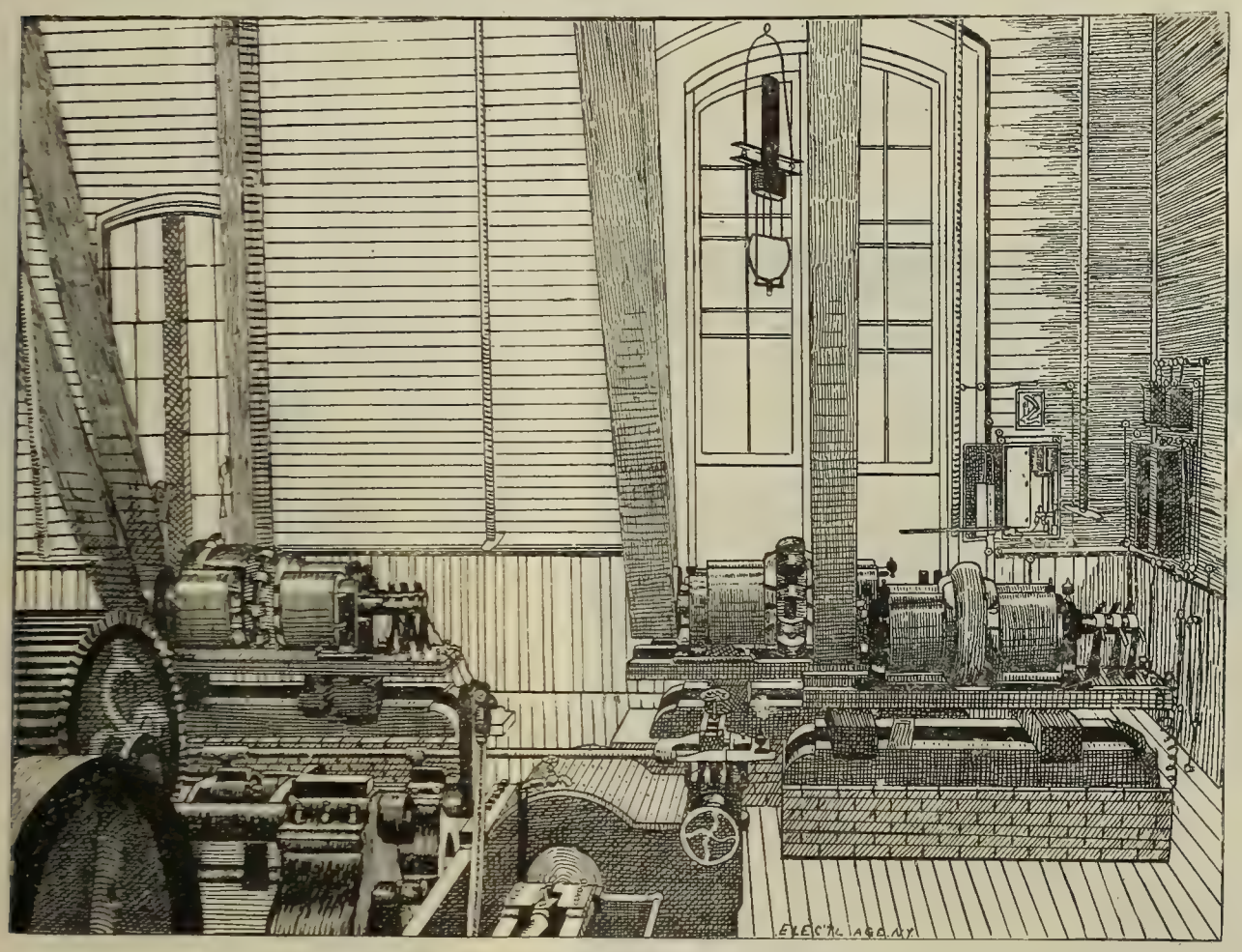


FIG. 3—BRUSH DYNAMOS, BANGOR ELECTRIC LIGHT PLANT.

ARC LAMPS ON INCANDESCENT CIRCUITS.

The question of the use of arc lamps on incandescent circuit, has been the subject of discussion for central station owners and owners of isolated plants for some years. The first efforts in this line did not prove successful. One of the first lamps placed on the market in this country, was the Simplex Arc Lamp, and many of these were in use up to one year ago, when the Electric Construction and Supply Company brought out the Ward Arc Lamp for direct current. Since that time thousands of these lamps have been in use on central station and isolated work and they have proved to be commercially successful.

The largest number of these lamps in use on the circuits of any one central station is between 600 and 700. The largest number in use on isolated plant work is 80 lamps and many plants are fur- nished with from 30 to 60.

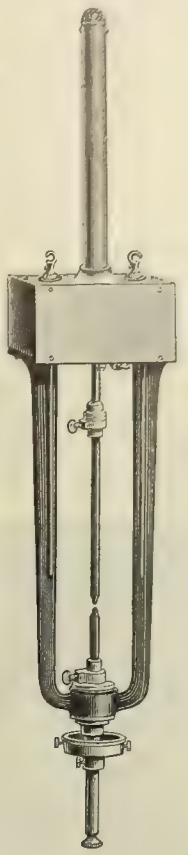
In isolated plants the benefit of arc lamps, in connection with the incandescent plant, is obvious. Many large spaces can be better lighted with arc lamps run from the same plant than with incandescents, the light obtained, in proportion to the current used, being about as 12 to 1 in favor of the illuminating power of the arc lamps. There is, of course, a saving of the extra apparatus necessary to run a special arc plant, and each pair of lamps being separate, they can be turned on or off, as the light is desired. Another point in their favor is that they are absolutely safe.

In central station plants, even where series arc circuits are run in connection with the incandescent service, there are frequently out-of-the-way places where it is desirable to use arc lamps, but to which the arc service is not conveniently near. In such cases these arc lamps can be connected to the incandescent circuit, which usually may be easily reached, whereas to run the arc service to these points would be too costly.

There also often arise cases where day service is in demand but not in sufficient quantity to run the series arc circuit. In these cases the incandescent service lasts through the entire 24 hours and it is cheaper to run the arc lamps from the incandescent circuit rather than to run a special series arc circuit. Many central stations are using these lamps, putting them out both on contract and on meter. The price obtained for the current, when on meter rates, is equivalent, or nearly so, to the price obtained for current when supplied to incandescent lamps.

For inside store lighting, in connection with central station work, the use of arc lamps from incandescent circuits is of special interest to owners of direct current incandescent plants. The light from arc lamps on these circuits is clear, steady and perfectly quiet.

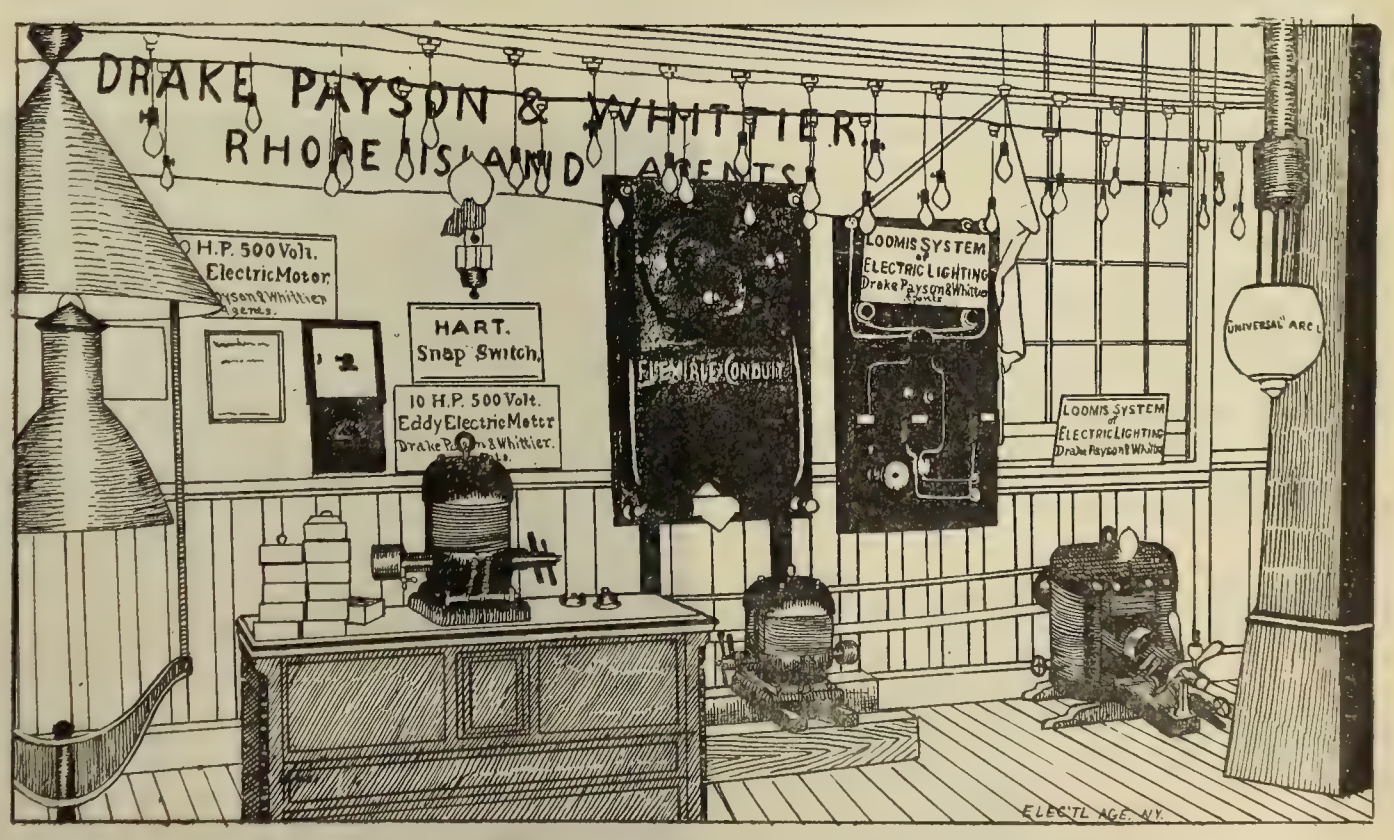
The Ward Arc Lamps are manufactured by the Electric Construction and Supply Co., 18 Cortlandt street. Figures with reference to price obtained for current, life of carbons, cost of running, etc., etc., will be furnished any central station on application at the Company's office.



WARD ARC LAMP FOR INCANDESCENT CIRCUITS.

A COMPLETE AND INTERESTING DISPLAY.

A very comprehensive display at the Providence Exhibition, was that of Drake, Payson & Whittier, of Providence, R. I., state agents for the Eddy Motors, the Loomis system of incandescent lighting and the Hart Snap Switches. We give herewith an illustration of this firm's exhibit, which is reproduced from a photograph. The exhibit consisted of two Eddy motors of ten horse power each at 500 volts pressure. One of these motors, taking current from the general supply circuit in the Hall, ran a Loomis Dynamo (shown at the right of the illustration) which fed 100 incandescent lamps. These were arranged along the wall in the manner shown in the illustration, and lighted up that portion of the hall with great brilliancy.



DISPLAY OF DRAKE, PAYSON & WHITTIER AT THE PROVIDENCE CONVENTION.

LEAKAGE.—Wiring may have two kinds of leakage. One may take place between the two leads, and the other between one or both leads and earth.

This firm are also makers of the Russell Mast Arms, the lower portion of one of which is shown at the extreme right of the illustration. On a counter was placed an Eddy motor, which was very critically examined by the throngs of people, and its design and finish were universally admired.

This was one of the most interesting exhibits on account of the fact that a motor was used to run the dynamo which, in turn, supplied the light for so many lamps. This display of transformation of energy was new to a great many of the visitors, and undoubtedly they received a very favorable impression of electric lighting.

A NOTABLE EXHIBIT.

One of the most attractive exhibits at Union Hall during the Providence Convention of the Electric Light Association, was that of the Weston Electrical Instrument Company, of Newark, N. J. Their display of instruments is well shown in the accompanying illustration, which was reproduced from a photograph taken by our special artist. The exhibit comprised in all about 40 instruments in every variety for measuring electric power. These ranged from 1/100,000 of a volt to 6,000 volts and from 1/10,000 to 3,000 amperes of current. As is well known these instruments are direct reading and are "dead beat." They are celebrated for their accuracy and excellence in finish.

At the right of the illustration is seen the exhibit of the Standard Electric Time Company, of New Haven, Conn., who exhibited Warner Patent Electric Gauges, etc. The Warner gauge is valuable for testing the current strength of batteries of either the open or closed circuit type, and they are said to accurately indicate the condition of single cells.

A RELIABLE WATERPROOF LAMP SOCKET.

Among the many new and improved appliances for electric light work that are being marketed by the E. S. Greeley & Company, attention is especially attracted at this moment by a thoroughly waterproof socket which we illustrate herewith, and which seems to leave nothing further to be desired in the way of a fixture of this kind.

It is the invention of a practical as well as theoretical electrician, whose name the socket bears, it being called the Cartwright Waterproof Socket. It has the following distinct features, that while not startling in themselves, show the close attention to details that are necessary to produce an article of merit that will warrant the confidence of those upon whom the responsibility of installation of incandescent plants fall.

The porcelain itself, which forms the shell of the socket, instead of being of the common porous article, merely glazed over, such as is familiar to the market at the present time, is a thoroughly vitrified substance, completely impervious to moisture. The metal parts are fastened to the porcelain frame in a workmanlike manner, and do not depend for their security upon the sealing compound. The sealing compound itself is of a quality that will stand a zero temperature without deteriorating, and at the same time will admit of the heat that results from a 3 ampere lamp without softening.

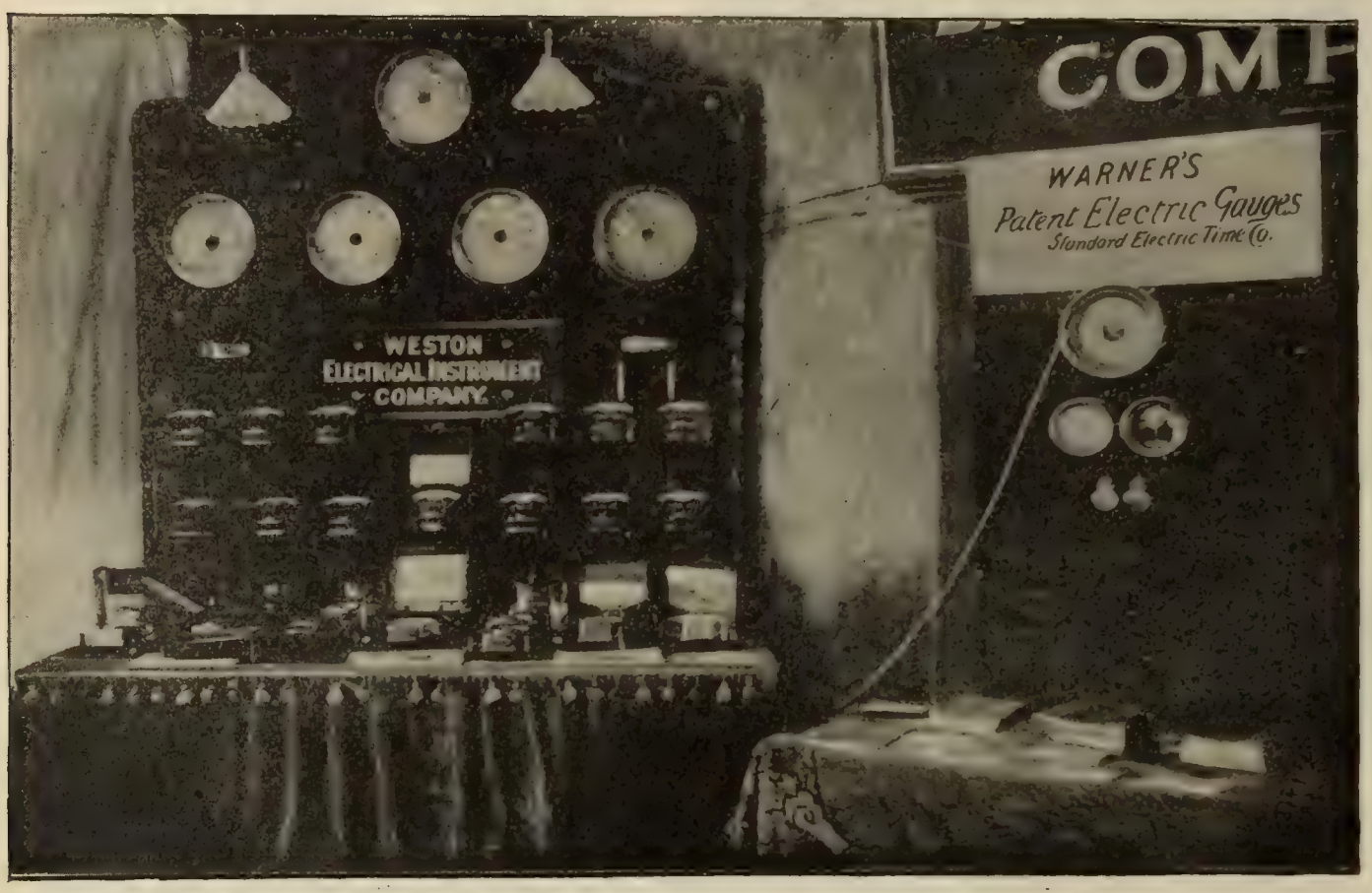
When it is considered that the device is designed simply to meet the requirements of lamps of ½ to 1 ampere capacity, the large margin allowed will be better appreciated.

SOME PROVIDENCE EXHIBITS.

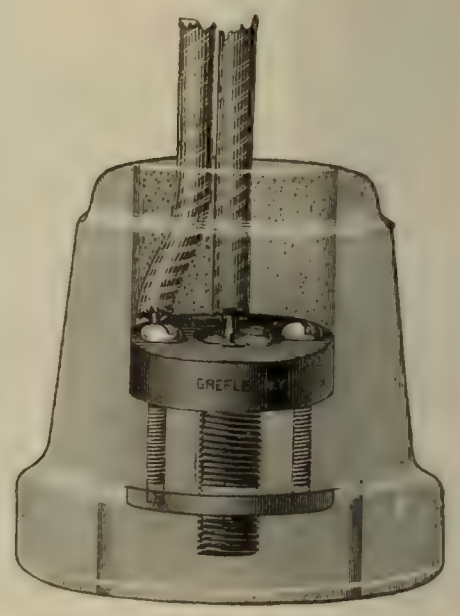
We give herewith an illustration of some of the exhibits at the recent Providence Convention of the National Electric Light Association.

In the centre of the picture is displayed in a prominent manner, the sign of H. T. Paiste, of Philadelphia, the manufacturer of the celebrated Paiste electrical specialties. These include snap switches, switch sockets, china switches, etc., and the display of these goods was quite attractive. Some of them were tastily arranged on an easel, and Mr. Paiste himself, together with Mr. J. F. Chamberlain were present, and explained to all interested inquirers their valuable features.

At the right of the illustration are seen the large letters "E. E. S.," which were composed of electric incandescent lamps. This exhibit was of the Electrical Engineering and Supply Company, of Syracuse, N. Y., and consisted of general supplies, including a large variety of lamps, sockets and switches for any system; clocks for automatically cutting off arc and incandescent lamps at any prearranged time, and many other valuable devices in the general electrical line.



WESTON ELECTRICAL CO.'S EXHIBIT AT THE PROVIDENCE CONVENTION.



CARTWRIGHT'S WATERPROOF SOCKET.



EXHIBITS AT THE PROVIDENCE CONVENTION.

CARRYING CAPACITY.—According to the Boston Board of Trade standard, the No. 1 B. & S. gauge copper wire has a safe carrying capacity of 127 amperes; No. 2, 101 amperes; No. 3, 80 amperes and No. 4, 63 amperes.

APPOINTMENT.—Mr. J. W. Beane has been appointed secretary and treasurer of the National Electric Light Association vice Allen R. Foote resigned. Mr. Beane will assume charge of the office April 1st next.

At the right hand lower corner is shown the exhibit of Pass & Seymour, of Syracuse, N. Y., manufacturers of china for electrical purposes. The feature of this china is its extreme toughness which renders it peculiarly adapted for electrical use.

EXHIBITION OF WIRES.

The American Electrical Works, of Providence, R. I., had an extensive display of their well-known wires at the recent exhibition in connection with the Electric Light Convention at Providence. Our illustration shows this display of wires very well. The wires range from the smallest magnet wire to the heaviest cables, and the spools on which they

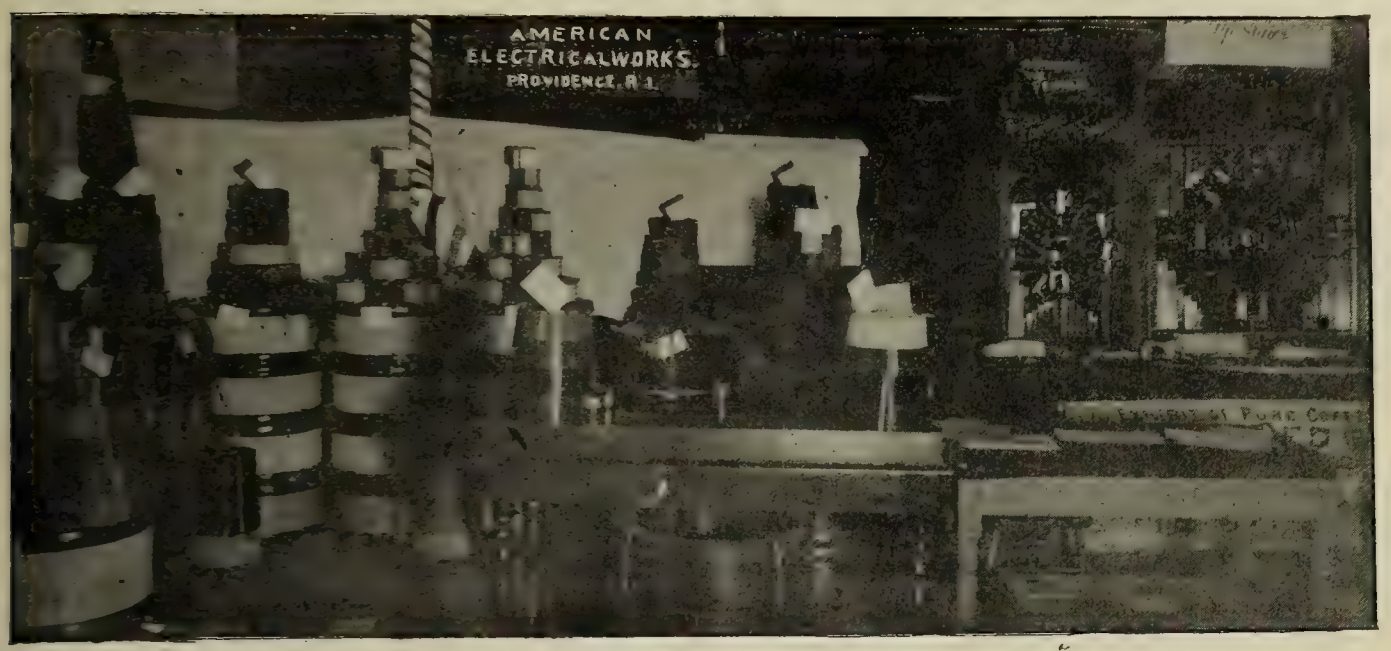


EXHIBIT OF THE AMERICAN ELECTRICAL WORKS, PROVIDENCE.

were wound were arranged in a manner designed to give the best and most pleasing effect.

At the right is shown some of the exhibits in cases of the Eureka Tempered Copper Company, of North East, Pa. Two cases are shown in the picture, and the one at the left is that intended for the Franklin Institute, Philadelphia, of which we spoke in our issue of February 28th. These goods were very closely examined by the electric light people, as copper is a most important material in electric lighting practice, and only the best gives satisfactory results. This quality the Eureka Tempered Copper Company claim their goods possess in an eminent degree.

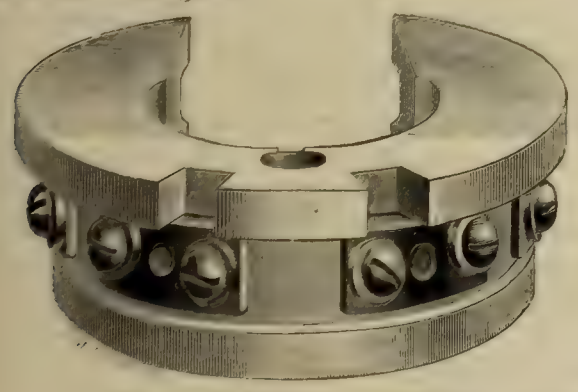


FIG. 3—CHANDLER CUT-OUT.

THE AMERICAN PATENT SYSTEM.—There is every indication that the celebration of the beginning of the second century of the American Patent System to be held in Washington, April 8th, 9th and 10th next, will be a great success. The largest public hall in Washington has been secured for the ceremonies and arrangements have been made for overflow meetings.

THE PROVIDENCE EXHIBIT OF PETTINGELL-ANDREWS CO.

Among the interesting exhibits at the Providence Convention, was that of Pettingell-Andrews Company, of Boston, Mass. They had a large variety of supplies for electric lighting and electric railways, and many other specialties. This firm is the sole manufacturers of the K. W. rosettes, main and branch cut-outs. Fig. 1 shows the K. W. bracket cut-out with the cap removed. Reference to this figure will show that the cap is attachable with extreme ease, and may be as readily removed.

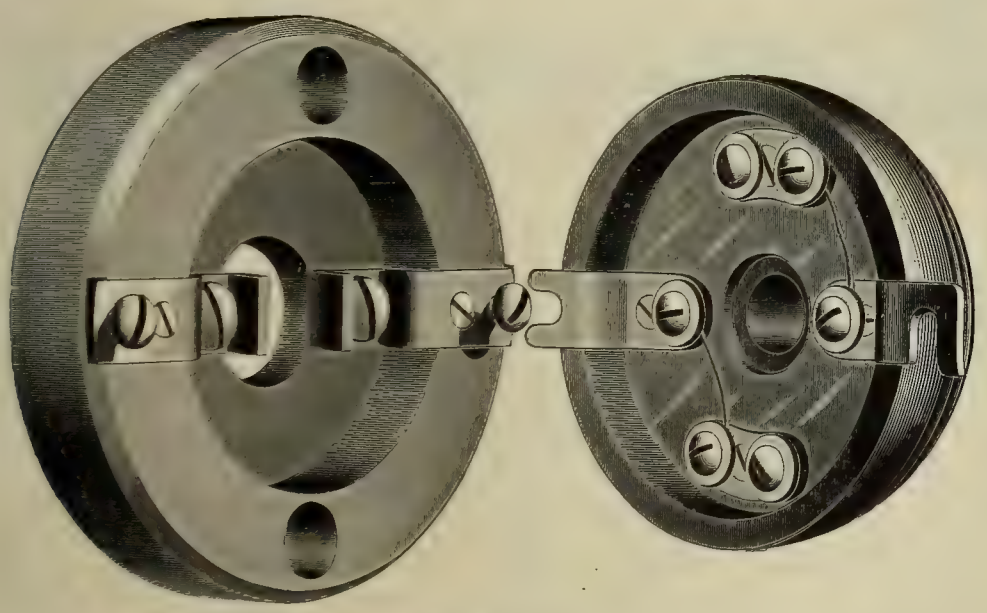


FIG. 1—K. W. BRACKET CUT-OUT.

Fig. 2 shows some of the various designs of tubing used for the K. W. bracket cut-out. This tubing gives a very artistic effect in electric lighting fixtures.

Fig. 3 shows the Chandler cut-out, which is made of wood or porcelain.

The Brennen Patent Wire Connector is illustrated in Fig. 4. These connectors are adapted to heavy electric light and electric railway work, and the joints effected by their use are perfect. The ends of the wire to be connected are inserted in the holes, one at each end, and then the connection is made complete by hammering the connector as flat as possible after the wires have been inserted. The blows are applied to the connector on the ridge shown on the upper surface, which tightens the joint and effects a very firm contact around the ends of the wire.

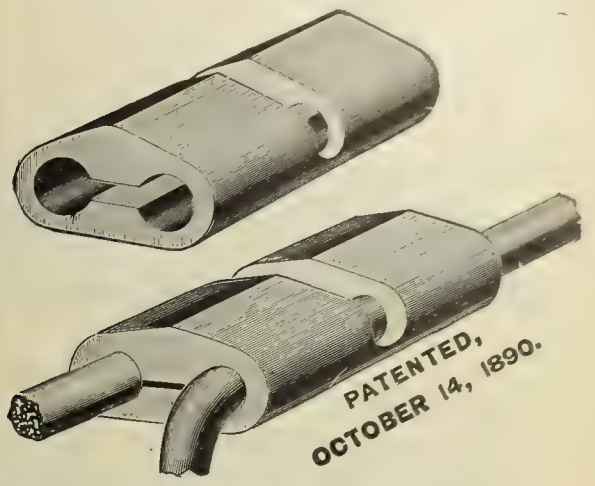
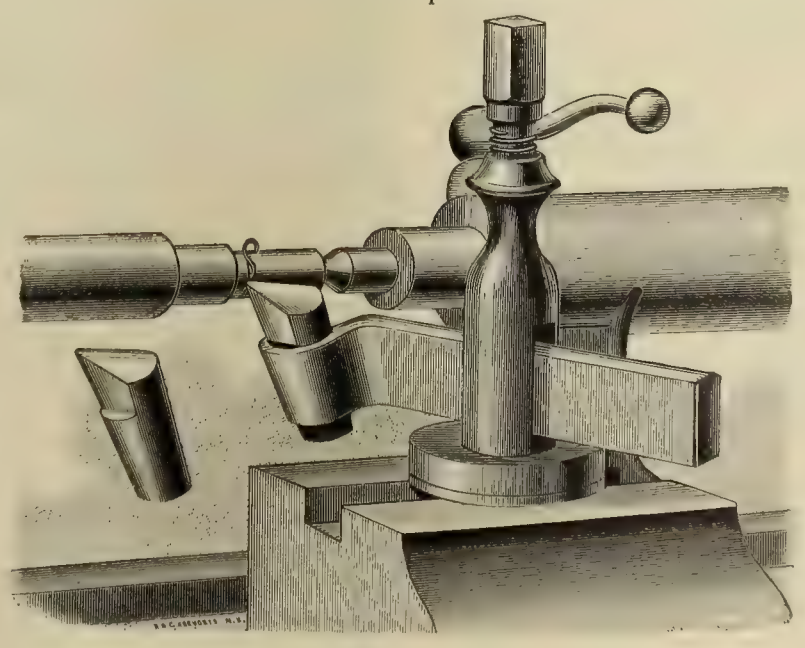


FIG. 4—BRENNEN WIRE CONNECTOR.

A HANDY LATHE TOOL.

We illustrate on this page a new lathe tool so simple that less skilled labor is possible in many classes of work where only the most skilled is usually employed. It has interchangeable points, and yet is composed of only two pieces. The construction is such that when the point is worn or broken, it can be instantly replaced with a new one without removing the holder from the tool post.



REESE & CO'.S NEW LATHE TOOL.

The cutters are all made with taper shanks to fit the hole and only need to be gently tapped into place to hold securely, and when they are to be

removed a light tap on the projecting lower end loosens them, and the holder need not be removed from the tool-post. The cutter can be put in as for a straight tool, or may be turned either to the right or left, and the cutters are furnished of any desired form. They will cut either way, as the points can be adjusted in any desired direction.

The cone point will not turn, because as long as the cutting edge is in contact with the work the resistance at that point is but a fraction of that of the surface of the two cones; therefore the lesser friction is overcome by the greater.

They are as strong as any solid tool; always uniform; made on correct principles, and admit of many new and time-saving forms not possible nor profitable to make in the usual solid form.

Two sizes of tools are regularly made—$\frac{3}{8}$ inch by $\frac{7}{8}$ inch and $\frac{5}{6}$ by $\frac{5}{8}$—each having ten cutters or points. Other sizes, as well as any form of cutters are made to order by the makers, S. W. Reese & Company, 182 Fulton street, New York City.

THE INVENTIONS OF THOMAS DAVENPORT.*

BY FRANKLIN L. POPE.

The year 1837 marked a very important era in the history of the industrial development of electricity. During that year, two of the most extraordinary inventions of the present century made their advent in this city—the electric telegraph of Professor Samuel F. B. Morse, and the electric motor of Thomas Davenport. The motor came first. Davenport, a self-taught Vermont blacksmith, who had invented and constructed his machine in a remote country village in a crude form as early as 1834, came to New York in February, 1837, bringing with him some of the machinery, which had been made for the purpose of exhibition by himself and Ransom Cook, with a view of enlisting capital to build a large motor. During the season of 1837 he occupied rooms in the city where he exhibited models of his motor and various other electrical inventions. Articles were published in the newspapers of the day, and his exhibitions were attended by a great number of people. In letters written about that time, Davenport mentioned that one of the most frequent visitors was Professor Morse.

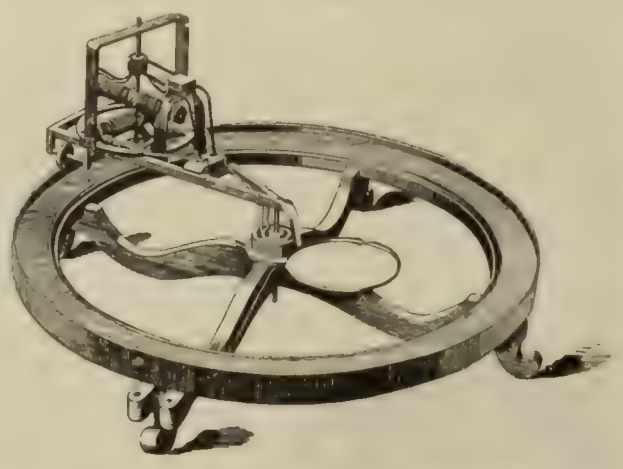
With the history of Professor Morse and his inventions of the telegraph the world is quite familiar. With the history of Davenport and of the invention of his electric motor—as I soon discovered in endeavoring to obtain information about it myself—scarcely anything was known. This difficulty ultimately led me to interest myself in trying to find out more about the matter. In this undertaking I was fortunately very much more successful than one can reasonably expect to be, in attempting to resuscitate the history of an invention which has lain unknown for the best half of a century.

The first newspaper notice of the electric telegraph which appeared in America was in the *New York Observer* in the summer of 1837. I will read you an extract from it:

"A gentleman of our acquaintance several years since suggested that any intelligence might be communicated almost instantaneously hundreds, if not thousands of miles, by means of very fine wires, properly coated to protect them from moisture and extending between places thus widely separated. It is well known that the electric fluid occupies no perceptible time in passing many miles on a wire, and if it is possible by connecting one end of the wire with an electrical or galvanic battery to produce *any sensible effect whatever* at the other, it is obvious that if there are twenty-four wires, each representing a letter of the alphabet, they may be connected with the battery successively in any order, and if so connected in the order of the letters of any word or sentence, that word or sentence could be read or written by a person standing at the other end of the wires. All the paragraphs of a newspaper could thus be touched by a man in Philadelphia, and the contents, *verbatim et literatum* conveyed to New York as fast as a compositor could set up the type!"

It has always been a mystery to me what invention was referred to in that article. The *New York Observer* was edited at that time by a brother of Professor Morse. The "gentleman of our acquaintance" referred to, was no doubt Professor Morse, but what was meant by the telegraph of twenty-four wires I could never make out, because we all know that Morse never entertained any idea other than that of a single-circuit telegraph at any time from the beginning of his experiments in 1835, or earlier. But I received a few days since a letter from a gentleman who had read some articles recently published by me in reference to Davenport's work, in which he stated that he visited Davenport's exhibition in the summer of 1837, here in the city of New York, and that he himself saw in that exhibition a model of a telegraph of twenty-four wires invented by Davenport, and that model must undoubtedly be the telegraph referred to in the extract I have just read.

In pursuing my investigations into the history of Davenport's work, I was fortunate enough to find that several of his original models were still



DAVENPORT'S ELECTRIC LOCOMOTIVE.

in existence. One of these models, a circular railway two feet and a half in diameter with a locomotive traveling on it, similar to the one which we have here to-night but very much more finely finished, I was able to satisfy myself by contemporaneous evidence was built in 1837. The one which is before you was found in the cabinet of the Female Seminary in Troy, formerly Miss Willard's. The records of the institution show that it was purchased in 1840, but it evidently must have been built by Davenport himself prior to the more finely finished model of which I have just spoken, which was constructed in 1836–7, with the assistance of Mr. Ransom Cook, of Saratoga, a very ingenious person and a finished mechanic. I think there is no doubt that the model before us was built in the early part of 1837 and possibly as early as 1836. Fortunately it is, as you see, in a very good state of preservation. I have had it mounted to-night with the same battery that was found with it—a three-cell Grove battery of pint cups, and I think we shall find that it is in tolerably fair running order. [The model was set in motion]. It does not go quite a hundred and twenty miles an hour, but it goes. This locomotive, you will observe, has a fixed field magnet below, and a revolving armature above, which is reversed twice in every revolution. So far as I am able to discover, that is a combination found in every practical motor today, which Davenport was the first to make known and to use in 1834. The motor is connected to the driving axle by bevel gear. The field and armature in the model before you are connected in series. In the other model of 1837 of which I spoke, they are connected *in shunt*. Among other models of Davenport was one having a horse-shoe field and a four-pole armature with curved pole-pieces, which is really quite an advanced type of motor. That also was built in 1837. Altogether, Davenport, between 1834 and 1840, built over 100 motors of different patterns and of varying sizes, scarcely any two of them alike. I discovered also, quite to my surprise, that he was undoubtedly the first to make use of the solenoid with a movable core as a means of moving machinery of any kind. He built in 1839 quite a large motor operating upon that principle, which from the best description I have been able to find of it, must have approached one horse power. He set that up at 42 Stanton street, in New York; attached a printing press to it and started to publish the pioneer electrical journal of America—a small weekly paper called *The Electro-Magnet and Mechanics' Intelligencer*, printed by electrical power. Through the kindness of Mr. Davenport's son, Rev. Willard G. Davenport, I have the pleasure, on his behalf, of presenting to the American Institute of Electrical Engineers two copies of that paper. [Applause]. These, so far as is known, are the only editions ever published; they are number one and number two. This was in 1840. I have received within a day or two an interesting letter from Mr. H. S. Davenport, a nephew of Thomas Davenport, still living in Vermont at an advanced age, who, as a boy, was with him a great deal and in that way became quite familiar with his work. I will take liberty of reading extracts which give some idea of the manner of man Mr. Davenport was. He says:

"Many of his models never left his shop and were but little known, even at the time of their construction. They were only made to show to how many uses the power could be applied, and also to work from on a larger scale, if he could get pecuniary aid to do so. The different models which interested me most, at the several times I was at his shop, were a trip-hammer, a turning lathe, and a machine for doubling, twisting and reeling cotton or silk, all at the same time. A circular frame fitted with two intersecting tracks, on which four miniature cork images glided around, he called his "puppet-show." He was naturally of a retiring disposition, but when waked up was very strong in argument. His two favorite subjects were nature and electro-magnetism. He considered magnetism the most important element in the creation of the universe and thought it would be in its destruction. Magnetism kept the heavenly bodies in their places, and if that failed everything would be turned to chaos. He could see in every rock of the earth the battery of which it was composed. So also in the animal kingdom, the bones, muscles, and blood constituted a complete battery, which exercised a repulsive or attractive force with respect to another organism of the same kind. He was a great lover of fun and exceedingly fond of a joke. On one occasion he received an order from a party in Chicago for half-a-dozen bottles of electricity. He said he knew by the tenor of the letter that it was intended as a joke, and he accordingly replied that he bottled up his *wrath* for such would-be ignoramuses as he was, but had no electricity for him."

I might go on and relate many other facts of interest which I have learned about Mr. Davenport and his inventions, but the hour is already late, and I will forbear. But I may remark in conclusion, that I find him to have been one of the most interesting characters with whom I have ever become acquainted, and I cannot but feel highly gratified that my attention chanced to be directed to the subject, in season to rescue at least some of the more important of his work from impending oblivion. In two or three years more it would have been too late. There are people now living, although at an advanced age, who knew him and remember him perfectly, but in a year or two more perchance they will be gone. [Applause.]

*Paper read before the American Institute of Electrical Engineers, Feb. 24, 1891.

EARTH CURRENTS.—During magnetic storms earth currents on the British lines of telegraph have been know to attain the strength of forty milliamperes. This is stronger than the usual working currents.

HIGH SPEED RAILROADING.

During the discussion which followed the reading of the paper by Mr. O. T. Crosby before the American Institute of Electrical Engineers, February 24th, on high-speed electric railway work, Dr. P. H. Dudley made some very interesting remarks on the subject of train resistance.

The greatest improvement that has been made in decreasing train resistance, said Dr. Dudley, is in the improvement of the track by bringing up the standard of excellence and adoption of heavier and stiffer rails. I have been making a number of heavy rail sections for different railroads, and instead of making them simply heavy, I had made them very stiff, which has reduced the deflection or wave motion under each of the wheels. Comparing the resistance of the Chicago limited express on stiff 80 lb. rails, with that of 65 lb. rails which have been on the track some time, it makes a difference of 75 to 100 horse power per mile. I have just made some 95 lb. rails for a road, which will be very much stiffer than the 80 lb. rails. We find now, that the condition in which they are keeping the line is so perfect that there is scarcely any oscillation on the best roads, and there is very little difference in the oscillation now in riding on a tangent or a curve. I should prefer a tangent for smooth riding, although the wheels press against the rails on curves. Unless they are properly elevated, there will be some oscillation, though our present trains move very steadily on the best tracks. I have made careful experiments, and with a track in good condition the heavy cars ride very steadily, leaving little to be desired.

In answer to a question as to what would be the possibilities with ordinary steam locomotion if large sums of money were spent on the track and on maintenance, Mr. Dudley said :

I do not know how to answer the gentleman. Our experiments are not sufficiently carried out to determine yet all those points. About the best results are those that I have given you, that is a reduction of nearly 100 H. P. per mile, compared with the ordinary 65 lb. rail. I have designed some 105 lb. rails which are nearly 100 per cent. stiffer than the 80 lb. rails. We will probably save on the fast express trains nearly 200 H. P. per mile, as compared with worn 60 or 65 lb. rails. We have not rolled such a large rail yet; but it will not be long probably before that will be done. All trials show a very material reduction in train resistance with the heavy rails, as we increase the stiffness. I think it will be perfectly safe on a track of the 105 lb. rails, to run 120 miles an hour. I have ridden several times 75 miles an hour on heavy rails and did not feel it nearly so much as on light rails when running 45 miles an hour. There is scarcely any oscillation. The track is in perfect line and the joints are all kept up. I might show you on the black-board the shape of some of the rails we find in tracks. Taking a 30 ft. rail on our best tracks; its surface to the eye would be represented by a straight line. (See Fig. 1.) The joint is well maintained in uniform surface with other portions of the rail. Take even 65 lb. rails, after they have been run over a little while, if the joints are laid opposite, we find the rails in this form (see Fig. 2), down at the joints and high in the centre. Now, of course, as the locomotive or train is passing over this depression, it further deflects and the wheels strike on the receiving end of the rail and cut out a piece from the head of the rail. This has been very common. Sometimes the effect is sufficient also to bend the rail down at this point. The apparatus I have on my car ejects paint on the rails where there is a certain deflection. In Fig. 2, it will be noticed the receiving ends of the rail are commencing to cut out. By ejecting the paint, the trackmen have been able to surface the track, so that on rails 15 or 16 years old, they have not only checked the cutting out, but have brought up the surface of the rails to a much better condition, and they are nearly in a straight line at the present time. One serious trouble with many of the railroad people is, that, while they want a heavy rail, they never consider the question of stiffness. I distribute my metal so as to make the section very stiff, not allowing so much in depth of the head of the rail as usually is done, but widening the head, because when these rails have been in the track a few years, they become worn very unevenly, and must be removed from the track. I am making the heads on that account very much broader and the sections stiff, so the deflection of my 75 and 80 lb. rail is less than $\frac{1}{10}$ of an inch in the track. We mark all those rails for any deflection exceeding $\frac{3}{32}$ of an inch, under a load of six tons per wheel. That is about as close as the trackmen can work on a 65 lb. rail. On an 80 lb rail they can work closer, but require great skill. The ejection of paint also shows where there is a rotten or loose tie. The form of rail where the joints are low, and high in the centre I call the first form. Then there is another form in which the joints and centre are low, and high at the quarters, which I call the second form. (See Fig. 3.) Then there is another rail of which the surface is all full of waves. I call that the third form. (See Fig. 4.) A few years ago that was a very serious matter. We are often able to tell from the diagrams in the car, what mill made the rails as we run over them. That feature has been materially improved by the mills. You will see at once, with trains running over rails of these various forms and with the deflections, there is a large amount of force lost. Rails high in the centre to the eye, will be loose on the ties, so that there is quite a wave under each wheel. Even with very good track we find that under each wheel there is a depression depending on the weight on the wheel and speed of train.

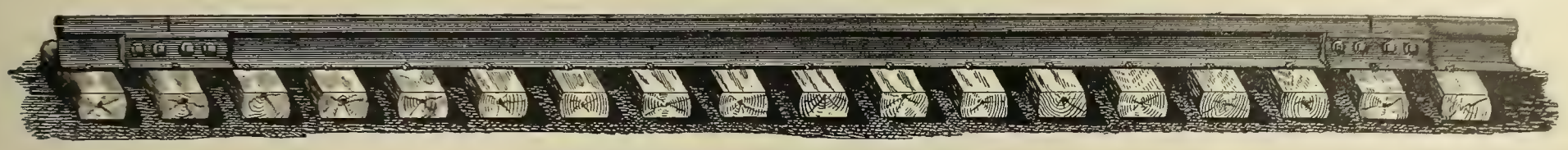


FIG. 1.

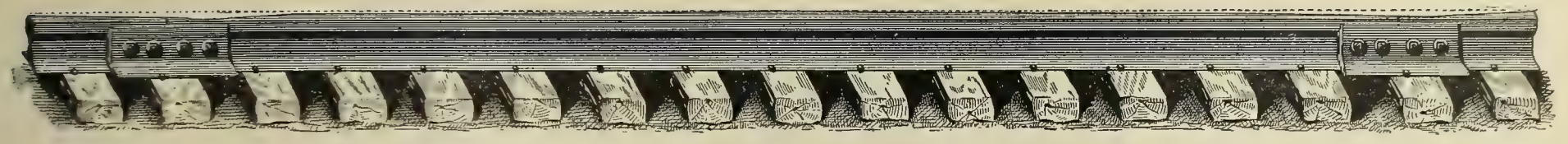


FIG. 2—CUT OUT AT END.

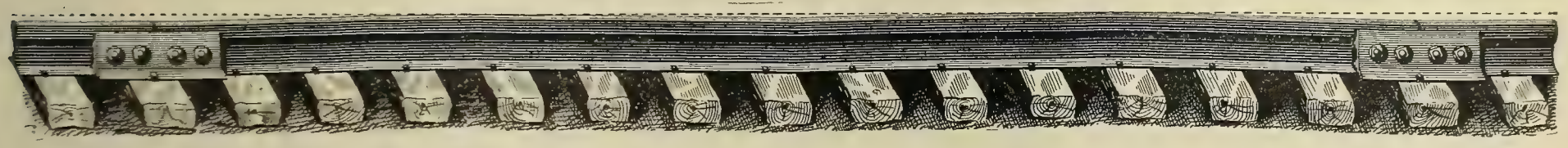


FIG. 3—LOW AT JOINTS.

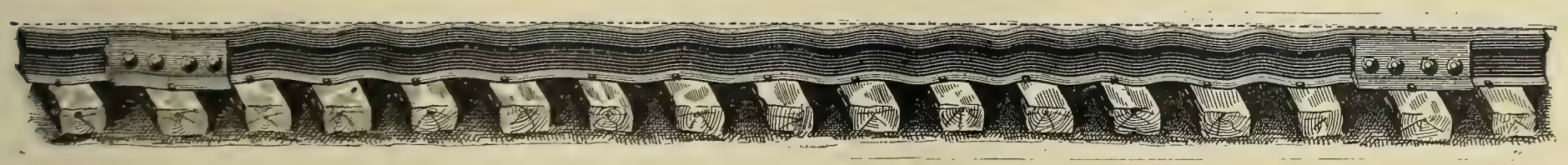


FIG. 4.

LOCUST INSULATOR PINS.

S. F. Chapman, of Asheville, N. C., is manufacturing insulator pins of locust. Oak, which is a slightly cheaper material, is generally used for this class of work, but the difference in durability should make a place for the locust pins. Cheaper material seldom proves the best, and the rule holds good in this case. Line constructors have become so accustomed to the use of oak for insulator pins that they find it difficult to recognize a better material, but it would pay to make a change for a wood that will last five times as long, even if it is at a slight increase in cost. Little is known about the effect changes of temperature have on the two woods, but as carpenters agree that locust will last fifteen times longer than oak, and some even place its durability at twenty-five times longer, it follows that moisture or dryness either has less effect on this material or that it has a greater initial strength. In either case it is more durable than oak, and has more of the attributes of the high priced teak, which, when well seasoned, does not split, crack, shrink or alter its shape, besides possessing great elasticity and strength. The difference in cost, however, is not as great, the price being but little more than that of oak. There are over forty species of oak in America, some of them very little better than the softer woods. Manufacturers of oak pins are as likely to turn out poor pins as otherwise, especially when not careful as to the species of timber they use. There is but one species of the locust tree known, the *Cratonia Siliqua*, and pins of this timber would depend for their durability

on the seasoning of the wood and cutting, so as to absorb the least moisture or heat. Timber is practically unchangeable in the direction of its length from the mere absorption of either heat or humidity, which is absorbed by the ends of the fibre more readily, than in the direction in which it is compressible. Hence it rots more rapidly by the ends than by the sides. With the grain of the locust parallel to and running the full length of the pins, they should outlast any firm using them. A strict adherence to this rule would add to the life of any wood. Oak has an ultimate strength of from three to seven tons per square inch, but locust never goes below five, while under the same circumstances it always has nearly double the strength of oak. Line builders will do well to stipulate for locust pins in their contracts, even if they pay half as much again for them, but the difference in cost will not be as great as this. Locust for pins and cross-arms is a step in the right direction.

Every shrewd business man will, in making purchases of goods, consider their lasting qualities. If he has two grades to choose from, and he knows that one is far superior to the other in the matter of serviceability, while the difference in cost is much less in proportion, he will select the better quality of goods.

The same argument is applicable in the case of the construction of an electrical line. On the long distance telephone lines, which are constructed to last as long as possible, locust pins are used, and it is a noteworthy fact that these lines are improving in their physical and electrical condition. Some credit for this must be given to the locust pins. Telegraph and telephone lines, as they were formerly built, did not show such results as these. The contrary was the usual experience. But it has been proved to the entire satisfaction of all parties interested, that such lines constructed of the best material, including locust insulator pins, are, in every way, superior to lines of cheap construction. The insulation is greatly improved, and consequently there is less waste of battery power. In this one item alone the saving effected probably overbalances the extra cost for the first-class material used.

All contractors would do well to bear these facts in mind. There is one thing certain, first-class results can not be obtained from poor material, and it is well known that the best results can be depended on in the use of the best material. The first cost is, of course, what deters builders from using the best, but when it can be shown that lines are improved physically and electrically by the use of the best material, it does not require much calculation to demonstrate that by so doing the extra cost is more than offset in the direct saving in other directions.

Mr. Chapman has left a sample box of 100 1½ inch locust screw insulator pins with us for inspection by parties interested in the construction and maintenance of electrical lines. They have been carefully manufactured from selected locust, and it is easily seen, as the pins are unpainted, that they are split from the wood of the tree and not sawed. There is no danger, therefore, of getting cross-grained pins and consequently all the strength of the wood is secured.

From the following offer which Mr. Chapman makes, it will be seen that he has the utmost confidence in all the material he turns out. One thousand pins will be sent to any party wishing to make a contract, provided that party will have a test made, and a record kept, of the breaking strain of each pin. If the test and inspection is satisfactory, and a contract is made, a thousand pins may be taken out of any shipment made thereafter at his (Chapman's) expense and put to the same test and inspection, and if it falls materially below the former test, a stipulated amount proportional to the size of the contract will be forfeited.

FIRE ALARM WIRES.

Mr. Wm. W. Henshaw, secretary of the New York Board of Fire Underwriters, recently transmitted the following communication to the Board of Fire Commissioners:

Referring to the report made to the New York Board of Fire Underwriters by the Fire Patrol Committee in the matter of the almost total destruction of the Fire Alarm Telegraph System (except the portion which operates underground) by reason of the storm of snow and sleet on the morning of the 25th of January last, and realizing the great danger to which our city was exposed by reason of the inability to transmit alarms of fire (except in isolated cases) by wire on account of the storm, I have the pleasure of transmitting to you a copy of resolution adopted by this board at its meeting yesterday:

Resolved, This board desires to extend its thanks to the Chief of the Fire Department, his deputies, officers and men, for their watchfulness and untiring efforts in discovering fires, and for their usual prompt response to all alarms, thereby keeping the insurance loss at its normal figure during this eventful period; and the Board also takes pleasure in extending its thanks to the Superintendent of the Fire Alarm Telegraph and his assistants for the speedy manner in which the fire telegraph system was restored, thereby relieving the uniformed force of the fire department of much extra duty, and the fire underwriters and citizens generally of much anxiety as to the safety of property and life, and would respectfully urge your Honorable Board to use its prompt endeavors to secure sufficient appropriations, by the use of which all the fire department lines may be placed underground as speedily as possible.

CORRESPONDENCE.

THE TELEPHONE PATENTS.

EDITOR THE ELECTRICAL AGE: It is not certain that there remains nothing more to be said on the subject of Bell's Telephone patent of January 30th, 1877, being alive or dead. Mr. Thomas D. Lockwood, electrician of the Bell Telephone Company, in your March 7th number, agrees with all patent law commentators that it is a question "when is an invention patented in England;" but Mr. Lockwood, by inference at least, would inspire the belief that there had always been one unvarying answer to this question by the courts. An invention in England becomes protected by patent from its date, provided the patent is allowed and "sealed." Consequently Bell's magneto telephone invention was a patented article in England for fourteen years from December 9th, 1876. On March 19th, 1888, three years after Judge Shipman's decision, referred to by Mr. Lockwood, the United States Supreme Court in the celebrated Bell telephone suits, in which there were five appellants, viz.: Dolbear, Molecular Telephone Co., Clay Commercial Telephone Co., People's Telephone Co., and Overland Telephone Co., upon issues adjudicated in the lower courts involving every conceivable fact and fiction bearing on the validity of Bell's 1876 and 1877 patents, decided as follows: ". . . This disposes of all the cases so far as the patent of March 7th, 1876, is concerned. It remains now to consider only *the other* patent. It received but little attention by counsel or court in either of the cases below. In the Dolbear case it was, by consent, excluded from the decree.

In the case of the Clay Commercial Co. it was alleged in the answer that substantial and material parts of the things described and claimed were described and claimed in a prior British patent taken out December 9, 1876; and inasmuch as the foreign patent does not bear the same date, if the American patent is not limited it is void. This point has not been pressed in the argument. In *our opinion* it has been settled by the decisions of this court in O'Reilly *vs.* Morse, and in Siemens *vs.* Sellers at the present term, "that the effect is not to render it *invalid* if it is for the same invention, *but only to limit its term.*" This was the opinion of the full bench, as Justices Bradley, Field and Harlan only dissented on the question of Drawbaugh's invention. In this dissent they said: "We think that Drawbaugh did anticipate the invention of Mr. Bell." I have not a copy of the Clay Commercial Co.'s case at hand; yet, I take it for granted that the Bell Co. set up the "seal" question as part of its defense, and in spite of this the Supreme Court decides the American patent to be limited in its term by the English patent of December 9th, 1876, provided the inventions are identical.

F. W. JONES.

THE FIRST ELECTRIC ROAD ON THE PACIFIC COAST.

SAN JOSE, Cal., March 6, 1891.

EDITOR ELECTRICAL AGE: Your Oakland, Cal., correspondent is in error when he says "Oakland will soon boast of being the first city on the Pacific Coast to make electric railroading a success," for San Jose, Cal., has two electric roads operating under the Thomson-Houston system, one since April 15th, 1890, the other since February 22d, 1891.

Very truly yours,

J. B. KEENE.

ANSWERS TO INQUIRIES.

W. S. C., LITCHFIELD, MICH.—We would advise you to take an electrical engineering course in some educational institution first thing, and afterwards engage with some electrical establishment. In this way you will get both the theoretical and practical knowledge of electricity, which you could not very well get otherwise. To engage in business first and depend altogether upon books for the acquirement of theoretical knowledge will not be so satisfactory. Books, while good in themselves, lack some essential things in the thorough study of electricity. The advantage of having a reliable teacher is very great, and that would be lost if books alone were depended upon. We would therefore advise a college course first and the practical education afterwards.

MR. BARTON'S PREDICAMENT.

Mr. S. E. Barton, President of the Electric Mutual Insurance Company, of Boston, recently took a trip South in company with Mr. L. Stieringer, of New York for the purpose of spending a few weeks in sport and pleasure. Both gentlemen had guns with them, and Mr. Stieringer carried a camera.

Mr. Barton, in addition to his official position with the Electric Mutual Insurance Company, is also special agent for a couple of English companies and one of Philadelphia. While in Atlanta, on their way South, it is said that Mr. Barton transacted some insurance business in that city. Much to his surprise he was arrested later on, charged with violating the insurance law of Georgia.

The specific charge against Mr. Barton was that he solicited business in the State without making the deposit required by the insurance law. Mr. Barton denied having transacted any insurance business while in Atlanta.

CURRENT AND PRESSURE.—In the series dynamo up to the point at which the magnets become saturated, the current and pressure grow together; beyond this, supposing the speed to remain constant, the waste field and the loss due to armature resistance are both increased by the greater current, so that at the terminals the electromotive force will begin to fall away again.

A NEW ELECTRICAL FIRM.

The following notice from Truex & Vail explains itself: "We beg leave to advise our friends and the electrical trade generally, that we have formed a co-partnership under the above title, and have secured the exclusive selling agency in New York, New Jersey and adjacent territory for the Accumulator Co., of New York, the Electro Dynamic Co., of Philadelphia, and the Walker Electric Co., of New York.

We are prepared to supply electrical accumulators, Edco dynamos, Edco motors, Edco switches, etc., Walker electric meters, all of which are well known to electrical engineers, dealers and others, as perfect, efficient and reliable.

We are also prepared to furnish electric supplies and do general construction work."

Mr. C. R. Truex, the senior partner in the new firm, has been for the past five years assistant general manager of the Accumulator Co., No. 44 Broadway, New York. That position he resigned on February 1st, to form the partnership as above.

Mr. Truex has been identified with the Accumulator Company since the time of its organization in 1886, and under his careful and judicious management the affairs of the company have been carried on in a most successful and satisfactory manner. Through his efforts the well known accumulators of this company's manufacture have found their way into extensive use in nearly every city in the United States, and large shipments have been made to foreign countries besides.

Mr. Truex is well known to every electrician in the United States, and his reputation for integrity and business capacity is beyond question. In October, 1879, he engaged with the National Bell Telephone Company, of Boston (now the American Bell Telephone Company), of which Mr. Theodore N. Vail was general manager.

Mr. Truex was special agent for this company, and organized several companies as licensees for exchange and private line rights, and also arranged with local individuals and firms for similar privileges. This was in the early days of the business, when there were very few exchanges, and the advantages and merits of the telephone were not then fully appreciated.

In May, 1886, the Electrical Accumulator Company began operations with Mr. Theodore N. Vail as president. Mr. Truex then resigned his position with the Telephone Company and accepted one with the Accumulator Company, and became the assistant general manager. In addition to the general office work, Mr. Truex had sole charge of the locating of selling agencies, the selling of goods and handling of traveling men.

Mr. W. A. Vail, who is the partner of Mr. Truex, is also well known among electrical people. He was for several years general superintendent of the Metropolitan Telephone and Telegraph Co., New York. In August, 1889, he resigned from the Telephone Company to accept the position of vice-president and general manager of the Boston Heating Company, which office he still holds, and will manage the affairs of that company until they resume active operations. He is very popular among the electrical fraternity, and is a first-class business man of strict integrity, and possesses, to an eminent degree, that quality which is so essential to the successful conduct of business in these days—energy.

The many friends of these two gentlemen will, no doubt, be glad to learn of their co-partnership, and will wish them a prosperous career in their new venture.

PERSONAL.

Mr. Fred H. Angell, of E. M. Carhart & Company, Providence, R. I., manufacturers of electric light specialties, called at this office during the past week. His familiar face looked as genial and earnest as ever. He had been hustling business between Providence and New York, and his people may feel proud of him. Mr. Angell has gone West, and I venture to say that he will surprise his house with some large orders from that section of the country.

Mr. H. C. Richardson has resigned his position with the United States Electric Lighting Company, Newark, N. J., and accepted one with the New York Lighting Department of the Thomson-Houston Company, No. 115 Broadway.

Mr. Charles J. Hubbell, the inventor of the Hubbell primary battery described in our issue of February 21st, has been seriously ill at his home in Washington for some weeks. His ailment is pneumonia; his many friends hope for his speedy recovery.

TRADE NOTES.

R. D. Nuttall & Co., manufacturers of fine machinery and tools, Allegheny, Pa., produce some excellent goods for the use of electrical manufacturers. This firm is represented in New York by J. G. White & Co., No. 50 Broadway, and these agents should be consulted by those in the electrical trades looking for machinery.

J. G. White & Co., electrical engineers and railway contractors, No. 50 Broadway, are doing excellent work in their line. As consulting engineers for the installation of electric railway plants they have a high reputation, and they use nothing but the very best equipment in their work, which is guaranteed.

E. M. Carhart & Co., electrical engineers, electrical supplies, etc., Providence, R. I., have just issued a price list of some of their specialties. It has a very artistic heading, the name of the firm being composed of scroll letters artistically intertwined. Illustrations of many of the specialties manufactured by this company are effectively disposed among and about the letters; and the heading altogether is an extremely handsome piece of work.

The Pittsburg Reduction Company, manufacturers of pure aluminum, No. 95 Fifth avenue, Pittsburg, Pa., have reduced the price of this metal to one dollar a pound for any quantity. This reduction is made in order to develop a larger market. At this rate aluminum, which is nearly four times lighter than nickel or German silver, is a much cheaper metal to use than either of them. This price renders it possible to use the metal economically for many useful purposes, being nearly as cheap as copper.

A pamphlet issued by the Eddy Electric Manufacturing Company, of Windsor, Conn., gives a description and some information in regard to the celebrated Eddy Motors. These machines, as is well known, stand at the front of electric lighting and electrotyping dynamos, and a perusal of the partial list of parties now using them is convincing evidence that they are efficient for this class of work. Among the names are many prominent ones in the electroplating trade all over the country. The New York office of the Eddy Electric Manufacturing Company is at No. 15 Cortlandt street. Nothing but the best of material and workmanship is employed in the construction of these machines.

C. H. Tucker, Jr. & Bro., No. 126 Liberty street, represent the Barr Pumping Engine Company, Keasey Wood Split Pulley Company, Wiley & Russell Manufacturing Company and the Windsor Lathe Company. They are also dealers in machinery, tools, and general supplies for export and home trade. The Universal Thread Cutter, manufactured for this firm, is a most perfect, simple and effective tool in any trade where the fitting of pipes is necessary.

Mr. J. W. Schroeder, for a number of years engineer and contractor for the Edison Company, and a gentleman of well known practical ability, is the New York agent for the Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, Md., with offices at No. 15 Cortlandt street.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, Mass., March 13, 1891.

Charles E. Bibber has been elected general manager of the Consolidated Electric Manufacturing Company, 355 Congress street. The company has one of the best equipped factories in the United States, and with fresh capital and new management propose to push business. Mr. Bibber has been connected with the Holtzer-Cabot Electric Company for a number of years and enjoys a national reputation in the electrical field. He has the best wishes of his numerous friends for his success.

The Pittsfield Street Railway Company have decided to equip their road with electricity. The Berkshire Electric Company have secured the contract.

The Springfield Street Railway Company have given the contract for the electrical equipment of fifteen miles of their road to the Thomson-Houston Company,

The New England Printing Telegraph Company are encountering some opposition from the city government in getting right of way through this city, but they expect to go through just the same. They have a good thing and should succeed.

The Holtzer-Cabot Electric Company have purchased the business of the Providence Construction Company and moved it to Boston.

The electrical class of the Institute of Technology of this city are making some elaborate tests at the Malden Electric Light Station.

One of the American Fire Alarm Company's automatic fire alarm appliances showed its efficiency one night not long since in the factory of J. W. Hitchings in Lynn, where a fire broke out caused by an over-heated stove. Prompt responsive action of a few firemen prevented what might have been a large and disastrous fire. There are about twenty of these alarms in Lynn. The system is a good one and should be adopted by every factory or large business block.

Mr. Frank Cobb, private secretary to Henry M. Whitney, president of the West End Street Railway Company, died on shipboard while on a trip to California by way of Cape Horn for his health.

The West End Street Railway Company are equipping their road as fast as possible with the Robinson Radial car trucks.

F. E. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., March 13, 1891.

The Davidson Opera House, Milwaukee, Wis., is completing its electrical equipment by the installation of a storage battery plant. This theatre has been lighted by electricity since being built from its own station, and the storage batteries will be used to supplement the dynamos. The Pumpelly Storage Battery Company of this city are supplying the batteries, 180 cells being used.

The West Side Street Railway Company, Kansas City, Kansas, is to be turned into an electric road in the near future. The road extends eight miles and will operate eight cars. The Rae system will be used.

The St. Louis Cable and Western Road, St. Louis, Mo., will change its motive power from cable to electricity. This is one of the most extensive cable roads in the west. The system to be used has not yet been decided upon.

The Sperry Electric Mining Machine Company has an electric locomotive in operation in the No. 3 shaft of the Chicago Wilmington & Vermillion Coal Company, at Streator, Ill., which is giving intense satisfaction to themselves and also to the officials of the coal company. The mine contains a heavy grade 1200 feet long up which the coal has to be hauled. This is done by the locomotive without difficulty, sixteen cars being taken at a time. Other locomotives are in process of construction to be placed in the mines of the same company.

Mr. George B. Foster, formerly with the Thomson-Houston Electric Company, has accepted a position with the Illinois Electric Material Company, of this city. This company is rapidly extending its business and find it necessary to have an electrical expert on the road continually. Mr. Foster will act in this capacity.

Mr. Ernest Hoefer, of the Illinois Electrical Material Company, has been out of the city some days on business.

The Jackson Street Railway Company has been incorporated at Jackson, Mich., with capital stock of $150,000.

The Anna and Jonesboro Electric Street Railway and Power Company has been formed at Anna, Ill.; capital stock, $20,000; to furnish electric power and light and operate a street railway; incorporators, F. S. Dodds, C. L. Ostrich, J. E. Lufkin, R. B. Stonson, A. D. Finch, W. Henderson.

F. M. I.

NEW YORK NOTES.

Mr. C. Stewart Hunter has severed his connection with the New York Safety Insulated Wire and Cable Company, and accepted a position with the Bishop Gutta Percha Company, of 420–426 East 25th St. Mr. Hunter is a gentleman of enterprise and intelligence, and the Bishop Gutta Percha Company are to be congratulated on securing the services of so valuable a man. No doubt the business will show a material increase, and Mr. Hunter undoubtedly will keep a sharp lookout for the company's interest.

McLeod, Ward & Company, 91 Liberty Street, New York, are doing a large business in hoods for arc lamps. They make a specialty of sheet and other metal work for electrical purposes, and although a comparatively new firm, are doing a thriving business.

Mr. C. W. Price is now representing the National Electric Manufacturing Company, of Eau Claire, Wis., in New York City. His offices are in the Tower Building, 50 Broadway, where he will be pleased to see those desiring to use his company's transformer system of incandescent lighting.

Charles A. Schieren & Co., Nos. 45-51 Ferry street, New York, manufacturers of the well-known Perforated Electric Leather Belting, have just issued a neat and handy book of reference in matters concerning their goods. It contains a good many interesting and valuable facts about these perforated belts, and also a large number of testimonials from different electric railways and electric lighting companies using the Schieren belts. A telegraph code is given in the back of the book for the benefit of those living in foreign countries who desire information, etc., concerning the perforated electric belts.

Mr. William Grunow, Jr., of 204 and 206 East Forty-third street, New York, is a gentleman thoroughly skilled in mechanical designing and manufacturing, and one having a fully equipped shop with the latest improved power machinery. Mr. Grunow has made a large number of special electrical apparatus for college and other laboratories, including a large Bolometric spectrometer for the Smithsonian Institute at Washington, and a 500-pound electromagnet for the Columbia College School of Electrical Engineering. As this gentleman has greater facilities for manufacturing than he at present needs, it would prove advantageous for some electrical company seeking a manufacturer for their machinery or apparatus to consult him.

The Empire City Electric Company, 15 and 17 Dey street, New York, are doing a large trade in telegraph, telephone and electric light wires and cables. The celebrated "Helmet" brand is rapidly coming to the front, and as it is waterproof and weatherproof, it is much sought after for outdoor uses. All copper wires used by the company are guaranteed to be of the highest conductivity, true to gauge and of uniform tensile strength. The "O. E." weatherproof wire; the "E. T." taped and braided wire; the "F. C." composite wire and "H. G." rubber wires are some of the company's highly favored brands.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	
American Motor Co.			$ 5 00
American Private T'phone (Parent)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	*40
Averell Insulating Conduit	3,000,000	100 00	4 00
Asbury Park L. & P.	50,000	10 00	
Ball Electric Light	2,000,000	100 00	
Bell Telephone	12,500,000	100 00	200 00
Boston Electric Light			105 00
Brooklyn Edison Electric Light	1,500,000	100 00	100 00
Brooklyn Citizens' Electric Light	500,000	10 00	13 00
Brooklyn Municipal Light	500,000	100 00	122 00
Brooklyn City R.R.	6,000,000	10 00	18 00
Brush Illuminating (N. Y.)	1 000,000	100 00	75 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	26 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Consolidated Electric Light	1,929,400	100 00	50 00
Complete Elec. Con. Co, N. Y.	50,000	100 00	175 00
City Electric Street Ry. Co., 6's	200,000		
Consol Gas & E.L.Co. of West Co.6's	250,000		
Consol Gas & E. Co. Batavia, 6's	80.000		
Daft	1,000,000	50 00	
Edison Elec. 5s	2,000,000		*99
Edison Illuminating	4,500,000	100 00	78 00
Edison General	14,000.000	100 00	106 00
East River Electric Light Co.	1,000,000	100 00	80 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Erie Telephone			47 00
Essick Printing Tel.	5,000,000	100 00	75 00
Excelsior	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
East River E. L. Co. 6's	600,000		
Excelsior Electric Co., 6's	300,000		
Fort Wayne Elec. Co.	4,000,000	25 00	13 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	25 00
Hudson Electric Light (N. J.)	100,000	100 00	
Harlem Electric Light Co.	250,000	100 00	70 00
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co.	197,480		20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's	50,000		
Laclede Gas Co.	7 500,000	100 00	17 00
Laclede Gas, pref.	2,500,000	100 00	55 00
Laclede Gas Firsts			*50
Law Telephone			
Long Branch Electric Light	50,000	100 00	75 00
Lincoln Electric Lighting & Pr. Co.	50,000		
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light			90 00
Morristown L. H. & P.	50,000	100 00	100 00
Manhattan Elec. Light Co. Lmtd. 5's	1,000,000		
Marysville L. & W. Co. 6's	60,000		
N. E. Telegraph and Telephone			51 00
N. Y. and N. J. Tel. and Tel 6s			par
N. Y. and N. J. Telephone Stock		10000	96 00
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North New York, Lighting	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Plainfield, Electric Light	100,000	100 00	75 00
Port Richmond (S. I.)	100,000	100 00	80 00
Queen City Elec. Lt. & Pr. Co 5's	100,000		
Russell Electric Lamp Co. (Boston)	300,000	100 00	90
Rockaway Beach Elec. Light	50,000	100 00	75 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Saratoga Gas and Elec. Light 6s			*86
Shaver Corporation	100,000	1 00	3 00
Swan Incandescent	800,000	100 00	2 00
Saginaw Elec. Light & Pr. Co. 6's	50,000		
Standard Ug'd Cable Co.	1,000,000	100 00	95 00
Thomson-Houston Electric Co.	10,000,000	25 00	47 00
Thomson-Houston Pref.	5,000,000	25 00	25 00
Thomson-Houston Electric Co. 5's	500,000		
T'son-Houst'n E. L. Co. Yonkers, 6's	100,000		
Thomson-Houston Lt. Ht. & Pr. Co. Binghamton, 6's	100,000		
Union Switch & Signal Co.			
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	2 50
United States Elec. Co.			40 00
United States Illuminating	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co.	5,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.			50 00
West End, L. (Boston)			22 00
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

That the industry of the promotor, like that of Cupid, does not always advance smoothly is shown by the cruel fate of those interested who thought they had secured $1,500,000 to develop the town of Glasgow, Va., and vicinity, but found at the last moment the investors preferred to forfeit $25,000 and quit. Such incidents in finance generally mean ten years of delay at least. On the other hand, the vendors of the Milwaukee and Chicago breweries claim a successful negotiation for $7,500,000. The receiver for the American Loan and Trust Co. has filed his bond for $200,000, and the loss and profit account will soon assume tangible shape; a new departure in the Barings has been announced which will no doubt read about the same and fasten a value on all claims and securities which caused the late unpleasantness in the old house. They organize a new house in New York to begin business May 1st, swallowing up their American agents, Messrs. Kidder, Peabody & Co., and taking a brand new name, Baring, Magoun & Co. That this house will immediately take a decided and important position as principals in American finance there can be no doubt. The Boston house will retain and continue that portion of the business which has hitherto been conducted at that city. The Argentine Government has gained a respite, with funds in hand, after heroic measures had been resorted to. Westinghouse has had the blinds removed by the election of Directors by the Union Switch and Signal Co. "We are the people," as a public company motto simply means that the management of an electric or other corporation is conducted by those behind the table, and the new contact appears to contain high tension current with the machinery at full speed and cold journals. The governing or controlling circuit may be lengthened by legal action, but a ground is safe to exist at an insulated spot on the line somewhere which will not be discovered until both law and war is over. The only exception to this general rule is publicity, list and quote your stocks; have the public interested and largely; your wants will then be their wants, and they will roll the clouds away. The year 1891 promises to witness the conversion of a great many of our large manufacturing and commercial firms into joint stock companies. This is far better for the country generally than the amalgamation of immense interests, including, as near as possible, all in a given line into what is now known as trusts. The shareholders have an opportunity in the one case to know something of the value of their holdings, and a voice, suggestive, if not commanding, in the management, while the owner of a few hundred shares in such concerns as the Standard Oil, Sugar, Lead, Whiskey, Lard, Salt, Brewery, Tobacco, Grape Sugar, Cotton Oil, Soda Fountain, Biscuit, Wool, Hat, etc., etc., are seldom even taken into consideration by the master spirit, much less are they expected at any time to do more than sign a proxy, without question. A few moments consideration will convince them that in strict loyalty and obedience lies their hope of pecuniary reward. *Per contra*, there is no logical reason why every firm in the country, be it factory, store or other industry doing a business of a million dollars or more per year, should not enjoy the benefits of the joint stock

ect, or why the possessor of a few thousand dollars should not realize in the particular line of business suiting his pleasure the greater profit rendered probable by a reasonable concentration of capital and experience coupled with corresponding ease of mind concerning his investment on account of its relation to the gross capital, and the full knowledge that "he is in it," "not a little bit," but to the extent of every share standing in his name. The protection and immunity enjoyed by public companies under the act should be repaid by a line drawn between close corporations and those the people are part of.

The market for all electric stocks continues firm and steady; among the dividends are 1¼ per cent. on the Western Union, and $3 per share declared by the Bell Telphone. I shall be pleased to send a receipt for a year's subscription for the ELECTRICAL AGE to every shareholder in return for his dividend on one share, and am confident he will find this the most profitable way to invest it. A large lot of Westinghouse stock has lately been sold in Boston, ranging from $6 to $12 per share. Pittsburg unloading.

PHILADELPHIA NOTES.

In visiting the office of O. D. Pierce & Co., No. 808 Walnut street, the attention of the visitor is immediately drawn to the magnificent, and more than ordinary display of the "Perkins" incandescent lights, as arranged by Mr. Pierce, on black velvet-covered boarding, about eight feet square. The board contains 46 lamps, from 45 to 130 volts, and varying from 10 to 50 candle power. The unique part of the display consists of the variegated colors of the lamps' bulbs. The "Perkins" lamps are in constant demand.

The Applegate electric floor matting, manufactured by the Applegate Electric Floor Mat Manufacturing Co., No. 37 Market street, Camden, N. J., is a terror to burglars, professional thieves, etc., and insures a good night's slumber to the occupants of a house protected by this valuable device. Write for estimates and a reply with full information will be sent by return mail.

H. T. Paiste, of this city, has just completed orders for several thousand switches for European use. He has also received an invoice of 5,000 pieces of English ivory china, for his handsome china switches, which are being put out in all variety of finish. Nothing could be handsomer or more stylish.

Among the plants lately installed by Walker & Kepler, No. 531 Chestnut street, are, one for the Keystone Watch Case Co., Nineteenth and Brown streets, of 800 lights; and one at the Hahnemann College, Fifteenth and Ray streets, of 540 lights. This latter plant includes two Armington & Sims high speed engines, which were also installed by the same firm. The company has put in a plant at the establishment of William Wood & Co., Twenty-second and Spring Garden streets, of 2,335 lights. It includes five Edison dynamos and three Westinghouse Automatic engines, two of 100 horse power and one of 10 horse power.

Among the steam power plants recently completed and furnished by Mr. J. W. Parker, of No. 38 South Fourth street, are the following: Schuylkill Electric Railway Co., Pottsville, Pa., one 150 horse power engine; Clearfield Electric Light Co., Clearfield, Pa., one 80 horse power engine; Charlotteville, Pa., Electric Light Co., one 80 horse power complete plant, and the Port Deposit, Md., Edison Electric Light Co., one 100 horse power complete plant. H. G. G.

MICA.—Connecticut is destined to become as famous for mica as it was for its nutmegs. Within a comparatively recent period three mica mines have been discovered, and, it is reported, the mineral is of good quality. Mica stands unique among minerals as an insulating substance, and there is a great field for its use.

THE BEST—SUPERIOR TO ALL OTHERS.

All who contemplate purchasing a Medical Battery should read the following late extracts from the daily business letters received by Jerome Kidder Manufacturing Company, the old established firm at 820 Broadway, New York:

L. Dowse, M. D., writes from Petoskey Sanitarium, Petoskey, Mich., March 3d, 1891, "Have used your batteries for four years, and think them the *best out.* Have an almost new —— battery I would exchange for anything in the shape of a Kidder." W. H. Hoag, Esq., of Amsterdam, N. Y., writes, February 10th, 1891, "I have used your battery for the last six years; it is *the best.* Would not do without it for twice what it cost." And J. H. Mosely, M. D., of Tomah, Wis., writes under date of February 12th, 1891, "I have had a varied experience with electric batteries, but yours prove *far superior to all others* in the treatment of chronic and acute diseases."

"THE ROYAL ROUTE."—It has become a widely prevalent practice among railway companies to bestow upon their respective lines brief and catchy "trade mark" titles, in order to designate them more concisely than by their proper corporate names, as well as to impress their individuality, so to speak, upon the minds of the traveling public. The old reliable Reading Railroad, in common with the rest of these nicknamed lines, has had applied to it a title that is particularly appropriate, "The Royal Route." Everybody who has traveled on the splendid lines operated by the Reading, between Philadelphia and New York and between Philadelphia and Atlantic City, will concede that the name is well applied and unquestionably well deserved. "The Royal Blue Line," between New York, Philadelphia and Washington, is claimed to be the best constructed and most completely equipped through line in America.

TO INVESTIGATE LIGHTING COMPANIES.—It is said that a petition is being circulated for signatures, asking the Legislature to take steps to investigate the methods by which the electric light and steam heating companies in Brooklyn, N. Y., conduct their business.

FLEXIBLE GLASS.—It is reported that Mr. Bradford McGregor, of Covington, Ky., claims to have solved the problem of making glass flexible, and cheap enough for commercial purposes.

ELECTRICAL PATENTS.

ISSUED TUESDAY, MARCH 10, 1891.

447,767. Electric-Arc Lamp. Henry C. Forgason, Oakland, Cal., assignor of one-half to H. G. Comstock, same place. Filed May 23, 1890.

447,768. Combined Annunciator and Telephone System. John C. Francis, New York, N. Y., assignor to Elias M. Greene, same place. Filed Nov. 5, 1889. The telephone instruments are placed in a normally open branch circuit around the push-button of an annunciator system. When the push-button is closed the bell and annunciator is operated and the drop of the annunciator automatically closes the circuit through the telephones at the central office.



447,858.—INDUCTION PREVENTIVE FOR TELEPHONES.

447,788. Electric Switch. John M. Orford, Bridgeport, and John C. English, New Haven, Conn. Filed Dec. 19, 1890.

447,826. Electric Switch and Cut-out. William Hochhausen, Brooklyn, N. Y. Filed Mar. 12, 1889.

447,827. Electric Starting-Switch. William Hochhausen, Brooklyn, N. Y. Filed Nov. 26, 1889. The combination, with the main switch and its actuating devices, of a resistance-switch, operating in a direction to throw out the resistance and having a lost motion adjusted so that an interval shall elapse after the closing of the main switch before the resistance-switch may be moved by the actuating devices to a position where the resistance will be thrown out.

447,832. Electric Light Fixture. Joseph Kintz, Ballard Vale, Mass., assignor of one-half to the Craighead & Kintz Company, New York, N. Y. Filed May 15, 1890.

447,833. Coupling for Electric Wires. Climpson M. Knight and Thomas Hawken, Salem, Mass. Filed Nov. 20, 1890.

447,857. Galvanic Apparatus for the Human Body. Percy G. Williams, Brooklyn, N. Y. Filed June 6, 1890.

447,858. Induction-Preventive for Telephones. Thos. F. Wright and Ed. G. Wilson, Chicago, Ill. Filed July 28, 1890. An induction-preventive for telephones, consisting of a perforated hollow casing, a tube extending between the perforations and a coil, one end of which is embedded in a block of wood or its equivalent and the other end terminating opposite the centre of a perforation in the casing opposing the diaphragm of a telephone-receiver, to which the casing is secured.

447,861. Conduit for Electric Wiring in Buildings. Sigmund Bergmann, New York, N. Y. Filed Aug. 1, 1890.

447,867. Electric Switch. Horace T. Clark, Bridgeport, Conn. Filed Jan. 26, 1891.

447,885. Trolley-Carriage and Conductor. Chas. J. Luce, Niantic, Conn. Filed Apr. 4, 1890.

447,894. Electric Light Signal. Walter R. McCann and Simon S. Creider, Sterling, Ill. Filed Sept. 8, 1890.

447,896. Insulation of Electric Conductors. Frederic J. Nash, Brooklyn, N. Y. Filed May 12, 1890. An electric conductor insulated by a surrounding bed or layer of insulating material in the condition of an impalpable powder, whereby the particles thereof pack together so closely as to exclude air and moisture.

447,897. Electric Conductor. Frederic J. Nash, Brooklyn, N. Y. Filed May 13, 1890. A wire inclosed in a layer of pulverized insulating material, the particles of which are free to move relatively, and a retaining envelope for holding the insulating material against the wire.



447,896.—INSULATION FOR ELECTRIC CONDUCTORS.

447,906. Electric Railway Signal. William W. Rosenfield, New York, N. Y., assignor to the American Electric Railway Signal Company, Jersey City, N. J. Filed May 17, 1890. In a railway signal system, the combination of a permanent magnet, a circuit controlled by trains upon the track and operating when closed to neutralize or partly neutralize the magnet and a signal device operated by the permanet magnet to give a danger signal when the neutralizing circuit is broken.

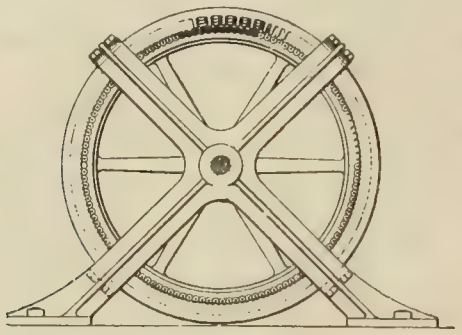
447,918. Automatic Telephone-Exchange. Almon B. Strowger, Kansas City, Mo. Filed Mar. 12, 1889.

447,920. Method of Operating Arc Lamps. Nikola Tesla, New York, N. Y. Filed Oct. 1,

PATENTS—Continued.

1890. A method of abating or rendering inaudible the sound emitted by arc lamps supplied with or operated by an alternating or pulsating current by increasing the rate of such alternations or pulsations up to that of the limit of audition.

447,921. Alternating Electric-Current Generator. Nikola Tesla, New York, N. Y. Filed Nov. 15, 1890. The combination, in an annular field of force formed by opposing polar faces with radial grooves or serrations and with the poles of a connected series of radial conductors so disposed with relation to the serrations that while one portion of the radial conductors is passing between the strongest parts of the field, or the



447,920—METHOD OF OPERATING ARC LAMPS.

points where the two poles most nearly approach the adjacent or intermediate conductors will pass through the weakest parts of the field or the points where the two poles are most remote.

447,939. Electric Motor. William H. Chapman. Portland, Me., assignor to the Giant Electric Motor Company, same place. Filed July 5, 1890. In a multipolar motor, a series of field magnet cores constructed and arranged in pairs, the two cores in each pair being placed parallel to the axis of revolution of the armature and connected together in one piece, but removed from contact with the cores of the next magnet and having their pole ends curved tangentially to a plane at right angles to the axis of revolution in both directions from the centre of the width of each of the cores.

447,943. Railway-Car Telegraphy. William S. Cook and Moses C. Cook, South Omaha, Neb. Filed Apr. 21, 1890.

447,998. Electric Alarm. George W. Adams, Boston, Mass. Filed June 6, 1890. A number of circuits simultaneously employed for the sending of signals of different electrical character to the same central office.

448,024. Telephone Toll Apparatus. William Gray, Hartford, Conn., assignor of one-half to Charles Soby, same place. Filed Apr. 5, 1888.

448,031. Electric Railway Signaling Apparatus. Eugene L. Harrison, Crookston, Minn. Filed Mar. 4, 1890.

448,040. Commutator. William Hornberger. Elkhart, Ind. Filed Aug. 2, 1890. A metallic commutator-section having a body of soft metal and its side edge or edges re-enforced by hardened metal to prevent sparking.

448,084. Electrode for Arc Lamps. Albert C. Seibold, Mount Vernon, N. Y. Filed Dec. 24, 1890. An arc lamp having a metallic tubular holder inclosing the positive carbon and provided with a removable flat plate arranged in immediate proximity to the arc to sustain the carbon, through an opening in which the point of the carbon projects, and a metallic cap or shield consisting of a short cylinder having an inwardly turned edge upon its upper end, the cylinder surrounding the upper portion of the negative carbon and sustained thereon by the inwardly-turned edge, which rests upon the end or point of said carbon.

448,107. Electric Arc Lamp. La Motte C. Atwood, St. Louis, Mo., assignor to the Atwood Electric Company, same place. Filed Oct. 28, 1890.

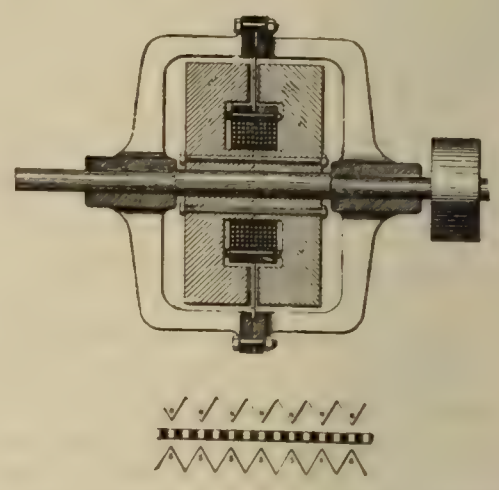
448,110. Electric Door-Opener. Louis Bates, Jersey City, N. J. Filed July 14, 1890.

448,125, Train-Order Annunciator. Leonard T. Crabtree, Oconto, assignor of one-half to Gilbert Milligan Knapp and Dayn Eldridge Wescott, both of Shawano, Wis. Filed July 11, 1890.

448,153. Apparatus for Intensifying Electrical Undulations. John C. Ludwig, San Francisco, Cal., assignor of seven-eights to Henry T. Compton, Louis F. Monteagle, Timothy Paige, and George H. Roe, same place. Allen T. Ayres and William C. Mason, Oakland, Cal., and Hiram J. Ayres, Akron, Ohio. Filed Sept. 10, 1889.

448,164. Device for Raising or Lowering Incandescent Electric Lamps. Charles F. Reinmann, Brooklyn, N. Y. Filed Feb. 8, 1890.

448,166. Automatic Switchboard and Safety Cut-Out for Electric Circuits. Edgar A. Sweet, Milford, Mass., assignor of one-half to Joseph L. Buxton, same place. Filed Oct. 22. 1890.



447,921—ALTERNATING ELECTRIC CURRENT GENERATOR.

448,167. Switch for Incandescent Lamp Sockets. Alfred T. Tregurtha Everett, assignor of one-half to John A. Murray, Boston, Mass. Filed Sept. 20, 1890.

448,169. Polarized Annunciator. Ernest P. Warner, Chicago, Ill. Filed Jan. 9, 1890.

448,172. Trolley for Electric Railways. Merle J. Wightman, Scranton, Pa., assignor to the Wightman Electric Manufacturing Company, same place. Filed Aug. 12, 1890.

448,173. Trolley for Electric Railways. Merle J. Wightman, Scranton, Pa., assignor to the Wightman Electric Manufacturing Company, same place. Filed Aug. 12, 1890.

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NEW YORK, MARCH 28, 1891.

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INDUCTIVE DISTURBANCES IN THE TELEPHONE.

The telephone, as well-known and understood as it is, still has many secrets for man to reveal. There are many active electricians at work, however, endeavoring to interpret by scientific analysis things that are as yet known only as manifestations.

Mr. J. J. Carty is one of these wide-awake investigators, who is not content with what he sees and hears, but wants to know the reason for the existence of things familiar to his senses only.

In the paper read by that gentleman before the American Institute of Electrical Engineers on March 17th, many interesting facts are added to our knowledge concerning the phenomena developed in telephony.

To obtain complete freedom from inductive disturbances in the telephone it is necessary not only to use a metallic circuit but to place the two wires composing the circuit in a special relation to the source of disturbance. This is Mr. Carty's first proposition. He then describes various experiments made with the object of determining the true nature of the disturbances in the operation of the telephone. His experiments seem to prove that under the conditions above referred to the inductive action instead of tending to produce a simple current on each side of the metallic circuit actually does produce a number of different currents in each wire and in both directions. One of his experiments, he said, furnished very striking proof of the electro-static nature of induction between telephone circuits.

The supplementary note communicated by Mr. T. D. Lockwood gives other views on the same subject which are of exceeding interest and value.

A SIMPLE METHOD OF DESIGNATING LOOPS AND LAMPS.

Simplicity and system are absolutely necessary for the proper management of business of any kind. Without these, disorder and dissatisfaction generally prevail and if any one interested desires information concerning the business it at least involves a laborious and round-about-way method of getting at the facts. There is no business or industry where system and simplicity are any more essential than in that of electric lighting. Every detail should be looked after carefully, and an accurate record kept of every thing that transpires in the ordinary course of business, from the most insignificant trifle to the most momentuous transaction. The only safe and satisfactory way to carry on any business is to simplify and systematize the method of operation. In electric lighting the property of the operating company is scattered so extensively that it requires a method peculiar in itself to keep an accurate record of everything that affects the condition of the plant. Each company has its own way of keeping records; generally, however, these methods are susceptible of modification and simplification.

One of the departments of electric lighting which require close and careful watching is that embracing the service wires and lamps.

It is unhandy and really inconvenient to refer to such-and-such a loop or wire by some name. Why not adopt some brief designation for loops?

This Mr. W. H. Markland, of Altoona, Pa., does in his practice in an extremely ingenious and simple manner. He uses figures and the decimal point to designate loops and the lamps thereon, and two or three figures with a decimal point dividing them will at once indicate the number of the loop and the particular lamp thereon to which it is desired to call the attention of the linemen.

We print on another page in this issue an interesting article on this subject from Mr. Markland, and his plan is extremely simple and comprehensive, it cannot fail to receive the favorable consideration of electric light managers who usually adopt the briefest way of getting at facts and recording them.

ELECTRIC WIRES IN NEW YORK.

Many New York streets down town are to be opened for the purpose of constructing electric subways. On March 18th the Subway Company was ordered by the Board of Electrical Control to build subways in certain streets, the work to be completed by June 1st. It will require some very energetic work to accomplish the task in the allotted time. If the executive and administrative machinery can be freed of red tape long enough, so as to allow freedom of action, the work may be done, but it will make a mess of the down town streets for the time being. New Yorkers, however, are used to seeing the streets turned upside down, so it probably will not excite any unusual comment.

Mayor Grant has asked the Police Commissioners to instruct the patrolmen to arrest any one stringing wires over housetops and across streets without authority. He claims that wires are being thus strung at night to escape observation.

THANKS TO THE FIREMEN.

The Board of Fire Underwriters in this city, at a recent meeting, passed a resolution of thanks to the chief of the Fire Department and his subordinates for their vigilance and promptness in responding to fire alarms during the period when the fire-alarm telegraph system was disabled by the recent heavy snowstorms. It was a graceful thing to do, and it is safe to say that the fire underwriters have no more energetic allies than the firemen. The latter stand in the face of danger and death in order to check the ravages of the fire fiend when he becomes unshackled. The fire underwriters are the ones most interested in fires, generally speaking, and it is to their interest to applaud and encourage the efforts of the brave firemen to save property from destruction.

The resolution also suggested that steps be taken to place the fire alarm wires underground so that they will not be subject to interruption by storms.

The whole city is placed in jeopardy when these wires are interrupted, and every means should be adopted to maintain the service intact under all conditions.

ELECTRIC RAILWAYS IN FAVOR.

It is pretty good evidence that electric railways are in favor all over the country, when statistics show that the mileage is constantly increasing.

Some people labor under the impression that electric cars should run continuously without ever giving out. Electricity is a wonderful and convenient force, but the mechanism necessary to enable us to get the power out of it is like any other piece of machinery and it is liable to be abused. Probably no other machine suffers so much hard usage and rough handling as the electric car motor, and it is astonishing how well it performs its work. It is, therefore, very significant that the electric motor is so successful in the face of all difficulties.

The total mileage of electric railways in the United States on March 1st, was 2,852, and the figures are constantly increasing. There is hardly a newspaper printed that does not record the building of an electric road somewhere. In all parts of the country, in every nook and corner, the electric street car is found, and wherever it is there enterprise and prosperity abound. The record of the electric railway is a grand one, and how much grander it will be in the future no one dares to predict.

Are Boys "Travelers" when Playing Tag?—A curious suit for damages was argued in Boston on March 20th, for injuries caused by an electric wire. Four small boys were playing tag in Charlestown, October 7, 1889, and during the course of the game one of them took hold of a "live" wire, which was lying across the street. His companions, in order to release him, took hold of the same wire to pull it away, and all four were held fast until the arrival of a policeman, who rescued them from their predicament. The boys brought suit against the city for damages, and the case was argued before a jury. The defence was that the boys were not "travelers" within the meaning of the law, by reason of their stopping to play tag. Judge Dunbar allowed the case to go to the jury with the understanding that if the Supreme Court decided that the boys were "travelers" the city shall pay them damages.

THE ISOLATED ELECTRIC LIGHT PLANT IN THE "WORLD'S" NEW BUILDING.

Every new business building that is erected these times is not considered complete without an isolated electric light plant of its own. The isolated systems of lighting have rapidly grown in favor in late years, and the large buildings depending upon an outside central station for their light current are now very few. Many of these are installing isolated plants so as to secure independence from outside sources of current. Isolated plants also insure to the consumers within the building immunity from many of the annoy

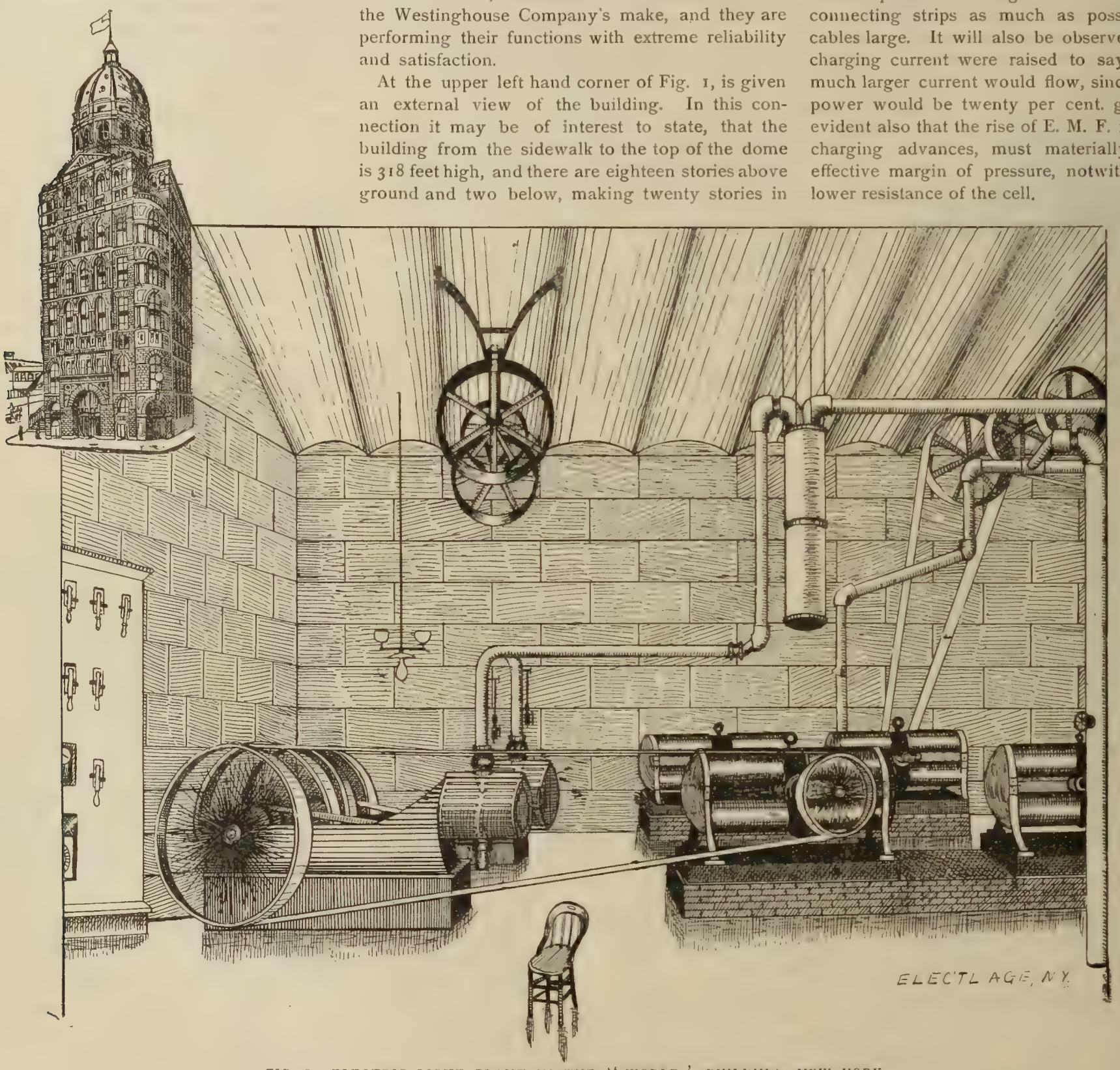


FIG. 1—ELECTRIC LIGHT PLANT IN THE "WORLD" BUILDING, NEW YORK.

ances which are liable to occur when the current is obtained from street mains or wires.

Among the latest installations of isolated plants is that in the new *World* building on Park Row, New York, in which are located the offices of the ELECTRICAL AGE.

In our issue of November 15, 1890, we gave an excellent description of this magnificent building, including the electric light plant. We then promised to produce at a later date an illustration of the latter, and in fulfillment of that promise we present to our readers to-day two excellent illustrations of this efficient installation.

The plant consists of four United States dynamos, each with a capacity of 800 16 candle power lights. The machines are compound wound, and are of the well known form of the United States Electric Lighting Company. They are very massive in construction and the switches, cut-outs, etc., are of the most approved design. The foundations of the dynamos are very substantial, and the machines run with remarkable steadiness and absence of noise.

The power plant consists of two New York Safety engines, and the arrangements are such that in case of accident to the Safety engines, the dynamos may be run by the great Corliss engine, which furnishes the power for the printing presses.

There are 4,000 incandescent lamps distributed throughout this enormous building, and so far the light service has been extremely satisfactory to the tenants.

Fig. 1, gives a general view of the plant, showing clearly the dynamos at the right and the engines at the left.

Fig. 2 is an illustration of the switchboard. The voltmeters, ammeters and switches are all of the Westinghouse Company's make, and they are performing their functions with extreme reliability and satisfaction.

At the upper left hand corner of Fig. 1, is given an external view of the building. In this connection it may be of interest to state, that the building from the sidewalk to the top of the dome is 318 feet high, and there are eighteen stories above ground and two below, making twenty stories in all. A most extensive view can be had from the top of this dome of the city and surrounding country.

The annunciator and telephone system was installed by the Complete Electrical Construction Company, of New York, and twenty miles of the tubing of the Interior Conduit and Insulation Company, was used in wiring the structure. There are sixty miles of Grimshaw White Core and Okonite wire used in this building. The United States Electric Lighting Company did the wiring as well as putting in the plant. Thirty-five miles of wire was used for the telephone service alone, and each office is equipped with a metallic circuit for telephone service.

The entire plant, including the light, telephone and annunciator installations, is one of the most complete and extensive in the country.

In electric lighting accidental short circuits must be guarded against, and the temperature in the conductors should never exceed 100° F.

ACCUMULATORS.

The necessity for keeping all the connecting strips of accumulators short and of low resistance, the junctions clean, and the cables short and large, may be illustrated by an example. Suppose a set of fifty cells with a normal charging current of thirty amperes, which has an E. M. F. of 110 volts. Since the fifty cells themselves give 100 volts, this acts as counter E. M. F., *i. e.*, in opposition to the charging current; thus 10 volts is the true pressure which forces the thirty amperes through the accumulator, so that the total resistance for cells, cables and connections is about one-third ohm. This is considerably increased if the connections are not clean, or the cells are not placed close together to shorten the lead connecting strips as much as possible, and the cables large. It will also be observed that, if the charging current were raised to say 112 volts, a much larger current would flow, since the forcing power would be twenty per cent. greater. It is evident also that the rise of E. M. F. in the cells, as charging advances, must materially reduce the effective margin of pressure, notwithstanding the lower resistance of the cell.

The next point to consider is why boiling occurs. It must be clear that, as the surface of the positive plates becomes converted into lead peroxide, the material to be acted upon by the current grows less and less, the plate becomes virtually smaller; and consequently, the current becomes too large, resulting in decomposing the water of the electrolyte, and often warming it considerably.

However, in practice it would not pay to gradually reduce the current as the charge advances; therefore, it is not done. Yet, it can be experimentally shown that, by reducing the current in exact proportion to the diminishing active surface of the plate, boiling never occurs, and hundreds of ampere hours may actually be added beyond what is accomplished in the usual way. In fact, an infinite charge in point of time, but finite in quantity, might be given if the current is continually reduced to suit the lessening active surface of the positive, since the total quantity becomes the sum of a special form of an infinite series. Boiling does no

harm unless the paste is loose, when much material will be removed by the agitation of the liquid.

Frequent and prolonged overcharging, with currents about 30 per cent. below maximum, is the only way to reduce the higher sulphates of lead, which are apt to form when the cells are allowed to run too low. Such sulphates are most obstinate to reduce, and the least speck remaining indicates that more will form, almost like a growth of mould; so that when this is observed, overcharging must be resorted to. These higher sulphates then fall off in scales or powder, for want of adherence to the healthy oxide forming beneath them.

It must be borne in mind that the addition of caustic soda in a great measure prevents the formation of these higher sulphates.

If, when the cells boil, the charging is stopped for half an hour or more, and is re-started, it will be found that boiling does not recommence for some time; and this process may be repeated again and again. When boiling takes place a kind of gas battery is produced, both positive and negative plates being covered with a layer of gas. When charging is stopped, this gas escapes or becomes partly absorbed, so that the plates are once more exposed for a short time to the current, before the phenomenon recurs.

If too large a charging current is used for the area of the plates, buckling is likely to ensue, and very rapidly, if any bad sulphate is present on the positives. Then short-circuiting, due to plates touching one another in the liquid, soon takes places. Buckling is due to unequal expansion of the plates, and even under the best treatment, this trouble arises if the makers have not given them a proper form. The paste expands on discharge and *vice versa;* therefore, it is absolutely necessary that such expansion and contraction should be symmetrical over the whole surface These continual changes in the volume of the paste, after a time, loosens it from the grids; but, if these are uninjured, repasting can be resorted to. With judicious treatment, some years may elapse before this becomes necessary, and it is applicable chiefly to the positive plates.

When running main wires for electric lighting, the two conductors should be as far apart as practicable, and thoroughly insulated.

SHIPMAN ENGINES FOR ISOLATED PLANTS.

Our cut shows one of the well-known Shipman engines running an isolated electric light plant. The use of these engines in connection with small launches is so familiar that the words "launch" and "Shipman" are almost synonomous to a large number of people, but these petroleum burning steam engines have been designed for use anywhere that a moderate amount of power is required and are particularly adapted for such uses as our illustration represents.

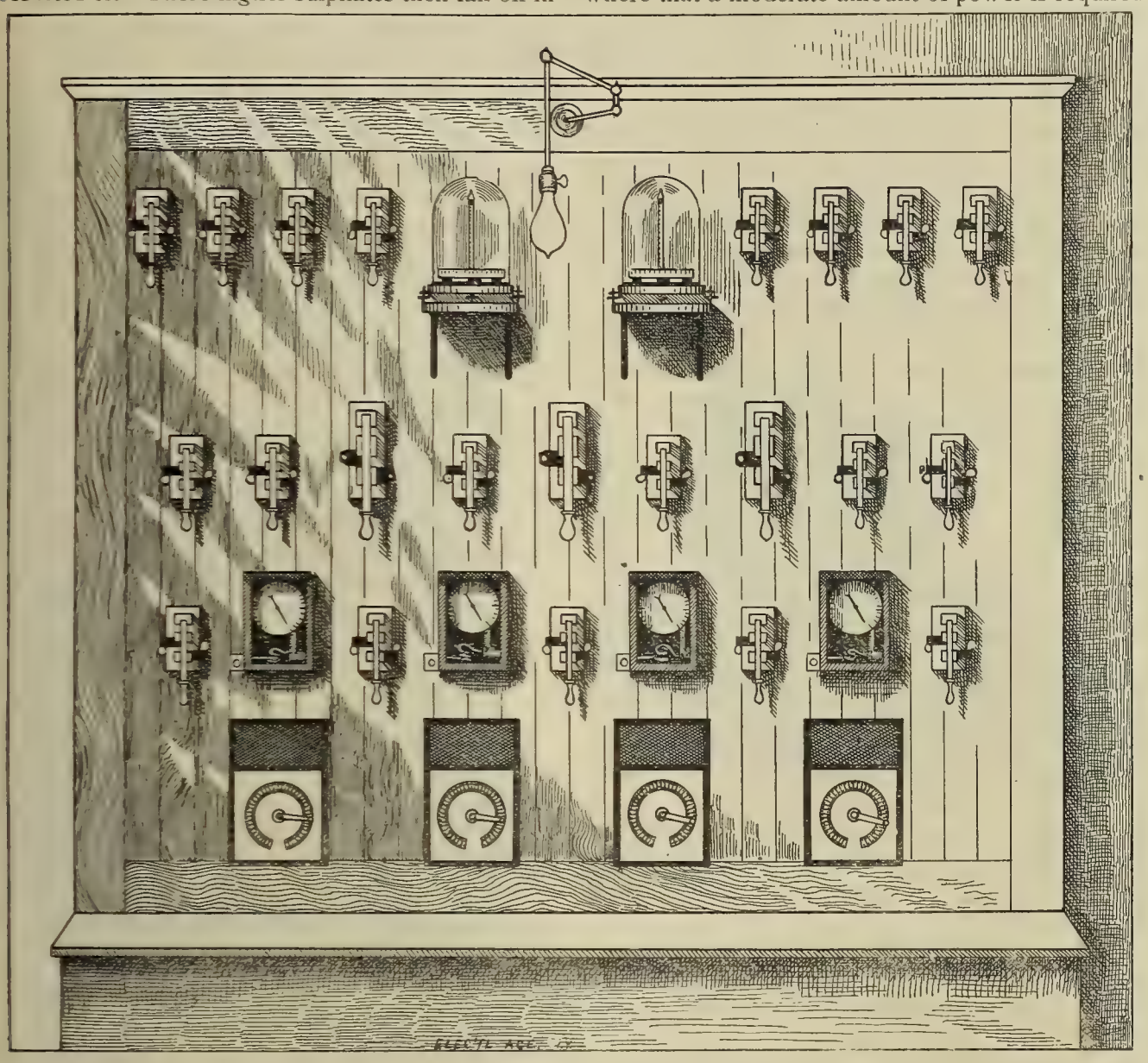


FIG. 2—SWITCHBOARD OF THE "WORLD'S" ELECTRIC LIGHT PLANT.

One of its essential points is that it is automatic, so that when once steam has been generated in the boiler, practically no further attention is required beyond that of opening and shutting the steam-valve whenever the engine is started or stopped, the fire, speed, and water-feed being so arranged as to attend to themselves.

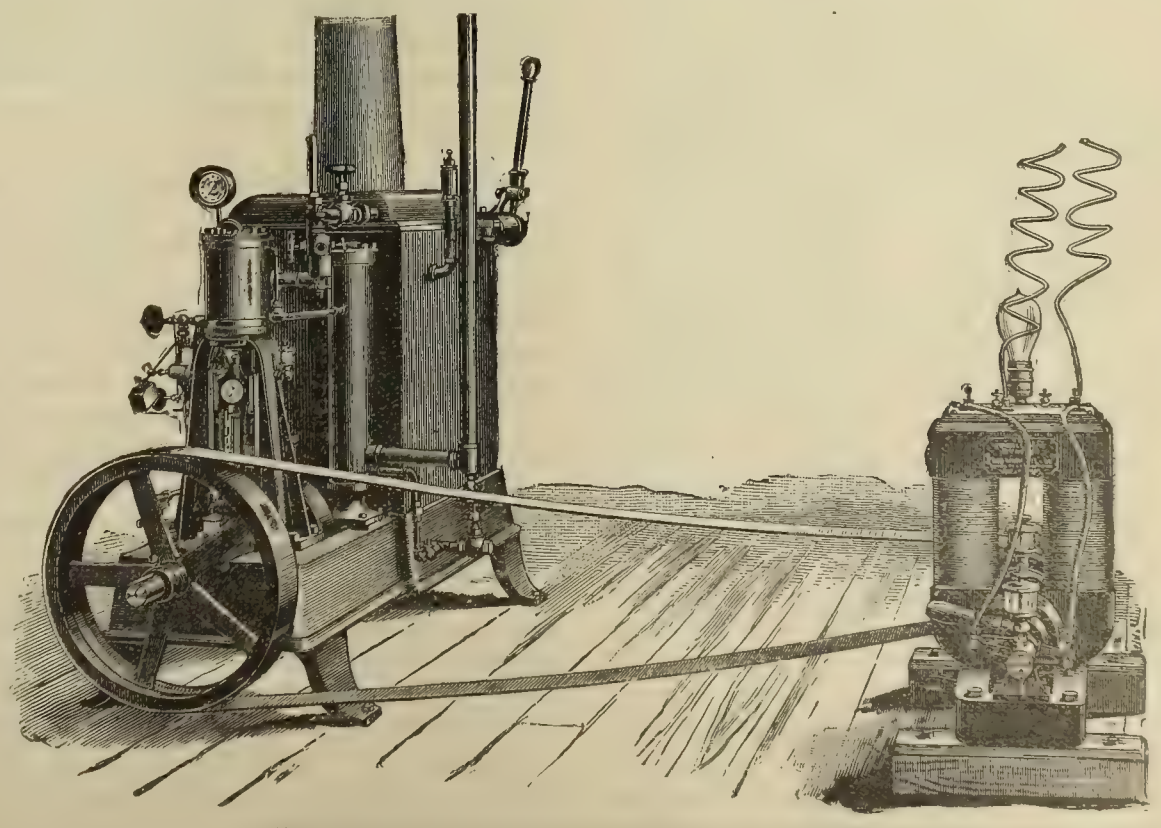
The engine is simple or compound, as may be best suited to the work it has to perform, and is built upon the same frame as the boiler. This latter is composed of tubes about eighteen inches long, which are screwed into a flat, oblong chamber at one end and closed at the other and is fired externally.

Two small aspirators or atomizers taking steam from the boiler, suck up the petroleum which is used as fuel, from a chamber below, and drive it into the furnaces in the form of a fine spray. A couple of torches ignite this spray as it passes inward, and the flames produced by its combustion rush round and among the boiler tubes. The amount of steam and petroleum that is used by the atomizers is regulated by a diaphragm connected to a valve in the steam-pipe that supplies them.

This diaphragm is exposed to the steam pressure on the one side, and is held down by a spring, loaded to a certain pressure, on the other, and moves upwards or downwards as the steam exerts more pressure than the spring, or *vice versa.* Its movement is conveyed to the valve by means of a rod, and it thus regulates the amount of steam passing at any moment to the atomizers. In this way the fire is made to vary inversely as the pressure in the boiler, and thus keeps the latter constant.

The petroleum is stored in a tank at any convenient distance from the motor, and is led to it through a pipe having a regulating valve in it. The water in the boiler is kept at a constant level by means of a float, connected to a tap in the suction-pipe of the pump. This float is placed in a chamber, which is joined to the top and bottom of the boiler, and rises or falls with the level of the water. The movement is conveyed, through a stuffing-box and by means of levers, to the tap in the suction-pipe, which it opens or closes as the water level changes.

The speed of the engine is kept regular by means of a governor, which works directly on to the eccentric, and the lubricating of all journals, cylinders, and slides is performed by the ordinary sight-feed lubricators and cups, except that of the crank-pin, which is effected by means of a centrifugal oiler attached to the crank-disc. But when first starting a sufficient pressure is required in the boiler to work the atomizers, and for this a hand air pump is provided. A few strokes of this pump will suffice to start the fires, and it is only necessary to pump slowly for five minutes to raise sufficient pressure of steam to keep them going, fifteen minutes in all being required to get steam up to one hundred pounds per square inch.



SHIPMAN PETROLEUM ENGINE RUNNING DYNAMO.

The Shipman engine is compact, light and simple to understand, and does not require much space, strong foundations, or skilled attendants.

These engines are manufactured by the Shipman Engine Company, 262 Summer street, Boston, Mass.

ELECTRIC BELLS—THEIR CONSTRUCTION AND APPLICATION.

BY THOMAS R. TALTAVALL.

One of the most common and useful applications of electricity is for the ringing of front door bells. In this direction its use is extended for signaling between house and stable, between different parts of a house, factory or building of any kind, and for burglar alarms, fire alarms and annunciators.

One of the greatest advantages electric bells have over mechanical bells, is the fact that the bell may be placed at any distance from the point where the push button is located. It is manifestly impracticable to operate a mechanical bell under like conditions, and the electric bell is, therefore, the only available, practical and satisfactory means of signaling at a distance.

Thousands and hundreds of thousands of electric bells are in use to-day throughout the country, and yet many people using them labor under the misapprehension that this simple application of electricity is beyond their comprehension and always will be. This is a great mistake. Nothing in the world is simpler to understand than the operation of electric bells. Any one of ordinary intelligence and without any previous knowledge of electricity, may learn all about them with very little effort and study.

For these persons and others interested we have prepared this article on the subject of electric bells, descriptive, in a general way, of how they are made and how they are used and applied in practice.

The electric bell consists essentially of three parts, namely, the magnet, the armature (to which is attached the hammer) and the bell. (See Fig. 1).

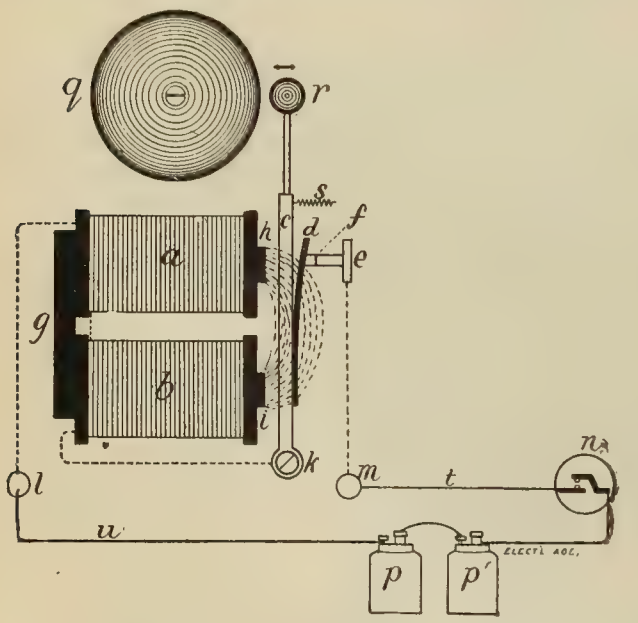


FIG. 1—ELECTRIC BELL AND CONNECTIONS.

For the benefit of those who have no knowledge of electromagnetism we will briefly consider its phenomena, as it is the underlying principle of electric bell action.

Electromagnetism is the magnetic force produced by the passage of a current of electricity through an insulated wire wound around an iron core. The magnetic force is strongest at the ends of the core—the poles as they are usually called. *a* and *b* in Fig. 1 show the magnets of an electric bell. It will be noticed that there are two of them, or rather two bobbins. The magnets are made in the form shown, so that the poles may be brought closer together. By bringing the poles close together the magnetic action is more concentrated, and consequently stronger at the point where we wish to utilize the force than it would be if the magnet was composed of one straight bar.

The form of magnet shown in Fig. 1 is commonly called the horseshoe magnet, although it does not resemble a horseshoe in any respect. Magnets were at one time made more in the shape of a horseshoe, by being bent in the shape of a letter "U," but this shape has been displaced by the present one, which is that of three sides of a square.

In Fig. 1, *h* and *i* represent the poles of the magnet, *g* the yoke, which is for the purpose of connecting the cores of magnets *a* and *b*; *c* is what is commonly known as the armature. The dotted lines emanating from the poles represent the magnetic lines of force. These lines in reality are invisible, but it is customary to represent them graphically in the manner shown, in order to give some idea of their action. Now these lines of force pass from one pole to the other, and it will be noticed that they embrace the armature, c, which is of soft iron. Magnetic lines of force have a strong attraction for iron, and they tend to draw any bodies of this metal toward the poles from which they issue.

The armature *c* is hinged at *k* so that it will move in the directions shown by the arrow when the bell is in action.

The magnets and armature are the most essential parts of almost every piece of electrical mechanism. They are to electrical apparatus what the steam engine is to a power generating plant; *r* is the hammer which strikes the bell, *q*, when the armature is attracted to the magnets in the manner to be explained presently. Attached to the armature, *c*, is a metal tongue or flat spring, *d*, the function of which is important and will be explained later on; *e* is an adjusting screw, by the variation of which the play between the end of the screw and the spring *d* may be increased or decreased; *s* is a light retractile spring attached to the armature for the purpose of drawing the latter away from the magnets when the electric current ceases to flow; *l* and *m* represent what are called binding posts, or wire terminals. They are screws for the purpose of making a firm connection with the ends of the wires *t* and *u*; *n* represents a push button and *p*, p^1 two cells of battery.

It will be noticed that in the push button the ends of the two wires are separated, and there is no apparent connection between them. That is the normal condition of the push button, but by pressing the knob (not shown in the diagram) the two wire ends are brought together, which closes the circuit.

Now let us see what takes place when we push the button. The circuit closes first thing and immediately a current of electricity flows through the wire. Let us trace its course. Starting from the battery cell, *p*, going to the left, the current flows to *l* where it is connected with the short wire running to magnet *a*. It then flows through the wire of magnet *a*, then passes around magnet *b*, thence to *k* through a short connecting wire. The current then passes from *k* through the armature *c* to the tongue *d*. As the armature is drawn back against the screw *e* by the spring *s*, the current flows on through *e* along the short wire to the other binding post, *m*. From thence it continues along *t*, to the push button *n*, and back to the battery, thus completing the circuit.

When the circuit has been completed by pushing the button, the magnets being charged with electricity attract the armature towards their poles. This attraction causes the connection between the tongue *d* and the screw *e* to be broken at *f*. This, of course, breaks the continuity of the circuit, and the cessation of the current causes the magnets to lose their magnetism, and the armature is drawn back against screw *e* by the action of the spring *s*. The moment the connection at *f* is re-established the current again flows and the magnets attract the armature towards them as before. In so doing the circuit is again broken at *f*, and the armature falls back, only to be immediately attracted by the magnets the moment the circuit is closed at *f*. These actions are repeated with great rapidity as long as the circuit is kept closed at the push button, but the moment we release the pressure there the circuit is opened at that point and no current can flow until it is again closed.

The bell or gong, *q*, is so placed on electric bells that the hammer will strike it before the latter is drawn back by the force of the retractile spring *s*.

It should be explained that the broken lines shown in the illustration represent the electrical connections with the different parts of the bell, and are part and parcel of the apparatus itself. The unbroken lines represent the connections *outside* of the bell.

Having thus described the general construction of an electric bell and its action, we will next consider the push button and the batteries used for this class of work.

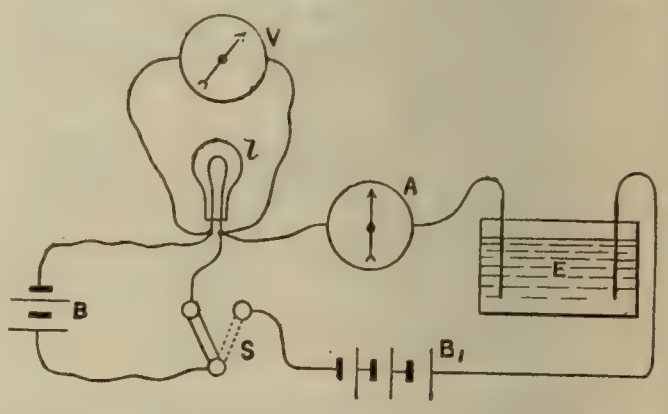
(*To be continued*).

TESTING PRIMARY BATTERIES.

The following method for testing small primary batteries designed for lighting small incandescent lamps, is recommended by Mr. I. Probert in the London *Electrical Review*.

It is found impossible to determine the exact amount of current flowing by the direct use of the ammeter, as the resistance of the latter, although low, is usually sufficiently great to materially reduce the current when the instrument is inserted in the circuit. The method herewith described is said to overcome this difficulty entirely. The illustration shows the connections.

The battery, B, to be tested, is joined up to the lamp, *l* (which has a voltmeter, V, across its terminals) the switch, S, being turned to the position shown. Under these conditions the battery works direct on to the lamp which glows at its full brilliancy, and the voltmeter, V, gives the voltage between the lamp terminals. In order to determine the current, the switch, S, is turned to the position shown by the dotted lines; this brings into circuit



METHOD OF TESTING PRIMARY BATTERIES.

the auxiliary battery (preferably small portable accumulators as they have a low resistance) the ammeter A, and the electrolytic cell, E. The current from B, although reduced by the resistance of the ammeter, is reinforced by the auxiliary battery B_1, and by adjusting the distance between the plates of the electrolytic cell the current can be adjusted to the greatest nicety, until the deflection on V is the same as it was previous to the turning of the switch, S, hence the ammeter, A, now shows the current which under the latter conditions was flowing through B. The observation being taken on A, the switch, S, is turned back to the position shown in the figure and the battery, B, continues to work under the practical conditions.

It should be added that by this arrangement not only can the true energy expended in the lamp be obtained for the stated candle power, but by removing the lamp from the battery, and adapting it to a movable bridge astride a suitable mercury trough, the light can he easily measured without interposing unnecessary resistance between the battery and its lamp.

CARE OF NEGATIVE PLATES.—When the negative plates of a storage battery are removed from the cells, they, on drying, become hot; and this is probably due to the finely divided lead they contain oxidizing in air. Negatives exposed to the atmosphere for a length of time, especially if it be moist, show signs of blistering in use. This is very troublesome, for the blisters frequently become detached in the form of scale, which sticks between the plates, thus partially short-circuiting them and eventually causing the positives to sulphate.

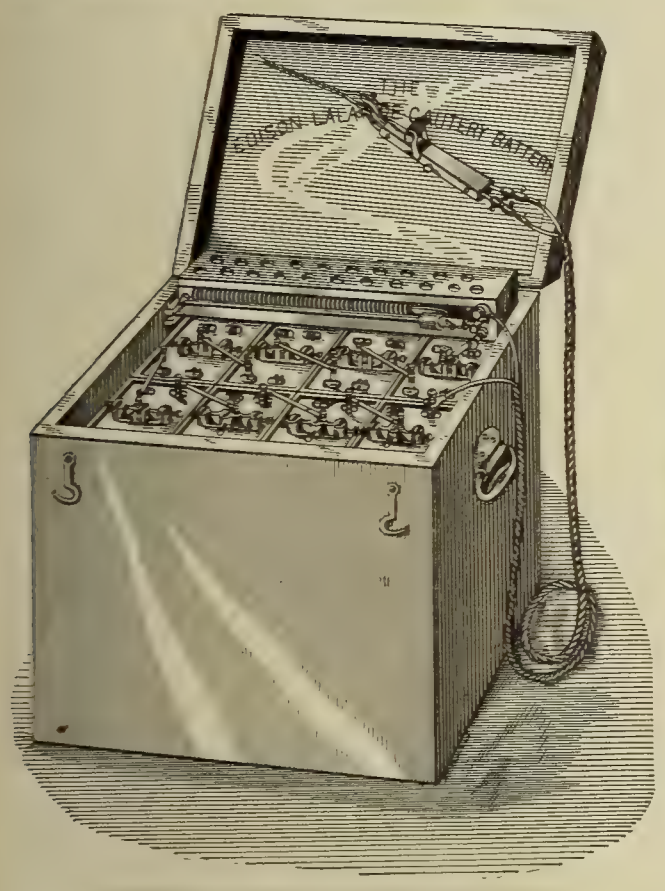
The New York *Commercial Advertiser* will move into its new building, No. 29 Park Row, in the early part of April. One of the features of the new establishment will be the running of the presses by electric motors.

CAUTERY BATTERY.

The use now made by physicians and surgeons of electric current and electric appliances is so extensive as to warrant special effort in adapting apparatus to their necessities, especially where it is evident that a number of advantages can be gained.

The Edison Manufacturing Company, of Orange, N. J., in order to meet the demand for an efficient battery for use in these professions, has recently adapted the well-known Edison-Lalande Battery to this purpose, and it has been brought out in a form which renders it particularly suitable as a part of the medical cabinet or outfit.

We give herewith an illustration of a battery of eight of these cells, enclosed in a finely finished oak box. The case of each cell is hard rubber, and



EDISON-LALANDE CAUTERY BATTERY.

the connection between the cells are effected by means of nickel plated straps. The resistance is included in the outfit, and is placed in a very novel manner in the top of the case on a little hinged lid that can be thrown up so as to expose all the battery cells clearly to view.

The resistance consists of a metallic tape, and operates after the manner of a fishing reel or ordinary yard measure. It is pulled out to any length required, and when the proper resistance is obtained, the tape is held at that point. As the battery current falls off the tape can be released and rolled up automatically, gradually or all at once, as desired.

As is well known the usual cautery knife requires a volume of 15 to 20 amperes of current to keep it at white heat. In practice, the cautery knife is used only a few seconds at a time, but should it be necessary to use it for an extended period, it may be kept at white heat for eight hours with a single charge, and there will still be sufficient current to maintain the ordinary snare at proper heat for many hours.

The prominent features of the Edison-Lalande cell are its low internal resistance and its great constancy, rendering it available equally for both open and closed circuit work.

The whole outfit as shown in our illustration is extremely neat and portable, and it possesses many advantages over batteries of other makes designed for this work.

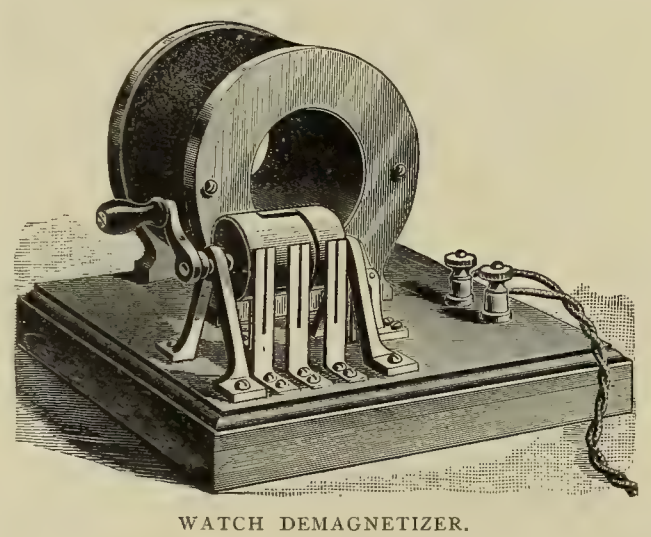
Effect of Different Windings.—The volts in the shunt dynamo fall, whilst those in the series rise as the current rises. By employing compound winding, the mean of the two effects is obtained, and the volts can be kept practically constant over a wide range, without change of speed.

THE BERLIN DEMAGNETIZER.

Since the general adoption and use of heavy currents of electricity, it has been difficult to secure immunity from magnetization for the watches that get into the magnetic field of dynamos or other magnets. Most people who carry a watch are familiar with the fluctuating time-pieces, caused by their coming into too close quarters with magnetic circuits, and they often feel the need of knowing the address of a watchmaker having the necessary apparatus to demagnetize their watches.

A good reliable demagnetizing machine is indispensible to the work shop of every watchmaker having the care of fine watches, and valuing his reputation.

The Berlin Demagnetizer, of which we give herewith an illustration, is said to fill this long felt want, and, it is claimed, can be relied upon to remove all traces of magnetism from the most delicate watch without injury.



WATCH DEMAGNETIZER.

As will be seen from the cut, it consists of a coil of wire within whose field of force the watch is moved, and a commutator for rapidly changing the direction of the current in the coil.

The coil is made of solid rubber, mounted on brass-nickled standards, and is covered with purple velvet. The binding posts are made to keep the thumb-screw parts from coming off. The key is done away with, and the commutator slides on its bearings, making the contact the same as in the old magneto bells.

The demagnetizer is an attractive and necessary addition to a watchmaker's outfit; is made in cherry with brass and nickel trimmings, and is but 10 x 10 inches and 7 inches high.

The coils are wound for either arc or incandescent circuits, and by furnishing information as to quantity and pressure of the electric light current used, are furnished wound for use on such circuits.

THE FIRST AMERICAN PATENT.

In connection with the Patent Centennial Celebration of the beginning of the Second Century of the American Patent System, by Inventors and Manufacturers, at Washington, D. C., April 8th, 9th and 10th, 1891, it might be interesting to know that the first American patent was granted July 31, 1790, to Samuel Hopkins for the manufacture of potash and pearl ash, and was signed by George Washington, President of the United States, and Timothy Pickering, Secretary of State. All efforts to recover this almost invaluable memorial of the American Patent System have thus far proved fruitless.

Closely associated with this first patent to Hopkins is Thomas Passmore's machine, the "Conjurer for cooking and boiling water," granted February 23d, 1796, which was also signed by President Washington and Secretary Pickering. This valuable relic has been preserved and is now to be seen at the National Museum at Washington, D. C., and will doubtless be an object of great interest to inventors and manufacturers attending the Centennial celebration. The patent of Hopkins is interesting to every American, not only because it is the first American patent, but on account of the signatures attached to it; and the patent of Passmore, not only on account of the same signatures thereto, but also because of its peculiar title.

Very few patents were granted in the first six years of the American Patent System; three in 1790, the first of which to Samuel Hopkins, of Vermont; the second to Sampson Joseph, of Boston, for manufacturing candles, and the third to Oliver Evans, of Philadelphia, for manufacturing meal; thirty in 1791; eleven in 1792; thirty-five in 1793; twenty-nine in 1794; sixteen in 1795 and forty-eight in 1796.

Since 1796 the growth of the Patent System has been wonderful, each year showing a gradual increase until in 1890 the number of patents issued, had reached 443,168.

THE INTENSITY OF TELEPHONIC EFFECTS.

BY E. MERCARDIER.

The intensity of the action of a telephone depends principally on the thickness and diameter of the diaphragm, the strength of the magnetic field and the shape of the magnetic field, and of the magnetising coils. I have already investigated the influence of the thickness of the diaphragm, in a contribution to the *Comptes Rendus* in April, 1889, and shown that for every telephone with a given magnetic field there is a thickness of diaphragm which gives maximum effect.

Influence of the diameter of the diaphragm.—Knowing the thickness of the diaphragm for maximum effect, we can vary its diameter. If we do this we discover that there is also a particular diameter, which gives the best effect. This may be attributed to two causes:—(1) The magnetic field only produces a sensible effect on a limited portion of the diaphragm. So that if we increase the diameter we also increase the proportion of the diaphragm, which, from the point of view of induction is inert, and do not increase the part subjected to induction. (2) By progressively increasing the diameter, we doubtless augment its flexibility, and thus assist its movements; but on the other hand we also increase its mass, and consequently render its movements more difficult. For the necessarily limited variations in magnetic intensity, it follows from this and experiment, moreover, confirms the fact, that the diameter which produces the best effect must be greater the stronger the field. We thus see how telephones of large diameter and relatively strong magnetic field, like the Gower, Pollard, and other instruments, do not give better results than instruments with weaker fields and smaller diameters, as the D'Arsonval, Ader, and Aubry telephones. Hence if we wish to obtain the maximum effect with a given telephone, it is necessary to proportion the thickness and diameter of the diaphragm to the intensity of the magnetic field.

Influence of intensity of magnetic field.—This influence is far from being as great as is commonly thought. I carried out a long series of experiments on this point, magnetizing the soft iron cores of the magnetizing spirals by means of an electromagnet, instead of fixing them as is usual on the poles of a permanent magnet. In this manner it is easy by varying the strength of the exciting current to produce magnetic fields of widely different intensity. On gradually increasing the strength of the field, a limit is soon attained, after which the telephonic effect is not sensibly increased. This is because the diaphragm rapidly becomes magnetically saturated and an ever-increasing number of lines of force pass across it, as one can see by throwing iron filings

* From the *Comtes Rendus*.

on it. Hence an increasing proportion of the magnetic field is useless, so far as the production of telephonic effects is concerned. It must, moreover, be remembered that these effects are due to deformation of the lines of force of the field, and that the stronger the magnetic field the more the lines resist deformation by the waves coming from the voice, and the energy of these waves is necessarily limited. This applies equally well to the receiver, in which the energy of the voice waves is replaced by the energy of the electric waves, which the transmitter has produced. We can thus explain the want of success of the many attempts which have been made to increase the intensity of telephonic effects by increasing the strength of the magnetic field, and how, finally, practical men have decided only to use instruments of small dimensions (which are consequently more manageable) with relatively weak magnets.

Influence of the shape of the magnetic field and of the coils.—It may be said, without exaggeration, that all possible shapes have been tried, but it is evident that, other things being equal, theoretically the best shape is that in which the lines of force are perpendicular to the direction of the coils. That this is so, indeed, M. D'Arsonval has shown in his telephone, and my own experiments on this subject corroborate this conclusion. Moreover the variation of the shape of the field (the source of telephonic effects) can be facilitated by increasing the mobility of the field, and this can be increased to a certain point by increasing the mobility of the magnet, and of the cores of the coils. This result was recently obtained by Aubry, who fixed the magnet to a vibrating plate, but there is a limit to this which must not be passed, and which experiment determines.

It follows from these well-known effects, which I have pointed out, and from my own investigations, that to obtain the maximum effect from a telephone it is necessary:—(1) To increase the mobility of the lines of force. (2) To pass as many lines of force as possible through the coils in a direction perpendicular to them. (3) To diminish the thickness of the diaphragm, until this is just sufficient to absorb the greatest number of lines of force existing in its vicinity. (4) To increase the ratio of the volume of the diaphragm under induction to the total volume, which necessarily leads to diminution of the diameter up to a certain point.

ELECTRIC MOTORS IN NEWSPAPER WORK.

The press, freight elevator, weighing machine and the machinery of the stereotype foundry in the new establishment of the Lancaster, Pa., *New Era* are driven by a 20 horse power Perret motor. The *New Era* people are very much satisfied with the work of the motor. It does not take up as much space as the cylinder of a steam engine of equal power. The machinery in the job department is driven by a 10 horse power Perret motor.

These motors were selected from many others after thorough investigation of their merits as the best adapted for this particular work. The great point in favor of the Perret motor is the fact that it develops its full power at such a moderate speed that renders countershafting to reduce the speed of the main shaft unnecessary. The 20 horse power motor runs at 700 revolutions per minute and the 10 horse power machine at 550.

The Elektron Manufacturing Company, of Brooklyn are very proud of this installation, and, judging from the glowing account given in a recent issue of the *New Era*, they have very good reason to feel as they do.

The Nashua, N. H., Iron Foundry has been installed with a 25-horse power motor, which will furnish the power for the entire works. The electric power will give greater satisfaction on account of the great economy of room.

INDUCTIVE DISTURBANCES IN TELEPHONE CIRCUITS.*

BY J. J. CARTY.

It was not known until 1838 that the earth might be used instead of a return wire in the circuit of a telegraph line. This fact was discovered by Steinheil, while making experiments to determine whether the track of a railroad could be used to complete the circuit instead of a return wire. Steinheil's discovery has been considered as one of the most important in the art of telegraphy, and since his time it has been the almost universal practice to use the earth as a return in telegraph circuits. When, however, the earth return is used with the telephone, it is found that owing to the extreme sensitiveness of that instrument, many foreign currents, which would produce but little effect on telegraph instruments, become a source of serious trouble. For this reason, in telephony it is often necessary to use a complete metallic circuit. Thus it has come to pass that a return to the original practice of employing metallic circuits, as in the case of the crudest telegraph instruments, is now regarded as a most important improvement in connection with that most highly developed of telegraph instruments, the telephone.

To obtain complete freedom from inductive disturbances in the telephone, it is necessary not only to use a metallic circuit, but to place the two wires composing the circuit in a special relation to the source of disturbance. One of the methods of so arranging the wires is shown in Fig. 1.

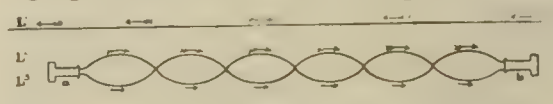


FIG. 1.

In this case the two sides of the circuit L^2 and L^3 are twisted spirally about each other so that their average distance from the disturbing wire L^1 shall be the same. With such a plan, the telephones *a* and *b* are not affected by induction from the wire L^1. This fact has usually been explained by assuming that a current, commencing to flow in L^1, tends to induce two currents in the opposite direction to itself, one in the wire L^2 and the other in the wire L^3; that both currents are of the same strength because the average distance of L^2 and L^3 from the disturbing wire L^1 is the same; and that the telephones *a* and *b* are silent because they are acted upon by two equal and opposite forces. The above theory seems at first sight to be correct, and indicates the line of explanation adopted in many works treating of the subject.†

I have made a number of experiments which seem to prove that in the case described, the inductive action, instead of tending to produce a simple current in each side of the metallic circuit, actually does produce a number of different currents in each wire and in both directions.

In Fig. 2, L^2 and L^3 are two well insulated copper wires, 500 feet long and three feet apart. These wires are joined together at each end through an ordinary telephone. L^1 is a well insulated wire similar to the other two and placed within one-half an inch of L^2. At one end of L^1 is placed a Blake transmitter T and at the other end is placed a subscriber's bell s: L^1 being grounded at both ends as shown. When the transmitter T is operated, either by speaking into it or by vibrating a powerful tuning fork in front of it, disturbances are produced at

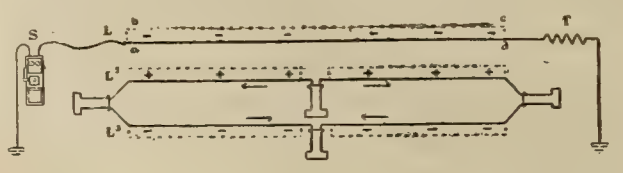


FIG. 2.

the end telephones.

If telephones are inserted at the centre of L^2 and L^3 it is found that at those points no sound is heard, while the noise of the end telephones continues as before. This constitutes a simple case of inductive disturbance, and can only be explained by assuming that the wire L^1 acts electrostatically upon the circuit composed of L^2 and L^3, or in other words, that we are dealing with a system of condensers in series, of which L^1 constitutes one plate, the earth another and the wires L^2 and L^3 two intermediate plates which are joined together through the end telephones.

Let us assume that at a given instant, the height of potential along the wire L^1 is represented by the lines *a b* and *c d*, and the charge upon L^1 by the rectangle *a b c d*. The presence of this charge, which we will say is of the minus sign, is accompanied by an equal but plus charge on L^2. This produces a minus charge on the wire L^3, which in turn acts upon the earth. Now we will assume that the potential on L^1 is reduced to zero. This causes a restoration of the equilibrium in the circuit composed of L^2 and L^3, which is accompanied by a set of currents as represented by the arrows. The plus charge on L^2, flowing through the end telephones, neutralizes the minus charge on L^3, thus leaving a neutral point at the centre of each of the wires L^2 and L^3.

In this and the succeeding experiments the induced charges are represented by rectangles. This

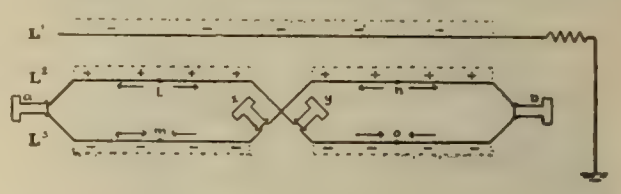


FIG. 3.

is not a strictly accurate method, but as an error in this respect only affects the result quantitatively, and cannot alter the conclusions, I have adopted it on account of the simplicity of treatment which it permits.

The potential along the wire L^1 at a given instant is represented as being constant, as it is found that owing to the high impedance in the instruments, there is practically no fall of potential in the wire itself. Furthermore, it was found in the experiments about to be described that the results were the same whether the disturbing wire was open or connected to earth through the bell s. There would be a fall of potential along the wire L^1 if it were of such a length as often found in practice, and the distribution of the charge would be modified accordingly. But as this fact would only affect the location of the neutral points, the question of the fall of potential will not be taken into consideration, and the disturbing wire will be shown open at one end.

Fig. 3 shows the same circuits as used in the previous experiment, except that the wires L^2 and L^3 are caused to change places at their centres but are continued in the same plane, as in Fig. 2. This is what is called a "transposition." The telephones at the ends and in the middle are retained as before. Under these conditions, when the transmitter is operated, a diminished sound is heard at *a* and *b*; and *x* and *y*, instead of being silent as in the first case, now emit a sound of the same intensity as *a* and *b*. When telephones are placed at the quarters *l*, *m*, *n*, *o*, the sounds at *a b* and *x y* continue as before, but nothing is heard at *l*, *m*, *n*, *o*. The effect of this one transposition has been to reduce the disturbance at the end telephones *a* and *b*, and to cause a shifting of the neutral points from the centres to the quarters, and an increase of their number from two to four.

An examination of the induced charge shows how these results have been brought about. It will be seen by reference to Fig. 3, that there is on the first half of L^2 a positive charge and on the second half a negative charge, and on the first half of L^3 a negative charge, and on the second half, a positive charge. When the positive charge on L^2 discharges half of it goes through the telephone *a* and half through the telephone *y*. The positive charge on L^3 escapes in a similar manner, half going through telephone *x*, and half through telephone *b*. This produces four currents, two starting from point *l*, and two starting from point *n*. One of the cur-

* Paper read before the American Institute of Electrical Engineers, New York, March 17, 1891.

† "A Handbook of Practical Telegraphy," R. S. Culley, 1885, p. 330. "The Telephone," Preece & Maier, 1880, p. 134. "Die Technik des Fernsprechwesens," Dr. V. Wietlisbach, 1886, p. 135.

rents from *l* meets a current at *o*, coming from the point *n*, and one of the currents starting at the point meets a current at *m*, which started from *l*. The currents flowing through the end telephones in this case are not so strong as when no transposition is employed, because they are due to an induced charge which is represented by an area half as great. It is found that as the number of transpositions is increased the number of neutral points is also increased, and that the area representing the charge, which escapes through the end telephones, is reduced. To obtain silence, therefore, it is necessary to increase the frequency of transpositions until the discharge through the end telephones is so small as not to produce sounds therein. Fig 4 shows a circuit containing three transpositions, one at the centre and one half-way between the centre and each end. In this case, if we could neglect the resistance of the telephones, the current going through the ends would be reduced to one-fourth of its original proportions, and eight neutral points would be produced, one in each wire at the centre of each transposition.

In practice the impedance of the telephone must be taken into consideration, so that if in Fig. 3 the middle telephones *x* and *y* were omitted, the neutral points would be found to move towards the

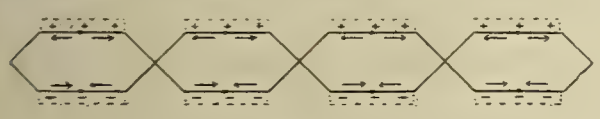


FIG. 4.

ends, and the currents flowing through the end telephones would be correspondingly reduced.

According to this theory of transpositions, if the instruments and distances between wires on a given circuit remain constant, for a given period of alternations in the disturbing wire, the number of transpositions necessary to obtain silence will depend on the E. M. F. of the disturbing wire, and the specific inductive capacity of the dielectric. An increase in the value of either of these factors will, if silence is to be maintained, require additional transpositions, their number depending upon the value of the change which is made.

Where the disturbing wire is placed at an equal distance from both sides of a metallic circuit, no noise is produced in telephones located in that circuit, and a balance once being obtained it is independent of both the E. M. F. of the disturbing wire and the specific inductive capacity of the dielectric. Fig. 5 shows such an arrangement of circuits—L^2 and L^3 are the two wires composing the metallic circuit placed the same distance apart as before, and the disturbing wire is at an equal distance from both. When the disturbing wire is in operation, no sound is heard at the end telephones or at telephones located at the centres. This may be accounted for by assuming that at a given instant a negative charge is on the disturbing wire which produces a positive charge on the inside of L^2 and L^3 and a negative charge on the outside of those wires; and that when the charge is removed from the disturbing wire, a set of currents is set up in the wires L^2 and L^3

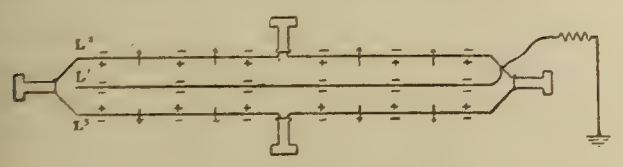


FIG. 5.

in a direction at right angles to their axes, as shown by the arrows. In this case the flow is lateral, and no current passes through the end telephones or through telephones located at the centres. It will thus be seen that this method of arranging wires differs essentially in its action from the plan of using transpositions. Unfortunately, however, its practical application is limited to two circuits.

Where the disturbing wire occupies the position shown in Fig. 5, the flow in the conductors is lateral only when the wires L^2 and L^3 are insulated from the earth. If a ground be attached to the centre of L^3 as shown in Fig. 6, the flow of current becomes longitudinal, and the telephones *a* and *b* are found to be affected by loud disturbances, while the telephone *x*, at the centre of L^2, is found to be silent. This is because the disturbing wire, which we will say is negatively charged, induces a positive charge upon L^2 and L^3 and a negative charge upon the earth. The discharge in this case is affected by two currents starting from *x* which thus becomes a neutral point and passing

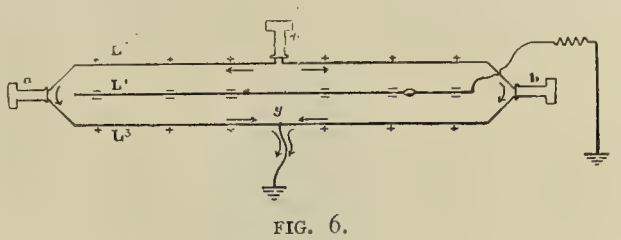


FIG. 6.

through the end telephones to the ground as shown by the arrows. If the ground be removed from the point *y* toward the telephone *a*, the neutral point will be found to move toward telephone *b*, and if the ground be put at the centre of resistance of the telephone *a*, the neutral point will be found to be at the centre of the telephone *b*. This is well illustrated in Fig. 7, where *a* and *b* are telephones of special construction, admitting of the attachment of grounding keys K^1 and K^2 at their respective centres. In this instance, when the disturbing wire is in operation and both keys open, no sound is heard at any of the telephones, the flow of current being lateral. If the key K^1 be closed, sound is immediately heard at telephones *x* and *y* located at the centres of L^2 and L^3, but the telephones *a* and *b* are still silent. This is because the charge and discharge take place along the conductors L^2 and L^3 to and from the earth at K^1, thus passing through *x* and *y*, *a* being silent because the currents go through it differentially, and *b* is silent because it is located at a neutral point. To prove that current flows through telephone *a*, another telephone may be inserted in the ground branch at K^1, and it will be found to be loudly affected. If both keys K^1 and K^2 are closed,

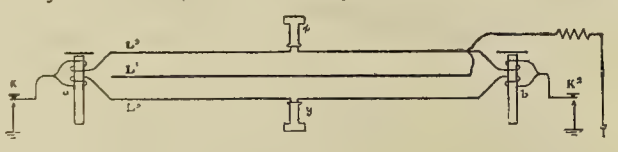


FIG. 7.

silence is again obtained in the four telephones, *a*, *b*, *x*, *y*. In this case the charge and discharge from the wires L^2 and L^3 divide at the centre and flow back and forth at both ends, *x* and *y* being silent because they are at neutral points, and *a* and *b* are not affected by the currents which flow through them because of the differential action referred to.

Two systems have now been described, one in which the induced current is lateral, and the other in which it is longitudinal. I think it follows from the foregoing experiments, that where wires are twisted about each other as shown in Fig. 1, both of these actions are combined. At the left hand of Fig. 8, a cross section of the three wires, L^1, L^2 and L^3 [Fig 1.] is shown. In this position the wires occupy a place with reference to each other exactly as in Fig. 2. and the tendency of the disturbing wire is to cause a longitudinal flow in L^2 and L^3. If repeated cross sections of these wires are made, a point will be reached at which the three wires are disposed as shown at the right hand of Fig. 8, where it is seen that the disturbing wire L^1 is at an equal distance from L^2 and L^3, and the tendency is to produce a lateral flow. The actual currents produced must be the resultant of these two actions.

Fig. 9 shows a plan quite different in principle from anything heretofore employed. It is of interest not so much on account of any practical application which it may have at present, but because it is a very striking proof of the electrostatic nature of induction between telephone circuits.



FIG. 8.

L^1, L^2 and L^3 are the same wires as used in the previous cases, L^1 being half an inch from L^2, with the addition of an extra wire L^4 placed half an inch from L^2 and joined by conductor *w* with the disturbing wire L^1. L^2 and L^4 are three feet apart. When in this condition the transmitter is operated, no disturbance whatever is heard in the end tele-

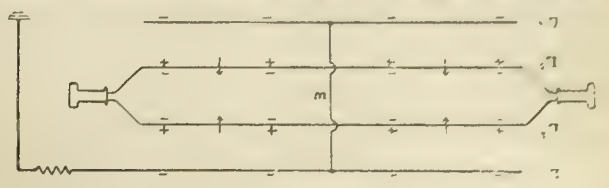


FIG. 9.

phones; if the wire *w* be disconnected, the usual noise is heard, but is found to disappear as often as L^1 and L^4 are joined together. This action is explained by the fact that L^4 is at the same potential as L^1, on account of their being joined to it by the wire *w*, and acts with the same force on L^2 that L^1 does on L^2. The flow in this case is lateral, as indicated by the arrows; and the telephones are silent.

Neutral points may be produced in a circuit by the use of shunts. Fig. 10 shows the usual arrangement of circuits with the telephones *a* and *b* at the ends, and another telephone *x*, of equal impedance branched between the two wires at the centre. In this case four neutral points are found, two in each wire. The currents produced by the discharge are indicated by the arrows. Thus, by the addition of one shunt, the disturbing currents in the end telephones have been reduced one-half. If similar shunts were placed at the quarters, the currents at the end telephones would be still further reduced to one-quarter of their original strength.

This plan is not a practicable one because of its shunting effect on the telephone current, but is of value as showing one of the actions which occur

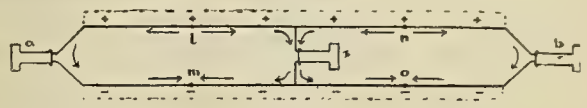


FIG. 10.

when instruments are bridged into metallic circuits. It is interesting to note that in Fig. 10 the telephone *x* is affected by a current twice as great as that which flows through either of the end telephones.

Before closing I shall describe one more experiment. In Fig. 11, L^1 is the disturbing wire and L^2 is a grounded telephone circuit placed one half an inch from L^1. At the centre of L^2 there is an ordinary telephone repeating coil or transformer c, containing two windings *e* and *f* of copper wire, each having a resistance of 160 ohms. One end of each winding is grounded, and the other end is connected to the line as shown. Assuming that the impedance of each telephone is equal to that of each coil of the transformer, a neutral point will be found at the centre of each half of L^2, and the disturbing currents flowing through the end telephones will be only half as strong as is the transformer was omitted. If now the connections of the transformer be reversed so that the discharges from the two sections of line pass through it in opposite directions, no magnetism will be produced in the core *k*, and consequently the transformer coils offer an

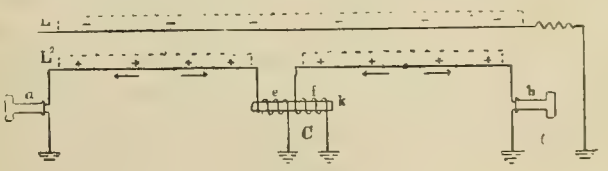


FIG. 11.

easier path to the discharge. This causes the neutral points to move toward the end telephones and consequently reduces the disturbance still further.

I have not had an opportunity of trying this experiment with a transformer whose coils contained a low copper resistance and a high inductance, but according to theory, we might expect that such a transformer having its coils connected differentially, should free a grounded line of considerable length from cross talk and other electrostatic disturbances. The number of such coils which can be worked in a given line is of course limited, but with properly designed apparatus a

large number of them might be used. This arrangement is also interesting when considered with reference to electro-magnetic induction, and brings to mind a question as to whether we may not at some future time abandon the use of metallic circuits and again make use of Steinheil's discovery.

[Supplementary Note, Communicated to the Secretary, by Thomas D. Lockwood.]

I understand that Mr. Carty's paper is to be read this month. If in that understanding I am correct, I regret exceedingly that it is not in my power to be present with you in a tangible form. It is, moreover, difficult to make a written communication upon a topic which as yet is unannounced, but as I have some reason to believe that Mr. Carty will speak upon the subject which he has largely made his own, I will have the temerity to hazard a word or two.

If Mr. Carty continues to hold the views of two years back, I understand him to believe that electrostatic in contradistinction to electromagnetic induction is chargeable with the major amount of discredit as an agency in disturbance on telephone lines; or at any rate, that it is a much more important agent in the development of such disturbance, whether noise or cross-talk, than has been supposed.

From long experience and observation, it appears to me that the several agencies in causing disturbing phenomena in telephone circuits which manifest themselves in the telephone receiver preponderate largely in accordance with the conditions of the circuit; that the environment (to use the language of social science) of a telephone circuit has a good deal to do with its behavior. Thus a line which has considerable leakage uniformly distributed throughout its length will suffer very little from electrostatic induction either manifested as a disturbance or as a retarding agency; not because the electrostatic induction is not exercised, or is not present (or to put in a more modern and I think a more correct phraseology) not because inductive circuits are not formed; but because there being by virtue of the leakage or poor insulation an opportunity for a number of short cut or cross conductive circuits, these are utilized for the conduction of the electricity, permitting the establishment of equilibrium or discharge, at the expense of the utilization of the inductive circuits which tend to retain charge. The phenomena exhibited is comparable to a gallon vessel, say, in which liquid may be poured; but which has a number of holes bored through its sides. The vessel has a capacity of one gallon, but being leaky does not hold its charge, and the said charge is dissipated as quickly as it is formed. In this case, leakage tends if accentuated, to become the chief adverse agency, as not only does a leaky circuit dissipate induced charges quickly, but it also permits stray currents which may disturb, to come on the line from external points.

As a matter of fact the several disturbances upon telephone lines are due to a large variety of causes. It is customary to say that the telephone is an extremely sensitive electroscope, or galvanoscope; and that it will take cognizance of almost infinitely small currents. This statement, however, should be made with some reservation.

The more correct statement is of course, that the telephone is a sensitive indicator of *changes* in electrical currents.

A current may be caused to circulate through its helices which is sufficiently strong to make them warm, but if that current be steady, it will not be able to produce a sound in the telephone. Telephone disturbances then, broadly stated, can result only from changes which occur in the electric condition of the circuit within which the telephone is included, and these changes may be produced by conduction from other electrical organizations; by electromagnetic induction, sometimes brought about by changes going on in substantially parallel circuits, and sometimes caused by the mechanical motion of the disturbed circuit itself in a magnetic field; as when a line swings across the magnetic meridian of the earth and by the successive charges and discharges which cause the alternate completing and disrupting of electrostatic inductive circuits.

If we exhaustively examine the literature of the subject we shall find that the idea that electrostatic phenomena are concerned in disturbances of telephone and telegraph circuits, is by no means new. Mr. Culley presented a paper once upon this subject, before the Society of Telegraph Engineers; which paper, together with a most instructive discussion, is published in the journal of that society, and Mr. Preece and myself from time to time have also repeatedly referred to it. It is due, however, to Mr. Carty to say that his considerations and researches in this line show him to be an original and independent thinker and observer, and that I have found his work to be instructive in the highest degree.

I think while he is undoubtedly right in attributing a large share of inductive disturbance in telephone lines, that he does not give sufficient weight to the equally undoubted fact, that electro-magnetic induction is also an important factor; and that, as I have already pointed out, the conditions of any individual circuit largely govern its action. An interposed plate or an envelope of metal between the disturbed and disturbing circuits, will, if sufficiently thick, and if united to earth, screen so much of the induction as is electrostatic in its origin; but it will not screen electro-magnetic induction; and thus whenever it is worth while the sources of inductive disturbances can be analyzed. And while the inductively neutral metallic circuit,—the circuit with two wires closely adjacent and twisted together,—is indeed a specific against electro-magnetic inductive disturbances; it also tends to increase the retarding effect of electro-static induction exercised between the two wires of the circuit.

Some of the considerations which tend to delay the universal employment of metallic circuits in telephony are, however, that there are an immense number of wires even when but one is used to a circuit; that twice the number of wires means twice the number to get out of order, to cross, break and leak, and consequently twice the number to take care of, and handle.

I hardly think that sufficient thought is given to these matters by many who talk glibly about the necessity and essentiality of using metallic circuits only, for all classes of telephone work.

In conclusion I wish to suggest, that inasmuch as the telephone only notes electrical changes, we cannot accurately say that sounds can be produced in it by electrostatic charge.

It is the fact that it is the motion caused in the act of forming and dissipating charge that produces the disturbing sound. But a charge in the act of formation or dissipation is practically a current; and as a current in the act of change, it necessarily varies also the magnetic field constituted by the circuit within which it is circulating; and as a further consequence therefore sets up in an adjacent and disturbed circuit electro magnetic induction currents. Thus the disturbing action is a compound one; operating first by the successive inductive charges and discharges induced in the disturbed circuit, by the changes occurring in the disturbing circuit; and secondly, by electro magnetically induced currents developed in the disturbed circuit by changes in the magnetic field constituted by the disturbing circuit.

Electrical Investments Pay.—It is reported that the Vanderbilts have secured additional interest in the Edison General Electric Company. The story goes that these financiers are satisfied that electrical properties are a paying investment. It is for investment only that they are purchasing electrical stocks.

NUMBERING AND RECORDING ARC LAMPS AND LOOPS.

BY W. H. MARKLAND.

Some time ago I inaugurated a system of numbering and recording arc lamps which has worked well in practice and may be of assistance to others.

My plan briefly is as follows: The dynamos are lettered "A," "B," "C," etc., and the loops, or lamp circuits, are numbered 1, 2, 3, etc.

In numbering the position of lamps, be they hanger board or pole inside or out, the number of loop or circuit is indicated by numbers to the left of a decimal point, and the number of lamps starting out on the positive wire by numbers to the right of the decimal point, thus: the first lamp on loop one would be marked 1.01, the next 1.02, etc. The first lamp on loop 2 would be marked 2.01, the tenth lamp 2.10, the twentieth 2.20, etc. On loop 12, the first lamp is marked 12.01, the tenth lamp 12.10 etc.

As before mentioned the number to the left of the decimal point indicates the number of the loop, and that to the right the number of the lamp. This plan as can readily be seen is easily remembered. A person familiar with the loops can tell the number of any particular position of a lamp by simply counting the lamps on the loops.

If additional lamps are put up they can be given a higher number than those on the loop; or, if only a few intermediate lamps are added they can be numbered with a third number to the right of the decimal; thus, if two lamps are put on loop one between 1.01 and 1.02, they could be numbered 1.011 and 1.012. The men would readily remember these numbers as they are different from the regular run. When a loop gets too badly mixed up it is a short job to renumber.

A tin tag having a number painted on it is nailed to the lamp board or the pole. Where the poles or hanger boards are numbered from one up, without reference to loops, it is difficult to remember on which loop the lamps are run, the number not indicating the loops. By this plan the loop number is always known. Trimmers notice the numbers while trimming and become familiar with them very readily.

I consider it is very much better to number loops than to name them, it being much easier to tell the dynamo man to put on loop 1 at 6 P. M., than to say "Put on Jersey Swamp loop at 6 P. M."

In the dynamo room a sign is posted, giving the number of the loops, where they go, and the number of lamps on each.

The trimmers and inspectors in making out reports of lamps simply report lamps of such a number as giving trouble. The blanks for inspector's reports are made out as follows:

"S"—Started Lamp No —
"U"—Unable to Start Lamp No.—
"A"—Adjusted or Repaired Lamp No.—
"R"—Renewed Lamp No.—
"G"—Globe put on Lamp No.—

In the log book, which need be nothing but a common blank book or ledger, a line is used for each lamp. When anything goes wrong a record of it is made thus: Suppose on March 14, 1891, the inspector reports it necessary to start lamp 1.08. On the line for that number would appear "1.08 S, 3/14/91,"—the letter "S" indicating what was wrong and followed by the date. If three days later the lamp would not burn, the record would appear thus: "1.08 S, 3/14/91. U. 3/17/91;" if afterward the lamp was adjusted or repaired the entry would read: "1.08 S. 3/14/91. U. 3/17/91. A. 3/17/91." If it is necessary to replace it with a new or repaired lamp, this would be the record: "1.08 S. 3/14/91. U. 3/17/91. A. 3/21/91. R. 3/24/91;" or if a globe was put on, a "G" before the date would be used to indicate what was done to that lamp.

In the same book a record of each lamp should be kept giving the number, position, kind of lamp, how hung, and the date put in service; also a route

diagram giving the run of the wires, their position on the poles and to which lamps they go. A trouble report of dynamos, etc., should also be kept. One very important point is to date everything entered.

This plan as can readily be seen takes but little space in a book, and gives clear and accurate information. At a glance it is possible to tell where the difficult places to maintain arc lamps are.

This plan can be further extended if desired, by putting the maker's number of the lamp under the year. A lamp when repaired should be as good as new.

A very simple manner of telling the cost of running arc lamps is as follows:

HOURLY RECORD OF ARC LAMPS, MARCH, 1861

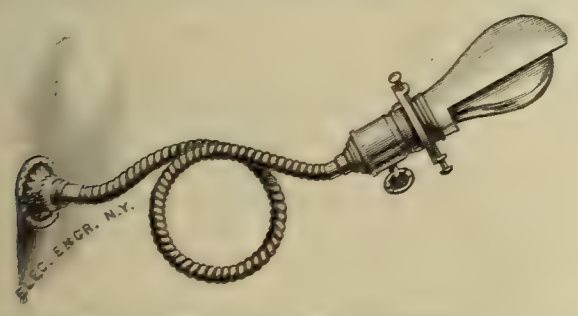
Loops	Dates 1 2 3 4 5 6 7 8 9 10 etc.	Total Hours for Loop.	Lamps	Total Lamp Hours
1				
2				
3				
4				

By entering every day the number of hours a loop was in use, and at the end of the month adding these hours together and multiplying by the number of lamps on the loop, total hours for one lamp is obtained. By adding together the total or lamp hours for all the loops, and dividing that into the cost of running the plant, the cost an hour per lamp is readily obtained. This gives one of the very best of records.

FLEXIBLE TUBING.

A very novel method for constructing tubing for electric light purposes has recently been devised and an illustration of the tube is given in the accompanying cut.

This tubing is a made-up structure, and consists of a spiral metallic spring, between the coils of which is closely fitted another spiral coil of a cross section triangular in shape. This method of construction gives remarkable flexibility to the tubing, rendering it possible to twist it into almost any desired curve. It remains fixed in whatever shape it is twisted, and this feature permits of placing the lamp in any desired position. For desk or any



FLEXIBLE TUBING FOR INCANDESCENT LIGHT FIXTURES.

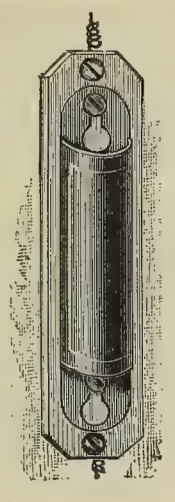
work where it is necessary to change the lamp from one position to another this tubing is of great practical value, and this feature of the invention will be greatly appreciated. Incandescent lamps as now used have a very limited range of change in position, and very often it would be more convenient to have them placed at different angles. But this can not always be done under the present methods of hanging or fixing lamps.

The McCreary Electrical Specialty Company, No. 18 Cortlandt street, New York, are now handling these flexible metal fixture tubes for electrical purposes, and 6, 12, 18 and 24 inch brackets are now ready. Special lengths of the tubing are furnished to order.

To Consolidate.—The Citizens'and the Municipal Electric Light Companies, which operate respectively in the western and eastern districts of Brooklyn are, it is reported, about to combine and form a single company. The capitalization of the combination is placed at $2,000,000.

THE "SIMPLEX" BATTERY FRAME.

Our cut shows a simple but convenient arrangement for connecting the well-known capsule batteries of the Nassau Electric Company, No. 112 and 114 White street, to door bell, burglar alarm and other circuits. It consists of a black walnut frame 8½x1¾ inches, upon which are two spring contacts. These springs make a firm contact with the silver



BATTERY FRAME.

wire protruding from one end of the battery and with the zinc cover at the other end.

The battery when in position is protected by a neat metal cover, which can be removed when the battery is exhausted and a fresh capsule substituted, the whole operation taking less than half a minute.

The "Simplex" battery frame is supplied, as shown in the cut, with wires attached to the contact points and all ready to be placed in any electrical circuit.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The National Electric Light Association's headquarters during the Montreal Convention will be at the Windsor Hotel in that city. It is stated on reliable authority that it is probable that arrangements will be made for a very large electrical exhibit, to be open for the entire week.

The following committees were appointed at the recent meeting of the Executive Committee of the National Electric Light Association:

Committee on Amendments to the Constitution.—George B. Shaw, chairman; Marsden J. Perry, Hon. E. A. Armstrong.

Committee on Underground Conduits and Conductors.—M. J. Francisco, chairman; T. Carpenter Smith. A. M. Robertson, John A. Seeley, M. D. Law

Committee on Finance.—John A. Seely, chairman; E. F. Peck, H. H. Fairbanks.

Committee on Transportation.—Mr. Edgar, Montreal, chairman; C.O. Baker, C. A. Brown, Henry D. Stanley, A. J. Corriveau.

Mr. Allen R. Foote at that meeting requested as a personal favor that his resignation as secretary and treasurer of the association be accepted, as he desired to devote more time to work in connection with the electrical department of the United States Census and his economic studies. Mr. Foote's resignation was accepted, to take effect April 1st next. Mr. John W. Beane of Brooklyn was appointed to fill the place, as was noted in our last issue.

NEW ARC LAMP FOR INCANDESCENT CIRCUITS.

The constantly increasing demand for an efficient arc lamp for use on low tension incandescent circuits has led to the production of late of various lamps of this character. What is needed in arc lamps for such use is simplicity in construction and reliability of action. Hitherto it has not been a very easy matter to adapt the arc lamp to an incandescent circuit, but by constant experimentation and thought the ideal has about been reached.

We illustrate herewith the new Loomis arc lamp, which is being brought out by the Eureka Electric Co., No. 18 Broadway, New York.

This lamp is especially designed for use on low tension incandescent circuits, and the Eureka Electric Co. have given it a practical test in their factory during the last year, with most satisfactory results. So successful have these experiments been, that the company now claim to possess the best lamp yet brought out for this class of work. They are prepared to install the lamps two in series on a 110 volt circuit.

The lamp is remarkably simple in its construction, and is free from all complicating mechanism. There are few parts; no clock work and no liquid dash pots.



ARC LAMP FOR LOW TENSION CIRCUITS.

The regulation of the lamp is secured by an electromagnet, whose armature swings perpendicularly, being pivoted at the upper end. The armature carries a lever fixed securely to it, and this lever by means of a clutch effects the separation of the carbons. The upper carbon is fed by its own gravitation.

In order to overcome the objections of sudden movements of the mechanism which affect the steadiness of the light, an air dash pot is provided. This corrects any tendency to sudden action on the part of the armature, and remarkably uniform rate of feed is by this means secured.

The lamps burn without flickering and without hissing, both of which features are of great value and advantage in any lamp.

The simplicity of the design of this lamp, will undoubtedly create much favor for it in the public mind.

Siemen's Armature.—The characteristic feature of the Siemens armature is that the wire is wound lengthwise along the armature coil, which is usually two or three times, or more, longer than its diameter. The advantage of this method of winding is that a greater number of lines of force are cut when rotated in the field of electromagnets.

ELECTRIC RAILWAY NOTES.

The Boston *Record* in speaking of the success of operating the West End electric cars in that city during a recent heavy snowfall, states that it is only a question of time when all the Boston lines will be run by electricity, and that the sooner that time comes the better will the citizens be pleased.

The Thomson-Houston Electric Company, have been awarded the contract for the complete steam and electric epuipment for the Chattanooga and Northside Railway Company.

The Thomson-Houston Electric Company have just closed a contract for the delivery of 40 additional cars to the Cincinnati, Ohio, Street Railway They are also to deliver six new cars to the Pueblo Street Railway Company, Pueblo, Col.

The Denver Tramway Company have decided to abandon the use of the cable on their 18th street line, and will substitute therefor electric power.

Thomson-Houston System will be used on the Wythville, Va. Electric Railway, which is soon to be constructed.

A dividend of 5 per cent. to all stockholders of the Lynn Belt Line Street Railway Company, Lynn, Mass., will be paid July 1st next.

The total number of electric railways in operation in the United States on March 1st, 1891, was 327. The various systems were represented as follows: Thomson-Houston, 129; Edison, 121; United Electric Traction, 15; Short, 13; Rae, 13; VanDepoele, 8; Westinghouse, 7; Thomson-Houston and Sprague, 6; Thomson-Houston and Edison, 3; Storage Battery System, 3. The total mileage of road at the same date was 2,852.

LEGAL.

It is reported that the Tropical American Telephone Company, is about to bring suit against the Western Electric Company for infringement of the "Hynes" drop patent for manufacturing and selling "Williams" drops since April, 1890; also against the New England Telegraph and Telephone Company, for using the "Williams" drop in many of its exchanges throughout New England. The City of Boston, it said, has surrendered two "Williams" switchboards containing one hundred "Hynes" drops, at the suggestion of the Tropical American Telephone Company.

The Trinidad Heimann Insulated Wire Company, New York, has been placed in the hands of a receiver. The works of this company are at Harrison, N. J., and the application for receiver was made in Newark, N. J. Mr. Jeremiah O'Rouke was appointed receiver by the Chancellor on March 17th. Mr. O'Rouke, it will be remembered, was the receiver in New Jersey for the Callendar Company. The New York offices of the Trinidad Heimann Insulated Wire Company is at No. 189 Pearl street.

TELEPHONE NOTES.

The inaugural telephone talk between London and Paris over the new land and submarine cable line, took place on March 17th, amid considerable ceremony. Mme. Roche, wife of the French minister of Industry and the Colonies uttered the first words over the new line, from Paris. M. Roche subsequently held a conversation with Postmaster-general Raikes of Great Britain. Many other persons of note held conversations over the wires.

Mr. Moses E. Hatch, superintendent of the Southern Massachusetts Telephone Co., New Bedford, Mass., will retire on account of ill-health. It is said that Mr. James P. Francis will be appointed to fill the vacancy.

The Hudson River Telephone Co., has purchased a lot 21x85 feet on the corner of Chapel St. and Maiden Lane, Albany, on which they propose to erect a three-story building for their headquarters. The new building will cost about $25,000.

A bill is now pending before the State Legislature of Pennsylvania with the object of effecting a reduction in telephone rates in that state. Much opposition is urged against the bill by the telephone people, who claim that they will be unable to continue business under the provisions of the bill if it passes

It is stated on the authority of a daily paper of the 21st inst., that a meeting of the Telephone Subscriber'ss Association of New York, was held on March 20th, to protest against the high rents of telephones. A proposition was made that every telephone subscriber in New York and Brooklyn, be requested to contribute $2.00 towards a fund to pay for printing and circulating documents, etc., and also to pay the expenses of a representative in Albany, to look after a bill which they proposed to have introduced before the Legislature. The Association will continue its efforts until these objects are accomplished.

The Tropical American Telephone Co., Boston, have just received a large order from the United States Consul at Cienfuegos, Cuba, for a "Universal Long-Distance Berliner Set," with which to equip the fire department of that city.

The Bermuda Telephone Company report that their new Tropical Telephone sets have been tested in service, and are perfectly satisfactory, both as to price, as well as action.

PERSONAL.

Mr. John W. Beane, who has been appointed secretary and treasurer of the National Electric Light Association to succeed Mr. Allen R. Foote, was educated at the United States Naval Academy and graduated in 1873. He served as officer in the navy for six years and then resigned to enter business in civil life. Since then he has been connected with various electrical concerns, and recently held a special commission from the United Edison Manufacturing Company, in connection with their business in New England. Mr. Beane is well and favorably known in electrical circles, and all the members of the Association and others interested extend to him their cordial wishes for success in his new position.

Mr. J. S. Speer, secretary of the Partridge Carbon Company, of Sandusky, O., was in New York last week in the interest of his concern. While here he closed with Alexander, Barney & Chapin to act as the Eastern agents for his company. Alexander, Barney & Chapin will handle electric light carbons and carbon specialties manufactured by the Partridge Carbon Company.

Mr. S. R Hatch, formerly of Hudson, N. Y., has accepted a position as electrical engineer with the San Gabriel Mill and Mining Company, with headquarters at Azusa, Cal.

Mr. A. J. Corriveau of Montreal, was in town last week, and paid his respects to the ELECTRICAL AGE. He reports great interest in Canada in the coming convention of the National Electric Light Association in Montreal, and he finds much enthusiasm among those interested on this side, with every indication that efforts will be made to make the Montreal Convention a great success in every particular. Mr. Corriveau is interesting himself in an effort to secure the attendance at the Montreal Convention of prominent persons in the electrical science, such as Mr. T. A. Edison, C. P. Brush, M. M. M. Slattery, F. B. Crocker and others.

NEWARK CORRESPONDENCE.

The C. McIntire Co., of 1315 Franklin street, Newark, N. J., are furnishing all the fuses from 150 to 200 ampere capacity for station work, and all the fuses for the fuse boxes on the electric cars running on the Newark Passenger Railway Co., and the Rapid Transit Company's systems. They are also furnishing all the fuses for the Interior Conduit and Insulation Company's junction boxes. This company is making fuse-wires a specialty in connection with their metal 'erminals. The fuse wire is furnished for any carrying capacity from 50 to 100 amperes. The connectors and terminals of this company's make are having a big sale. Forty-five hundred connectors were the number on an order shown a representative of this paper. This company has just received letters-patents from Great Britain and Belgium for their connectors. They have been furnishing lately, and are receiving excellent orders for the same, compressed copper sleeves for office and inside work, doing away with soldering, which effects a saving of 75 per cent. of the labor of soldering and making joints. They make perfect joints. These copper sleeves are made to fit any size wire, so that in place of soldering the joint, you clean off the end of the wire and introduce it into the copper sleeve, after which you compress the tube with pliers, making it one compact mass.

Baker & Co., No. 408 N. J. R. R. avenue, Newark, N.J., are said to be the largest refiners known of gold, silver and platinum. They are also said to be the only refiners of of crude platinum in the United States. There is no doubt as regards the facilities of this company for refining the crude material of these three fine metals. The demand for platinum has so increased within the last few years that it has been the means of somewhat reducing the price. The present price of platinum was never closer. One of the causes is the fact that Russian exchanges are advancing, Russia being the headquarters for the mining of platinum. The state of affairs in this country has had the effect of stiffening the price of this valuable metal. At the price at which platinum is sold to-day, every large user of this metal ought to avail himself of this opportunity and lay in a large stock for future use. Now is the time to do this.

The McIntire Manufacturing Company, of 1315 Franklin street, Newark, N. J., electrical manufacturers and contractors, are dealers in everything electrical, from an electric light plant to a speaking tube, including motors, fans, lamps, bells, household specialties, testing instruments, household wiring, etc. The officers of the company are C. H. McIntire and J. H. Wesler, two industrious and ambitious young men. Mr. McIntire, as is well-known, is at the head of the firm which manufactures the celebrated McIntire connectors, terminals, etc. The McIntire Manufacturing Company are just bringing out a new line of switches and cut-outs—switches in all sizes, from a small single lamp switch to a large central station switch, some of which were shown the writer. They are compact, convenient and simple. The company have every facility for producing these goods in large quantities for the trade and buyers generally.

The Hanson & Van Winkle Company, of 219-221 Market street, Newark, N. J., were established in 1820 and incorporated in 1891. They are said to be the oldest house in this country manufacturing nickel and electroplaters' materials, also acids, chemicals, etc., used in conjunction with electroplating generallv. They are manufacturers also of dynamo electric machines for electroplating and electrotyping, plating outfits, and dynamo electric machines for all purposes. They also furnish single and double batteries with tanks for small electroplating outfits, for nickel, gold, silver, etc.

The Backus Water Motor Company, of Newark, N. J., manufacturers of water motors of all sizes, have lately introduced a double cylinder gas engine running vertically in opposite directions from the shaft, so that a steady power can be obtained. They make a specialty of fitting out stores, offices, restaurants etc., with their small fans which can be placed on the ceiling or on a handsome metallic post with the fan at the top, the post resting on the floor. The power runs up through from the floor below. They also make exhaust fans of any size desired for exhausting foul air from poorly ventilated rooms, etc.

Geo. S. Davison, successor to Davison & Driggs, 61 N. J. R. R. Ave., Newark, N. J., has a well equipped machine shop where he gives special attention to the building of machinery of all kinds. Mr. Davison has excellent facilities for the manufacture of electrical specialties of all kinds in large quantities, and solicits correspondence or a call upon him.

The Hewes & Phillips Co., manufacturers of the noted Corliss engines of any horse power, are as busy as they can be on present orders, but are always looking for any new developments in power generally. Their excellent engines may be found in the station of the East Side Electric Light Co., of New York, where two of 700 H. P. are in use. Also the Daft electric power station of Newark, N. J., where there is in use an engine of 500 H. P. Many other large engines of this make can be found in different sections of the United States, giving every satisfaction.

The Watts Campbell Co., of Newark, N. J., manufacturers of the improved Corliss steam engines of all types, are contractors for complete power plants. This firm was established in 1851, and incorporated in 1883. They have had most excellent success in the introduction of their engines, large numbers of which can be found in this immediate vicinity. Several of their engines are in use in the isolated electric light plant in the New York Post Office, and other buildings, and many electric light stations in New York are also using them.

Edward O. Chase, contractor and manufacturer of models for light and fine machinery, dies, tools, etc., makes a specialty of intricate and interchangeable machines. Mr. Chase is located in the handsome Wilson building, 54 Lawrence St.

W. T. H

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., March 20, 1891.

The Central Electric Company, Chicago, are showing a very unique and effective patented dust protector for contact points in bells, telegraph instruments, etc., which the ELECTRICAL AGE will fully illustrate when the cuts are prepared.

The Electric Merchandise Co., No. 11 Adams St., Chicago, W. R. Mason, general manager, has been appointed the selling agents for the Tramway Rail Co., Pittsburg, Pa., manufacturers of steel rails of all descriptions, chairs, tie plates, spliced bars, frogs, switchings, crossings and other street railway equipment. It is not the intention of the company to try any experiments, but to follow well established principles, making all equipment strong and durable.

For good construction in electrical apparatus where insulation is important, the famous Okonite wires have no equal, and this is practically demonstrated by the orders for this wire during the dull season, when all other wires are suffering. The Central Electric Company, who are the general Western agents, booked orders last week for more than 2,000,000 feet of varied sizes, the demand being unprecedented, proclaiming "Okonite still King."

A St. Louis paper is responsible for the statement that the Adams Electric Company has been organized in that city, with Mr. J. W. Slaughter, president, and Mr. H. S. Prichet, secretary and treasurer. The capital stock of the company is $5,000,000. It is asserted that suits against the various companies said to have infringed upon the Adams patent, will be instituted within thirty days. It is further stated that the company has not yet decided just when or where it will bring suit, but hints that Boston may be the place. The company was incorporated under the Illinois laws.

The Central Electric Company are making a special drive on hard rubber goods, offering the celebrated products of the Butler Hard Rubber Company, New York, at prices lower than ever, and making prompt shipments, which is telling with the trade and consumers. They are introducing a compound that takes a good finish, and is specially recommended for its insulating qualities.

PHILADELPHIA NOTES.

The Hale & Kilburn Manufacturing Company, of 48 and 50 N. 6th street, are still crowded with orders for their Patent Car Seats. The company has recently made a shipment of seats for eleven electric cars for the Tacoma & Stielacoom Ry. Co., of Tacoma, and are now engaged on a large order for seats of the No. 71 pattern, to be shipped to the Pacific coast. The peculiar advantages of this new seat for cable and electric cars, are attracting the attention of builders of roads, and contractors for electric railways, and from the remarkable improvements that have been made recently in the electric lines throughout the country, it is evident that we are approaching an age when the uncomfortable crowding of passengers into small illy-ventilated street cars will be a thing of the past. With the great progress in the general equipment of these lines must necessarily come an improvement in the method of seating, and from present appearances it would seem that we shall soon be riding in cars fitted up with comfortable reversible seats, with high backs and spring cushions, such as the Hale & Kilburn people turn out, holding but two persons each, in place of the present hard wooden seats capable of being crowded with three or four more people to a seat than was originally intended. An important feature of this new method of seating is that more people can be seated in a car than by the old method.

H. T. Paiste is sending out some handsome sample boards of some of his specialties, including sockets, switches, cut outs, and shade holders. He is sending them for the cost of the samples alone, which is refunded upon receiving orders amounting to $100. They are gotten up very neatly on a mahogany board.

H. B. Underwood & Co., machinists and engineers of 1025 Hamilton street, have a large force of men engaged in their particular line of re-boring cylinders. This firm receives orders from all parts of the United States, keeping their mechanics on the go at all times. Manager F. Ayer, can be found at the desk busily engaged in booking orders between 7 A. M. and 6 P. M. He says the St. John packing is in brisk demand, and he invites orders.

The Star Electrix Company of Philadelphia, are enjoying a large run of business on their new double pole switches, which are the cheapest in the market. They are besides very neat in appearance, and durable. The popular treasurer of the Company, Mr. D. C. Spruance, is still hustling in the orders, and will this week start on a trip to California in the interests of the company.

Mr. O. D. Pierce of this city will visit Boston this week, purely on a matter of business, and on his return, will put in a day doing New York City, leaving his autograph at the office of the ELECTRICAL AGE.

The firm of Vallee Bros. & Co., of this city have accepted the agency of the Simplex Electric Co. of Boston to handle their wire, etc. This firm has also in stock a large amount of Eureka Tempered Copper for the trade and the enterprising members of the company are doing a fairly good business with much encouragement for future growth of their enterprise. This is an old established house and is well worth the confidence of the trade in general.

H. G. G.

TRADE NOTES.

The Partridge Carbon Company, of Sandusky, Ohio, commenced the manufacture of electric light carbons and carbon specialties in September of last year and they are doing a very active business. They are independent and out of the combine, and are meeting with very great success in the trade. They make a superior quality of goods, which fact alone is sufficient reason for the largely developing trade they are enjoying. The factory has every facility for turning out carbon goods of the highest grade, and in large quantities. The officers of the company are D. F. McIntosh, president; James Partridge, manager; J. S. Speer, secretary and J. G. Wertz, treasurer. Mr. Partridge is the oldest man in the carbon business, and his experience is of course of great advantage to the new company, which to a great extent accounts for the excellence of the goods they turn out.

The journal of the Franklin Institute for March, just, issued contains the report of the Committee on Science and the Arts, on the system of the Interior Conduit and Insulation Co. The committee indorses the merits of the invention, and add that in their opinion it is an improvement of importance and value. In view of these facts they recommeded the reward of the John Scott legacy medal and premium. The same journal contains the paper read before the Institute, December 17, 1890, by Mr. E. H. Johnson, president of the Interior Conduit and Insulation Co., New York, on the system of house and underground wiring of this company.

The Ansonia Brass and Copper Company, Nos. 19 and 21 Cliff street, makes a variety of parts of electrical machines of Tobin Bronze. This metal is suitable for commutator bars and possesses many qualities necessary in material used for electrical machines. When rolled hot, Tobin Bronze is remarkable for its high elastic limit, tensile strength, toughness and uniform texture, and is stronger than ordinary mild steel rods or plates. From the testimonials the Ansonia Brass and Copper Company have with reference to this metal, it is evident that it is giving excellent satisfaction wherever used.

ELECTRICAL FORMULÆ.—In Mr. Fay's article on electrical formulæ published in our last issue, there was a slight error. Equation 10 (page 169) should read:

$$K = \frac{21.58 \times 100}{E}$$

and not $K = \frac{21.58 \times 100}{E} = \frac{L}{2}$ as originally published.

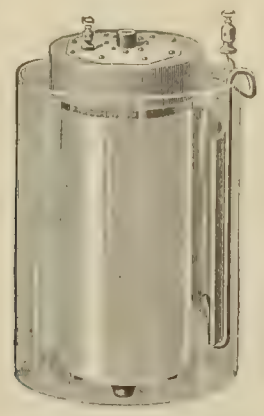
LECTURE.—Mr. E. H. Cutler, manager of the Elektron Manufacturing Co., Brooklyn, delivered a lecture on "Electric Motors and their Construction," before the Department of Electricity of the Brooklyn Institute on March 20th. The lecture was illustrated by examples of the laminated type of motors, and was greatly appreciated by the audience. It was extremely interesting and instructive.

THE TAYLOR BATTERY.

In one of our recent issues we called attention to a new battery which had been put upon the market by Messrs. Taylor & Son, of No. 39 Dey street, New York. This battery was invented by Mr. Theodore F. Taylor, the well known electrician, and expert in the branch of electrical science relating to batteries.

This new battery possesses some admirable features which deserve more than a passing notice. It was gotten up to meet the demand for a constant, clean and cheap battery that would maintain a large current, and the result seems to have been attained to a large degree. There is no local action when the cell is standing idle, and the zinc is thoroughly amalgamated by a process of Mr. Taylor's own invention. The battery is of the zinc-carbon element, and is constructed on a scientific basis with the object of giving a large, powerful and steady current at a minimum cost. It is the result of twenty-eight years of experience in telegraph and electrical work. The best material is used and special care taken to insure low internal resistance.

One feature of this battery is that the zinc element is wholly immersed in the solution. The active zinc surface in the No. 2 cell is twenty-seven and one half square inches. By the total immersion of the zinc, about thirty per cent. of the outlay for that material is saved. The solution around the zinc remains clear and there are no creeping salts.



TAYLOR'S NEW BATTERY.

A No. 2 cell (6x8 inches in size) gives 1.80 volts in open circuit work, and delivers a current of 22.5 amperes on short circuit. The internal resistance of the cell is only .077 ohms. The porous cup holds one pint of the depolarizing solution, which is good for seventy ampere-hours at a cost of six cents. The cell can be set up with a saturated solution of common salt around the zinc.

Some idea may be had of the power of this battery, when it is stated that one No. 2 cell will run an Edison phonograph thirty-three hours, replacing thirty gravity cells necessary to do the same amount of work. Two No. 2 cells and a good series wound motor will run a light sewing machine.

These cells are admirably adapted to electric lighting. A No. 1 cell (12x7 inches) has a capacity of 350 ampere-hours, and a No. 2 cell (8x6 inches) of 70 ampere-hours.

Taylor's depolarizing solution is one of the most powerful depolarizing agents used in batteries. It does not stain the hands and there need be no fear of spoiling the carpets in case the solution should be spilled by accident. Indeed the battery may be put any place in the house without danger of injury to furniture or fabric.

The accompanying illustration shows a cell of the Taylor battery, and any one interested in batteries will do well to communicate with the firm of Taylor & Son, No. 39 Dey street.

MECHANICAL STRAINS IN DYNAMOS.—The mechanical strains in a dynamo which are likely to be injurious are confined to the armature. The chief one is the stress on the conductors, tending to make them slide on the surface of the core. In small machines bands of brass wire wound closely round the circumference produce sufficient adhesion to keep them in place, but in large machines it is desirable to provide a positive means of driving, for which purpose radial metal pegs can be let into the core. A considerable factor of safety is required in all parts of the armature, because accidental short circuits in the external circuit are liable to cause sudden rushes of current, producing enormous transient strains, which may cause the conductors to be displaced and may permanently strain the shaft.

THOUGHT HE WAS GOING TO BOSTON.

While Mr. Louis Walsh, the representative of the Crosby Electric Company, was on his way to Boston last week, accompanied by his decorated "coon," the steamer "Pilgrim" of the Fall River line, on which they were passengers, ran into a schooner while passing through Hell Gate. The surprised negro asked Mr. Walsh: "What under de sun is de matter, Massa?" When told the cause of commotion the darkey said: "Whar are we anyhow, Massa?" The reply, "Going through Hell Gate," brought forth the following remark from the surprised gentleman of color: "Oh, Lor! Is dat where we are done gwine? I thought we was done gwine to Boston."

NEW PUBLICATIONS.

The Canadian *Electrical News and Steam Engineering Journal* is the name of a new paper published on the first of every month in Toronto, Canada, by Charles H. Mortimer. As the name implies, it covers the electrical field as well as that of steam engineering. It is well printed and much care is evidently taken in the selection of matter for its columns.

"Electrical Motors Without Commutators," is the title of a little pamphlet just issued by the Elektron manufacturing Company, 79-81 Washington, street, Brooklyn. In it the company state that on account of the meddling with and negligence to motors in general, and consequent dissatisfaction with the machines, it has become necessary to devise a machine that would practically take care of itself under all possible conditions. The trouble that the motors usually give to users is brought about by improper handling of the brushes and switches, and in order to meet these difficulties the Elektron Manufacturing Company have introduced in their motors self-adjusting switches, which entirely avoid all the annoyances referred to.

Efforts have been made by inventors to abolish the commutator and brushes as being the parts requiring the most attention and most likely to be disarranged through accident or ignorance, but so far their efforts appear to have been unsuccessful. The Elektron Manufacturing Company, however, have got as near to these conditions as possible in the manner referred to.

The Eureka Electric Company, No. 18 Broadway, has just issued a very handsome catalogue respecting the Loomis system of incandescent electric lighting. The advantages of this system are set forth in a very clear manner and all the apparatus used is artistically illustrated. The new arc lamp for low tension incandescent circuits, which we describe and illustrate elsewhere in this issue, is fully and carefully illustrated in the new catalogue. The Loomis System has the reputation of being one of the most complete and efficient in use and a perusal of the new catalogue is quite convincing that the company has just grounds for their claims.

APPOINTMENT:—Commissioner J. P. Barrett, of the World's Fair, has appointed Mr. J. Allan Hornsby Secretary of the Electrical Bureau.

Active preparations are already being made in Montreal for the convention of the Electric Light Association next August.

NEW BOOKS.

THE DYNAMO AND ELECTRIC MOTORS; ALL ABOUT THEM. By EDWARD TREVERT. 96 pp. and several illustrations. Bubier Publishing Company, Lynn, Mass., 50 cents.

This is the latest addition to the series of excellent little works on electrical subjects produced by Mr. Edward Trevert. This last volume explains in a clear and popular manner the dynamo and motor. It then describes some different types of dynamos, which include the direct and alternating current machines. The construction of a dynamo is clearly explained, and the various parts are illustrated on scale. Different types of electric motors are well described, and rules are given for the construction of these machines. The volume ends by giving directions for the construction of an electric battery for electric motors.

This little work will be of great assistance and value to amateurs.

HISTORY OF AN INVENTOR, by Georges Barral, Paris. This is a complete account of the discoveries and travels of M. Gustave Trouvè in the domain of electricity. The volume has over 600 pages and 280 illustrations. An engraving of M. Trouvè is given on the frontispiece of the book. The work is an extremely interesting one and covers every device invented by this energetic scientist, who has produced probably as many electrical devices as Edison himself.

PANTOBIBLION.—A monthly international bibliographical review of the world's scientific literature, entitled *Pantobiblion* will shortly be issued in St. Petersburg, Russia. Each monthly issue of *Pantobiblion* will contain classified lists of all the new scientific books published in the principal languages, including English, French, German, Italian, Spanish, Dutch, Swedish, Danish, Russian, and Polish. A. Kersha, Fontanka 64, St. Petersburg, is editor. Subscription price $6.00 per year.

ELECTRICAL SOCIETY NOTES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the regular monthly meeting of Council held March 17th the following Associate Members were elected.

Adolph G. Greenberg, salesman, Fort Wayne Electric Company, 115 Broadway, New York City, 90 Pierrepont street, Brooklyn, N. Y.; Walter E. Harrington, Managing Electrician, Atlantic City Electric Railway, Atlantic City, N. J.; George W. Tuttle, storekeeper, Sawyer-Man Electric Company, 510 West Twenty-third street, New York City.

The meetings of Council are now held at 5 instead of 7 o'clock P. M. on the third Tuesday of each month, the same dates as the monthly Institute meetings. The change of hour proves to be very satisfactory.

NEW YORK ELECTRICAL SOCIETY.

Mr. Joseph Wetzler is booked to deliver a lecture before the New York Electrical Society, which will hold its next meeting at the New York Electric Club March 27th.

BUFFALO ELECTRICAL SOCIETY.

At the meeting of the Buffalo Electrical Society, March 16th Dr. Lucien Howe delivered an interesting lecture on the effect of electric light upon the eye. "Of artificial lights," said Dr. Howe, "electric is better than gas or oil." Dr. Howe believes the incandescent is the ideal artificial light. The arc light, if properly improved, especially in the matter of steadiness, he thinks might be better than the incandescent.

The Thomson Electrical Welding Company are preparing plans for a new factory at Lynn, Mass., for the purpose of manufacturing projectiles for the army and navy departments of the United States Government.

NEW YORK NOTES.

Mr. A. B. Laurence, 252 Pearl street, is agent for the Shultz Belting Co., of St. Louis, manufacturers of Shultz's patent fulled leather belting, and Shultz's patent leather woven link belts. A special feature of the link belt is the fact that it is all leather, no iron rod or hinge being used in its manufacture. Mr. Laurence makes a specialty of the leather pulley covering. As the cover is bolted under the surface of the pulley the use of cement is dispensed with. The Schultz belting is tanned on the surface only, the interior being the raw hide. The company guarantee no slipping or loss of motion. Mr. Laurence is one of the most active salesmen in this line. Among a few of the latest orders are: Four belts (electrical) 12 inches wide in the Deutcher Verein, a German club of New York; four 14-inch belts in the new Music Hall, Fifty-seventh street and Seventh avenue, New York: two 12-inch belts in the Madison Square Garden, New York; four belts in the Barriett Electric Light Co., 10 Cedar street, New York; one belt for the Union Ferry Co., New York: four belts for the Edison General Illuminating Co., Brooklyn; six belts 10 inches wide for the Edison plant, Lakewood Hotel, Lakewood, N. J., where two 150 H. P. Straight Line engines are being installed by Messrs. Williams & Potter, 15 Cortlandt street, New York. Three 14-inch belts were lately sent to Kobe, Japan, and one was sent to the Rome Iron Co., Rome, N. Y., for electric lighting. Mr. Laurence is having gratifying success with the Pulley Cover. He has lately covered 14 large pulleys for electric lighting companies, and has numerous testimonials from parties using these pulley covers, claiming a saving of 25 per cent. in the transmission of power.

The Crosby Electric Co., Nos. 87 and 89 South Fifth avenue, are sending out "special postal cards," setting forth the advantages of the celebrated dry battery made by this company; and the improved Hussey Bluestone battery; also giving the price lists of each class. The dry battery is made in all shapes and sizes for open circuit work only. It is claimed for this battery that it has no equal for electric bells, annunciators, telephones, gas lighting, burglar alarms, electrical clocks, medical electrical purposes, etc. The advantages of the Bluestone battery over all others of like nature are, absolute cleanliness, very low internal resistance, great saving of zinc, saving of labor, and no destruction of copper. The so-called "special postal card" is about four times larger than the government postal card.

Mr. G. C. Baillard, who has been connected with Messrs. Alexander, Barney & Chapin's A. B. C. Electrical Supply House, 20 Cortlandt street, since its organization, has been a most successful and enterprising salesman for them. Their appreciation of his services has been rewarded by giving him the position of outside salesman in New York, Brooklyn and New Jersey. The writer has known Mr. Baillard for a number of years, and knows his ambition for electrical knowledge, as well as to make himself competent and efficient in the introduction of electrical supplies generally. He will always be found courteous and ever willing to give his customers valuable information, which he has acquired through his long service in the business. We would advise buyers to meet Mr. Baillard before placing their orders for spring supplies.

The McCreary Electrical Specialty Co., 18 Cortlandt street, New York, manufacturers of the new fixture cut-out, the smallest made, is now putting this device on the market.

The Moore Electric Manufacturing Co., 106 Liberty street, New York, in order to accommodate their rapidly increasing business, have decided to move from their present quarters. They will on May 1st move to the corner of Thirteenth and Hudson streets, where they will have four times their present accommodations. They will carry on the manufacture of electrical apparatus and supplies, and will keep in stock a large assortment of wires, etc.

Reed & McKibbin, consulting electrical engineers and electric railway contractors, 32 Liberty street, will on May 1st move into more commodious offices at No. 2 Wall street, corner of Broadway. This firm makes expert work a specialty and furnishes estimates. They also negotiate bonds. They have had nearly eight years practical experience in the application of electrical power for street car propulsion, in designing apparatus and constructing, etc., etc., and are prepared to construct and equip street railways complete under any electric system. Parties contemplating work in this line would do well to first consult with this firm.

The Crocker-Wheeler Electric Motor Company finds business exceedingly good,—so much so, in fact, as to make larger quarters necessary. The company at present occupy one floor in the large brick building fronting upon West Fourteenth, West Thirteenth and Washington streets. An additional floor has just been leased, which will give them ample room. Contemplated improvements consist of special street entrance to the works, a large show room for exhibiting all sizes of Crocker-Wheeler perfected motors, with their various applications, in operation, and a dust-proof department of generous size for the storage of finished motors and motor frames ready for being wound, to fill special orders. The Crocker-Wheeler Electric Motor Company has just issued a handsomely-illustrated catalogue of its perfected motors, which can be had upon application.

Considerable curiosity was aroused at the recent Providence Electrical Exhibition, over a little book distributed by the well-known electrical house of Alexander, Barney & Chapin. It was called the A. B. C. Pole Finder, and its contents consisted of blank leaves, perforated after the manner of a check book. It was a sort of a puzzle at first, but on turning over to the back of the book it was learned what its object was. Found there were the following directions for use: "Detach from the book a strip of paper, moisten by the tongue or with water and place it on a clean piece of wood. Then touch the paper with the ends of both wires (which place near together or far apart, according to whether the current is weak or strong). A red spot will appear on the paper at the point where it is touched by the positive wire, as little as one volt being sufficient to produce the effect. The red spot indicates the positive pole of a dynamo machine or terminal of the anode of a primary battery or accumulators."

Mr. J. A. Rohnberg, president of the Dubuque Street Railway Company was in town last week. He recently made a contract to equip his road with eighteen Accumulator cars on the Edco system. This will be the largest and most full equipped road in the States on this system when finished.

A No. 5 accumulator cell, weighing less than three pounds, has been in use for four weeks on the long distance telephone at the office of Truex & Vail, 44 Broadway. They found one morning lately on arriving at the office, that some person had taken down the 'phone, and left a closed circuit all night. On calling up "Central" everything was found all right. This is said to be the first time an accumulator has been used on a subscriber's 'phone.

The following explains itself:

Office of the Complete Electric Construction Company, New York, March 12, 1891. Messrs. Truex & Vail, 44 Broadway, City. Gentlemen: In reply to your inquiry as to the successful working of storage battery for transmitter work, I respecfully state that I successfully worked small cells of storage batteries with "Blake" and "Hunning" transmitters, for a period of some six months with flattering results. I found the potential to be constant, thereby increasing the volume of sound. In my opinion, for [illegible] board work the storage battery is far superior to the "Leclanche" or closed circuit battery. Yours very truly. John A. Seely, General Manager.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, Electrical Age:

Name of Companies.	Capital.	Par.	Price.
Aluminum Co.	350,000	100 00	$10[illegible] 00
American Motor Co.			5 00
American Private T'phone (Parent)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Amsterdam Electric St. R R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec Light Mfg. Co.	2,500,000	10 00	40
Averell Insulating Conduit	3,000,000	100 00	5 00
Asbury Park L. & P.	50,000	10 00	
Ball Electric Light	2,000,000	100 00	
Bell Telephone	12,500,000	100 00	199 00
Boston Electric Light			105 00
Brooklyn Edison Electric Light	1,500,000	100 00	100 00
Brooklyn Citizens' Electric Light	500,000	10 00	13 00
Brooklyn Municipal Light	500,000	100 00	135 00
Brooklyn City R.R.	6,000,000	10 00	18 00
Brush Illuminating (N. Y.)	1 000,000	100 00	75 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	26 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Consolidated Electric Light	1,929,400	100 00	50 00
Complete Elec. Con. Co, N. Y.	50,000	100 00	175 00
City Electric Street Ry. Co., 6's	200,000		par
Consol Gas & E.L.Co. of West Co.6's	250,000		par
Consol Gas & E. Co. Batavia, 6's	80 000		par
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	
Edison Elec. 5s	2,000 000		*99
Edison Illuminating	4,500,000	100 00	85 00
Edison General	14 000.000	100 00	105 00
East River Electric Light Co.	1,000,000	100 00	80 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Erie Telephone			48 00
Essick Printing Tel.	5,000,000	100 00	75 00
Excelsior	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
East River E. L. Co. 6's	600.000		par
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	13 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	25 00
Hudson Electric Light (N. J.)	100,000	100 00	
Harlem Electric Light Co.	250,000	100 00	70 00
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1.000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's	50,000		par
Laclede Gas Co.	7 500,000	100 00	15 00
Laclede Gas pref	2,500,000	100 00	55 00
Laclede Gas Firsts			*50
Law Telephone			
Long Branch Electric Light	50,000	100 00	75 00
Lincoln Electric Lighting & Pr. Co.	50 000		
Metropolitan T. & T. Co.	2,000,000	100 00	
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light			90 00
Morristown L. H. & P.	50,000	100 00	100 00
Manhattan Elec. Light Co Lmtd 5's	1,000.000		par
Marysville L. & W. Co. 6's	60,000		par
N. E. Telegraph and Telephone			50 00
N. Y. and N. J. Tel. and Tel 6s	1,500.000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	96 00
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North New York, Lighting	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Queen City Elec. Lt. & Pr. Co 5's	100.000		par
Russell Electric Lamp Co. (Boston)	300.000	100 00	90
Rockaway Beach Elec. Light	50,000	100 00	75 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Saratoga Gas and Elec. Light 6s			*86
Shaver Corporation	100.000	1 00	3 00
Swan Incandescent	800,000	100 00	2 00
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Standard Ug'd Cable Co.	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
Thomson-Houston Electric Co.	10,000,000	25 00	45 00
Thomson-Houston Pref.	5,000,000	25 00	25 00
T.-H. Electric Co. 5's.	500,000		par
T.-H. E. L. Co. Yonkers 6's.	100.000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Union Switch & Signal Co.	1.370,000	100 00	
United Elec. Light and Power.	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	2 50
United States Elec. Co			40 00
United States Illuminating	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000.000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co.	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.	3,000 000	50 00	50 00
West End, L. (Boston)			22 00
Winston-Salem Elec. St R.R (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

The Hartford Carpet Company, Thompsonville, Conn., has recently installed a new isolated plant in their factory, using Edison and Mather incandescent lamps.

FINANCIAL.

Twenty per cent. dividend was what caused the "hear! hear!" at the general meeting of the St. James & Pall Mall Electric Company held on the 2nd. inst., after which the capital was doubled and the increase issued as 7 per cent. preference shares with the understanding that the money is to be used to increase the plant which is required by the influx of fresh orders. The accounts were made up to Dec. 31, 1890, and the dividend was chiefly made in the last six months. There are applications in for over 10,000 new lamps, and now the concessions cover the whole of St. James. If this business was located in Alaska, or even New Mexico, how the stock would soar.

Most of our readers have met the banking house of Richard B. Martin & Co., 68 Lombard street, London, in a business way, and of course the rest are aware that Mr. John B. Martin has become one of us, by forming a life partnership with our Victoria (Woodhull). The bank has had a large American clientele for more than twenty years. We have had a personal acquaintance extending over that period, and most cordially recommend all Americans having good business to offer in Europe, to negotiate it through the reconstructed house which has just joined the long list of joint Stock Companies under the corporate name of Martin's Bank, limited, with a capital of £2,000,000 in £20 shares. The subscribers are R. B. Martin, 11,000 shares, J. B. Martin, 11,000; F. H. Norman, 4,000; E. Norman, 3,000; G. Norman, 500; L. Hanson, 500; C. W. Stevens, 250. The first four are the first directors, qualification £5,000; remuneration, £4,000. If they were not so solidly settled in Lombard street, I should expect to meet their "shingle" in Wall street, before the end of the year. There is plenty of international business for them, and American capital with Yankee brains will gladly join a house so well and favorably known on both sides of the Atlantic.

Cristobal de Murrieta & Co., the great South American firm which perhaps did a larger South American business than the Barings, and who were reported in financial difficulty through their connection with the Paris Savings Bank (Societe des Depots et Comtes Courants), get over the trouble by organizing themselves into a joint stock company with £2,000,000 capital, and an extra million in 5 per cent debentures which Trust Companies have taken, the rest being retained by the members of the old firm. A still later complication has arisen by the failure of the Argentine government to deposit with Baring Brothers Company, Limited, the requisite funds to pay the interest on their 6 per cent bonds.

There has been quite a boom in Brooklyn arc shares on the report that the two companies have amalgamated and increased the capital to $2,000,000. The quotation of these shares, except in the ELECTRICAL AGE, has always been misleading, being per cent. instead of dollars. I hope it will not be forgotten by Brooklyn tax payers that Geo. B. Ellery, has had a proposal before the Board of Aldermen for over a year, and which was fully explained in the local papers, to light the city by Long Distance Incandescent Electric Light of 32 c. p. all night and every night in the year, for $20 per lamp per year. This means dividends to taxpayers, if ever accepted by Brooklyn.

I claim that at least 50,000 respectable men read the financial column of the ELECTRICAL AGE every week and of this number there are 3,000 in New York who are patrons of Hegeman & Co., and 5,000 outside of this city who are wholesale customers, using their chemicals. All of these will be pleased to hear that the business, including Hudnuts, has been incorporated in London, as the United States Drug Stores, Limited, with a capital of £110,000 divided into 50,000 preference and 60,000 ordinary shares of £1 each, to adopt an agreement to be made between H. T. Cutter, of New York and the Company. The subscribers are H. Watkins, W. Buttle, T. Pearson, E. Hart, Jr., A. W. Woods, S. W. Richard and A. C. Stone for one share each. The number of directors three to seven, qualification 250 shares, remuneration £200. Chairman £50 extra. This is practically the entering wedge of English capital into the supply of chemicals, etc., for electrical purposes in the United States. The stock is not for sale here yet but I shall quote it soon in the regular list which now includes nearly every class of electric industry.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, Mass., March 20, 1891.

The new catalogue just published by the Eastern Electrical Supply and Construction Company is very complete and tastefully gotten up, and reflects great credit upon the management of the company.

H. N. Bates & Company have taken the contract for a 300-horse power Ball compound condensing engine for the Milton Electric Light Company.

The Globe Street Railway Company, of Fall River, Mass., was sold recently for $600,000, and is to be equipped with electricity.

The Rodney Hunt Machine Company have recently installed a steam plant for an electric light company, at White River Junction, Vt., also one at Lebanon, N. H.

S. C. Nightingale & Childs are doing a good business with their magnesia pipe covering.

Mr. L. H. Hart, of New York, a hustler in every sense of the word, has been visiting his numerous friends in this city during the week past. Mr. Hart is the representative of the New York electrical journals, and is highly esteemed by all who know him.

Mr. Henry F. Kellogg, of the Eastern Electrical Supply and Construction Company, expects to start April 1st on a trip through Mexico and the Southern States. Mr. Kellogg speaks Spanish like a native, and will, no doubt, have a pleasant and profitable trip.

J. Starr Butler, of 103 Merrimac street, is doing a good business in all kinds of electrical supplies.

Mr. Chas. B. Burleigh, Superintendent of Construction of the Thomson-Houston Electric Company, a few days ago, at Chelsea, won the pacer Butcher Boy, with a buggy, harness, whip and robe, for being the most popular superintendent. Mr. Burleigh headed the list with 4,622 votes.

The Automatic Time Stamp and Register Company have sold to the Holtzer-Cabot Electric Company a time stamp register, to be used in their factory. These registers are an absolute check on employees on entering or leaving their work, as the stamp registers the exact time on a card signed by the employee.

Mr. W. A. Day has just sold to the Springfield Electric Company, of Springfield, Vt., a 100-horse power engine. This is a new electric light company, and they have not yet decided what electrical apparatus they will use.

The Brattleboro, Vt., Gas Light Company have purchased of Mr. W. A. Day, a 125-horse power compound engine for electric light purposes.

The Washburn-Moen Company, of Worcester, Mass., are to install a 25-horse power Ball engine for drawing and tempering wire.

F. E. B.

THE WESTINGHOUSE COMPANY.

A despatch from Pittsburg on March 13th, stated that at the conference between George Westinghouse, Jr., and E F. Waters of Boston, representing the Eastern stockholders of the Union Switch and Signal Company, it was agreed that A. T. Rowand, who had ousted Mr. Westinghouse from the presidency and himself installed, should resign and take the vice-presidency. Mr. E. H. Goodman will be president. This is practically a victory for Mr. Westinghouse. It is said that he is security for about $250,000 of the company's debts, and the Boston people decided on the change, having discovered that the Pittsburg banks did not take kindly to the new management.

A dispatch from Pittsburg on the 16th inst. states that it was rumored there that an English syndicate was about to secure control of the Westinghouse interests, but this report was denied by Mr. Westinghouse himself a couple of days later as being absolutely without foundation. In fact, there had been no negotiations of that character and there was no truth in the report.

In our article in last issue regarding Mr. George Westinghouse and his business difficulties it was erroneously stated that efforts were being made to oust that gentleman from the presidency of the Westinghouse Company. It should have read the "Union Switch and Signal Company," not the Westinghouse Company.

OUR ELECTROMOTIVE FORCE INCREASED.

It has become our pleasure and good fortune to secure one of the ablest and most enterprising gentlemen in this Electrical Age—Mr. H. T. Whitney—whose name and fame have gone before the electrical people of the United States. Mr. Whitney is an old journalist, and most successful all round class paper man. From journalism he entered the electrical field some few years ago, and met with universal favor in every city he visited. He has for some time managed successfully the agency department of the Consolidated Electric Storage Company at 120 Broadway, New York. Through our usual persuasive manners, we prevailed upon the above company to part with Mr. Whitney, who will represent us between New York and the Rockies, with headquarters at No. 1001 Opera House Block, Chicago, Ill.

Mr. Whitney will represent us in every department and will always be found ready to furnish any information regarding new specialties coming on the market, as well as to receive whatever news our friends may be willing to give to the public through the columns of our valuable medium, the ELECTRICAL AGE. He will be found courteous and gentlemanly under all circumstances, and we hope for a kind welcome by all whom he may meet, and from a generous public ever ready to encourage those who are ambitious for the success of a good representative journal.

We have in preparation the only complete directory of electrical people in the United States, Mexico and Canada, which Mr. Whitney will be pleased to explain to our patrons. We intend to hold it for the exclusive use of our large advertisers.

Wishing every enjoyment of a successful business for all the fraternity the coming year,

THE ELECTRIC AGE PUBLISHING COMPANY,
7-12 *World* building.

TELEPHONE RATES.—A bill was introduced in the New York legislature recently, providing that telephone companies must furnish service to all persons within their district applying for the same, in cities of more than 500,000 inhabitants, at the rate of $75.00 per year. A higher price may be charged where an exclusive wire is furnished. It is claimed by friends of the measure that the bill will pass the Assembly.

THEY PREFER STORAGE BATTERY LIGHTING.

The Pennsylvania Company for Insurance of Lives and Granting Annuities, has ordered from the Electro Dynamic Company of Philadelphia, three series of 58 cells—total, 174 cells—"15 L" type, accumulators with resistance cells, regulating switches, etc., complete, for lighting its building, No. 517 Chestnut street, Philadelphia.

The Pennsylvania Company moved into their new building last summer, and for five months lighted their offices by means of the direct lighting system of the United States Company, changing to the Edison system and taking the current from the mains in the street for three months They finally concluded that the storage battery system, which they had had in operation in their old building, was superior to the direct system.

BUSINESS NOTES.

The firm name of Meyrowitz Bros., the well-known manufacturers of optical, surgical and electrical instruments, No. 295 & 297 Fourth ave., New York, has been changed to E. P. Meyrowitz. This change does not denote any transfer of proprietorship, but is made in order that the name of the business may conform to the fact.

The Easton Electric Co., have just sold another of their Claus-Easton, or Improved Continental, Dynamos. This is to be installed on the Brooklyn Annex Ferry Company's new boat, No. 5.

Palmer Bros., of Mianus, Conn., are manufacturers of the "Brillian" dynamos, motors and electro-plating machines, and dealers in electrical supplies generally. This firm makes eight and sixteen light dynamos, sewing machines and fan motors and dynamos for experimental work in colleges and schools. They sell their machines complete or in parts and castings with instructions for building. Their dynamos are constructed on correct principles and are very efficient machines. The firm also deal in large plunge batteries for running motors. Their experimental dynamos are run by hand power, the whole apparatus being very compact.

The Bishop Gutta Percha Company, manufacturers of electric wires and cables, 420 to 426 East Twenty-fifth street, report great activity to keep up with the demand for their goods. They are working the factory to its full capacity.

Allsop's book on Electric Bell Construction gives a detailed description of the chief apparatus used in electric bell work and describes how material that is generally at hand in every fitter's shop can be employed. With 177 illustrations drawn to full or half size. Price, $1.25; E. & F. N. Spon, 12 Cortlandt street, New York.

AUCTION NOTICE.

Henry B. Hert's Son, auctioneer, will sell on Monday, March 30, at 11 o'clock, at the private mansion No 149 Second avenue, rear, Tenth street, the celebrated Barrow collection of electrical and scientific apparatus. Being a large and valuable assortment of galvanometers, Geisler tubes, batteries air pumps, Holtz machine, electromagnets, fine microscope with lenses, etc., etc., collected by the late John Wylie Barrow, Esq., founder and the first president of the Franklin Scientific Association. The goods will be on exhibition on Saturday, March 28, with descriptive catalogue.

RETIRED TO GO INTO OTHER BUSINESS.—Mr. L. L. Pardee, who has been connected with the Western Union at Syracuse for a number of years, and more recently as circuit manager for Superintendent Gifford's district, has retired from telegraphic service and, with a well-known business man, formed the Central New York Electric Company. They occupy offices at No. 607 Kirk Block, Syracuse, and are doing a general jobbing business in electrical supplies. They are prepared to furnish anything in that line, from a push button to a dynamo. Mr. Pardee's numerous friends wish him unbounded success in his new undertaking.

PERFECT SATISFACTION.

DOVER, N. H., March 17, 1891.

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Yours truly, CHAS. H. DAME,
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THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS.

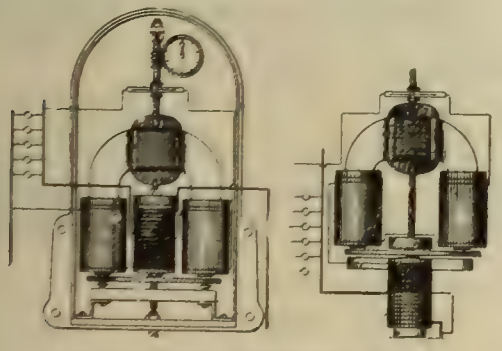
ISSUED TUESDAY, MARCH 17, 1891.

448,199. Electric Motor Truck. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company of Connecticut. Filed June 17, 1889.

448,246. Support for Electric Wires. Charles A. Lieb, New York, N. Y., Filed Nov. 19, 1890.

A supporter for electric wires, made of a single piece of metal, within which are insulating material, and a nut placed between the insulating material, the whole being held in place by bending a portion of the body part over the same, and hooks integral with the body part.

448,271. Electric Typewriting Machine. Edward J Silkman, Baltimore, Md.; assignor of two-thirds to George D. Penniman and Thomas K Worthington, both of same place. Filed Apr. 7, 1890.



NO 448,280—ELECTRIC METER.

A typewriting machine having electro-magnetic apparatus for reciprocating the actuating frame and thereby turning the type-wheel.

448,273. Electrically-Controlled Valve. John V. Stout, Easton, Pa. Filed Jan. 31, 1890.

A battery and magnets in series in the circuit, one magnet operating the circuit-controller and another magnet controlling the motor for the regulating-valve.

448,274. Electric Temperature Regulator. John V. Stout, Easton, Pa. Filed Jan. 31, 1890.

448,279. Electric-Lighting System. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 21, 1886.

448,280. Electric Meter. Elihu Thomson, Swampscott, Mass. Filed Nov. 20, 1890.

The combination of an electric motor of constant torque operating a register with a damping mechanism consisting of a closed-circuit conductor rotating in a magnetic field whose strength is determined by the differentiation between a definite magnetic force produced, in part at least, by the motor itself, and that due to the current flowing in the main work circuit.

448,303. Driving Mechanism for Dynamo-Electric Generators. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Nov. 6, 1890.

A dynamo electric generator mounted on an insulated base and having the steam-engine directly coupled thereto and provided with the driving-shaft in two parts, rigidly connected together, one supported on the steam engine and the other having the armature fastened thereto, with an insulating-section between said parts.

448,315. Tail Light for Railway Trains. Arthur W. Berne, New Orleans, La., assignor of five-eighths to Brownlee W. Taylor, Charles A. Fish, and Richard J. Lowden, all of same place. Filed March 14 1890.

Electro-magnetic devices for flashing a light.

448,317. Electric Sad-Iron. Charles E. Carpenter, Minneapolis, Min., assignor to the Carpenter-Nevens Electro-Heating Company, same place. Filed June 21, 1890.

448,322. Call System. Louis Digeon, Paris France. Filed Nov 1, 1887. Patented in France.

448,325. Electric Alarm Clock. Edward M. Edgerton, Chicago, Ill. Filed Nov. 21, 1889.

448,326. Method of and Apparatus for Developing Mechanical Motion from Electrical Energy. Rudolph Eickemeyer, Yonkers, N. Y. Filed July 20, 1888.

Intermittingly varying the polar conditions of an electro-magnetic field and in like manner varying induced polar conditions in a movable element by correspondingly varying separate supplies of field-exciting energy derived from any suitable source of electricity.

448,328. Electric Railway. Justus B. Entz, New York, N. Y., assignor to the Waddell-Entz Electric Company, same place. Filed July 3, 1890.

448,329. Telephone. Stephen D. Field, Stockbridge, Mass. Filed May 25, 1889.

A telephone having its diaphragm supported between polar extensions of the two limbs of a magnet and magnetically connected at or near the rim, with an iron bridge connecting the poles.

448,331. Commutator-Brush. Karl G. Frietsch, Schenectady, assignor to the Edison Machine Works, New York, N. Y. Filed June 28, 1890.

A contact-brush pressing against the commutator-cylinder and a brush to which the line is connected bearing against the contact-brush adjacent to its contact end.

448,338. Segmental Resistance-Board. Gideon D. Hand and Osborn P. Sells, Chicago, Ill. Filed Aug 11, 1890.

448,351. Electric Arc Lamp. Karl Kurmayer, Vienna, Austria-Hungary. Filed Sept. 15, 1890.

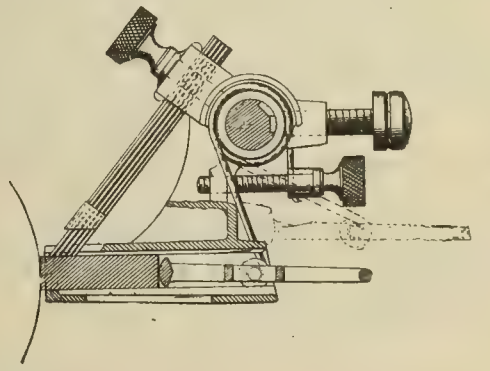
448,359. Support for Electric Cables. Henry B. Nichols, Boston, Mass. Filed Nov. 15, 1890.

A cable clamping or supporting device comprising a rigid plate or holder, clips or clamps engaged at their inner ends with the plate, the clips constituting a sectional socket formed to receive the cable.

448,365. Electric Switch. Ransom D. Pratt, Marlborough, Mass., assignor of two-thirds to Julian P. Wood and Herbert J. Willard, same place. Filed July 7, 1890.

448,378. Electrical Street and Station Indicator. Francis H. Soden, Chicago, Ill. Filed March 20, 1890.

The combination in a system of electrically-controlled street and station indicators on cars, of a dynamo operated



NO. 448,331—COMMUTATOR BRUSH.

from the running gear of the car and applied as a source of power for controlling the indicator, a battery applied to alternate with the dynamo as a source of power for controlling the indicator and a double switch provided with opposite contact-points adapted to complete the divided battery and dynamo circuits by alternately engaging the terminal contacts in the circuits, the switch being subject to and controlled by a current from the dynamo and arranged to normally place the battery in circuit as a means for controlling the indicator when the dynamo is not running or has not attained sufficient speed to render it efficient as a means for controlling the indicator and to cut out the battery and place the dynamo in circuit as a means for controlling the indicator when the dynamo has attained an efficiency suitable for the purpose.

448,392. Barber's Indicator. Simeon P. Watson, Brooklyn, N. Y. Filed June 7, 1890.

An electro-magnetic bell and dial indicator.

ELECTRICAL PATENTS—Continued.

448,395. Insulator. George K. Wheeler, Chicago, Ill. Filed Nov. 21, 1890.

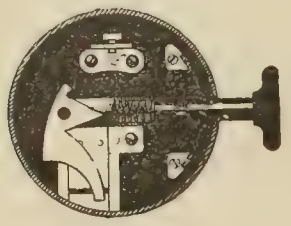
A cone insulator consisting of non-conducting parts screwed together and provided with hangers, one of the parts being conical at one end to receive the hood.

448,398. Signal Box. John C. Wilson, Boston, Mass., assignor to the Municipal Signal Company Portland, Me. Filed May 17, 1887.

A multiple-signal transmitter comprising an endless band and a series of groups of signaling-surfaces, each group arranged transversely thereon, and a contact-pen adapted to co-operate with any one group of signaling-surfaces.

448,399. Signal Box. John C. Wilson, Boston, Mass., assignor to the Municipal Signal Company, Portland, Me. Filed May 17, 1887.

448,400. Signal Box. John C. Wilson, Boston, Mass., assignor to the Municipal Signal Company, Portland, Me. Filed May 17, 1887. Renewed Feb. 18, 1891.



NO. 448,365—ELECTRIC SWITCH.

448,404. Process of and Apparatus for Electrically Reproducing Irregular or Undulating Surfaces. Noah S. Amstutz, Cleveland, Ohio. Filed Aug. 19, 1889.

A method of reproducing bas-reliefs, intaglios, and the like surfaces by running a tracing-point in contact with the surface to be reproduced and communicating variable vibrations to a reproducing point or device by means of an electric current.

448,418. Electric Arc Lamp. James W. Easton, New York, N. Y., assignor to P. Minturn Smith, Plainfield, N. J., and William D. Perry, Brooklyn, N. Y. Filed Mar. 20, 1890.

In an electric arc lamp, the combination of a brakewheel controlling the movement of a carbon-rod and a spiral spring bearing against the periphery of the wheel, one end of the spring being secured to a fixed portion of the lamp or frame and the other end being connected with the core or armature of a solenoid or magnet, whereby the tension of the spring is varied with changes in the resistance of the lamp circuit.

448,431. Electric Switch. Edward H. Johnson, New York, N. Y. Filed Mar. 27, 1885.

A hand switch for making and breaking an electric circuit.

448,461. Underground Conduit for Electric Railways. Robert A. Stewart, Allegheny, Pa. Filed Oct. 4, 1886.

An underground conduit for electric railways, having a chamber extending parallel with the rail and having a slot extending sidewise into the chamber for the passage of the trolley-arm.

448,468. Electric Wire Support and Cut-out. Edwin R. Whitney, Manchester, N. H., assignor to the Electrical Supply Manufacturing Company, same place. Filed Nov. 4, 1890.

A base-piece provided with wire seats, with a removable cap having spring clamps near its ends to engage the wires in the wire seats of the base, and wire-holding clamps adapted to be connected with the spring-clamps by easily fusible conductors.

448,505. Trolley Support for Electric Cars. Benjamin F. Crow, St. Louis, Mo., assignor to the Brownell & Wight Car Company, of Missouri. Filed July 12, 1890.

A truss composed of a compression member and a tension member mounted on the car, the tension member engaging the ends of the compression member.

448,523. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor by mesne assignments to the Thomson-Houston Electric Company, Boston, Mass. Original application filed March 18, 1886. Divided and application filed Sept. 21, 1887. Again divided and this application filed April 30, 1888.

Line conductors arranged in long sections with an electric generator for each section and controlling devices actuated by the strength of current in one section for controlling the supply of electricity to the next section, whereby the electric supply to all the sections may be the same, to the end that the same motor may run upon all sections.

448,540. Commutator-Truer. David McGenniss, Amsterdam, N. Y. Filed June 10, 1890.

In a commutator-truer, the combination of a support adapted for attachment to the brush-supporting arm, a rod movable lengthwise in the support, and an adjustable, abrading plate carried by the rod.

448,541. Process of Making Iodine by Electrolysis. Thomas Parker and Alfred E. Robinson, Wolverhampton, England. Filed Feb. 21, 1889. Patented in England.

A process for producing iodine, consisting of electrolyzing an acid solution of an iodide in contact with the positive electrode, an alkaline solution being in contact with the negative electrode, the two solutions being separated by a porous diaphragm, and then draining off and washing the iodine.

448,561. Electric Railway Motor. Charles J. Van Depoele, Lynn, Mass. Filed Oct. 22, 1889.

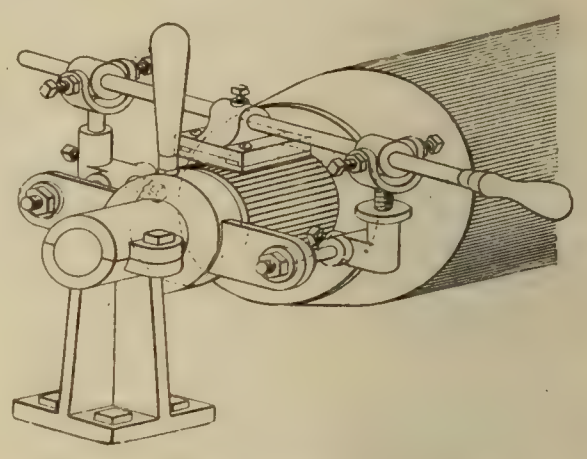
448,562. Electric Locomotive. Charles J. Van Depoele, Lynn, Mass. Filed May 26, 1890.

448,563. Electric Railway System. Charles J. Van Depoele, Lynn, Mass. Filed Dec. 13, 1890.

448,594. Method of Making Plated Wire. Charles R. Smith, Providence, R. I., assignor to the C. R. Smith Plating Company, of Kentucky. Filed Dec. 24, 1890.

448,598. Electric Transportation System. Schuyler S. Wheeler and Charles S. Bradley, New York, N. Y., assignors to said Wheeler, trustee. Filed July 29, 1889.

448,603. Electro-Magnetic Motors. Edwin D. Chaplin, Holliston, assignor to Eugene Humphrey, trustee, Boston, Mass. Filed Aug. 21, 1889.



NO. 448-540—COMMUTATOR-TRUER.

448,604 Electric Cable. William A. Conner, Pittsburg, Pa., assignor to the Standard Underground Cable Company, same place. Filed Nov. 8, 1890.

An electric cable consisting of a number of conductors, each covered with a fibrous insulating material, the conductors being grouped together to form a core, and provided with waterproof covering and a sheathing of material capable of withstanding a comparatively high degree of heat, and an exterior protective coating of lead.

448,618. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed Sept. 23, 1886. Divided and this application filed Sept. 1, 1890.

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NEW YORK, APRIL 4, 1891.

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OUR THANKS.

The ELECTRICAL AGE hereby tenders its grateful acknowledgment to its friends for their kindness in visiting our offices on Friday, March 27th. Their hearty expressions of good-will were greatly appreciated, and the occasion will always be remembered as one of the most pleasurable events in the history of the ELECTRICAL AGE.

THE PATENT CELEBRATION.

The Congress of Inventors and Manufacturers of Patented Inventions for the celebration of the beginning of the second century of the American patent system, will be held in Washington, D. C., April 8th, 9th and 10th. The opening session will be held in the afternoon of the 8th, and will be presided over by the President of the United States. Hon. C. E. Mitchell, Commissioner of Patents, will read a paper on "The Birth and Growth of the American Patent System." Hon. Samuel Blatchford, Justice of the Supreme Court of the United States, will read a paper entitled, "A Century of Patent Law," and Hon. R. S. Taylor, of Indiana, will read one on "The Epoch Making Inventions of America." At the second session of April 8th, Hon. John W. Noble, Secretary of the Interior, will preside, and papers will be read on subjects appropriate to the occasion.

On the afternoon of April 9th, Prof. Thomas Gray, of the Rose Polytechnic Institute, Terre Haute, Ind., will read a paper on "The Inventor of the Telegraph and Telephone." Other papers pertaining to invention will also be read at this session, and at the evening meeting among the subjects to be considered will be "The Effect of Invention upon the Progress of Electrical Science," a paper read by Prof. C. F. Brackett, of Princeton College.

Anniversary day will be observed on April 10th. This will be commemorative of the signing of the first American Patent Law by George Washington. An excursion will be taken to Mt. Vernon, where an address will be delivered by Dr. J. M. Tomer on "Washington as an Inventor and Promoter of Improvements." In the meeting of April 10th, Prof. Alexander Graham Bell, will preside, and several interesting papers will be read on various subjects.

A special reception to inventors and manufacturers will be held at the Patent Office, April 8th, between 9 and 11:30 P.M., by Hon. John W. Noble, Secretary of the Interior, and Commissioner of Patents, Mitchell.

THE ELECTRIC LIGHT IN A MURDER CASE.

The electric light is playing a curious part in the investigation now going on in New Orleans by the Grand Jury into the recent lynching in that city of Italian prisoners. It has been charged that the records of the Louisiana Electric Light Company were doctored in order to make it appear at the trial of the Italians that the light at the corner of Basin and Gired streets, near the scene of the murder of Chief of Police Hennessey, was burning dimly at the time that officer was killed. This fact was for some reason not brought up during the trial, and the local press are now ventilating the matter in a truly vigorous newspaper fashion. What it amounts to it is hard to tell.

TO BE MOVED ON TWENTY-FOUR HOURS' NOTICE.

Electric wires in New York are having a hard struggle for existence—on poles. The meetings of the Board of Electrical Control are becoming extremely interesting, and when the subject of poles and overhead wires is mentioned, Mayor Grant becomes at once seized with an uncontrollable desire to annihilate such property. Nothing so disturbs his Honor's serenity as the mere mention of electric wires, and the blue flames that "dead" wires emit when some one touches them to see if they will shock, are nothing in comparison with the color of the atmosphere immediately surrounding the person of New York's Chief Magistrate, when he suffers from these periodical attacks of electromania.

At the last meeting of the Board of Electrical Control it was developed that one of the New York electric lighting companies had strung a wire on the Metropolitan Telephone Company's poles in Thirteenth street, and because the rules of the Board had thus been violated a resolution was passed ordering the Metropolitan Telephone Company to remove all of its poles on Thirteenth street between First and Sixth avenues, within twenty-four hours. The Mayor gave instructions that the poles be cut down if the order was not obeyed.

All that can be said in favor of this method of correcting abuses is that it does not give the guilty parties a chance to escape. The same idea could be extended in another way. Supposing a "dead" and forgotten wire should suddenly come to life and it was disowned by every body, then the proper thing to do would be to chop down every pole in the city in order to punish the real owner of the wire. This process might be properly called electrical lynching.

LIGHTNING ARRESTERS.

The common enemy of electrical apparatus is lightning, and to insure protection against damage from these electrical discharges, much time and thought have been applied to the production of apparatus that will be reliable and effective in its operation. Naturally the inventions of this character are as varied as are the ideas of inventors as to how the object sought can be best attained.

One of the most ingenious lightning arresters yet produced is that of the Westinghouse Electric and Manufacturing Company, used in connection with their electric cars. A description and an illustration of this lighting arrester will be found on another page. The device is a novel one, and if it acts in practice as well as is reported it must be an effective apparatus. It is automatic in its action and the method by which the apparatus is set for successive lightning discharges is an extremely interesting one. The expansive power of heated air in an enclosed chamber is utilized in this arrester to adjust it for the next discharge.

During the tests made with this apparatus a 1000-volt generator was short circuited through the arrester, resulting in the circuit being several times automatically opened and closed in one second without injury to either dynamo or arrester.

SENSATIONAL STORIES ABOUT ELECTRICITY.—The propensity of the daily press for charging all sorts of horrible and impossible things to electricity, is strongly revealed and brought out by Mr. Eugene T. Lynch, Jr., of this city, in a communication which will be found on another page of this issue. Mr. Lynch, shows in a clever manner, how little mishaps are magnified in the brain of the average reporter for daily papers, and if there is the remotest suspicion that an electric current, however small, is involved, then electricity is immediately charged with being an exterminator of the human race. Mr. Lynch is correct in attributing this state of affairs in journalism to ignorance in electrical matters, both by the reporters themselves and the editors who pass upon these sensational stories. Some of the most absurd reports are printed and go unchallenged. Usually, they are based to great extent upon the imagination of an ambitious reporter, but the great majority of readers do not know that. They are as ignorant about electrical affairs as the reporters are, and they generally accept newspaper reports as truth. Now, to allow such stories to go the rounds—as they usually do, and quickly, too—is detrimental to electrical interests. These fairy tales should be promptly challenged by some one who is competent to undertake the task and their utter absurdity revealed to the public. Such a course would undoubtedly have a wholesome effect in favor of the much-abused electricity. Mr. Lynch has initiated a movement that should be taken up in every direction, and every time electricity is charged wrongly with doing damage to life and property a champion should rise up and present a true statement of the fact. Let the good cause grow and progress.

A SENSIBLE PRACTICE.—We have noticed of late that printed copies of the papers read at recent meetings of the American Institute of Electrical Engineers have been distributed at the meeting. This is a very good idea, as it enables those present to follow the speaker more closely and affords the members who desire to discuss the questions under consideration an opportunity to do so understandingly. It is an advantage, too, to the electrical press, because it gives them more time to have the matter set up in type. This, of course, results in better work. The practice of furnishing advance copies of papers is an excellent one, and cannot be too strongly commended. It would be decidedly advantageous to all concerned to make this practice uniform, and it would entail no additional labor on the part of the authors of these papers to prepare them a few days in advance. We hope that the practice will be adhered to.

THE ELECTRICAL AGE'S RECEPTION.

On Friday, March 27th, the ELECTRICAL AGE entertained its many friends at its offices in the *World* building. Invitations were sent to all of those engaged in every department of the electrical field, and also to the trade in general. It was our desire that no one should be forgotten, and that every one should receive an invitation, but it sometimes happens that some names are overlooked in the course of the clerical work attending the sending out of such a large number of invitations. If, therefore, anyone did not receive their invitation in time, we desire to have them understand that the omission was purely an oversight, and chargeable to the causes already mentioned. We trust that we covered the entire field completely, however.

Our offices were beautifully decorated with the stars and stripes, and various colored electric lamps. A beautiful soft light filled the rooms, giving a very handsome effect.

In the general offices large tables were set, and spread with all the delicacies for the good of the inner man. The main office with its beautiful furniture and handsome rugs was exceedingly attractive, and excited much favorable comment. On the various desks were placed electric cigar lighters of various designs for the use of those who indulged in the weed.

The hours of the reception were from 3 to 11 P.M., and promptly at 3 o'clock the first caller was welcomed. Over the door of the main office two large American flags were hung in graceful folds, and depending from the centre of the door case was an incandescent lamp with a globe of delicate blue tint, the whole forming a very beautiful picture. Within, a hearty welcome was waiting for all comers, and our visitors were conducted immediately to the refreshment room. After this stage of the entertainment was passed, they were shown through the different offices, and afterwards through the building, which was a marvel to all. On their departure everyone was invited to leave his autograph in the ELECTRICAL AGE register on a desk near the door, and as a result we have a long list of prominent names, which will henceforth be one of the treasures of the paper.

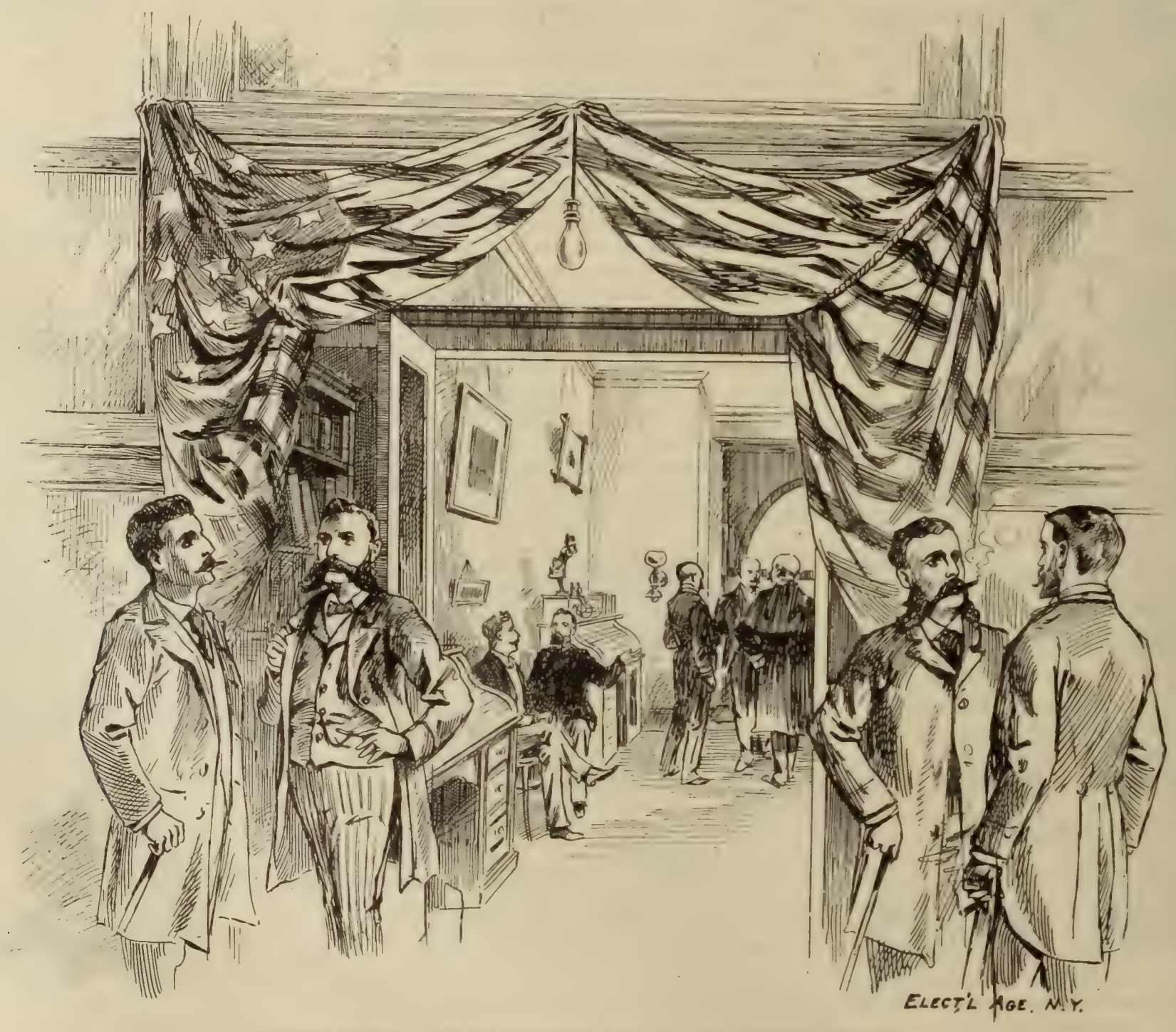
Our guests were entertained during the afternoon and evening at frequent intervals, by Mr. C. E. Tomson, Jr., of Brooklyn, in an exhibition of slight-of-hand. Mr. Tomson is yet in his teens, but is remarkably expert at his chosen, and evidently naturally fitted for, calling. He performed some puzzling and difficult tricks, which elicited a hearty applause from the spectators.

A general invitation to visit our offices during the night was extended to the New York Electrical Society, which was holding its regular meeting at the rooms of the New York Electric Club, on 22d street, and quite a few called on us after the meeting was over.

The affair was a most happy and successful one throughout, and our guests seemed to be well pleased with their visit.

The entire staff of the ELECTRICAL AGE was on hand doing the honors, and did all possible to entertain the guests and make them feel at home. The following is a list of those who called:

James H. Mason, M. F. Calhoun, T. W. Ness, J. C. Pierrez, H. C. Richardson, C. E. Tomson, Jr., A. F. Stanley, W. A. Vail, Bayard Whitehorne, E. Engeman, J. T. Hunt, R. Edwards, Chas. F. Fogg, Frederick Whitehead, D. Hawthorn, Ira A. Shepardson, Wm. H. Ketchum, C. J. Hirlimann, Benj. F. Baker, T. J. Smith, W. W. Kughler, C. H. McIntire, M. F. Adams, V. Gildersleeve, Geo. L. Garrigues, Andrew L. Riker, Edward P. Thompson, F. E. Baldwin, J. P. Gardner, J. E. Wright, D. H. Gildersleeve, C. E. Stump, Chas. Dutton, C. H. Barney, Thos. L. Fowler, P. H. Alexander, A. B. Lawrence, A. L. Brown, J. H. Wood, T. C. Martin, Louis Walsh, J. P. Hall, W. Tucker, C. W. Brown, W. T. Hunt, C. Moran, Alex. Welsh, L. Jacobsohn, F. E. Southard, Roger W. Allen, Jos. E. Leonard, F. D. Biggs, M. D. Law, H. Oakley, R. G. Gray, A. A. Taltavall, Jas. Jones, Jr., J. B. Taltavall, G. R. Sheldon, Homer Ladd, Wm. S. Dunloy, R. B. Corey, H. C. Whitney, A. W. DuBois, S. N. Robinson, C. T. Robinson, Wm. D. Bradborn, Robt. G. Anderson, T. R. Taltavall, G. H. Goodfellow, Geo. A. Smith, H. I. Jolley and others, including several ladies who graced the occasion by their presence.



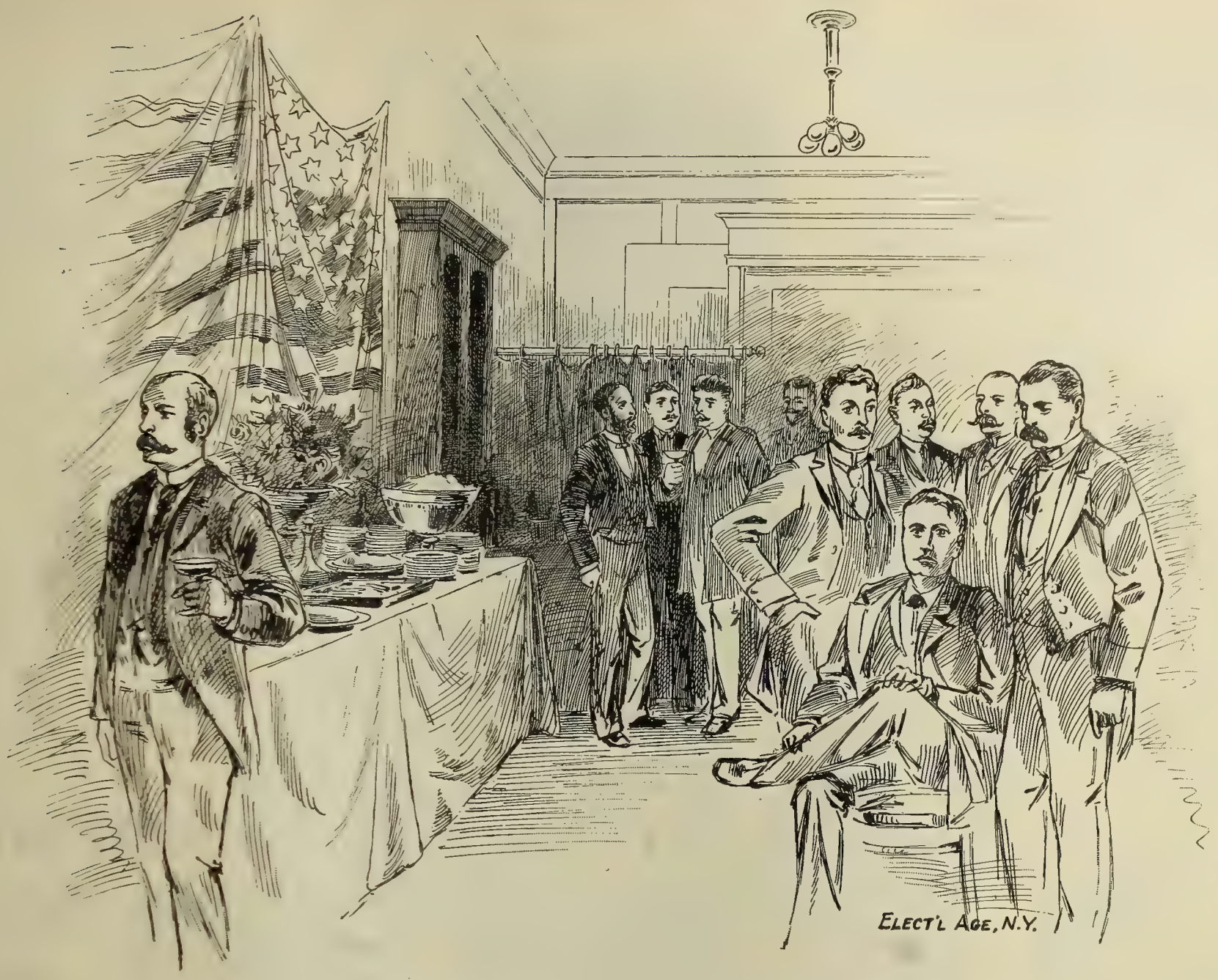
THE ELECTRICAL AGE'S RECEPTION—ENTRANCE TO BUSINESS OFFICES.

FOREIGN NOTES OF INTEREST.

During a recent heavy snow storm in London an electrically propelled omnibus was run about the streets for the purpose of testing its power on the road during such adverse circumstances. The omnibus ran with ease at a good pace without any hitch, and the trip was regarded as a successful one.

In order to show the application of electricity to aerial navigation, a captive balloon, capable of seating ten persons, will be exhibited at the forthcoming Frankfort Exhibition. The pulley which controls the ascent and descent will be operated by an electric motor, and a telephone wire will enable conversation to be carried on between those in the balloon and the people at the starting point below. Experiments will be made with the view to the steering of the balloon by electricity, and in the filling of the balloon with electrically prepared water gas. Messrs. Siemens and Halske will make the electrical apparatus.

An electric tramway is to be built from the City of Mexico to Tacubaya and Chepultepec.



THE ELECTRICAL AGE'S RECEPTION—VIEW OF RECEPTION ROOM.



THE ELECTRICAL AGE'S RECEPTION—THE EDITORIAL ROOMS.

A GROUP OF EXHIBITS.

The accompanying illustration shows a group of exhibits in Union Hall, Providence, R. I., during the recent convention in that city of the National Electric Light Association.

The first exhibit at the right hand is that of the A. W. Harris Oil Company, 110 and 111 South Water street, Providence. This company displayed samples of the celebrated oils of which they are the manufacturers. These comprise valve oil for internal and engine oil for external lubrication, and dynamo and high speed machinery oils. These goods have a high reputation for excellence of quality and the Narragansett Electric Lighting Company, of Providence, are regular consumers of the same. The American Electrical Works and the New England Butt Company, both of Providence, are also large users of the Harris oils and these concerns speak well of them. The A. W. Harris Oil Company are said to be the largest suppliers in the country of oils for electric light plants.

The next exhibit on the right, is that of the Gould and Watson Company, 35 Hartford street, Boston. This company had an extensive display of their moulded mica insulators which are well and favorably known everywhere for their high insulation and durability. On the stand at the front of the exhibit are shown samples of the various patterns of insulators and at the back is a display of screw drivers with handles made of the molded mica insulating material. The screw drivers were arranged on a display board, radially from a common centre. These goods are made by the Clement Manufacturing Co., of Northampton, Mass., and give excellent satisfaction in electric light plants on account of their insulating qualities. There is no danger of receiving a shock when using a screw driver of this make.

The balance of the picture comprises the display of the Pettingell-Andrews Company, 192-202 Summer street, Boston. This exhibit consisted of a large display of Okonite wire, electric light and electric railway supplies; key and keyless lamp sockets and receptacles, branch and main cut-outs, Okonite and Manson tape and "K. W." specialties. This company are exclusive agents in the East for the International Okonite Company, of New York, the Electrical Supply Company, of Ansonia, Conn., Bryant Switches, Paiste Switches, P. & B. Compound, the Universal Arc Lamp, Cutter's specialties, Brennan Connectors, and Novelty Motors. The company occupied a large space on the left side of the Hall near the entrance and their goods were arranged in an effective and attractive manner, as will be seen by our illustration.



THE ELECTRICAL AGE'S RECEPTION—C. E. TOMSON, JR. MAGICIAN.



A GROUP OF EXHIBITS AT THE RECENT EXHIBITION IN PROVIDENCE, R. I.

EFFICIENCY OF DYNAMOS.—The electrical or gross efficiency of a dynamo is the ratio of the power available in the external circuit, to that part of the energy transmitted by the belt which is converted into electrical energy; that is, to the electrical energy in the external circuit plus whatever is lost in overcoming the magnet and armature resistances. In the earlier machines the losses from all these sources, especially from armature resistance, were so high as often to reduce the net efficiency to below 60 per cent. In recent machines it is rare to obtain a return of less than 80 per cent.. and in the best machines it amounts to over 90 per cent., sometimes reaching 95 per cent., but small machines, or those run at very slow speeds cannot be expected to give so high a return, as the resistance of the armature conductors will be high.

The Edison General Electric Company, have secured a contract for the erection of an electric power plant for the electric railway company of Savannah, Ga.

PATENTED ARTICLES.

Patented articles must be so marked.

It shall be the duty of all patentees and their assigns and legal representatives, and of all persons making or vending any patented article for or under them, to give sufficient notice to the public that the same is patented, either by affixing thereon the word "patented," together with the day and year the patent was granted; or when, from the character of the article, this cannot be done, by affixing to it, or to the package wherein one or more of them is inclosed, a label containing a like notice: and in any suit for infringement, by the party failing so to mark, no damages shall be recovered by the plaintiff, except on proof that the defendant was duly notified of the infringement, and continued, after such notice, to make, use or vend the article so patented.

Every person who, in any manner, marks upon anything made, used or sold by him, for which he has not obtained a patent, the name, or any imitation of the name, of any person who has a patent therefor, without the consent of such patentee or his assigns or legal representatives; or

Who, in any manner, marks or affixes to any such patented article the word "patent" or "patentee," or the words "letter patent" or any word of like import, with intent to imitate or counterfeit the mark or device of the patentee, without having the license or consent of such patentee or his assigns, or legal representatives; or

Who, in any manner, marks upon or affixes to any such unpatented article the word "patent" or any word importing that the same is patented, for the purpose of deceiving the public, shall be liable for every such offense to a penalty of not less than one hundred dollars with cost; one-half of said penalty to the person who shall sue for the same, and the other to the United States, to be recovered by suit in any District Court of the United States within whose jurisdiction such offense may have been committed.

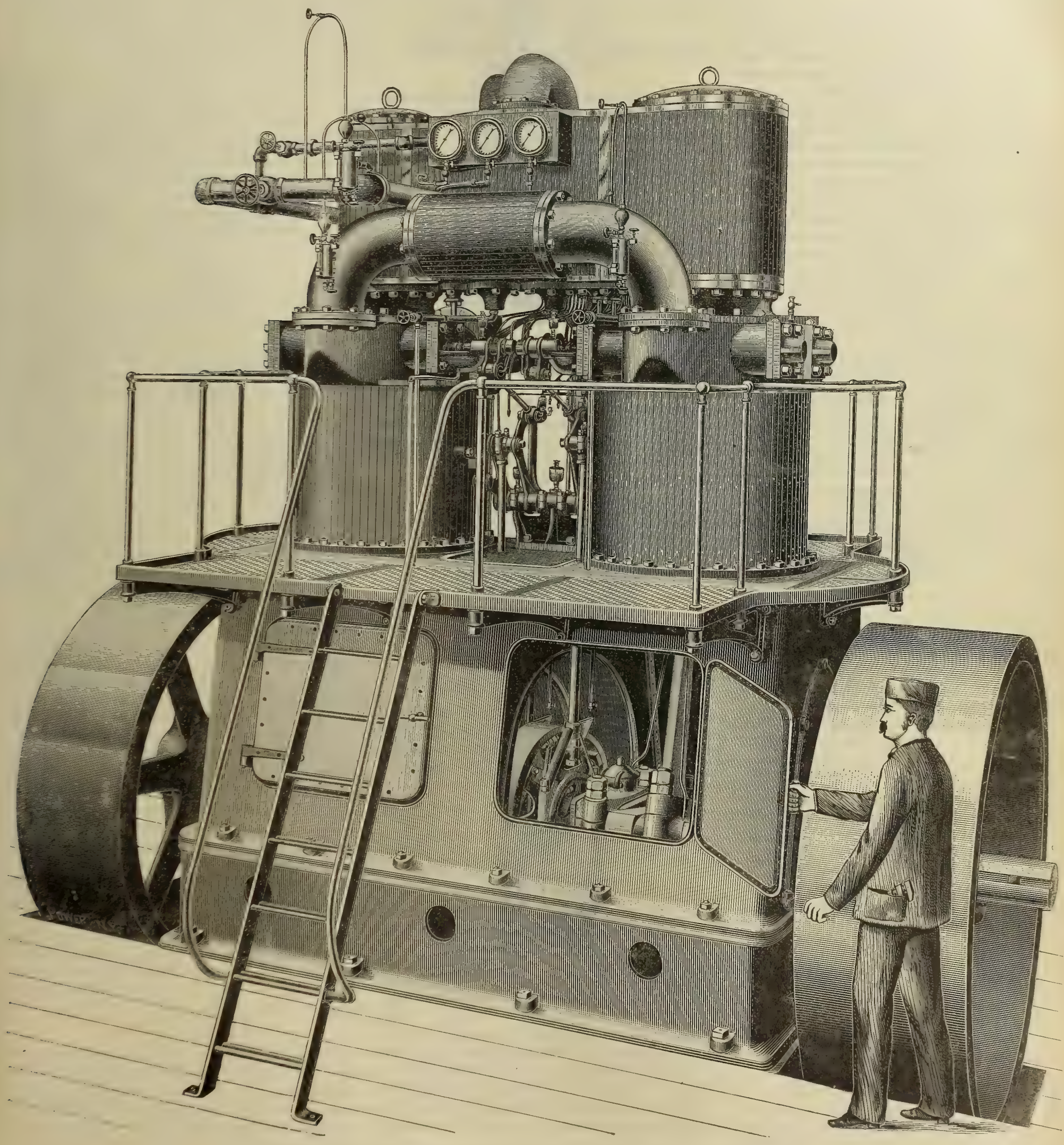
The record of the transactions of the American Institute of Electrical Engineers at the special meeting February 24, 1891, has been issued in the regular form of the society's official publications.

NEW VERTICAL TRIPLE EXPANSION ENGINE FOR ELECTRIC LIGHT AND POWER WORK

Owing to the conditions in thickly populated centres, the question of space is an important one in connection with the establishment of power plants. Electric light stations as a rule are limited as to room and it is a question of prime importance with the managers of such establishments as to how has come to be the fashion in erecting buildings to gain space by adding more stories to the structure, and the result is the enormously high buildings with which every one is familiar.

This same idea has been applied to the construction of steam engines, an example of which we give herewith.

The engine, of which the accompanying cut is an excellent illustration, was designed by Stephen Wilcox of the Babcock & Wilcox Company and



VERTICAL TRIPLE EXPANSION ENGINE FOR ELECTRIC LIGHT AND POWER WORK.

the most can be placed in the smallest possible space. Steam engines usually require a large space and some mechanical engineers have given their attention to the problem of constructing an engine which would be in every way as efficient as the best and at the same time occupy less room than is usually allotted to these indispensable machines.

In large cities where ground is very valuable, it

A. A. Goubert. M. E., of 32 Cortlandt street, New York. This engine consists of a high pressure cylinder with a diameter of 13¼ inches and an intermediate cylinder 21 inches in diameter and each is situated on top of a 33 inch low pressure cylinder. The high pressure and intermediate cylinders are both double acting, a rod extending through the stuffing boxes to the piston of the low pressure cylinders situated below, while the low pressure cylinders are single acting, using steam only on the upper sides of the pistons, and carrying upon their under sides wristpins for the connecting rods, which are connected directly to the crank upon the main shaft below, thus doing away with intermediate guides and cross heads.

The piston valve, taking steam at the centre and exhausting at the ends, controls the admission and exhaust of the high pressure cylinders. As the steam is exhausted from this cylinder, it passes through a device similar in construction to the Stratton separator, contained in the chamber between the high pressure and intermediate cylinders, and is relieved of any entrained moisture and of any condensation due to its first expansion. The volume of this separator, the intermediate steam chest and the connecting passages are so propor-

tioned as to properly serve as a receiver between the cylinders. The intermediate cylinder receives its steam supply from this and the steam supply is regulated by piston valves of the same type as that used upon the first cylinder. The exhaust from the intermediate is taken through another separator, also situated between the two cylinders, which frees the steam from further accumulated moisture and it is directed to the two low pressure cylinders through the branching connections shown at the front of the engine.

The distribution of steam in the low pressure cylinder is controlled by Corliss valves, separate valves being used for induction and exhaust upon each cylinder. These valves are located in the cylinder head, giving very short passages and small clearances for the final action of the steam.

The engine has a stroke of 21 inches and is run at a speed of 200 revolutions per minute. It develops 500 brake horse power with the initial pressure of 160 pounds and 16 expansions when running condensing, or 10 when non-condensing. The valve mechanism is upon the inside of the cylinders. The governor, of the shaft type, is located upon the main shaft below. The point of cut-off in all the cylinders is automatically regulated to suit the requirements of the load and pressure, the designers believing that in order to secure the requisite sensitiveness of regulation each cylinder should be made to respond instantly to any changes which may take place in the propelling forces or demands upon the engine. The governor has been ingeniously arranged so that while the weights are perfectly free to move the eccentric, under normal loads and conditions, the resistance of the valve mechanism cannot react through the eccentric to move the weights. Relief valves are provided in the steam ports of the high pressure and intermediate cylinders, through which any accumulation of pressure in the cylinder, either by water or excessive compression is relieved by discharging into the steam chest. An elevated oil reservoir is provided which is designed to be filled with filtered oil and which discharges through sight drips into pipes leading to all the bearings. In order to prevent the flying off of oil from the moving parts at the high speed at which this engine is run, the frame is made into a crank-case to enclose the moving parts and is furnished with light doors, front and rear, to enable the attendant to get at all the working parts, and large enough to allow of the removal of the low pressure piston. There is no attempt to have the engine revolve in a bath of oil, the objects of the enclosure being cleaniness and safety. Ample openings are provided to allow of the movement of air with the varying displacement of the low pressure pistons, the cranks being set at 90 degrees. The total height of the engine is 14 feet, 4 inches, and the floor space outside the fly-wheels 15 feet by 7 feet 2 inches.

The construction of the engine is such that, by removing the fly-wheels, the shaft of the dynamo armature may be coupled directly to that of the engine. This feature reduces still further the floor space. The engine is very regular in its action, which renders it very valuable in running dynamos, where so much is dependant upon the regularity of the speed.

GETTING READY FOR THE MONTREAL CONVENTION.

Under the head of "They Will Be Welcome" the Montreal *Gazette* of March 13th devotes an article to the Electric Light Convention, to be held in that city in August next. That paper gives a large measure of credit for the success in bringing the convention to Montreal to he pen of Mr. A. J. Corriveau. It will be remembered that he in a recent communication to this paper, dwelt on the advantages of holding the convention in the Canadian metropolis, and the enjoyment the members would have.

The *Gazette* states that the mayor and aldermen of Montreal have expressed their willingness to do all in their power to give the association a hearty welcome to the commercial metropolis of Canada, and states that no doubt when the proper time comes the city will do its duty. It is stated by the same paper that Mr. Corriveau has completed arrangements to hold the exhibition in the Victoria Rink. The convention will be held in the Windsor Hall. One of the features of the visit will be the great banquet to be given in the dining room of the Windsor Hotel, and special attention will be paid to electric lighting as part of the decorations.

Manager Sweet has already begun preparations for the reception of the electric light people.

THE GILES AUTOMATIC THERMOSTATS.

These thermostats are founded upon the well-known principle of difference in the expansion and contraction of metals. They are made from special

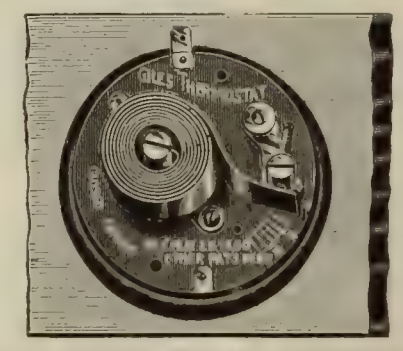


FIG. 1—CLOSED CIRCUIT THERMOSTAT.

grades of metals that, after separated tests, are found to produce the best results. They are free from the objections of all Liquid Thermostats, in this that they will not make contact when the floor or portion of the building where the thermostats are placed, is jarred. They are nicely finished, and all contact points are made of platinum.



FIG. 2—OPEN CIRCUIT THERMOSTAT.

Fig. 1 represents a closed circuit thermostat, which is adjusted by means of a screw on the right. It is made to adjust from 70 degrees to 170 degrees, and has one-half inch movement in 100 degrees.

FIG. 3—SIDE VIEW OF THERMOSTAT.

Fig. 2 represents an open circuit thermostat, which is adjusted by means of a lever below the coil, and has an adjustment of 100 degrees above the temperature of the room when placed in position and has one-half inch movement in 100 degrees.

Fig. 3 represents a side view of the thermostats.

These thermostats are being placed on the market by the Central Electric Company of Chicago.

EXCITATION OF DYNAMO FIELDS.—In a dynamo at rest there will be little if any magnetism. After starting, excitation depends on an infinitesimal current from the armature reinforcing the field, whereby a further increment of pressure is established, and the mutual reaction soon raises the strength to the full limit. The time required depends on the residual magnetism, and on the proportion of iron to copper, and may vary from a few seconds to many minutes, being greatest in a new machine.

LEGAL.

DECISIONS BY THE COMMISSIONER OF PATENTS.

The Commissioner of Patents has rendered a decision in the case of Stanley *vs.* Slattery. This was an appeal from the decision of the Examiners-in-Chief.

The Commissioner decided that inasmuch as Slattery did not conceive the invention prior to June, 1886, nor produce it to practice before December of the same year, it follows that the decision of the Examiners-in-Chief adjudicating priority to William Stanley, Jr., must be affirmed. The case was one of interference and is summed up in the following:

Where A conceived the invention in issue in September, 1885; tested it in an experimental apparatus and became satisfied that he had made an invention of value and importance in the same month; set up a plant embodying the invention in March, 1886, which was operated continuously until June of the same year; extensively introduced the invention thereafter, and applied for a patent in August, 1888, and B conceived the same invention in June, 1886, reduced it to practice in December of the same year, and obtained a patent in July, 1888, *Held* that A was the first inventor.

In determining whether A should receive a patent the record should be carefully examined by the Primary Examiner with reference to the question whether more than two years of public use preceded his application, and in view of certain prior printed publications the Examiner should inquire whether the claims of A are anticipated.

The Commissioner of Patents has affirmed the decision of the Examiners-in-Chief in the case of Deprez and Carpentier *vs.* Bernstein *vs.* Hunter *vs.* Gaulard and Gibbs. The following is the substance of the Commissioner's decision in this case:

When one of the parties to an interference is a patentee, the burden of proof is heavily upon his opponents, and, unless the evidence is such as would be held sufficient by a court to invalidate the patent already granted, the decision will be in favor of the patentee.

Novelty is not negatived by any prior patent or printed publication, unless the information contained is full enough and precise enough to enable any person skilled in the art to which it relates to perform the process or make the thing covered by the patent sought to be anticipated.

A foreign patent is evidence of perfected invention, if the description contained therein is sufficiently clear and definite, and reduction to practice is not necessary to consummate a title to receive an American patent based upon it.

Where a foreign patent exclusively relied upon as evidence of priority on behalf of an applicant as against a patentee, failed to fully, clearly and exactly disclose the invention of the issue, *Held* that it could not avail the applicant as proof of prior invention; and *Held*, further, that if the claim of the applicant when limited to that which was set forth as his invention in the foreign patent, contained anything patentable over the prior art, his right to a patent thereon was in no way affected by the granting of the subsequent patent.

LIGHTING RAILWAY TUNNELS.—The Railroad Committee of the Board of Aldermen of New York, are considering the question of compelling the railroad companies to keep their tunnels lighted at all times, and have been examining experts with the view to determining the best method for securing this result. Electricity is the only practical light that can be used for this purpose, and Mr. William J. Hammer, the well-known electrical expert, testified a few days ago before the committee, that the incandescent light would be the best one to use to illuminate the Fourth Avenue Tunnel. There should be many of these lights of great power and the tunnel should be well ventilated by openings at the top and by fans. The consideration of this subject is a result of the recent fatal accident in the Fourth Avenue Tunnel.

ELECTRIC BELLS—THEIR CONSTRUCTION AND APPLICATION.

BY THOMAS R. TALTAVALL.

PUSH BUTTONS, BATTERIES, ETC.

Push buttons are made in a great variety of designs and shapes, and they are finished in every degree of ornamentation. They are all alike in their essential parts, however. Fig. 1 illustrates the general principle of construction of push buttons. The wire terminals *a* and *b* are of course made of

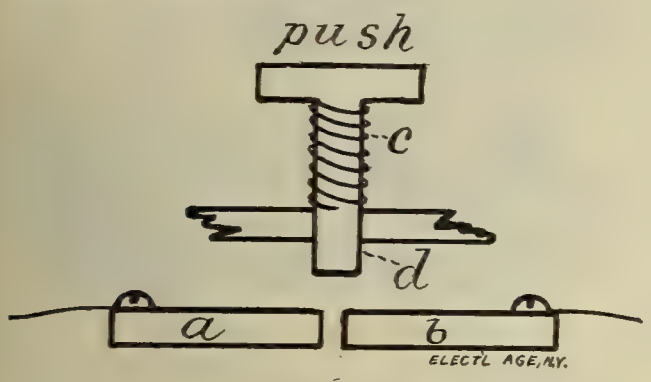


FIG. 1.
PRINCIPLE OF CONSTRUCTION OF PUSH BUTTONS.

metal, usually brass. The shank *d* of the push button is also of metal, and when it is forced against the wire terminals it forms a bridge across the gap and thus closes the circuit. The spring *c* forces the push back from the terminals as soon as the pressure of the finger is removed, and consequently the circuit is again opened.

It must be remembered that this diagram illustrates the principle only, and not the actual

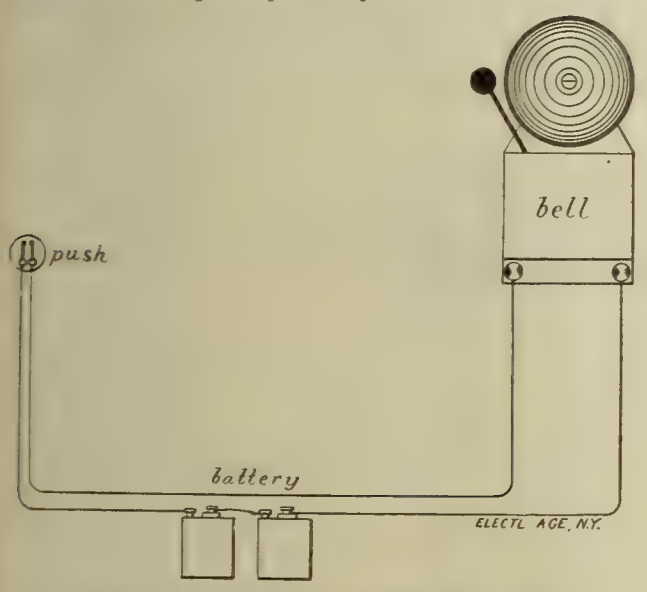


FIG. 2—SIMPLE FRONT DOOR BELL CALL.

construction of push buttons, though some are made to resemble the form shown in the figure.

The wire terminals in practice are usually placed one above the other, and made of brass with considerable spring to it. The pressure on the button

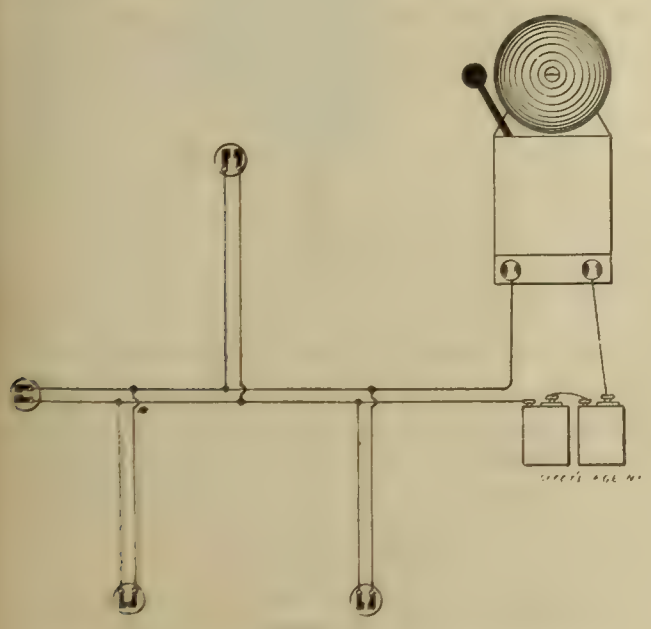


FIG. 3.
TWO OR MORE PUSH BUTTONS ON THE SAME CIRCUIT.

forces the two brass terminals together, thus closing the circuit, and on the removal of the pressure the terminals separate themselves.

We give herewith illustrations showing the actual appearance of a few of the great variety of push buttons on the market. Some of them are very artistically gotten up and are very ornamental.

The next essential thing for an electric circuit is the battery.

There are a great variety of batteries on the market, but the form that is best suited for electric bell work is the Leclanche. There are several

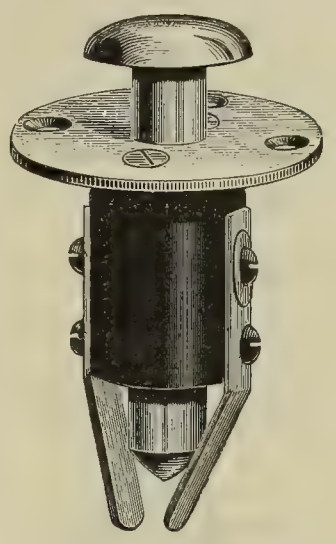


FIG. 4—FLOOR PUSH.

modifications of the Leclanche cell, but they are all practically alike as far as results are concerned.

The Leclanche is what is called an open circuit battery, that is, the circuit to which it is connected is open in its normal condition. The Leclanche cell is not used for closed circuits because it polarizes rapidly when the circuit is closed. For open circuit work, however, it is admirably adapted, because the current is not on more than a second, or a fraction thereof, at any one time. Its E. M. F. is 1.59 volts.

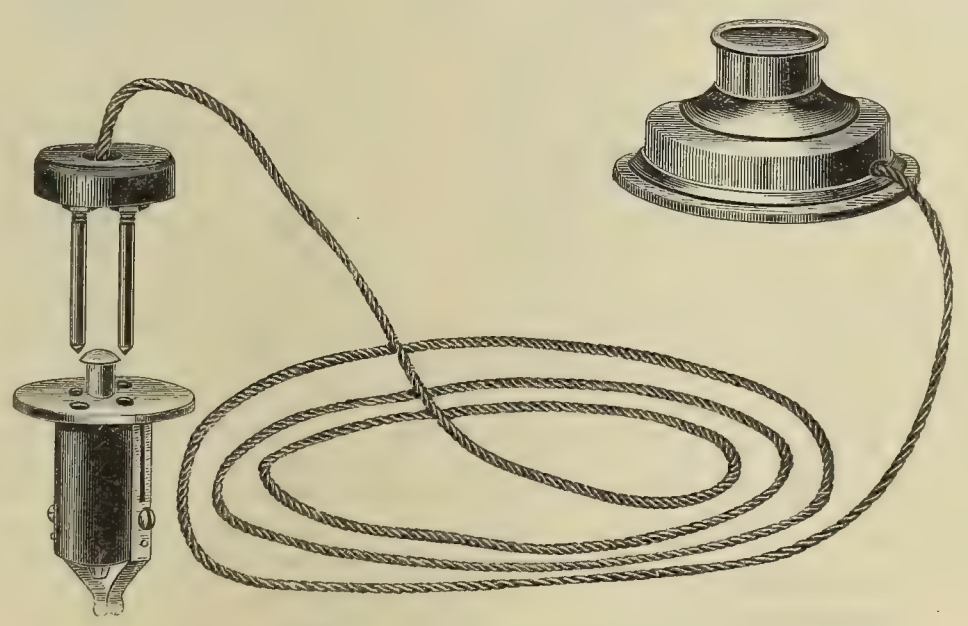


FIG. 5.—COMBINATION FLOOR AND TABLE PUSH.

The great point in favor of the Leclanche battery for domestic use is the fact that it does not require renewing for months and sometimes years, according to the work put upon it. The exciting fluid is a solution of sal-ammoniac.

Dry batteries—*i. e.*, batteries in which the fluids are absorbed within the cell—are rapidly coming into favor for electric bell, annunciator and burglar alarm work. The advantages of these batteries are cleanliness and the absence of fluids to spill.

The dry battery is very handy and portable, and several very excellent makes are on the market. Dry cells may be placed in any position—upside down if circumstances require it.

It now remains to consider the proper size of wire to use for electric bells and like purposes. Copper wire of No. 18 gauge is about the smallest that is ever used for this work, and Nos. 16, 14 and 12 are frequently used, depending upon the length of the circuit. There are 132 feet to the pound of No. 18, ninety feet to the pound of No. 16, fifty-two feet of No. 14 and 35 feet of No. 12.

In purchasing the wire the dealer can always tell what gauge is the best to use in each individual case.

Wire for bell work must be insulated. The insulation usually consists of a braided cotton covering saturated with paraffine, which is one of the best insulating substances known. Great care should be taken in running wires. Damp places should be avoided as far as possible. Double-pointed tacks should be used to fasten the wires to the material along which they are run. This is usually wood. It is not advisable to nail two wires with one tack; one tack for each wire should be used. Fastening two wires with one tack is a bad practice, and is likely to lead to trouble and annoyance. In case the insulation of the wires should be cut through or in any way damaged by the tack or hammer, a short circuit would likely occur at that point from one wire to the other through the material of the tack.

In making wire joints, bare the end of the wires of insulation for a couple of inches at least, and then scrape the bare ends well to free them from any dirt or grease. To make the joint, each wire should be twisted around the other as tightly as possible. A loose joint is an extremely annoying fault and should be carefully avoided.

Having considered the essential parts of an electric bell circuit we will now turn our attention to the circuit as a whole, *i. e.*, the assembling of the parts to produce a definite result.

As has already been stated, electric bell circuits are adapted to a great variety of uses, among which the following are most familiar.

1. Front door call bells.

2. Bells to signal from one part of the house, office, factory or building of any kind to another.

3. Burglar alarms which are operated by tampering with or opening of windows or doors.

The front door call bell is an example of the first class and is usually a simple circuit.

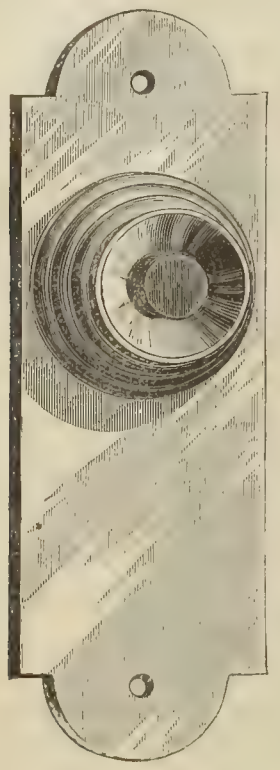
Fig. 2 shows the general method of connecting up a simple front door call bell. The push button is placed on the outside of the door casing, on the right hand side. The wires leading therefrom are run through the casing to the inner side, then down the molding to the baseboard, thence along the latter to the point where the batteries are located. Sometimes the batteries are placed in the cellar, in which case the wires connecting with the front door push may be run through the floor on the inside of the front door, and run along the overhead beams in the cellar to the point where the battery is located. From the battery the wires are run to the bell, which is frequently placed in the kitchen or at the rear of the front hall, so that it may be readily heard by the servants. The bell is usually placed at the top of the door casing or some other convenient elevated position.

These directions, of course, are general, and will not apply to every case. In running bell circuits the main thing to look after is to run the wires as direct as possible—that is, to keep the push button, battery and bell on as nearly a straight line as practicable. This not only saves wire, but keeps the resistance down, which is an important factor.

Fig. 3 shows a method of connecting two or more push buttons on the same circuit to ring one bell. These pushes may be distributed throughout the house and placed in any desirable position. For instance, each room upstairs and down may have

a push to ring the bell located in the kitchen or other convenient place.

Any number of push buttons may be connected to one circuit, and distributed throughout the building. The main thing to look out for, however, is to have the battery located between the bell and the last push button on the circuit; that is, the one nearest the bell.



FRONT DOOR PUSH BUTTON.

Another thing must be remembered, and that is, the branch wires leading to the intermediate push buttons must be connected with the main wire leading to the battery and bell in the manner shown in Fig. 3. This way of making connections is known as the multiple method. The necessity for making connections in this manner will be readily understood by tracing out the circuit from each push button; for the time being assume that each push under consideration is closed. It will be seen that in any one case the current will flow past the push button closed irrespective of all others.

The word multiple is used to distinguish this from the series method of connection. Series means one after another, and applies in the same sense to electrical apparatus, whether they be bells, push buttons, batteries or anything else that forms part of an electrical circuit. Multiple practically means a loop connection.

WOODEN PUSH BUTTONS.

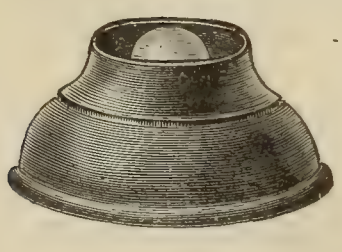


Fig. 3 of course is intended to give only a general idea of how more than one push button may be made to ring the same bell. The arrangement can be modified to meet the requirements in any particular case.

Fig. 4 represents a floor push button. The connections with the bell are just the same as those of the push buttons just described, its use, however, is a little different. The floor push button is set in and screwed to the floor under the dining table within convenient reach of the foot of the person sitting at the head of the table. When it is desired to call the waiter or attendant during the meal, all that is necessary is to press the push with the foot, and the circuit is closed by the pin making contact between the two metal jaws shown at the bottom of the illustration. By means of a spring within the device, the pin is drawn back to the position shown, as soon as the pressure of the foot is released.

An extension of this idea is shown in Fig. 5. The attachment seen above the floor push has two rods which are inserted in the holes in the plate of the floor push, shown in the illustration. The flexible conducting cord which is connected with this removable attachment, has a portable push button connected at the other end. This push button may be laid on the table in any convenient position to reach when it is desired to call the servant.

The operation of the portable button is practically the same as that of the ones alreadydescribed.

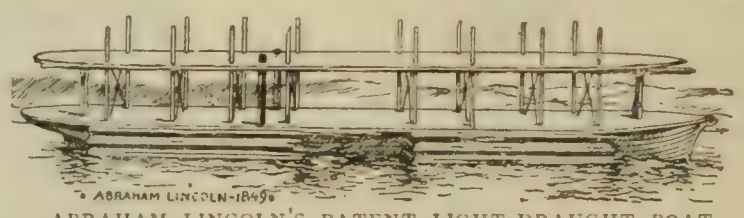
The conducting cord attachment is very convenient, as it enables placing the push button at a chair or desk, or wherever a person may be sitting. It is extremely handy for invalids, who by having one of them on the bed, no effort is required to call help or attention other than the mere pressure on the push.

To be continued.

ABRAHAM LINCOLN AS AN INVENTOR.

We have received the following interesting article from Mr. Edward T. Fenwick, of Washington D. C.:

Now that the Patent Centennial Celebration to be held in Washington, April 8, 9 and 10, is so close at hand, and inventors and manufacturers from all parts of the country are manifesting the greatest possible interest in the event, and so much is being said and written about the Centennial, the history of the Patent system and Patent Office; of famous inventors and curious patents, it might be interesting to know that Abraham Lincoln was an inventor, and received a patent on the 22d day of May, 1849, No. 6,369, for an improved means of combining adjustable buoyant air chambers with steamboats or other vessels to enable their draft to be readily lessened to permit them to pass over bars or through shallow water, without discharging their cargoes.



ABRAHAM LINCOLN'S PATENT LIGHT-DRAUGHT BOAT.

These adjustable buoyant air chambers were secured to the sides of the vessel (which in this instance was an old style Ohio steamboat), and were formed with the top and bottom portions composed of a plank or plate of metal of suitable stiffness, and with flexible side portions of India rubber, or textile material thoroughly waterproofed. These buoyant air chambers were very similar in construction and operation to an accordeon or a blacksmiths' bellows. The vessel was also supplied with a main shaft or shafts, and with sliding spars or shafts, the latter passing down through the buoyant chambers and made fast to their bottoms; also with a series of ropes and pulleys, whereby, by turning the main shaft or shafts in one direction, the buoyant air chambers would be forced downward into the water and at the same time expanded and filled with air for buoying up the vessel by the displacement of the water; and by turning the shaft or shafts in an opposite direction, the chambers would be contracted into a small space and secured against injury.

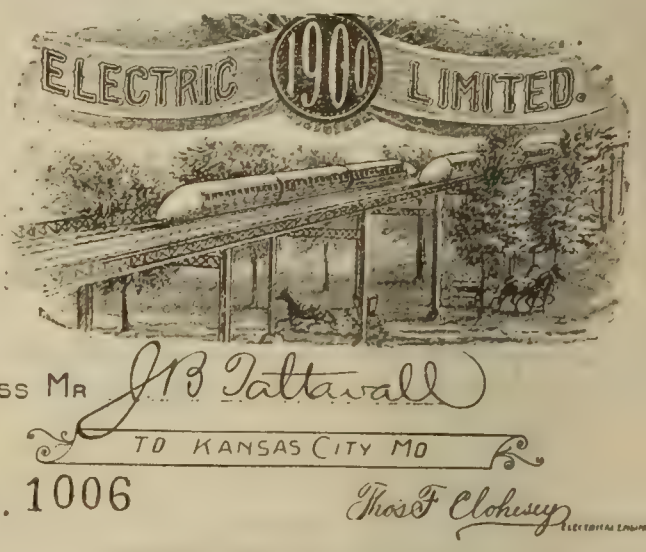
It is also stated that President Lincoln was the inventor of the very ingenious method of emptying boats of water when they had become so filled that bailing was necessary. He bored a hole in the bottom of the boat and by heading the boat up stream in an opposite direction to that in which the tide was moving, a suction was formed which very quickly drew out the water through the opening bored in the bottom of the boat.

LEAKAGE.—Leakage across from limb to limb is always a waste of the magnetic lines, so far as useful purposes are concerned.

MAGNETIC PULL.—It has been shown by various experimenters, particularly by Nickles, that if you want to increase the pull of a magnet with armatures, you may reduce the polar surface.

THE ELECTRIC LIMITED.

Mr. Thomas F. Clohesey, consulting and contracting engineer, Kansas City, Mo., has surprised the electrical fraternity by distributing decennial passes over the Electric Limited to Kansas City, Mo. Mr. Clohesey's generosity is only exceeded by his enterprise. On the reverse side of the pass is the information that the Electric Limited "is composed of Aluminum cars and is propelled, heated and lighted by electricity from the



PASS ON EBECTRIC LIMITED.

improved storage system manufactured by the Western Electric Storage Battery Company; its speed is 250 miles an hour, and when moving at that rate is apparently motionless to the passengers, vibration being completely eliminated by unique and ingeniously designed combination air cushions of special construction between wheels and rails. The weight of this train is greatly reduced by hydrogen gas uniformly distributed throughout each car and its pointed ends prevent friction in front and suction in the rear. "It is expressly understood and agreed to by the holder of this pass," continue the conditions, "that no claim for damages on account of death, resulting from loss of breath or heart failure will be recognized unless presented to Thos. F. Clohesey, consulting and contracting electrical engineer, 805 New York Life Building, Kansas City, Mo."

THE WORCESTER ELECTRICAL EXHIBITION.

Mr. H. H. Bigelow is deserving of considerable credit for his enterprise and success in bringing together such a splendid collection of exhibits. While the exhibition is not purely an electrical one, there are a number of electrical displays here and among them some rather extensive and elaborate ones. The Eureka Electric Company of New York (Loomis System) have a number of dynamos, motors, etc., and are furnishing the light and power for the building with two of their dynamos, of 50 and 40 horse power respectively. Mr. Henry A. Larned has charge of this exhibit and has shown considerable skill in the manner in which the temporary plant was installed. The plant is automatic in its regulation; no resistance box is used or needed. There is no switchboard, everything being automatically done. The dynamos are located in Chas. Baker & Co's. building, about 500 feet from the hall.

The Franklin Electric Company of Boston, have a very excellent display of motors, dynamos, etc. of their own construction, in charge of Mr. Fred. P. Snow. Their motors are used for various purposes throughout the building. There is an electrical boat on wheels and one of the most novel features, not only of the Franklin Co's display but in the

whole exhibition, is a human skeleton riding a stationary bicycle, propelled by a ¼ horse power Franklin motor. We all expect to be skeletons some day but few of us will ever ride bicycles when we arrive at that eventful stage.

The Shultz Belting Company, of St. Louis, Mo., have a number of their celebrated leather link belts.

The Washburn & Moen Manufacturing Company, of Worcester, have a magnificent exhibit of wire of all kinds.

The Thomson Electric Welding Company, of Boston, are represented with samples of their welding.

The New England Butt Company, of Providence, have in operation one of their wire covering machines—a truly wonderful piece of mechanism. The coil of wire was long enough to run some time.

The Pope Manufacturing Company, of Boston, have a large number of Columbia bicycles.

H. O. Hudson & Co., of Worcester, with a good line of sample belts, are represented, as well as a great many other firms and individuals, both local and from out of town.

The exhibition will be continued until about April 4th.

HINE'S ELIMINATORS.

The advantages in utilizing exhaust from steam engines, pumps, etc., for heating and various mechanical purposes, is becoming generally understood by steam users, and where steam power is employed the system is being generally adopted.

Mr. F. H. Prentiss in his paper on the "Distribution of Steam from Central Stations," published in in our issue of February 28th, shows conclusively that this element of heat is ample and that it costs nothing in comparison to heating by steam direct from the generating boiler. It is estimated that steam, in passing through an engine, will carry in the exhaust fully one-half of its heat power, and when permitted to escape freely to the atmosphere entails that loss.

But in a system of this kind the oil and grease used in lubricating the cylinders and rods, accumulates throughout the pipes and radiators, lessening their radiating capacity, and causing offensive and unwholesome odors to be emitted. When the water is condensed from these exhausts, it has all mineral or vegetable substances that will incrustate or dirty a boiler removed from it. If this distilled water can be returned hot to the boilers and be used

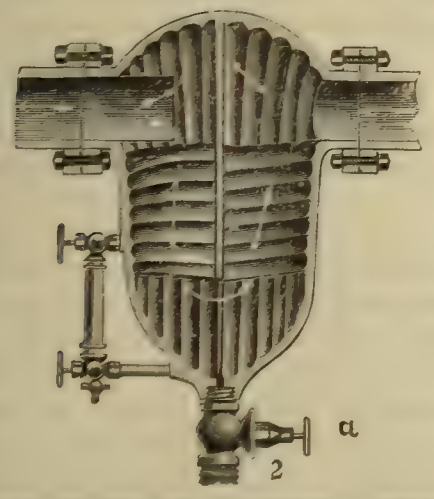


FIG. 1—ELIMINATOR FOR HORIZONTAL CONNECTIONS.

over again it would be the best possible for use and effect a material saving of fuel and a decided reduction in water tax bills, but in consequence of cylinder oil passing with the water into the boilers, this best of water is wasted.

To insure an exhaust steam from which oil, grease, and other chemical impurities are extracted, the Hine Eliminator was designed and placed on the market during the latter part of 1887, since which time its success has demonstated it to be an invaluable appliance for this purpose.

It is claimed to have a large area for steam expansion with no back pressure, and surfaces for the steam to impinge upon so constructed as to break up the steam most effectually. It is said they never clog up, as the water condensing in the body of the eliminator keeps them always cleaned.

By referring to the accompanying cuts the special features will be seen. When set into the exhaust pipes (flange connections from the engine or pump, as convenience will allow), the exhaust steam upon entering is dashed against a sharply corrugated deflecting partition, and expanding, impinges the transverse corrugated surface. This expels the oil, grease and dirty water, which gravitating to the bottom may be discharged through the valve *a*, while the clean, dry steam is conducted to where it is to be used. The eliminator shown in Fig. 1 is for horizontal, and that in Fig. 2 for vertical connections.

Among the many advantages claimed for this apparatus are:

1. Clean, dry steam for any and all purposes for which engine or pump exhaust can be used.

2. Clean heating pipes, radiators or valves, and consequently, better radiation and positive relief

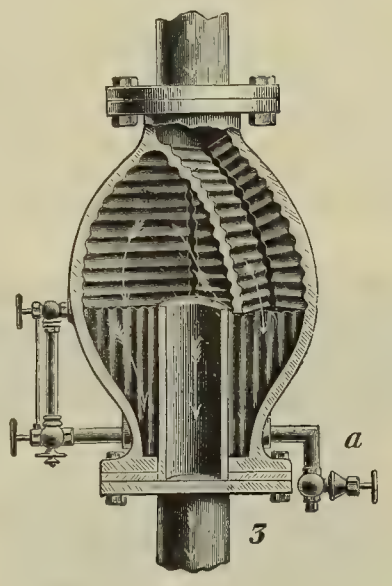


FIG. 2—ELIMINATOR FOR VERTICAL CONNECTIONS.

from unwholesome and obnoxious odors incident to oil coated pipes and valves where exhaust is used.

3. That by its use, the condensed water from the exhaust is kept pure and can be used over again in the boilers instead of being discharged into sewers, as is commonly done in exhaust heating.

4. That roofs and skylights do not get covered with oil, grease, and dirty water.

5. That it prevents exhaust injectors from clogging with oil and oil from passing through them into boilers.

6. That it saves cylinder oil to use over again for shafting, slides, &c.

The eliminators are manufactured by the Hine Eliminator Co., 106 Liberty street, New York, who furnish them complete with water gauges, to show the accumulation of water in order that it may be removed; flanges, bolts &c. Those designed for removing water from live steam are made heavier than those for exhaust, and are thoroughly tested to double the pressure required before being sent out.

The following testimonial from one of the many users of these valuable devices shows how they are appreciated:

GILLILAND ELECTRIC CO.,

ADRIAN, Mich., June 21st, 1890.

Gentlemen:—The Vertical Eliminator we purchased from you last February gives the very best of satisfaction, and you can refer any one to us in regard to its workings.

Very truly,

GILLILAND ELECTRIC CO.,
J. F. Gilliland, Sup.

Ft. Dodge, Ia., has decided to purchase and operate its own electric light plant.

AN INSULATED SCREWDRIVER.

Prominent among the rubber safeguards handled by George Cutter is the screwdriver which we illustrate herewith. It has a steel shank looped and flattened at the end, all except the tip being then moulded into a handle of vulcanized rubber. This material was chosen because it is considered the highest and most lasting insulating material, and nothing but the best would be at all suited for such a safeguard.

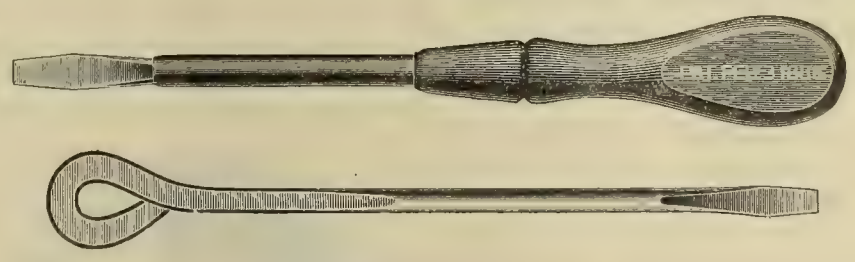
Armed with such a screwdriver one can safely work around live circuits, can place his fingers on the covered shank without getting a shock and can let this shank touch some other metal parts without burning the tip of the screwdriver. These points will appeal to the station men as well as trimmers, and promise quite a demand for the various sizes of this insulated screwdriver.

It is handled in the West by George Cutter, 333 "The Rookery," Chicago, who will also supply the trade in his territory.

MEETINGS OF SOCIETIES, ETC.

The representatives of various electric lighting companies in Pennsylvania, met at Harrisburg on March 17th, and organized the "Electrical Association of Pennsylvania." The object of the association is the proper development of the electric light business, mutual protection and information, and the determination of the best methods for assisting the State and local authorities in the formulation and enforcement of such laws and rules as will conduce to the interests of the community. The officers of the association are: Robert E. Wright, Allentown, Pa., President; J. K. Ewing, Uniontown, Pa., Vice-President; Clarence A. Woole, Bethlehem, Pa., Secretary and Treasurer.

An extremely interesting meeting was held by the New York Electrical Society in the parlor of the Electric Club, 17 East 22d street, on Friday, March 27th. Mr. Joseph Wetzler delivered a lecture on "Electrical Progress in 1890," during the course of which he called upon P. B. Delany J. J. Carty, C. O. Mailloux, F. Jarvis Patten, Nikola Tesla and several others, who described the improvements and developments made in the branches of electrical science with which these gentlemen are prominently identified. The subjects touched upon embraced the departments of electric lighting, continuous and alternating current motors, thermo-magnetic generators, telegraph, telephones, electric meausurement, prim-



INSULATED SCREWDRIVER HANDLE.

ary and storage batteries, electric railroading, etc. The meeting was one of the most successful and interesting ever held by the society, and was largely attended. We will give a full report of the proceedings in our next issue.

Mr. Charles Hewitt was booked to deliver a lecture on "Street Railway Motors and their Regulation," before the Department of Electricity of the Brooklyn Institute, on Friday, April 3rd. On April 17th, Mr. Edward H. Lyon will deliver a lecture before the same Department on "The Theory and Construction of the Telephone" with notice of recent improvements. The lecture will be fully illustrated and will be held in the lecture room of the Y. M. C. A. Building, Fulton street.

MAGNETIC LEAKAGE.—With real electromagnets there is always lateral leakage; the magnetic lines do not all emerge from the iron through the end face.

MAGNETIZATION CURVES.

The question of the permeability of iron is a very important one in connection with the design and construction of dynamos. In fact it is an important consideration in the construction of an electromagnet to be used for any purpose whatever, when it is desired to get the best results.

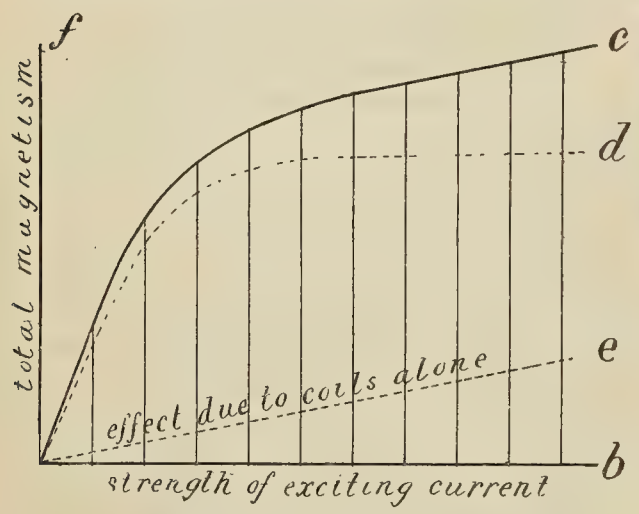
The saturation point of the iron core of an electromagnet depends upon the permeability of the iron, and the permeability depends upon the molecular construction of the metal.

Iron is more permeable than air, that is it will permit the transmission of a greater number of lines of force through its substance than would pass through an air space of similar dimensions and under like conditions.

There is no saturation point for air as in iron, consequently we can increase the current in a coil without a core and the magnetism will increase proportionately, but with an iron core in the coil the result is different, as shown and explained by the diagram given herewith.

The core of the electromagnet should be sufficiently massive to prevent the saturation point being reached, or at any rate passed, when the maximum current for which the coil was designed is flowing. The reasons for this are graphically illustrated in the accompanying diagram.

This diagram shows the relative strengths of the



CURVES SHOWING MAGNETIC EFFECTS.

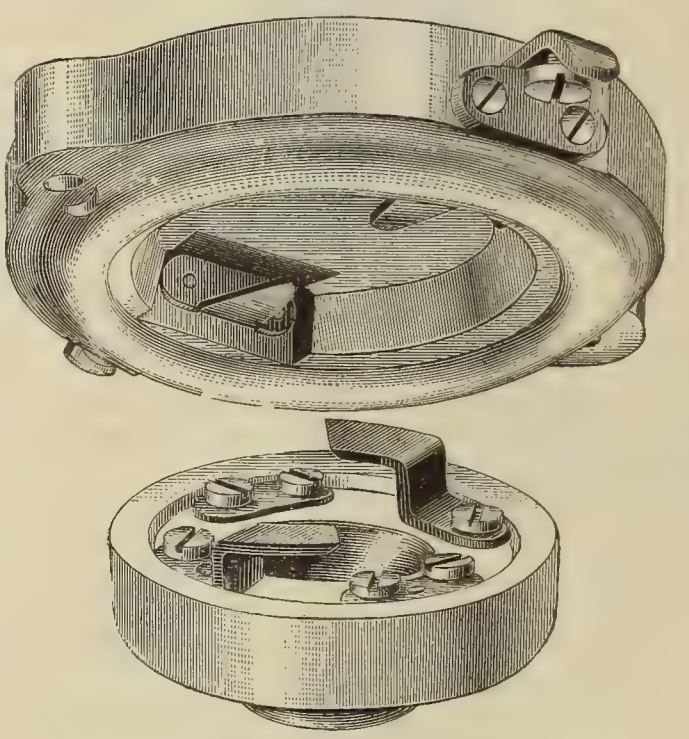
magnetic field under different conditions, by the plotted "curves." The line *a b* represents the strength of the exciting current. It is divided into ten parts, and ordinates are projected therefrom as shown. Each part represents 1/10 of the total exciting current and their combined effect is cumulative, the total length of the line representing the total strength of the exciting current. Five divisions will represent one half of the total strength, and so on.

The upright line *a f* represents the total magnetism evoked by the exciting current. Now let us suppose currents of various strengths indicated by the distances along *a b*, to be sent through the coil, the effect which the coil with its core exerts upon a compass needle can be marked off from the line *a f* upon the various vertical lines projected from *a b*. The thick upper curve *a c* drawn through the intersecting points, shows graphically by its distance from *a b* the deflecting effect produced upon the needle by the various currents corresponding to the distances along *a b*. Let it be further supposed that without in any way altering the position of the needle or of the coil, the core is withdrawn and the various currents again sent through the coil. Under these conditions the various magnetic effects of the coil upon the needle are shown by the "curve" (in this case a straight dotted line), *a e*, which demonstrates therefore that the field produced by the coil is proportional to the current flowing through it. The third curve, *a d*, is particularly interesting. Suppose the magnetic effect due to the coil alone, and represented by the distance *b e* to be deducted from the joint effect produced with the same current by the core and coil combined, and represented by the distance *b c*, then the remainder *b d* will represent the effect produced by the core alone. And if this subtracting process is carried out along each of the ordinates, the curve *a d*, known as the curve of magnetization, will be produced. Now, it will be observed that, after a certain point has been reached, this curve becomes a nearly horizontal straight line, indicating that the saturation point of the iron has been reached, and that any further increase in the current strength does not add appreciably to the magnetization of the core, the increase in the strength of the field developed being that due to the coil itself. The two curves *a d* and *a e* would, if the experiments were carried far enough, intersect at a point where the permeability of the air equals that of the saturated iron.

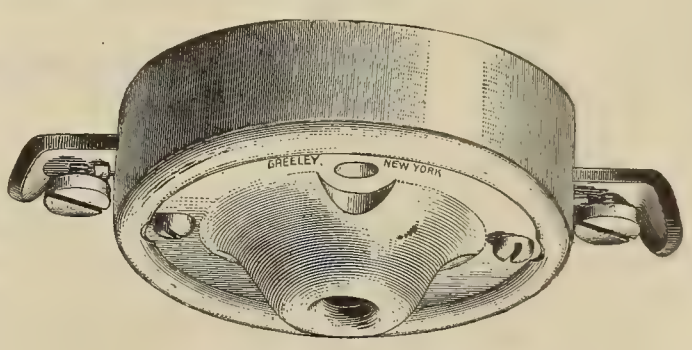
It follows from these considerations that at a certain stage of the magnetizing force developed in or by a coil of wire, the permeability of air equals, and beyond that stage, exceeds the permeability of iron.

NEW ROSETTES.

In order to keep our readers posted in regard to what is going on in the market with respect to devices that may be useful to them, we illustrate this week three distinct patterns of rosettes, which cover some novel and useful features. In the plain pattern Cartwright Porcelain Rosette and the ornamental pattern of the same, the brass connectors to which the wires are fastened have a slight projection from the base underneath the overhanging screw-head, opposite the point where the wire rests when it is clamped. The object of this projection is to prevent undue torsion of the screw when it is



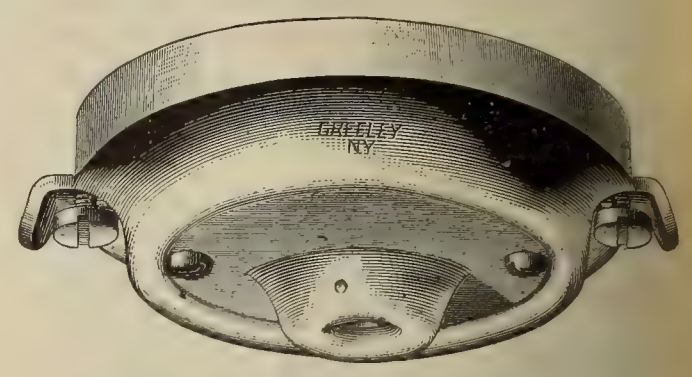
CARTWRIGHT WATERPROOF CUT-OUT



PLAIN PORCELAIN ROSETTE.

turned firmly down to clamp the wire. When there is no such support, there is a tendency to throw the screw-head out of plumb, and damage the connection, whereas, when the screw-head is equally supported on both sides, on one by the wire itself, and on the other by the projection, better results are obtained.

In the Cartwright Waterproof Cut-out, this feature in the connector is not only present, but special stress is laid upon the fact that there are no screw-holes or metallic connections of any kind leading from the inside of this cut-out that might form contact with a damp ceiling. In fact, as the name implies, it is a waterproof cut-out. There is nothing specially novel about the manner in which the cap of this cut-out connects with the base, as several other cut-outs are made upon the same general principle, and while there is no criticism to be made upon the way in which the cap containing the fusible wire and the base interlocks automatically, the waterproof character of this cut-out cannot be too highly commended. The cuts are full size.



ORNAMENTAL PORCELAIN ROSETTE.

These goods are being marketed by the E. S. Greeley & Co., of New York.

ELECTRIC LIGHT AND POWER IN AUSTRALIA.

According to recent reports from Australia, the people of that country are now rapidly awakening to the advantages to be derived from the utilization of electric light and power.

A central station plant of electric lighting has just been completed at New Castle, which operates the Westinghouse system of alternating current central station apparatus.

The installation of the plant comprises arc and incandescent lamps. The machinery for generating the electric current is driven by Westinghouse compound engines. The plant is composed of Westinghouse alternating current dynamos and exciters. Steam for the electric plant is generated by Babcock & Wilcox boilers, working at 20 pounds pressure per square inch. The switchboard controling the lighting arrangements is the most perfect and complete in the Australian colony. By its means the light can be switched on and off at any given point in the town. The street lights are worked on two independent circuits, and there are also two independent circuits for private lighting. The exciters and dynamos for the plant were manufactured by the Westinghouse Electric and Manufacturing Company at their works in Pittsburg, Pa. The installation of the apparatus was superintended by an engineer of that company who had been sent purposely to Australia.

To get an idea of what the public in Australia think of the plant, we quote a few remarks from the *Australian Mining Standard* of February 14, last.

"The public and council of New Castle," it says, "are more than pleased with the success of this installation. The plant has now been running for six weeks and no break has occurred since the moment the lights were first turned on. In the adoption of the electric light the town of New Castle has provided another example of its enterprise and progressive spirit. The advent of the electric light created some little commotion at first, but the fiat had gone forth and now a mild outburst of jubilation testifies to the installation of the electric light as a great public convenience. The occasion is certainly one of the greatest importance to the whole of the municipal centres in Australia, and we would advise municipal corporations in the colonies, who have the intention of putting up an electric light plant, not to make up their minds until they have seen the system operated at New Castle."

The Hotel Wyandotte, Wyandotte, Minn., has recently installed an isolated plant with a capacity of six hundred Edison incandescent lamps.

ELECTRICAL SENSATIONALISM.

BY EUGENE LYNCH, JR.

"Falling Wires Furnish Funerals among Firemen."

"Another Shocking Tragedy."

"Shocked in the Air."

"Death in the Wires."

"Volts, Violence and Victims."

"Caught and Crucified by the Constant Current from the Copper Conductors."

"Death Dealt by the Deadly Dynamo."

"Terrible Torture and Tragedy."

The above headlines have been selected from a collection of newspaper headings that have appeared in our daily newspapers within the past few years, and serve as an example to show the manner in whichany electrical accident is treated by a sensational newspaper that is suffering from a dearth of news, and which has been fortunate enough in having assigned this particular incident to some one of their reporters who happened to possess the particular qualifications that are born in the *genius* who aspires to be prominent as a sensational writer.

The use of electricity for light or power has only been developed within the past ten years. In both of these fields, light and power, electricity has been obliged to fight its way into public favor against the united interests of powerful rivals, some of whom had been entrenched for many years, and whose influences, backed as they were by heavy financial interest, were all directed to crush out the presumptuous rival who proposed to interfere with their business.

It is not to be wondered at, therefore, that many of the sensational articles that have appeared within the past five years have been so virulent in their attacks upon the electrical industries, and there is no doubt in the minds of all the electrical fraternity, that these articles have in the main been instigated by these rival interests.

The study of electricity, although a very simple science, presents to the average reportorial mind an air of delicious mystery. He has no doubt that his chief has even less knowledge of the workings of the science than he has himself, and that under these circumstances not only does his article stand less chance of pruning, but he himself becomes the proud possessor of a reputation of being a "scientific writer."

The great cry of the times is progress and originality; the first he leaves to the "circulation swearer," and for the second he relies upon the vagaries of electricity to furnish him an occasional article to "spout over." As I have stated before, the above headlines have been taken from the daily papers and, with one exception, they all represent different and separate incidents, accidents or occurrences. *In only one case* was there any reason for special mention, and in that one case alone was a life lost by contact with the wires. No mention is made of the fact that death was due entirely to the negligence of the unfortunate person, to whom the paper, however, insisted upon referring as the "victim."

In two instances the only apparent authority for the writing of such an article by the reporter was the sudden appearance of the same in a small crowd who were delivering chuckle-headed opinions upon the treatment of a car-horse that was suffering with the blind staggers. The scanty information imparted by some waggish bystander, together with the supposed credit to be derived by "beating" some other rival paper, inspired him to write a column article describing the "trembling" and "agonized sufferings" of the horse under the heading of "Caught and Crucified by the Constant Current from the Copper Conductors," and remarkable to relate his statements practically remain uncontradicted. The editors and owners of the newspaper were furnished with affidavits stating that the electric light station was completely shut down in the day time, but strange to state, the editor did not deem the matter of sufficient attention to even note this fact.

The victim, whose departure was noted by "Death Dealt by the Deadly Dynamo," jumped from the window of a burning building into a network of wires and was suspended there for some time, making loud appeals for help. The wall of the building fell over and crushed him before help arrived, and this unfortunate's death was attributed directly to an electric shock

As another instance, the gross ignorance and the wilful misrepresentation of the facts is shown by the statements that have been circulated upon the dangers to firemen in the discharge of their duty and their liability to receive shocks by playing a stream of water over the wires that may be bare of insulation. Some years ago a sensational article of this kind appeared in one of the New York papers and was then quoted all over the country. One of the electric companies promptly took "the bull by the horns" and invited the representatives of the press and the fire marshals of the near-by cities to view a practical test, and although that test was conducted to their satisfaction, the articles describing the same did not occupy one-tenth the space or travel one-hundreth as far as the original sensational article.

It appears, however, that electricity has not been the only sufferer from sensational newspapers. The first installations and uses of gas had to literally fight their way against public prejudice. I am informed that when gas was first introduced in England that Parliament passed a law regulating its use, one of the conditions of which was that "the gas pipe should not be placed within three inches of any wood-work or other combustible material." They had formed the impression that the fire was conveyed through the whole length of the pipe, and curious people would first wet their fingers before touching the pipe.

Mr. R. W. Pope, in a very clever article upon the "Past, Present and Future of Electricity," speaks of the following petition that was presented to the Common Council of the city of Philadelphia in 1833. This will be of interest, and I will give it exactly as he quoted it:

PHILADELPHIA, November 28th, 1833.

REMONSTRANCE AGAINST LIGHTING WITH GAS.

To the Honorable the Select and Common Councils of the City of Philadelphia:

GENTLEMEN:—The subscribers beg leave to respectfully remonstrate against the plan now in action for lighting the city with gas, as they consider it a most offensive, inexpedient and most dangerous mode of lighting. In saying this they are fully sustained by the accounts of explosions, loss of life, and destruction of property where this mode of lighting has been adopted.

We consider gas to be near as combustible as gunpowder and nearly as fatal in its acts; as regards the immense destruction of property, we believe that the vast number of fires in New York and other cities may be in a great measure ascribed to this mode of lighting. The leakage of pipes and carelessness of stopping off the gas, furnish almost daily instances of its destructive effects. And when we consider that this powerful and destructive agent must necessarily be left often to the care and attention of the youth, and domestics, and careless people, we only wonder that the consequences are not more appalling. It is also an uncertain light, sometimes suddenly disappearing and leaving streets and houses in total darkness.

The waters of the Delaware and Schuylkill, now considered the most pure and salubrious in the world, as many long voyages have fully tested, must soon, we fear, experience the deterioration which has reduced the water of the Thames to the present impure state; for no reservoir will be able to contain such fetid drains from such an establishment, and very soon the rivers must be their receptacle, to the destruction of the immense shoals of shad, herring and other fish, with which they abound; the same cause must produce the same effect. Salmon, smelts and other fish, formerly caught in vast quantities in the Thames, have nearly all disappeared. The constant digging up of the streets, the circumstances of the gas pipes which at the intersection of each square must come in contact with the water pipes, are difficulties and evils which we would anxiously avoid.

In conclusion we earnestly solicit that the lighting our city with oil may be continued.

And your petitioners, etc.

Signed by 1,000 of the leading citizens of Philadelphia, whose names are attached hereto, such as Horace Binney, Hartman Kuhn, Jacob Ridgway, Paul Beck, Henry Pratt, Benjamin Chew (on whose farm the battle of Germantown was fought), John Sargeant, Charles Wharton, Richard Willing, Edward Pennington, Robert Vaux, Joshua Longstreth, Matthew Newkirk and 1,200 others.

N. B.—The above are only part of the names, as many of the remonstrances have not yet come in."

Charles Reade, the well-known author, gives a very graphic description in one of his books showing the troubles encountered by a clever inventor in securing the adoption of labor-saving devices and the inventor's fight against labor unions and their methods of retaliation—blowing up by gunpowder, shooting and attempted mutilation with axes—that followed their warnings to him to stop working upon the development of his devices. The introduction of steam railroads also suffered from like futile objections, many farmers objecting on the ground that it would destroy the raising or breeding of horses, that there would be no market for the same.

The sudden development of an enormous business in electric light and power has thrown open the use of the same to a large portion of the community whose knowledge was necessarily limited. A conversation overheard between two footmen would substantiate such a statement: "Bedad, Tim," said Dennis, "have you heard tell of the electric fluid?" "I have not, Dennis; is it anything like beer, for instance?"

Within the past few months a very sensational article appeared in one of the prominent papers making serious charges upon the methods used in the late electrocution at Auburn. The writer claimed that the burning of the test lamps at the same time that the current was applied to the chair prevented the occupant from receiving the full force of the current. The electrical reader, who knows that these circuits were in multiple, will realize the absurdity of such a claim, as the amount of current available in the dynamo was largely in excess of what was required, and the placing of the test lamps in multiple would not affect the result in any way. The article, however, seemed to be accepted in perfect good faith and must certainly have made some converts among people who did not understand the absurdity of it. Let us hope, however, that the education of the public that is going on all the time will serve to eradicate in the future such useless and senseless journalism.

SOUTHERN NOTES.

The telephone company, Knoxville, Tenn., will tear down their old building on Eighty-first and Vine streets during March, and will erect a large building especially adapted to their use on the same site.

The Houston Street Railroad Company, of Houston, Tex., has purchased ground for an electric light plant, the building for which will be erected at once.

PHILADELPHIA NOTES.

Mr. J. J. Gates, General Manager of the Perkins Electric Lamp Company, was the happy recipient of a very handsome and most interesting present on March 14, 1891, *viz.*: a bouncing girl baby, the weight of which tallied with the date of birth. We send our congratulations.

We desire to call the special attention of all dealers in electrical goods to the advertisement of the Partrick & Carter Company, announcing the issue of their 1891 catalogue. A perusal of its pages will convince the most skeptical of the decided advantages to be gained in communicating with this firm if in want of any of the thousand and one articles pertaining to their business. This firm is forced to keep their employees at work until 8 P.M. daily, in filling contracts for their "King Annunciator and Bell" the two favorite kings of this country. Don't fail to read the Partrick & Carter advertisement.

Mr. H. T. Paiste, of 1201 Market street, has perfected a new handle for his 5 and 10 ampere switch. He formerly used a flatted head screw, vulcanized in rubber, but use demonstrated that this would become loose with wear. After considerable experimenting Mr. Paiste adopted the present method, that of using a dropped forged steel handle and covering the same with a thin covering of hard rubber for insulating purposes. For push and energy, Mr. H. T. Paiste is certainly full to overflowing of both. This young gentleman is as full of grit as an egg is of meat, and a visit to his packing room the other day showed 10 cases of the different kinds of electrical goods manufactured by him marked and ready for shipment by ocean steamers.

H. B. Underwood & Co. are very busy in their repair work, boring cylinders, making and putting in St. John self-adjusting cylinder packings and general repairs to all makes and sizes of engines. They have just completed work for the following well-known firms: Keasby & Mattison, Ambler, Pa.; Southern Lumber Company, of Suffolk, Va.; American Sugar Refining Company, Brooklyn, N. Y.; A. A. Jewett & Co., Philadelphia and other firms of equal prominence. Mr. Underwood is out nearly all of the time among the firm's customers giving them the benefit of his ripe experience and Mr. John S. Camer, the very competent Superintendent, gives all matters in the shop his careful supervision.

W. R. Griffith & Co. are now wiring the new theatre at Ambler, Pa. About 200 lights will be installed. The firm have also closed an order with the Suburban Rapid Transit Street Railway Company of Pittsburg, Pa., for four 80 horse power Mather generators. These machines are particularly adapted for street car work. The firm is also doing some construction work for this company and installing an arc light plant. H. G. G.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, Mass., March 27, 1891.

Application will soon be made for a charter for an electric road between Taunton and Middleboro, Mass.

A. F. Mason, general manager of the Simplex Electrical Company is confined to his home with pneumonia.

The Simplex Electrical Company have issued a new edition of their "Simplex Manual." This book contains formulæ, tables and much information valuable to those engaged in the electrical business.

The petition of the Merrimac Valley Street Railway Company for permission to increase its stock from $80,000 to $250,000 in order to equip the road with electricity has been granted by the railroad commissioners.

Frank H. Whipple has taken the sole New England agency for White's Automatic Fire Alarm and has opened an office at 1472 Washington street. This device is being rapidly adopted by all the leading hotels in the city.

At the meeting of the Boston Board of Aldermen last Monday these companies were given leave to erect poles in the streets of Boston: New England Telephone and Telegraph Company, 41 poles; the Charlestown Gas Company, 17 poles; Boston Electric Light Company, 8 poles.

The Electric and Machine Company, of this city, are doing a splendid business and their well equipped factory is taxed to its full capacity with the orders now on hand. This concern manufactures all kinds of electrical apparatus and does light machine work of every description.

There is some opposition in the board of aldermen to the petition of the West End Railway Company for leave to erect an awning or other suitable protection from inclement weather in front of the Granary burying ground on Tremont street, the point of arrival and departure of most of their electric cars.

The directors of the Erie Telegraph and Telephone Company have under consideration a proposition to sell a portion or all of their seventy per cent. interest in the stock of the Southwestern Telegraph and Telephone Company for $700,000, which is equivalent to $50 per share for Erie stock. The proposition comes from a Texas syndicate. The matter will be further considered at the next regular meeting of the directors.

The Employers' Time Register, manufactured by the Automatic Time Stamp and Register Company, 71 Sudbury street, Boston, is being adopted by many large electric light stations and construction companies. This machine is being used by construction companies to keep the time of men engaged on contract jobs in large buildings where it is difficult for the foreman to keep accurate time of the coming in and going out of the men employed, and, as it tells the truth, on the "boss" as well as the men, it is invaluable.

FITCHBURG, MASS.—C. H. Brown & Co. are placing a number of their engines with electric light and power people.

The Union Machine Company are preparing to manufacture a new friction clutch.

J. W. Colburn is receiving numbers of orders for his dynamos. They are rated among the best produced.

A high minded thief climbed the mason's ladders in the stack of the Narragansett Electric Lighting Co.'s station, Prov dence, last Thursday night, and stole the platinum tips that had just been placed in position on the lightning conductors.

SPRINGFIELD, MASS.—The Barrett Storage Battery Company are doing a good business with their battery. Their car which is in operation at the Worcester Exhibition demonstrates the practicability of the battery. Tests which have been made show that the battery is highly efficient.

The Springfield Felting Company are doing good business with their boiler and steam pipe covering.

Mr. D. Hale has been appointed treasurer of the Springfield Foundry Company.

HARTFORD, CONN.—The Perkins Electric Switch Company's switch continues in demand and they have enlarged their factory.

MERIDEN, CONN.—One of the most prominent electrical manufacturers in this city is Mr. Frank Wheeler, of Wheeler double trolley fame.

F. E. B.

INTERNAL RESISTANCE.—The resistance of the liquid between two small spheres, or two small discs of copper immersed in a large bath of sulphate of copper, is practically independent of the distance between them, provided they are not within ten diameters, or so, of one another.

THE WESTINGHOUSE TROUBLES.

For several months past, the daily press has constantly referred to what is called the financial troubles of the Westinghouse interests. While it is true that there are several industrial corporations which in one form or another bear the name of "Westinghouse," it is equally true that the "financial troubles" among these companies have been confined to what is known as the Westinghouse Electric & Manufacturing Company, or, in other words, to that company whose business consists in making and vending electrical apparatus.

The Westinghouse Machine Company, for instance, whose business consists of making and selling, through the medium of its agents in every part of the civilized world, its well known "Westinghouse Engines," (a new advertisement from which company appears elsewhere in this paper), has had no "financial trouble," and to use a current expression, is "not in it!" Instead of curtailing its operations, this old reliable institution is still further increasing its capacity as rapidly and as much as it can. New tool and store rooms are just approaching completion, and it is hoped by the management, during the coming Spring or Summer, to be able to add complete new erecting and testing shops fitted with large power cranes and all modern improvements, and which shops will have a producing capacity twice as great as the present ones. To those in want of steam engines, as well as to those interested in the development, progress and enterprise of American manufacture, we suggest a careful perusal of the advertisement of the Westinghouse Machine Company, which appears elsewhere in this issue.

EDISON ARC LAMPS.

Mr. M. D. Law, who has charge of the Arc Lamp Department of the Edison General Electric Company, is meeting with great success in the development of this new branch of the concern with which he is connected. He has just installed in Herkimer, N. Y., a plant of 50 Edison arc lights, and from the moment the current was first turned on the lamps have operated with the most satisfactory results. The success of this plant is unqualified, and reflects great credit upon Mr. Law's ability as an electrical engineer, as well as upon the Edison General Electric Company, in having an efficient arc lamp. The lamps used in this case are of the single carbon type. The power to run the dynamo is supplied by one of the celebrated Ball engines, many of which are found in electric light stations throughout the country. There is every indication that this branch of the Edison General Electric Company's business is destined to have unbounded success.

NEW CATALOGUES, ETC.

Palmer Brothers, of Mianus, Conn., have just issued a new catalogue and price list of their dynamos, dynamo castings, motors, electroplating machines and general electrical supplies. This firm furnishes amateurs with parts of dynamos and motors.

We are in receipt of a copy of a handsomely gotten up book, entitled "Illustrated Montreal," published by J. McConniff, Windsor Hotel, Montreal. The book is very fully illustrated by reproductions from photographs, and is written in an exceedingly interesting manner. Every one intending to attend the National Electric Light Convention in Montreal next August should read up about the place.

The Simplex Electrical Company, of No. 115 Broadway, New York, have just issued a new edition of the Simplex manual of valuable tables and formulæ, designed for the use of electrical engineers. As its title implies, the book contains tables, etc., of great value to every one engaged in the electrical trade. It is very artistically gotten up, and reflects creditably upon the enterprising company.

E. & F. N. Spon, No. 12 Cortlandt street, New York, have just issued a very handsome and fully illustrated catalogue of books relating to civil and mechanical engineering, arts, trades and manufactures. This catalogue is a valuable one, inasmuch as it gives the contents of many of the most valuable books sold by that firm. It is very complete and attractive.

We have received an artistically gotten up catalogue of the Bain Electric Manufacturing Company, of Chicago. It contains a full description of Foree Bain's new system of electric light and power and the well known Bain dynamos. In the back of the catalogue are found some very valuable electrical statistics and tables. There is also a good deal of collateral information, which will be of great value to every electrician.

NEW BOOKS.

Die Elektrischen Verbrauchsmesser, by Etienne de Fodor, Director of the Electrical Central Station, Athens. A. Hartleben, Vienna.

In this work, which is printed in German, over eighty electric meters, including American instruments, are more or less fully described. Those invented in late years are not included, however.

The work contains 219 pages and 77 illustrations and is of interest and value, compiling as it does descriptions of the various meters so far produced.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., March 27, 1891.

Mr. George Cutter, dealer in electrical specialties, No. 333 The Rookery, Chicago, while East in attendance at the Providence Electric Light Convention, closed a contract with the Simplex Electrical Co., of Boston. He will carry a large stock of their goods, and has rented a large place in the basement of The Rookery for that purpose. He also effected an arrangement with the Germania Lamp Co., of Cambridge, Mass., to carry their goods in stock; and also with the Electrical Supply Manufacturing Co., of Manchester, N. H., to carry a line of measuring instruments, including voltmeters and ammeters manufactured by that company.

The Central Electric Company have recently arranged with the Bryant Electric Company, of Bridgeport, Conn., to handle their sockets and switches and already report large sales. They carry a complete stock of all sizes and capacities. The same company are about to place a new carbon battery upon the market, the principal features being the purity of the carbon and the shape of the glass jar, which fits so tightly to the carbon that it makes it virtually air tight and thus prevents evaporation of the solution.

The orders for the Improved Candee Line Wire as recently received by the Central Electric Company have taxed their unequalled facilities for handling a large business to the utmost, and in consequence, has tested the factories' capacity to keep them in a large stock of all sizes in anticipation of the spring business; they are now, as usual, fully stocked.

PERSONAL.

Mr. T. W. Ness, manufacturer and importer of all kinds of telegraph, telephone, medical and general electrical supplies, No. 644 Craig street, Montreal, was in town last week and paid his respects to the Electrical Age.

Mr. James H. Mason, the well known electrician of Brooklyn, has become connected with the Practical Electrical Company, 166 Pierrepont street, Brooklyn, as its electrician. This company is engaged in general electrical construction work, and are dealers in electrical supplies.

NEW YORK NOTES.

The E. S. Greeley & Co., railway and electrical supplies, 5 and 7 Dey street, are doing a large trade with the "Williams," "Draper" and "Siphon" steel and brass oilers and lamps. These goods are constructed in the very best possible manner, with the best material, and there are several valuable features which commend the use of these oilers generally. The steamboat sets are now used on a great many steamers in this country and abroad, and are so constructed that through any motion of the boat the oilers will remain in their places. They are made with nozzles of all sizes and shapes, and adapted to every possible use in oiling machinery.

The Manhattan Electrical Supply Co., 36 Courtlandt street, are meeting with unusual success in the sale of their "Early Riser" outfits, including clock, battery and bell—all on one base. Their supply business is constantly on the increase. They are now in a position to meet competitive prices, as they are manufacturing household and other electrical goods at their own factory at the above address.

The Conover Manufacturing Company, consulting and mechanical engineers, No. 95 Liberty street, are very busy in preparing plans for electric light stations. They handle the Improved Independent Belting Power Air Pumps and Condensers, which apparatus is much appreciated by all the users. This air pump and condenser has been designed with the view to supplying the most efficient condensing apparatus on the market, and at the same time reduce the power required to operate it to a minimum. It is claimed that it is the most economical and efficient arrangement for the purpose, as well as one that is exceedingly durable and designed to operate with least attention.

Hawthorne & Co., 114 Liberty street, are agents for the Shipman Engine Company, and are meeting with excellent success. Mr. Hawthorne has introduced these compact little oil burning engines for electric lighting into a number of isolated plants. Leo Daft, the well known electrical engineer, is using one of these engines at his home in Plainfield, N. J., and speaks in high terms of its working. He is using it with his own dynamo in charging accumulators. This firm have installed a number of other similar plants. Mr. Shipman has made a specialty of the Shipman engines since their first appearance before the public years ago, and has made many improvements in them.

Truex & Vail, No. 44 Broadway, have secured a contract for lighting Austin Corbin's private car "Oriental" on the storage battery system. This car is said to be the finest in the country and is the second one fitted up for Mr. Corbin with the accumulator system.

The Excelsior Electric Company, 115 Broadway, are meeting with great success with the new Hochhausen alternating current motors, built for 52 and 110 volt circuits. Mr. H. D. Fuller, President and Treasurer of the Company, is to be congratulated on the handsome appearance of his new offices, which face Broadway. The former offices were located in the interior of the building. The company are arranging for an exhibition plant in one of their rooms that promises to be of great interest.

Mr. Frank B. Tracy, son of the Secretary of the Navy, is the manager of the New York Department of the Thomson Electric Welding Company, No. 115 Broadway. This most interesting system is attracting much attention, and Mr. Tracy is doing a very successful business. He is possessed in a large measure of those personal qualities so essential for the successful carrying on of a large and constantly growing business.

Mr. J. C. Pierrez of the Goodrich Hard Rubber Company, reports an active demand for his company's goods, and their works in Akron, Ohio, are kept running to their full capacity.

The Thos. Murray Co., engineers, contractors and builders of electric, steam and tram railways, successors to Thos. Murray & Co., on April 1st took possession of their new offices in the new Electrical Exchange Building, corner of Liberty and Washington streets. They have four commodious rooms, excellently situated. This firm have now in course of construction the following railroads: The complete equipment and construction of the Grand View Beach Railroad, of Rochester, N. Y., running from Charlotte to Manitou Beach, a distance of eight miles, to be in operation May 25th. The complete equipment and reconstruction of the Bridgeport, Conn., city railway lines, operating fifteen miles of track. The complete construction and equipment of the Long Branch Electric Railway of New Jersey, over fifteen miles in length. The reconstruction of the Buffalo City Railway tracks, operating a distance of over fifty miles. The reconstruction of the lines of the Consolidated Street Railway Company of Columbus, O., embracing all their lines, a distance of over forty miles; making a total of over 128 miles of track, all of which will be built in the most thorough manner, and equipped with the most modern electric appliances. In most of the above instances the company have contracted to equip the roads complete, furnishing the track, overhead appliances, wire, power plants, power and car houses, cars, etc., turning the roads over running successfully to the management. As engineers and general contractors, the company is in a position at all times to give estimates and make bids for the complete or partial construction of electric roads.

W. T. H.

Mr. Frank X. Cicott, formerly of San Francisco, who carried on a general agency business for eight years in that city, in electrical supplies and railway material, has assumed the management of of the rail department of the Electrical Merchandise Company of Chicago.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, Electrical Age:

Name of Companies.	Capital.	Par.	Price.
Aluminum Co.	350,000	100 00	$100 00
American Motor Co.			5 00
American Private T'phone (Parent)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	12,500,000	100 00	197 00
Boston Electric Light			105 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brush Illuminating (N. Y.)	1 000,000	100 00	60 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	22 00
Brush Swan (Ithaca)	50,000	10 00	8 00
City Electric Street Ry. Co., 6's	200,000		par
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Consolidated Electric Light	1,929,400	100 00	50 00
Consol Gas & E.L.Co. of West Co.6's	250,000		par
Consol Gas & E. Co. Batavia, 6's	80.000		par
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	80 00
Edison Elec. 5s	2,000 000		*99
Edison Illuminating	4,500,000	100 00	88 00
Edison General	14,000.000	100 00	105 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Erie Telephone			48 00
Essick Printing Tel.	5,000,000	100 00	70 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	13 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*90
Jamaica & Brooklyn Road Co.	197.480	20 00	2 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Laclede Gas Co.	7,500,000	100 00	16 00
Laclede Gas, pref.	2,500,000	100 00	46 00
Laclede Gas 5s			*78
Law Telephone			
Long Branch Electric Light	50,000	100 00	75 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		
Manhattan Elec. Light Co. Lmtd. 5's	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	2,000,000	100 00	
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light			90 00
Morristown L. H. & P. 5s	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
N. E. Telegraph and Telephone			50 00

Name of Companies.	Capital.	Par.	Price.
N. Y. and N. J. Tel. and Tel 6s.....	1,500,000		par
N. Y. and N. J. Telephone Stock...	2,535,000	100 00	99 00
Newark L. & P.....	150,000	100 00	85 00
Newark Elec. Light (Schuyler) ...	100,000	100 00	
North American Phonograph.....	6,000,000	100 00	20 00
North New York, Lighting.	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		par
Postal Telegraph.....	10,000,000	100 00	30 00
Passaic, Electric Light.....	15,000	100 00	92 00
Paterson, Electric Light.....	100,000	100 00	
Peoples' Elec. Light (Trenton)....	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Richmond L. H. & P. (S. I.).....	150,000	100 00	60 00
Rockaway Beach Elec. Light.....	50,000	100 00	60 00
Russell Electric Lamp Co. (Boston)	300,000	100 00	90
Saratoga Gas and Elec. Light 6s...			*86
Saginaw Elec. Light & Pr. Co. 6's ..	50,000		par
Shaver Corporation	100,000	1 00	3 00
Swan Incandescent.....	800,000	100 00	2 50
Standard Ug'd Cable Co.....	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.....	100,000	100 00	95 00
Thomson-Houston Electric Co.....	10,000,000	25 00	47 00
Thomson-Houston Pref..	5,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers 6's.....	100,000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Union Switch & Signal Co.....	1,370,000	100 00	
United Elec. Light and Power.....	3,000,000	100 00	80 00
United Elec. Traction Co.....	1,370,000	100 00	2 50
United States Elec. Co			40 00
United States Illuminating	1,250,000	100 00	50 00
Universal Arc Lamp Co...	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.....	2,000,000	10 00	6 00
U. S. Drug Stores (Ltd.) ord.....	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.....	250,000	5 00	6 00
Western Union	86,188,852	100 00	80 00
Westinghouse Electric Co....	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.....	3,000,000	50 00	50 00
West End, L. (Boston).....			22 00
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.....	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

Hello! Hello!!—Give me Electric Investor, please. Hello, yes; this is Ellery. I got your letter yesterday with your subscription and copy, with cuts for advertisement, thanks; in reply to your question: Electrical industry has in the last ten years of its commercial existence materialized profitably in so many directions that comparatively few investors realize its importance as a factor in the interest earning securities open to them. To the small investor an opportunity is offered in the shape of bonds or stocks in local companies which can be purchased in quantities from one bond or ten shares up, yet bearing a proportionate degree to the gross capital that makes one feel at home in the company; and you are not confined to a small compass, as will be seen by a careful perusal of the quotations in the Electrical Age, which includes twenty different branches of the electrical art or methods of applying or utilizing electricity rendered possible by the Joint Stock Act. The diversity of its development extending from telegraphy to smelting, from light to power, from pole to pole, from here to yonder, enables you to select that particular branch in which you can increase your wealth with the greatest personal pleasure and ever present gratification, growing up with a business now in its infancy, certain of a legacy for your children in which they, male and female, can take an active interest. The possibilities of electrical investments are not chimerical; experiments, except as to new or novel applications, are past and your money placed with a fair degree of intelligence in almost any of the securities in my list is as safe as a government collateral and returns a larger dividend. The list is carefully revised and corrected each week and is intended to include all classes of electrical corporations except those who request me to leave them out. You will find the advertisements in the Electrical Age one of the most beautiful kaleidioscopical advanced current electrical histories in the world. If you want anything ring me up; good bye.

Another American electric company is reported to have run up against the British Government, and of all old chestnuts conceivable, with the messenger call system. Is it possible there lives an international promotor who does not know that a concession was granted for this very thing over ten years ago, and recalled because the Post Office Department owns all business done over a wire. If Postmaster General Raikes' predecessor had been in office, without doubt the first man placing the first connection would have been locked up immediately. In case the U. S. buys out the Western Union and all other existing telegraph companies, giving a term of years' notice to the public, is it supposable it would permit a foreign company to come along and do business, or even trouble to discuss the question? The call system is electric telegraphy, pure and simple, and the moment the wire enters public ground or space in Great Britain it belongs to the government and the Postmaster General must "will ye, nil ye," own, defend and be responsible for it. In a few years our Post Office department will be in the same position. A wire for public business can then only be used by leasing it from its owner and its uses cannot be divided. Investors and speculators should not lose any time, but cover the domain with conductors. Uncle Sam at the sale will buy them all and pay a fair profit. You will hardly recognize your electric bond or share in the shape of a United States bond.

It has been customary among horse improvers, from time immemorial, to take their expected prodigies away off to some secluded spot and there develop the desired qualifications or become convinced of the weakness of that particular equine as an investment. The financial venture was much less than to enter him for an event, backed, of course, liberally, and find he was practically only a fair fourth at his best. Why should not the electric motor be treated the same way? There are railroads on the plains where you can connect your motor to a freight train, and take a thousand mile dash; you can have the right of way in many cases for ten or twelve hours at a time and jerk the daylight out of the motor, or the train, without seriously discommoding any one; you need be careful only on bridges; an ordinary tramp can repair any other damage to road or rail. Let us suppose your motor costs $50,000, and the expense of landing it on a track west of the Mississippi River in charge of your own electrical engineers and fastening to a heavy train is $25,000 more. You will not have to snake that freight over the road more than four or five times, if your motor can do the work as well as a sixty or seventy ton locomotive, before you will be offered for your "proven" engine more money than it can haul on a level road. It is the most economical method to produce the result, and will give you control of the business while others are wasting time and money experimenting in too narrow a space

The Electricity Supply Company, Limited, of Spain, have a fine central station just outside of the city of Madrid, from which they have circuits extending throughout the city. The Senate House has lately been wired and lighted with 1500 incandescent lamps, the current being taken from the main street line. The Queen after inspecting the light expressed an amount of pleasant satisfaction surpassed only by the fortunate shareholders. This contract will cause a grand receipt of large orders, and correspondingly increased income. New York will no doubt illuminate electrically, her municipal buildings,—after the subways are completed to perfection.

One million dollars in American gold coin, has just been exported, and no doubt the most of it will find its way to the melting pot within thirty days. It is simply a question of exchange, or supply and demand; there is no demand for American coin except to ship to New York, while as bullion or sovereigns, it will be useful all over the world. There still remain in the sub-treasury about $110,000,000 in gold coin, and for self protection, the door should be locked as soon as $10,000,000 more is called for.

ANSWERS TO INQUIRIES.

G. B. M., Poughkeepsie, N. Y.—Use No. 16 or 18 insulated copper wire for the primary coil, winding it one layer deep. No. 26 or 30 well insulated copper wire should be used for the secondary coil. Put about eight or 10 layers on top of the primary coil. No rule can be given to apply to every case for the proper lengths of wire for th primary and secondary coils, these vary so muc The longer the secondary coil the stronger wi be the induced current, all things being equa Dyer's "Induction Coils: How made and Ho Used," would help you. Price, 50 cents. Th lengths given above, however, will make a goo induction coil for amusement.

CORRESPONDENCE.

DEAD WIRES.

Boston, March 23, 1891.

Editor Electrical Age:—An extremely interest ing case was tried in the Fourth Session of th Superior Court, Boston, last week, wherein fou boys undertook to hold the city responsible f damages for injuries received from an electri shock from a dead telephone wire hanging in th street over an electric light wire. The moment th boys touched this dead wire, a connection wa made through them with the ground, and the were knocked senseless and horribly burned an mutilated. Under the statute, the highest amoun which a jury can award a plaintiff in any one cas is $4,000 or $16,000 for the four. In these cases the aggregate verdicts against the city were $11,500 but the cases have gone to the supreme court on a matter of law, the city claiming that the boys wer not technically "travelers." In the course of th trial, it appeared that this dead telephone wir was the property of the New England Telephon and Telegraph Company. Although this fact ha been suspected, yet naturally enough that com pany had strenously denied, and still denies an property in the wire, and Messrs. George A. O Ernst and F. D. Allen, counsel for the plaintiffs had hesitated about suing the company. Now however, that they have discovered the true owners they are about to bring suits against the New England Company, setting the damages in eac case at $20,000, as there is no statute limit lik that against the city. A jury is at liberty t give damages to any extent they see proper, an in such a suit the question whether or not th plaintiffs were travelers cannot, it is said, be raised It is high time that this question of responsibilit for dead wires should be settled. They are a constant menace to our people, and a few verdicts against the corporations responsible fo their existence will have a very salutary effect.

Jas. H. Howard.

WANT TO ENTERTAIN THE DELEGATES.

Mr. A. J. Corriveau, of Montreal, has received a communication from Quebec and Levis stating that these places will be glad to entertain the delegates attending the convention of the National Electric Light Association in Montreal next August, should they decide to visit those places. There is a 34 mile water power electric circuit, of which the people of those places are anxious that the Americans should see. This is one of longest circuits of this class in America.

Mr. Corriveau reports that the Canadians are taking a hearty and active interest in the arrangements for the coming convention

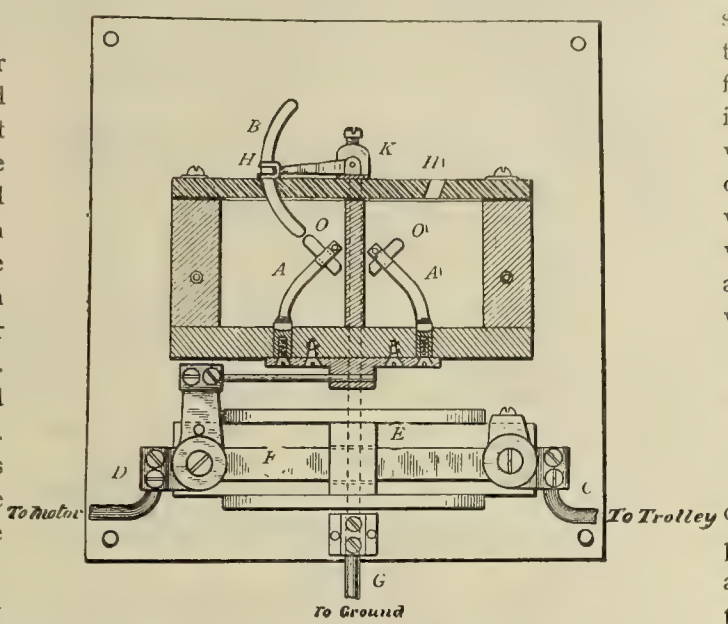
Loss of Magnetism in Heated Iron.—The suddenness with which iron loses its magnetic susceptibility at a red heat has often been noticed by different observers. Professor Rowland was the first to point out that for small magnetizing forces, the susceptibility of iron increases as the temperature rises, reaches a maximum at a red heat, and then falls suddenly to zero, but that the susceptibility diminishes as the temperature rises when large magnetizing forces are used.

Theodore B. Kline, formerly of 63d street and Madison Avenue, died of pneumonia, March 26th.

WESTINGHOUSE AUTOMATIC STREET CAR LIGHTNING ARRESTER.

The car lightning arrester consists of two air chambers, *a* and a^1, having vents shown at *h* and h^1, through which the curved carbon *b* hinged at *k* can freely pass, swinging from *o* to o^1. The carbon point *o* should be set so that it is separated from *b*, when in its normal position, as shown in the figure, by one-sixteenth of an inch. The distance from o^1 to *b* should likewise be one-sixteenth of an inch, when the curved carbon is the other chamber. *b* is connected to g^1, and *o* and o^1 to *d*. *f* is a lead fuse and *e* an insulating block provided with a slot, through which the lead fuse is passed. The points *c* and *d* should be connected in series with the motor and *g* should be connected with the ground, as shown in the figure. The action of the arrester is as follows:

When a discharge takes place, it passes through the lead fuse *f*, to one of the carbons *o* or o^1, depending upon the position of *b*, then across the air space to the curved carbon, *b*, and from there to the ground shown in the figure. The dynamo current then following causes an arc to be established between the carbon, *b* and *o* or o^1. The heat generated by this arc, expands the air in its respective chamber, increasing the air pressure therein, and causes



WESTINGHOUSE LIGHTNING ARRESTER.

carbons *b* to be instantly blown from one chamber to the other. This ruptures the arc and adjusts the arrester for the next discharge.

In the tests upon this arrester, 500 volt and 1000 volt generators have been repeatedly short circuited through it. In every case the circuit has been instantly broken without injury to the dynamo, and the arrester has as quickly set itself in readiness for future use. In one of the tests made to demonstrate its promptness and reliability, carbons *o* and o^1, were so adjusted as to touch carbon *b* in either of its two normal positions. A 1,000 volt generator was then short circuited through the arrester, which resulted in the circuit being several times automatically opened and closed in one second without injury to either dynamo or arrester.

BUSINESS NOTES.

The Jerome Kidder Manufacturing Co., makers of the celebrated electro-medical apparatus for physicians, surgeons and family use, report an active business in these goods. The fact that testimonial letters are being received every day, all speaking very favorably of these outfits, is evidence of their superiority.

For books on every electrical subject, address the ELECTRICAL AGE office, New York.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS.

ISSUED TUESDAY, MARCH 24, 1891.

448,627. Telephone Auditory Apparatus. George V. Benjamin, Ithaca, N. Y. Filed June 20, 1889.

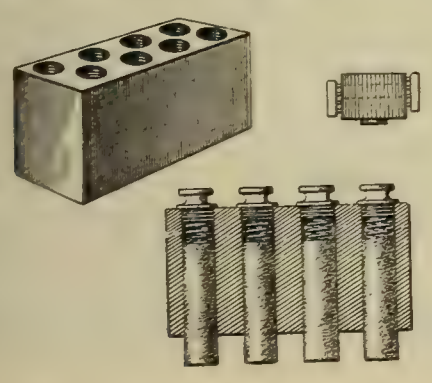
A cap of cartilaginous consistency and with a shape adapted to fit the head about the ear, to be used between the ear and the telephone.

448,644. Electric Converter. Moses G. Farmer, Eliot, Me. Filed Oct. 11, 1890.

A core for an electrical converter or inductorium, composed of laminæ of tinned iron with laminæ of non-magnetic metal interposed between them.

448,653. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Filed March 24, 1887.

The combination with a sectional conductor of two or more electric locomotives, each bridging a break in the conductor, and rotary horizontally-swinging switches, controlling connection between sections of the conductor and adapted to be operated by the locomotives.



NO. 448,669—ELECTRIC CONTACT DEVICE.

448,666. Dynamo Electric Machine. Samuel E. Nutting, Chicago, Ill, assignor to the Nutting Electric Manufacturing Company, same place. Filed May 13, 1890.

448,669. Electric Contact Device. Frank. A. Perret, Brooklyn, N. Y., assignor to the Elektron Manufacturing Company, same place. Filed June 28, 1890.

A contact device or brush consisting of a block or holder provided with two rows of perforations or chambers, the perforations or chambers of each row located opposite the spaces between the perforations or chambers of the other row.

448,676. Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, assignor by mesne assignments to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed March 13, 1890.

An electric meter for alternating currents having an armature constructed with dead-points.

448,677. Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, assignor by mesne assignments to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed March 13 1890.

The combination of a meter for electric currents and a short-circuiting device for the meter, connected in the circuit with the meter.

448,680. Connector for Electric Wires. Frank Shlaudeman, Decatur, Ill. Filed Nov. 3, 1890.

A coupling for a jointed water-proof electric circuit, consisting in the combination of a socket, an insulating washer at the bottom of the socket, an insulating guide block, and circuit wires extending circuitously through holes in the guide block, and terminating in protruding spiral coils.

448,681. Speed-Regulator for Electric Motors. Sidney H. Short, Cleveland Ohio, assignor to the Short Electric Railway Company, same place. Filed Oct. 10, 1890.

A speed branch composed of a resistance-shunt on the field and switch controlled by the means for adjusting the rheostat and arranged to send a current through the branch when the rheostatic resistance is reduced or cut out.

448,682. Adjustable Rheostat. Sidney H. Short Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Nov. 15, 1890.

An electrical resistance comprising a body of subdivided conducting material—like carbon powder for example—held in an insulating casing, and metallic end plates in contact with the subdivided conducting material and provided with a number of conducting projections which penetrate the material, in combination with switching means.

448,684. Fire-Alarm Signal Box. William F. Singer, Carthage, assignor to the Singer Fire-Alarm Company of Buffalo, Limited, Buffalo, N. Y. Filed March 11, 1890.

A fire alarm system provided with a main and an auxiliary circuit, signal boxes connected by both circuits, and a relay in each signal-box to automatically cut in the auxiliary circuit upon rupture of the main circuit.

448.698. Electric Switch. Donlee B. Turner, Chiccago, Ill. Filed June 18, 1890.

448,703. Support for Electric Line-Wires. Herbert C. Wirt, Boston, Mass. Filed March 17, 1890. Renewed Jan. 29, 1891.

448,711. Overhead Crossing Appliance for Electric Railways. Isaiah H. Farnham, Wellesley, assignor to the New England Telephone and Telegraph Company, Boston, Mass. Filed Nov. 20, 1889.

Intersecting electric supply conductors for an electric railway, with one or more automatically operated conducting bridging sections electrically connected with one of the conductors.

448,712. Electric Time Alarm. John J. Gallagher, St. Louis, Mo. Filed Nov 28, 1890.

448,741. Cover for Incandescent Lamps. Emil T. Mueller, La Crosse, Wis. Filed Oct. 18, 1889.

448,743. Electric Heater for Dental Vulcanizers. Jeremiah O'Meara, New York, N. Y.

448,751. Railway Circuit for Signaling and Controlling Trains. Frank E. Kinsman, Plainfield, N. J. Filed June 11, 1890.

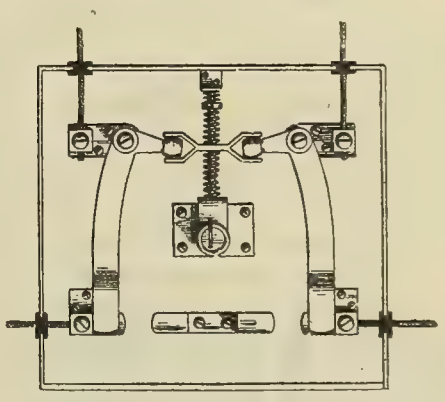
448,778. Electric Railway. Thomas A Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Aug. 7, 1882.

448,779. Telegraph. Thomas A. Edison, Llewellyn Park, N. J. Filed July 19, 1886.

448,780. Device for Turning Off Phonogram-Blanks. Thomas A. Edison, Llewellyn Park, N. J.. assignor to the Edison Phonograph Company of New Jersey. Filed July 7, 1888,

448,782. Electric Lighting. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 30, 1890.

The combination of a line circuit, an electric lamp connected therein in series, a shunt circuit in the line circuit about the electric lamp, a heating coil arranged in the shunt circuit, a receptacle having fixed terminals connecting with the line circuit, and an expansible fluid-conducting substance in the receptacle adapted to be expanded upon an excessive current passing through the heating coil for the purpose of reducing the resistance to the passage of current in the line in case the lamp should burn out.



NO. 448,698—ELECTRIC SWITCH.

448,786. Brace for Telegraph Poles. Henry Ogden, Fall River, Mass., assignor of one-half to James H. Ogden, same place. Filed Oct. 29, 1890.

A rigid two-part brace attached at one end to the upper part of the pole.

448,792. Electrical Indicator. Charles Wirt, New York, N. Y. Filed May 2, 1887.

448,798. Galvanic Battery. Charles J. Hirlimann, Fort Lee, N. J. Filed Nov. 26, 1890.

A porous vessel made of molded carbon and filled with manganese or other depolarizing agent, and having a concaved bottom provided with perforations, whereby when the vessel is inserted into the solution the latter will be forced through the perforations into contact with the depolarizing agent and immediately render the battery active.

448,831. Trolley for Electric Railways. Rudolph Eickemeyer, Yonkers, N. Y. Filed July 19, 1890.

448,838. Insulator for Electrical Conductors for Mines. Francis A. Pocock, Scranton, Pa., assignor of two-thirds to Elmer H. Lawall and Rufus J. Foster, both of same place. Filed June 26, 1890.

In the insulation of electrical conductors for the gangways of mines, the combination with a conduit or casing having a

ELECTRICAL PATENTS—Continued.

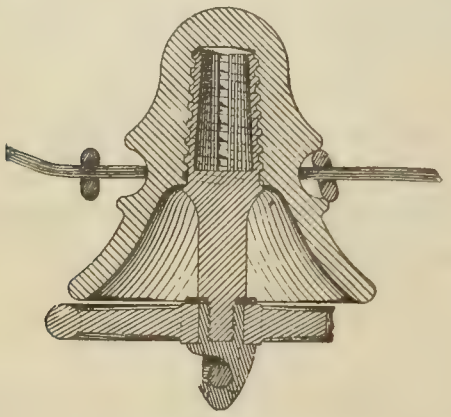
longitudinal or extension rail for supporting the collector of the motor, of insulating blocks secured within the conduit or casing and supporting the main conductor or main feed-wire, and flexible sheets which close an open side of the conduit or casing and permit the passage of the collector arm.

448,840. Protecting Motor Mechanism of Electric Cars. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Nov. 15 1890.

A car-motor frame formed by the yokes of an electric motor, with a pan constituting an integral part of the yokes and extending below the space for the armature and field-magnets, in combination with a magnetic casing inclosing the whole motor and secured to the yokes.

448,847. Clamp for Electric-Battery Zincs. James H. Leakin, Baltimore, Md. Filed Dec. 24, 1890.

A clamp and wire-connector for electric battery zincs comprising a collar to contain the zinc, a cam pivoted to the collar in such a position as to take against the zinc and clamp it in the collar, and means of connection between the cam and the connecting wire.



NO. 448,703—SUPPORT FOR ELECTRIC LINE WIRES.

448,856. Electric Signaling Apparatus for Railways. Edwin D. Graff, New York, N. Y. Filed Sept. 29, 1890.

A railway signal-block system in which the locomotives are provided with bell-circuits, the combination of suitable conductors extending continuously throughout the length of the block along the line of the railway, a switch forming a part or continuation of one of the conductors, and means arranged in proximity to one of the rails adapted to be acted upon by a locomotive to move the switch to connect with another conductor so that the locomotive following in the same direction may have its circuit completed through the conductors.

448,865. Lamp for Electric Railway Cars. Charles G. Smith, Brooklyn, N. Y., and Louis Pfingst, Boston, Mass. Filed Feb. 26, 1890.

448,879. Electric Heating Apparatus. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed Jan. 20, 1890.

In an electric heating apparatus, a suitable metallic case, one or more resistances or heat-developing electric conductors within the case and formed in layers, metallic plates between the layers, a fibrous refractory material in contact with and enveloping or covering the conductor or conductors and means to maintain the material in close and constant contact with the conductor or conductors.

448,894. Electric Meter. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. Filed Sept. 26, 1890.

In an electric meter, an electric motor having a commutator, the brushes and segments of which are both made of pure silver.

448,910. Electric Street-Car Driving Gear. Conrad M. Conradson, Madison, Wis. Filed Dec. 3, 1890.

448,914. Filament for Incandescent Electric Lamps. George Erlwein and Friedrich G. A. Heller, Berlin, Germany, assignors to Siemens & Halske, same place. Filed July 22, 1890.

A filament for electric lamps, composed of a carbon core and a coating of carbide of manganese.

448,915. Filament for Incandescent Electric Lamps. George Erlwein, Berlin, Germany, assignor to Siemens & Halske, same place. Filed July 22, 1890.

448,916. Filament for Incandescent Electric Lamps. George Erlwein, Berlin, Germany, assignor to Siemens & Halske, same place. Filed Oct. 25, 1890.

A filament for electric lamps, composed of a carbon core and a coating consisting of phosphorus, combined with a hardly fusible metal.

448,920. Filament for Incandescent Electric Lamps. Friedrich G. A. Heller, Berlin, Germany, assignor to Seimens & Halske, same place. Filed July 22, 1890.

A filament for electric lamps, consisting essentially of a small carbon rod or core with a covering of metallic chromium deposited upon the outside thereof.

448,936. Electrolyte for Galvanic Batteries. John J. Collins, Washington, D. C. Filed Sept. 30, 1890.

An electrolyte consisting of an alkali, bichromate of potash, or bichromate of soda, blue-stone, an exciting acid, sulphur, and sulphate of mercury.

448,953. Electric Belt. Willie C. Fuller, Kirwin, Kans. Filed Jan. 21, 1891.

448,956. Electric Insulator. George H. Graham, Ridgeland, and Thomas Gannane, Chicago, Ill. Filed Aug. 2, 1890.

An externally-screw-threaded insulator provided with a transverse groove in the end thereof, a screw-threaded collar fitted to the threaded portion of the insulator, and a loop or loops for clamping the conductor in the grooves of the insulator.

448,980. Electrical Protector. Isaac M. Miller, Cincinnati, Ohio. Filed Oct. 28, 1890.

448,998. Independent Electric Clock. William S. Scales, Everett, assignor of two-thirds to Joseph H Clark, Quincy, and John B. Humphrey, Boston, Mass. Filed July 19, 1890.

448,999. Secondary Electric Clock. William S. Scales, Everett, assignor of two-thirds to Joseph H. Clark, Quincy, and John B. Humphrey, Boston, Mass. Filed Oct. 20, 1890.

449,001. Method of Measuring Alternating Electric Currents. Oliver B. Shallenberger, Rochester, assignor by mesne assignments to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed Dec. 26, 1888.

Employing the leakage current of the circuit to overcome the inertia of the meter and in operating the meter by the current flowing in excess of such leakage current.

459,002. Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, assignor by mesne assignments to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed March 3, 1890.

The combination, with a meter for electric currents, of a thermostatic brake connected in circuit therewith and operated by currents traversing it to release the meter under influence of currents of a predetermined value.

449,003. Meter for Alternating Electric Currents. Oliver B. Shallenberger, Rochester, assignor by mesne assignments to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Filed March 13, 1890.



NO. 448,914.

FILAMENT FOR INCANDESCENT ELECTRIC LAMPS.

449,035. Electrical Heater. John V. Capek, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed July 21, 1890.

449,036. Electrical Heater. John V. Capek, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed July 21, 1890.

The combination of a strip of heat-resisting insulating material, and a flat zigzag heating-conductor on one face of the strip.

449,044. Electric Lighting System. Edward H. Johnson, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed Jan. 10, 1884.

449,081. Electric Time-Stamp. Warren B. Martindale, Kenosha, Wis., and Ernst R. Malmborg, St. Louis, Mo., assignors by direct and mesne assignments to the Electric Date and Time Stamp Company, of Illinois. Filed Aug. 22, 1889.

449,090. Electric Rock Drill. William M. Schlesinger, Philadelphia, Pa., assignor to Charles F. Van Horn, same place. Filed Nov. 17, 1888.

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THE ELECTRICAL DEPARTMENT AT THE WORLD'S FAIR.

If the reports that we hear about the provisions made for the electrical exhibition at the World's Fair are true the situation is indeed disheartening and the outlook anything but encouraging.

From all accounts it seems that ample space for the electrical department of the great exhibition has not been provided, and that, unless some better arrangements are made, the electrical exhibits will likely be scattered among several buildings.

This is an unfortunate state of affairs, and the electrical fraternity and press should use their united and strongest influence to secure for the electrical exhibit plenty of space, and the recognition that its importance demands.

No other department at the exposition will be so important and so interesting. Electricity is holding the world spell-bound to-day, and its marvelous development in recent years is the wonder of the age. People everywhere hear and talk about it, and expect to find at the World's Fair an exhibit commensurate with its importance. The possibility of the exhibit being scattered is sufficient cause for regret, and while the situation is an unfortunate one, no good will result by merely expressing regret that it is not more promising. It is no time for sentiment. Work is what is needed, and the sooner all hands interested take hold and "give a lift" the better it will be for the success of the electrical department. What is needed is an emphatic and able-bodied protest against the proposed plans, as far as they apply to the electrical exhibit, and if the electrical trades would unite with this one object in view, we think that they will not labor in vain. It is a stupendous mistake for a person or a body of persons to assume that the electrical industry is of any but primary importance. It would be a great misfortune, and work irreparable injury to electrical industries, to scatter the exhibit and tuck it away in corners that no one else care to use.

Prompt action is needed, and, no doubt with the full power of the current of determination turned on, the energy, if properly applied, will accomplish the desired result.

GEARLESS ELECTRIC RAILWAY MOTORS.

We describe and illustrate this week two new gearless electric railway motors, designed and made by different concerns, and which, by a singular coincidence are placed before electric railway managers simultaneously. Without discussing the merits of the two motors at the moment, it is strikingly evident that the gearless motor is the future motor for the propulsion of cars on electric roads.

The slow speed motor is rapidly coming to the front in electric railway work, and judging from the operation of this class of machines up to the present time it is safe to assume that they have come to stay.

The main objection to high speed motors for electric cars is that considerable gearing is necessary in order to effect a reduction of the rotary speed of the armature shaft to the proper limits, before the power can be applied to the axles of the car. The greater the number of parts to move and keep in motion the greater is the friction and wear, and conversely, the fewer the parts, the less is the friction and wear. Friction and wear mean to the manager and the engineer, loss of energy and loss of money. It has, therefore, been the aim of inventors to produce a machine that would overcome these objections, and that success has attended their efforts is evident from the fact that two large manufacturing concerns have at about the same time offered to railway managers for their consideration a slow speed, gearless motor. Slow speed motors to the manager of an electric railway mean less expense to maintain and greater efficiency in practical results.

It has been stated that the cost of operating electric roads is less than that for horse roads, but the expense for repairs is yet too large. The problem that electric motor manufacturers have been applying themselves to for solution, was how to keep the expenses for repairs down. There was only one solution, and that was to reduce the speed of the armature and use fewer parts in the construction of the driving machinery.

The two motors described in this issue have, to all accounts, attained these results to a highly satisfactory degree, and it is a rather singular coincidence in this connection that both concerns should claim that their own motor is the final form for electric railway work. This is a rather broad claim to make, but it shows this, that the manufacturers have the utmost confidence in the efficiency of their new machines.

There are many points of similarity between the two motors, and to many readers they may appear to be one and the same. Each concern, however, claims for its own machine points of superiority over all others, and both the Short and Westinghouse Companies are to be congratulated on the success they have attained in producing what appears to be a reliable and efficient railway motor.

ART IN CATALOGUES.

The catalogues issued by the large electrical houses are veritable works of art. They represent great labor in their compilation, the best efforts of the printer and designer, and much ingenuity.

A complete catalogue of a modern, first-class electrical supply house, is little short of an electrical cyclopedia. In it we usually find valuable tables and information relating to wires and currents, which are useful to an electrician every day in the year. The information is, of course, in brief form, but that is just the form in which the practical man likes to have it. The typography of these modern catalogues is of the highest grade of excellence, and the artistic features are models of richness and beauty. The covers are usually ingenious and elaborate affairs, being made of heavy board with designs embossed thereon, and beautifully decorated in various shades of bronzes.

While these catalogues are beautiful to look at, there is a practical and unsentimental side to them. It is noticed that they grow larger and larger in scope, which is indicative of the marvellous expansion of the electrical industries. Indeed, some houses have already ceased issuing general catalogues, and in their stead get up special catalogues devoted to the different branches of the trade. Thus we find catalogues devoted exclusively to electric railway machinery and appliances; the same as to electric light machinery, and electrical measuring instruments are in the same manner considered specifically and independently.

The modern electrical catalogue might be taken as a measure of the vastness of electrical industries, and it also indicates that there is a great deal of energy and enterprise applied to the business.

THE MONTREAL CONVENTION.

In a communication to us from Mr. A. J. Corriveau, of Montreal, that gentleman says, in reference to the preparations for the coming meeting of the National Electric Light Association, that everything is looking very bright, and he has good hopes, if everything continues as he expects, that it will be the best meeting the Association has yet held. It was his intention to call a meeting of the citizens during the past week, and have a citizens' committee formed of prominent Montreal men, who will arrange for excursions, promenades, receptions, etc., for the members of the association.

Mr. Corriveau has secured the large Victoria Skating Rink Hall for the exhibition. It is well adapted for such a purpose, and is situated at the rear of the Windsor Hotel.

Mr. Corriveau reports that several large exhibits have already been promised.

REMOVING OVERHEAD WIRES.—The work of removing overhead wires and poles from the streets in New York has been resumed. Broome, Howard, Pearl, New Bowery, Fulton, Leonard, Greenwich and Chambers streets and Chatham Square are the ones involved. A row of tall poles in Forty-second street, beginning at Fifth avenue, was taken down by the city pole levellers. The Brush Electric Light Company have several gangs of men at work taking down their own lines and putting them into the subways.

DIVIDEND.—The Edison General Electric Company has declared the sixth quarterly dividend of two per cent. on all stock of that company, payable on May 1st next at the office of the company, 44 Broad street, to holders of record March 27th The transfer books will be reopened May 2d.

THE SHORT GEARLESS MOTOR.

Some two or three years' experience with the electric motor in street railway service has demonstrated beyond peradventure that it is a great financial and electrical success. Wherever electric railway apparatus has been put into operation upon existing horse roads, the traffic has materially increased and the mileage has nearly doubled.

The cost of operating an electric system is somewhat less than that of horse roads, but the expense for repairs is much too large, and the necessity for reducing running expenses is recognized by both street railway managers and electric railway people. It has been generally conceded that the only practical method to reduce the maintenance expenses is to reduce the large number of wearing parts in the machinery; inasmuch as the motor having the least number of parts and running at the lowest speed will require the least repair, and cost less to operate.

Most of the motors heretofore in use have had no less than three shafts. Such systems had four gear wheels to wear, three shafts running at different rates of speed and six boxes to oil, and the wear and tear on these parts was, in consequence, very heavy.

Several railway companies have recently placed upon the market a new type of motor with intermediate shaft, one pair of boxes and one pair of gears being cut out. These improvements, while valuable in themselves, undoubtedly reduce the expense of repairs and maintenance and greatly lessen the noise in their operation.

The latest of these improved machines is the one forming the subject of this article, made by the Short Electric Railway Company, Cleveland, Ohio.

The motor is peculiar in its design, and every objection thus far made against this form of machine has been overcome in its careful design. It is placed directly on the axle, and runs from 100 to 150 revolutions a minute.

Fig. 1 shows a pair of wheels with the axle running through the hollow armature shaft of the

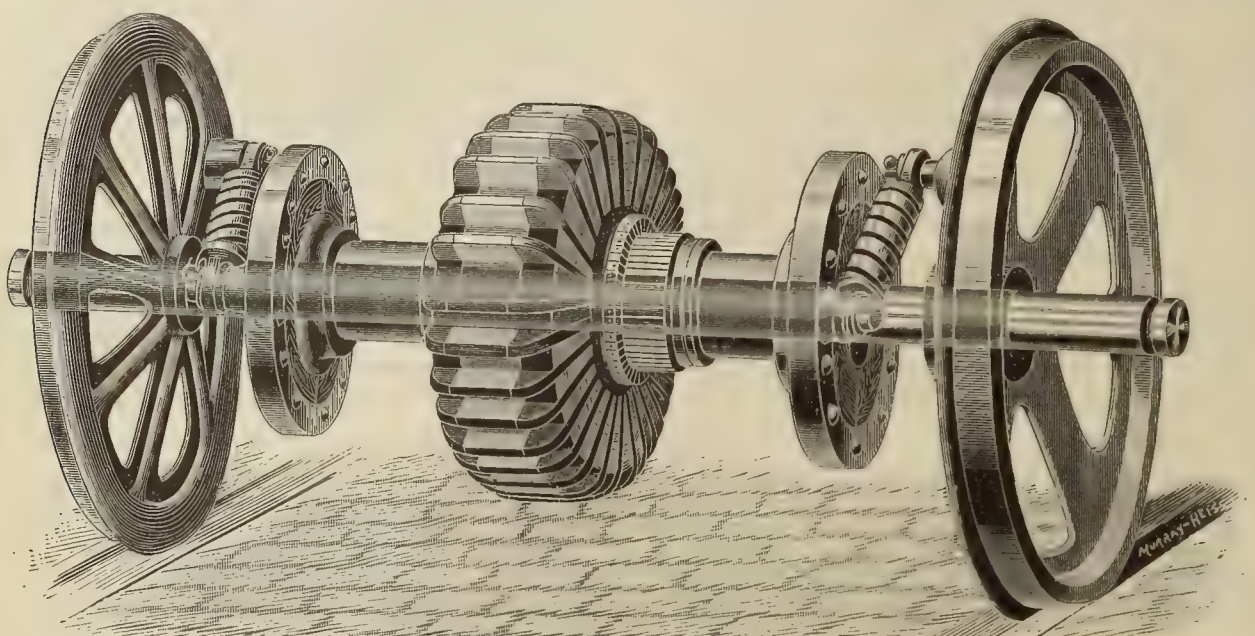


FIG. 1—AXLE RUNNING THROUGH HOLLOW ARMATURE SHAFT.

gearless motor ; there is one inch air space between the car axle and the inside of the armature shaft. The armature is of the well-known Short type, with separate bobbins and laminated ring. On each end of the armature shaft are keyed heavy crank discs, made with the iron hub and rim and wooden web, which have been used with so much success by this company. By this arrangement the armature shaft is thoroughly insulated from the rim of the crank wheel. The crank wheel rim also has a crank pin on one side, as shown. On the car wheel is placed another crank pin, and between the two is a heavy coil spring, capable of operating under the slightest tension from 2,500 to 3,000 pounds. The power of the motor in turning the wheel is transmitted through these springs, and the wheels turn readily in the direction in which the armature tends to rotate.

Fig. 2 shows the motor frame, which is made of two steel castings, with arms projecting forward and backward. The arms rest on rubber cushions placed on channel bars, which go from side to side of the motor frame. The armature is thus held up from the axle and in the frame, the entire weight resting on the four spring cushions and the car box, outside of the car wheels, where the car is supported. None of the weight of the motor falls on the axle inside of the wheels. This arrangement avoids weakening of joints, and the detrimental effect of the heavy hammer blows upon the rails. Crystalization and breaking of the motor frame is also avoided. Spring cushions have never before been used under motors.

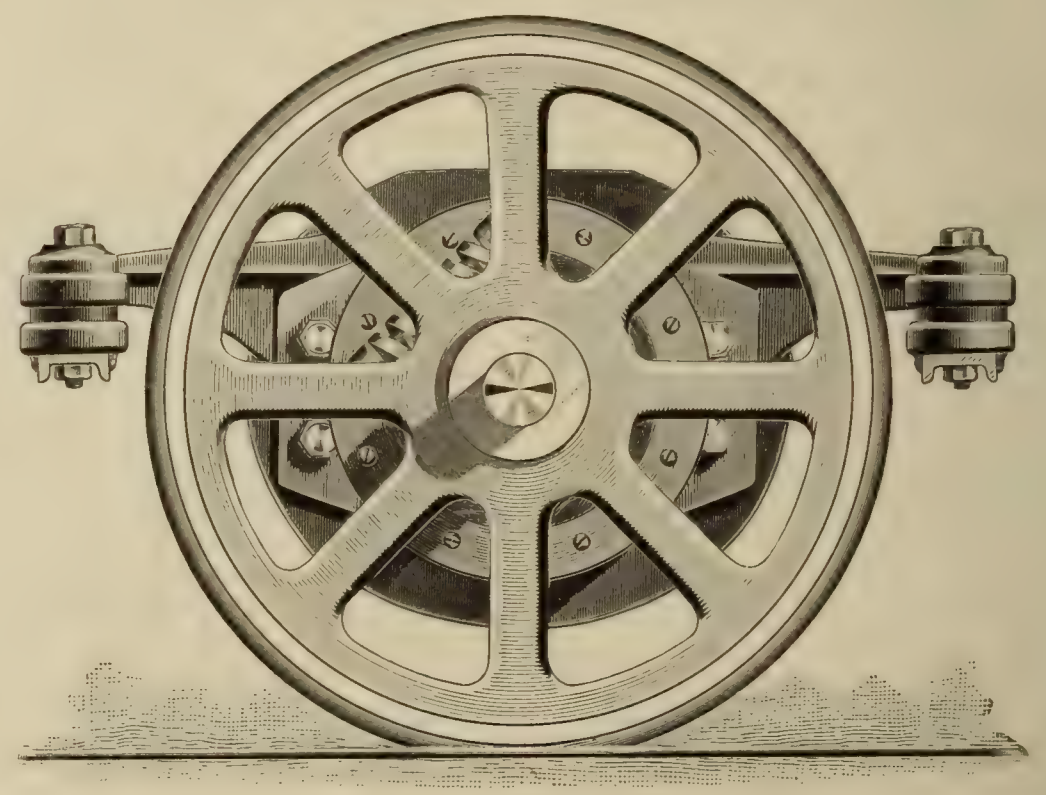


FIG. 2—MOTOR FRAME.

Fig. 3 shows a motor complete on the axle, with a sheet iron casing covering the entire machine. The casing supersedes the dust-pans and curtains on the gear boxes, and all other devices for protecting the machinery under the car from water and mud. It is hinged on each side at the top and left open in the centre underneath, where it is fastened with a latch screw. The upper part is open about a foot for the purpose of ventilation. In order to examine the motor, the car is run over a pit and the casing is opened out, which exposes all the machinery for inspection.

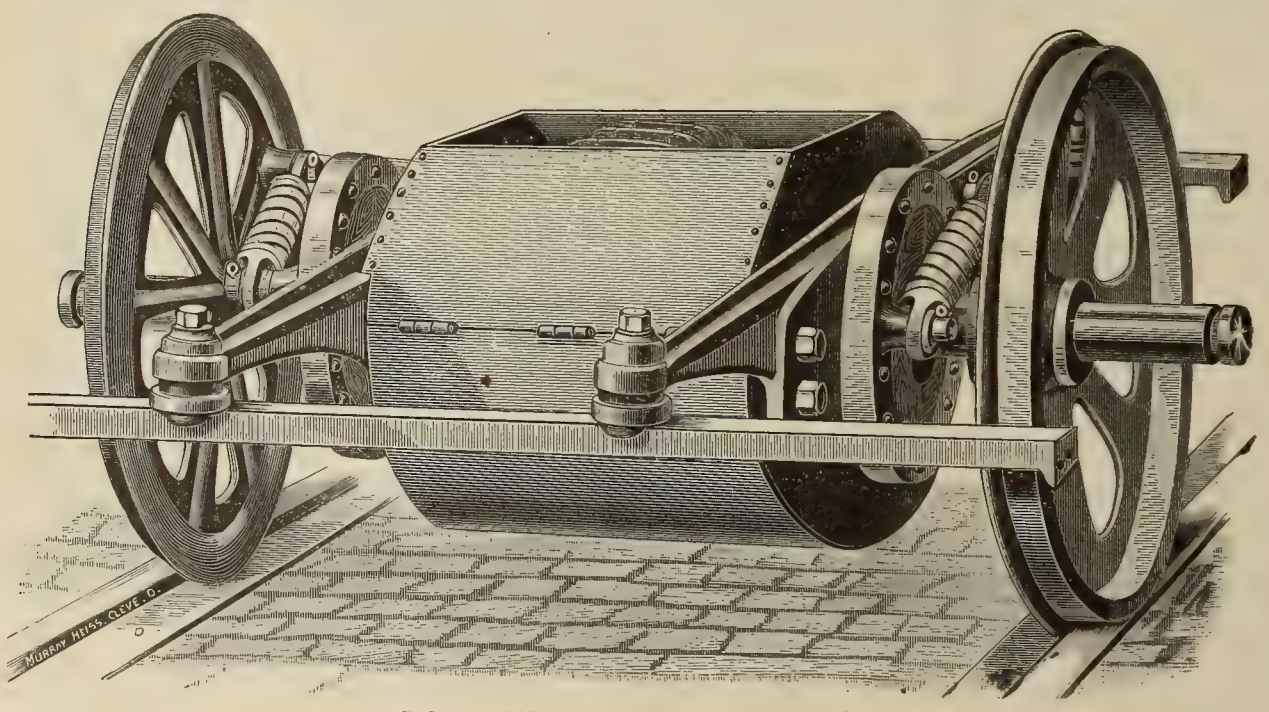


FIG. 3—MOTOR COMPLETE ON AXLE.

Fig. 4 shows a truck fitted up with two motors, and the simplicity of the arrangement is striking. Compactness is one of the great points of the new motor, which is made of wrought iron and steel, very heavy and strong, so that there is no possibility of breakage.

The rheostat and controlling mechanism and all the car apparatus, is the same as that used with the Short Standard motor.

The coil springs take the first movement of the motor and prevent jerking and jarring, the car moving off with great ease, and quietly.

Both the commutator and brushes are inside the casing, thus being protected from injury and preserving their efficiency unimpaired.

The weight of the gearless motor is less than 2,000 pounds, and the efficiency is somewhat greater than that of the standard motor, especially at normal loads, from 5 to 10-horse power, where a motor usually runs. A series of tests have determined that the average current necessary for

this motor is less than that of any motor in use, and the company claim that it is a final form of street railway motor.

This new motor has been subjected to all sorts of tests and trials for several months, and has proved itself to be an extremely efficient machine, and as it is simple in construction, it consequently costs less to maintain.

The features claimed for this new motor are:

1. Slow speed. On account of the commutator running slowly, there is no heating under the pressure of the brushes; there are no eddy currents in the iron and steel of the frame of the armature.

2. Large bearings placed where the wear will be slow, two in number.

3. Low centrifugal force, and consequently small tendency to burst the bands and throw the bobbins.

A speed of from 25 to 30 miles an hour means no more to this motor than from eight to ten miles to a Standard.

The Short Electric Railway Company report that the popularity of this new motor is already assured, and that a large number of them have been ordered.

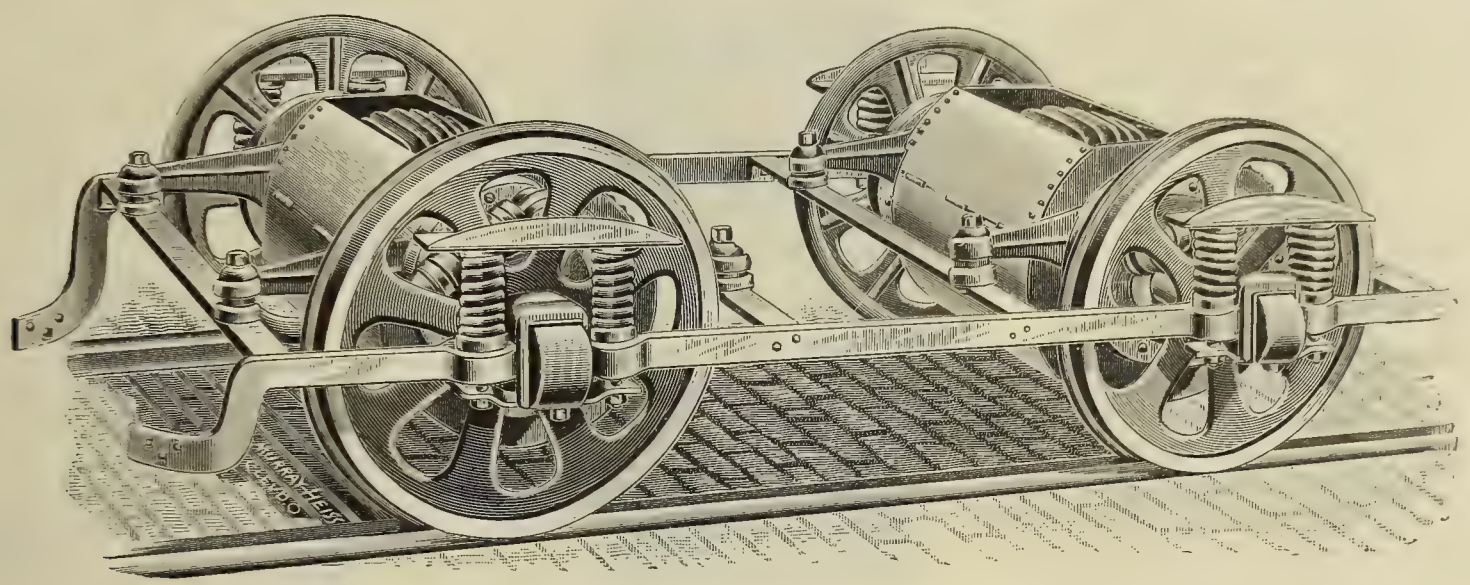


FIG. 4—THE SHORT GEARLESS MOTOR—TRUCK FITTED WITH TWO MOTORS.

DAIMLER GAS AND PETROLEUM MOTORS.

One of the greatest difficulties in the production of an engine for running the dynamos of small isolated plants, has been the designing of an efficient power motor that could be handled by any one, whether a mechanical expert or not, with safety and economy. It is inconvenient to employ an expert engineer for many isolated plants, and to overcome this difficulty engineers and inventors have applied themselves to the designing and constructing of a perfect motor of small and medium powers that could be used anywhere and by any one.

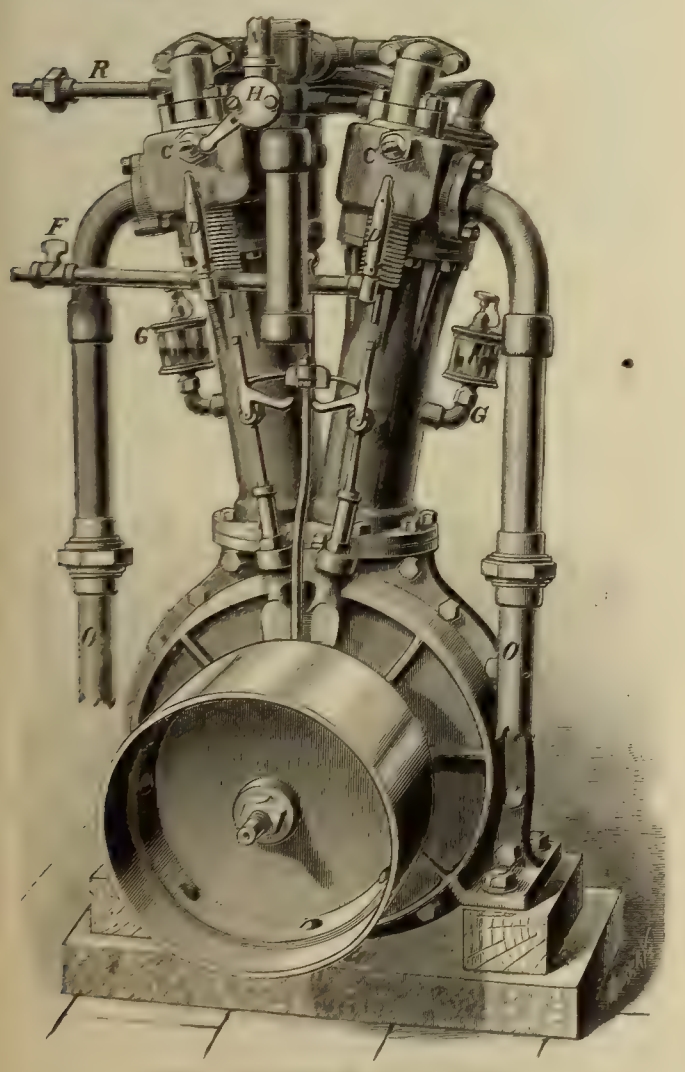


FIG. 1—DAIMLER GAS MOTOR.

A machine designed to overcome the difficulties usually met with in engines of this class, was recently invented by Mr. Gottlieb Daimler, an eminent engineer of Cannstadt, Germany. It is a gas and petroleum engine and, as will be seen from our illustrations, is small, compact, and although light, of solid construction. They vary in size from one to ten horse power, and are modified somewhat in form to adapt them to various uses. The larger sizes are suitable for running dynamos efficiently and ecomically. They are made vertical to economize space and reduce friction.

The base of the motor consists of a cast-iron gas-tight, circular chamber, with a valve inlet for combustible mixture or air. In the base are placed two discs, mounted upon the two sections of the main shaft and connected by a crank pin, the discs serving the double purpose of a crank and fly-wheels. In one of the discs is formed a double slip-cam groove, which passes twice around the crank shaft, and returns into itself. In this cam groove is placed a follower, which operates the valve gear so as to make every alternate stroke a working stroke.

Upon the base are mounted one or more working cylinders. Each cylinder contains a piston furnished with a valve for the transfer of air or gaseous mixture from the base, the valve being provided with a fork by which it is operated. It will be observed by reference to Fig. 1 that both the connecting rods of both pistons in the double cylinder engine are received upon the same crank pin. The space in the upper end of the cylinder above the piston is the explosion chamber, with which are connected the inlet and exhaust valves. All the valves used are of the type known as poppet valves, these having been found in actual practice preferable to sliding or rotating valves. Every alternate stroke of the piston is a working stroke. During the upstroke of the piston, following the working stroke, a preliminary charge of air is drawn into the lower part of the working cylinder, from the crank chamber in the base, as the piston rises. At the same time, the upward movement of the piston forces the products of combustion from the explosion chamber through the exhaust valve, which is opened by the slip cam. During the following down stroke, the air in the cylinder below the piston is forced upwardly into the working part of the cylinder. At the same time a charge of combustible gas is admitted, and the following upstroke of the piston compresses the explosive mixture in the explosion chamber, forcing it out into a capsule projecting from the inlet valve chest, and this capsule being heated by the burner, ignites the explosive mixture, the expansive power of which forces the piston downward. The ignition of the charge is retarded until the crank is on the dead centre, by the introduction into the ignition tube of a charge of mixture weaker than that contained in the cylin-

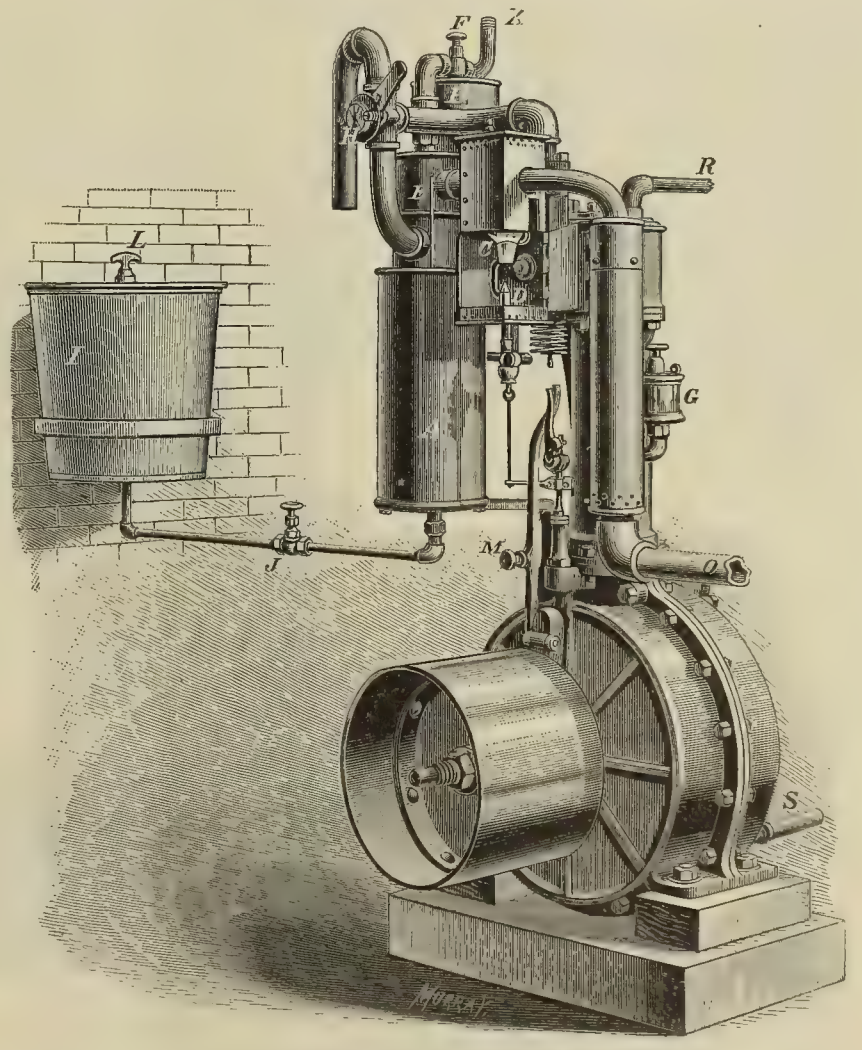


FIG. 2—DAIMLER PETROLEUM MOTOR.

der. The speed of the engine is controlled by a sensitive governor contained in the pulley, and arranged to intermit the admission of the combustible gas when the speed exceeds the normal. The movements of the piston, when no combustible mixture is introduced, resulting in simply compressing and recompressing the air contained by the cylinder.

The engine is practically noiseless, partly contributed to by the ingenious mechanism for securing the alternating motion of the valves, and partly by the working parts being inclosed in a casing. In engines using gears for actuating the valves, there is always more or less noise caused by the rumble and jarring of the gearing, but the construction of this machine is such that this objectionable feature is done away with and also insures a rigid base.

The motor is lubricated by a single oil cup connected with the lower part of the cylinder.

The explosion chamber is surrounded by a water jacket, and is kept at the proper temperature by a small quantity of water passing through it, the water being taken from a tank and circulated by gravity in stationary engines, while in portable engines the circulation of the water is effected by means of a pulsometer worked by the exhaust. By this means the necessary cooling of the cylinder is effected without any outlay for water or consumption of power.

Where petroleum is used as fuel, a carbureter is employed. The lower part of the carbureting apparatus consists of a small petroleum tank, containing a float, which rests upon the petroleum. The float is provided with a central funnel which communicates with the main body of the liquid in the tank through a small opening at the bottom, so that while the liquid is maintained at a constant level in the funnel, it is practically isolated from the main body of the petroleum. The float is provided with an air tube entering the funnel, and perforated below the surface of the petroleum. This air tube slides freely in a tube attached to the cover of the apparatus and acting as a guide, allowing the float to rise and fall, according to the supply of petroleum. Hot air is admitted to the carbureter through the pipe attached to the upper part of the apparatus, the air being heated in its passage to the carbureter by the products of combustion, which pass through a jacket surrounding the air pipe, on their way to the open air. The carbureter air passes through the vapor pipe and unites with a stream of air drawn into the motor cylinder through an admission valve. This valve is provided with a graduated scale, which facilitates the adjustment. It has also an automatically operating safety valve. The reservoir is filled through a supply pipe extending down to the bottom through the air tubes and float. The supply pipe communicates with the lamp font, which furnishes the fuel to the burner which heats the ignition capsule.

This motor is not only applicable to all stationary work, such as running dynamos, etc., but has been applied successfully to the propulsion of small boats, as is illustrated in Fig. 3.

As the motor is readily supplied with fuel and is independent of water supply, it can be used in many places where a steam engine would be out of the question.

The company have been making several trials with dynamos, and are now running at their factory a Perret dynamo with a two horse power motor. From this combination they get twenty-two sixteen candle power lights, which are perfectly steady and satisfactory to the company in every way.

This engine is manufactured by the Daimler Motor Company, Nos. 937, 939 and 941 Steinway avenue, Steinway, Long Island City, N. Y., where the different sizes can be seen in operation. The New York office is at No. 111 East Fourteenth street.

Every line of force produced in an electromagnet makes a complete circuit.

ANNUNCIATOR AND POLICE CALLS.

There is probably no other branch in the electrical field that equals in variety and number of methods and mechanism, that division coming under the general head of electric signals and alarms. There are annunciators, call bells and signal boxes for hotel, fire, police, messenger and house service in seemingly endless variety, each having its good points, and also its faults.

It is a difficult matter to design any piece of

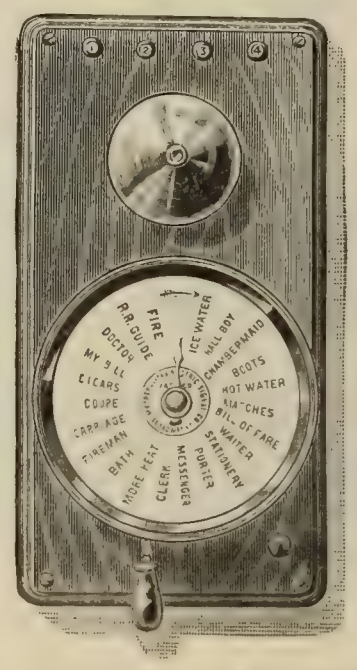


FIG. 1—SIGNAL BOX OR TRANSMITTER.

mechanism without faults, but the Metropolitan Electric Signal Company's systems that we describe and illustrate below seem to be all that could be desired.

Their annunciator system for hotel, factory or messenger service is simple, effective, durable and ornamental, and it is claimed that it is not only non-interfering, but that any number of signals can be sent from the rooms to the office without confusion or delay.

The Signal Box, or Transmitter, Fig. 1, is placed in each room of the hotel, from which communication with the office is desired. The Annunciator or Receiving Instrument, Figure 2, which resembles the ordinary annunciator for

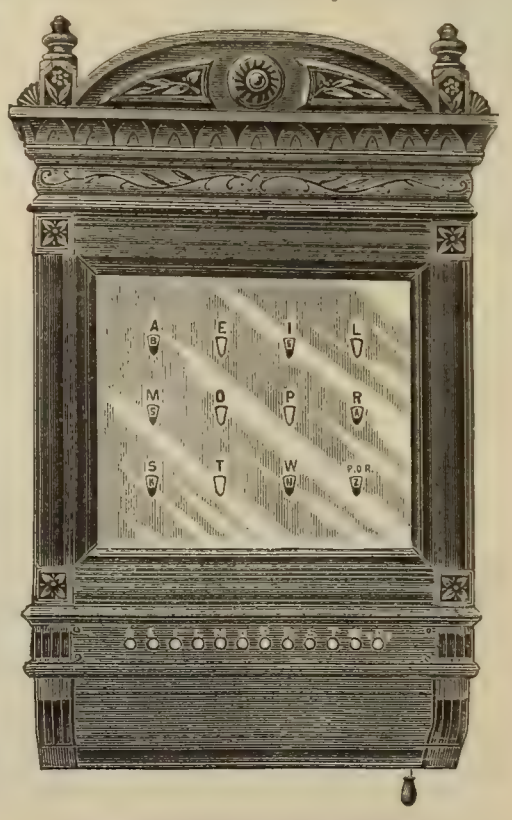


FIG. 2—RECEIVING INSTRUMENT.

electric call bells, is placed in the hotel office. There are as many openings or squares on the face of the annunciator as there are rooms in the hotel to be connected with it, each one of which is numbered to correspond with the number of the room with which it communicates. The push buttons at the bottom of the annunciator frame connect with each room, and have the number of each room plainly stamped thereon.

The Signal Box for messenger service has thirty "calls" or printed "wants," with a return signal bell to notify the sender of the message that it has been recorded at the receiving office. For factory use the signal box has printed on its face twenty-two letters or names of workmen, as required, and is a very useful means of communication between the superintendent or general manager's office and the men.

The non-interfering police service system of this company shown in cuts 3 and 4, is another valuable addition to the many police calls and alarms on the market. As no knowledge of electricity is required to operate it, it will probably be used to a large extent in cities, towns and villages where reliable police patrol service is needed.

A receiving apparatus is placed in each police station house. At certain designated places on each patrolman's post a signal box is attached to a lamp post or a post erected especially for it, and on top of each signal box, and at certain other designated places flash-light lamps are placed, one of which is always in constant view of the patrolman. These lamps are dark when not in use. When the officer on duty in the station house desires to communicate with the patrolman on post, he signals him by causing each lamp to flash a powerful light at intervals of a few seconds, the number of flashes varying according to the signal sent. The bell on the door of the police box also rings the same number of times that the light flashes; thus the eye and the ear are both attracted. A receiving apparatus placed inside

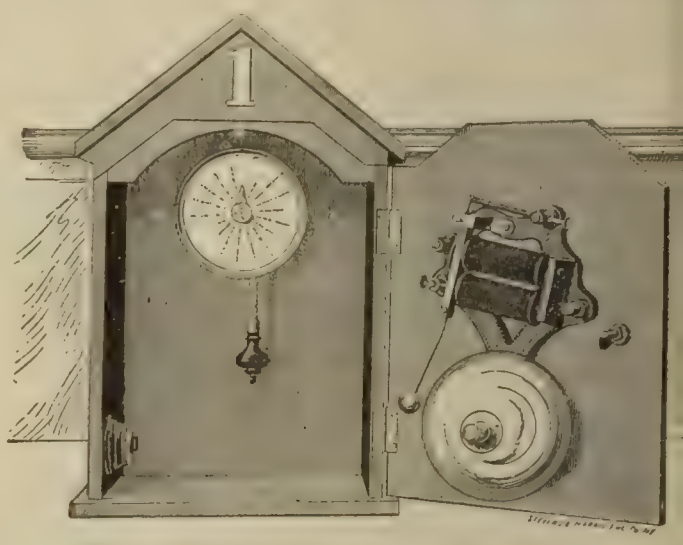


FIG. 3—POLICE SIGNALING APPARATUS.

the signal box also shows, in printed letters, the signal sent, so that, should the patrolman by mistake count four flashes on the lamp and four rings on the bell instead of five (five meaning "Report at station house") he would, on opening the signal-box door, see the words "Report at station house" registered inside; consequently no misunderstanding or confusion of signals could result. When the patrolman receives the signal, he answers back to the station house by moving the pointer or needle on the face of the dial inside the signal box to the words "Message received," pulls the chain at the bottom, and instantly the station house receiver at the opening corresponding with the patrolman's box, from which the signal is sent, shows the figure "3," which on referring to the code at the side of receiver, is interpreted to mean "Message received." In the event of the patrolman desiring to communicate with the station house, he opens the street box and turns the pointer or needle on the face of the dial to any one of the printed words or sentences thereon; for instance, to the words "Murder on post." He then pulls the chain, and instantly the receiver in the station house tells that there is a murder on the post in which that box is located, and immediately the answering signal, on flash light and bell informs the patrolman that help is coming.

The apparatus, with slight variations, is used as a fire-signal system, with a view of placing instruments in public buildings and private houses so that the householders are placed in direct communication with the fire department, as well as providing a city or town with the usual street boxes.

Cuts 5 and 6 show another device of this company for communication between employer and employee, or between different parts of a house or factory. This is the Telecall.

Fig. 5 shows the transmitter, on the face of which are 22 letters, and a pointer that can be turned to any letter. The receiver or indicator, with a knob on one side, is shown in Fig. 6. Accompanying each is a code on which are printed the 22 letters. These letters may represent persons, wants or sentences, at the pleasure of the parties using the instrument.

The standard apparatus has 22 letters. It is made to order with more or less letters, and for factory service can be made with letters as large as desired and visible for a long distance. It can be run for any ordinary distance with three Leclanche cells or their equivalent.

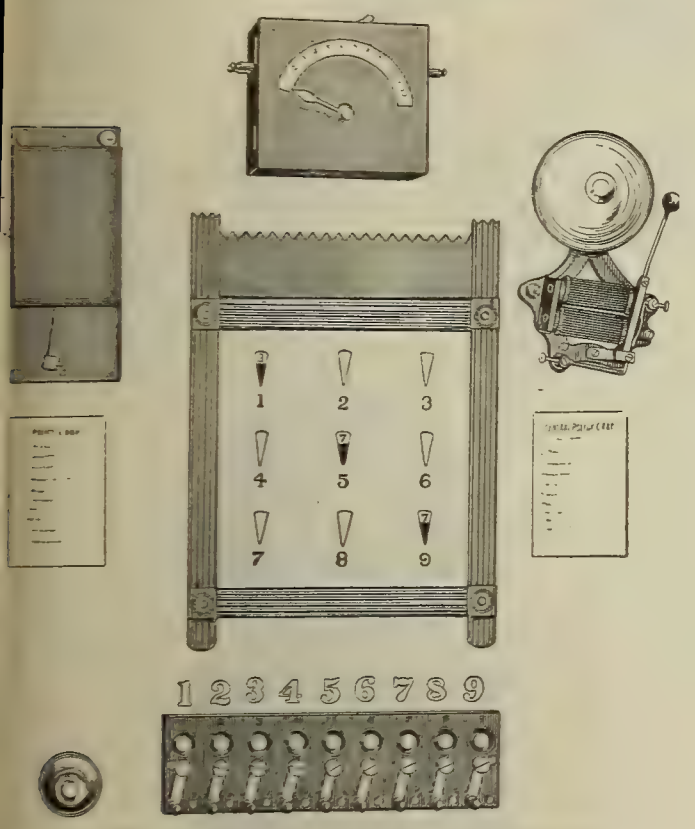


FIG. 4—POLICE RECEIVING APPARATUS.

If desired, dials can be furnished having words or names, instead of letters. The system is installed and in active operation in many prominent establishments in New York City and Brooklyn and is giving excellent satisfaction.

Among these we may mention the Sheriff's office, St. James Hotel, Morton House, Progress Club and Hall's Stables, Yuengling's Brewery and Martin B. Brown, public printer, New York City, and the Greenpoint Optical Works, Greenpoint, L. I.

We are pleased to see that the company has secured the services of Mr. W. W. Kughler, an old time telegrapher and journalist, who is very active in selling a good article.



FIG. 5—TELECALL TRANSMITTER.

For economy of cost, for the repetition of signals, for the simultaneous sending and receiving of signals, and above all for the simplicity and durability of all apparatus employed, the devices of the Metropolitan Electric Signal Company deserve special recognition. The offices of this company are located at 45 Broadway, New York City (Aldrich Court building), where the system is exhibited in detail.

THE WESTINGHOUSE "IRONCLAD GEARLESS" RAILWAY MOTOR.

The single reduction motor lately put on the market by the Westinghouse Electric and Manufacturing Company has given such excellent results that the company has decided to go a step further and build a direct acting gearless railway motor. Two of these motors have been built in their Pittsburg

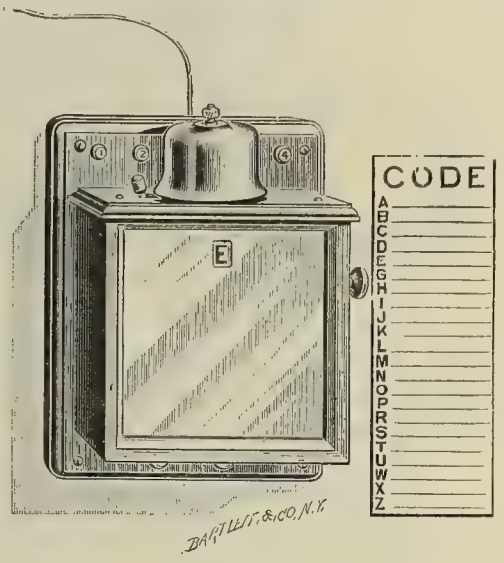


FIG. 6.—TELECALL RECEIVER.

factory, and after careful tests, have been found to exceed the most sanguine expectations. In the accompanying cuts, Fig. 1 shows a diagonal view of motor mounted on the wheels. Fig. 2 shows a completely equipped car with two motors, and in Fig. 3 we have represented the car body raised at one end in order to remove or replace the motor.

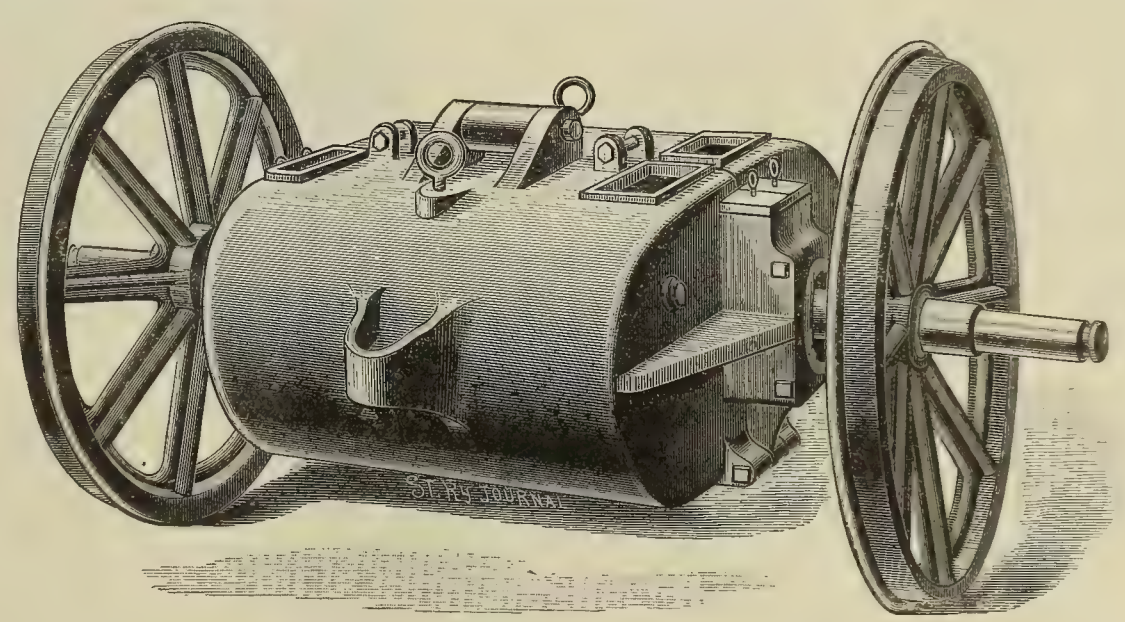


FIG. 1—WESTINGHOUSE IRONCLAD GEARLESS RAILWAY MOTOR.

This motor the Westinghouse Company has termed the "Ironclad Gearless" for, as will be seen in Fig. 1, it is completely surrounded and protected by the field frame which forms a natural casing of sufficient strength to withstand all shocks and obstructions of the roadbed. The field consists of two symmetrical castings of special iron sleeved upon the armature shaft or axle, hinged on top and secured together by bolts. The joints are made water-tight, and the bearings are provided with leather cups for the same purpose, which makes it dust proof and possible to operate the motor on inundated tracks. The armature, which is of the drum type, is built upon the car axle. The sheet iron discs being solid and keyed to the axle, give the axle an additional strength which precludes any possibility of its bending. This arrangement, of course, eliminates all gearing. The car wheels are fastened to the shaft by a new and novel arrangement, which makes it possible to quickly and easily replace them without any special tools, or skilled labor. The armature is but 16 inches in diameter with a grooved periphery for the wires, which not only increases the efficiency, but holds the wires absolutely rigid. This construction has been found to be of great value for railway work, as the severe strain upon the armature in starting the car, has a tendency to displace the wires.

The drum type armature was selected by the Westinghouse Company for this motor, as they consider it more efficient electrically, and mechanically much superior to the Gramme or disc armature. Special attention has been given to the design of a commutator of great solidity and durability. It is securely fastened to the shaft, and connections with the armature are made by short, heavy wires which will overcome the trouble which has been experienced from broken connections. The brush holder, which is rigidly fastened to the magnet frame, is of very simple design, well insulated and easily accessible by openings provided with water-tight lids. It will be seen from the cuts that the weight of the magnet frame is counterbalanced and cushioned upon powerful spiral springs which rest upon the cross bars of the truck. These springs prevent the field from rotating, and give the motor the necessary flexibility for easy starting. The total depth of the "Ironclad Gearless" motor is but 20 inches, giving 5 inches clearance between the bottom of the motor and the rail, with a 30 inch wheel. One point of great importance is the ease and rapidity with which these motors can be changed. In case of accident, one end of the car body may

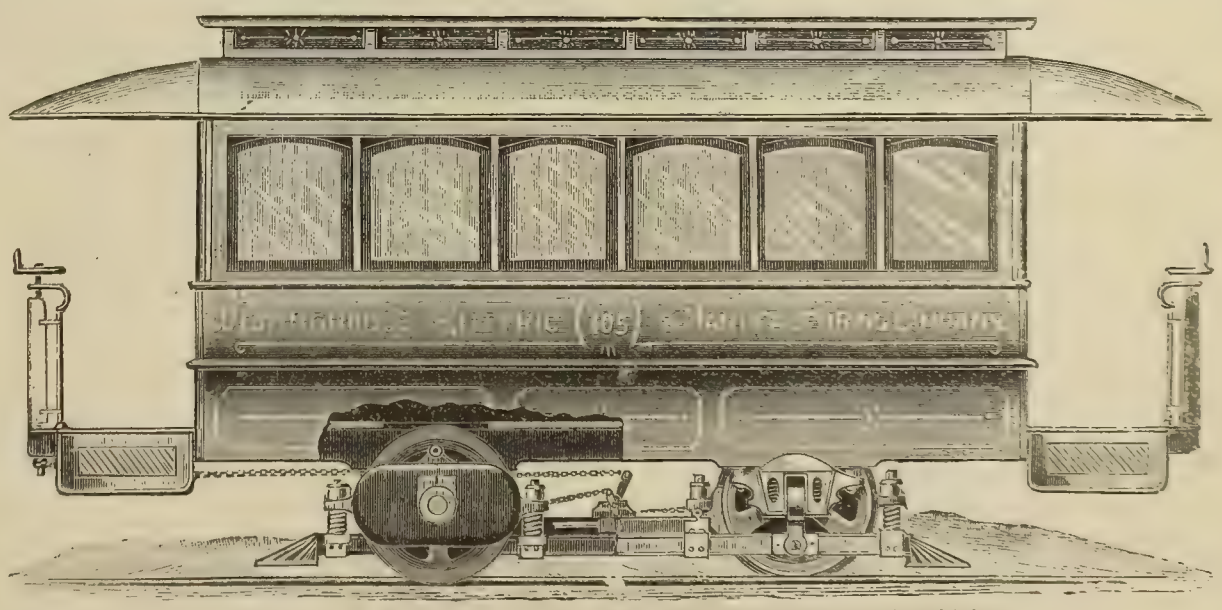


FIG. 2—CAR EQUIPPED WITH WESTINGHOUSE GEARLESS MOTOR.

be raised by means of jacks, and by simply unscrewing two nuts, the motor can be rolled out on its wheels, and a complete motor, which may be

kept tested in the car house for that purpose, can be rolled into its place. The fields of the motor can then be opened by one man as shown in the engraving, which will at once liberate the armature. For all this no pit is required, and the work can be done intelligently and conveniently. The Westinghouse Company claim that their "Ironclad Gearless" is the most efficient railway motor now on the market, actual tests having shown a working efficiency of over 90%. It is also proven by the fact that, after two hours' run with a load of over 20 horse power, the rise in the temperature of the armature and field coils was only 30 degrees Centigrade above the surrounding air. All sparking is avoided by the excellent electrical design.

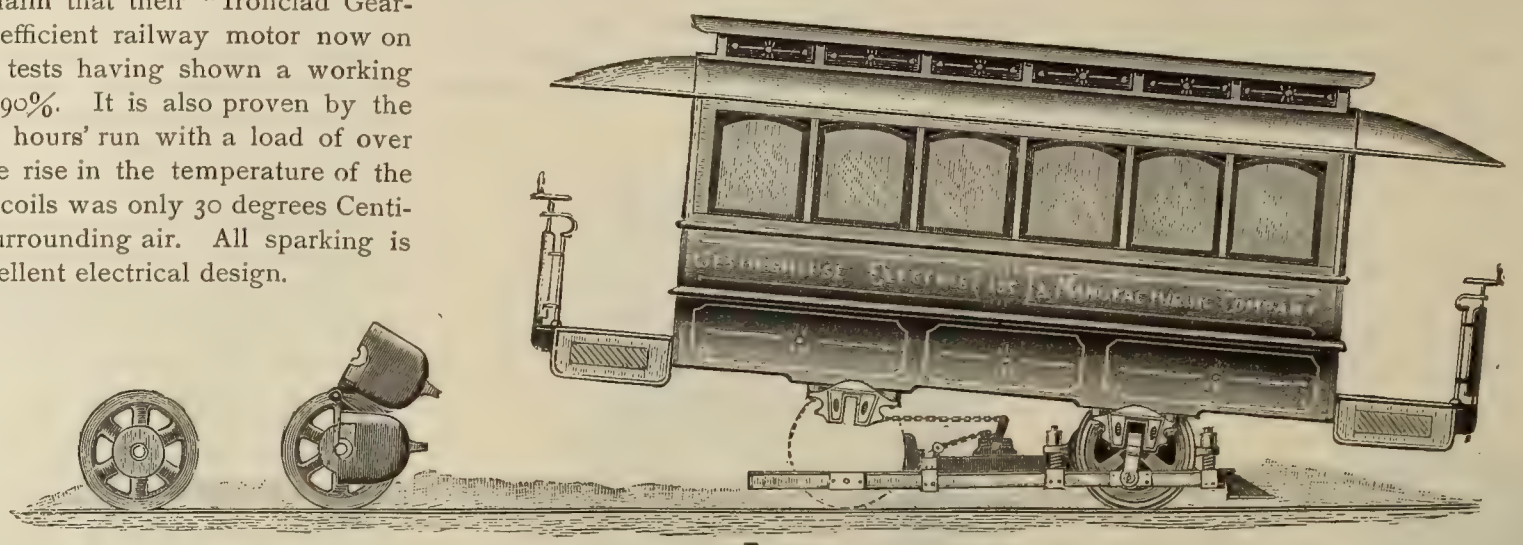


FIG. 3—WESTINGHOUSE GEARLESS MOTOR—METHOD OF REMOVING MOTOR.

This form of motor is naturally entirely free from leakage and external magnetism. On account of the absence of gears, it may safely be stated that at least 5 horse power per car is saved over the double reduction motors, thereby diminishing coal bills, or allowing more cars to be operated by the same generating capacity, or in other words, requiring less generating capacity for a given number of cars. The wear and tear and maintenance on cars equipped with these motors will be enormously reduced on account of the low speed of the wearing parts, small inertia of the armature and the low peripheral speed of commutator. The comparatively light weight of the equipment, dispensing with the weight of an elaborate truck, is a point that should be carefully considered. The "Ironclad Gearless" can be adapted for any and every gauge from 3 feet 6 inches up. The Westinghouse Company claim that this is the limit of improvement in electric motors for street car work.

ELECTROSTATIC WATTMETERS.

At a meeting of the Physical Society, London, March 6th last, Mr. James Swinburne read a note on electrostatic wattmeters.

After referring to the history of the electrometer

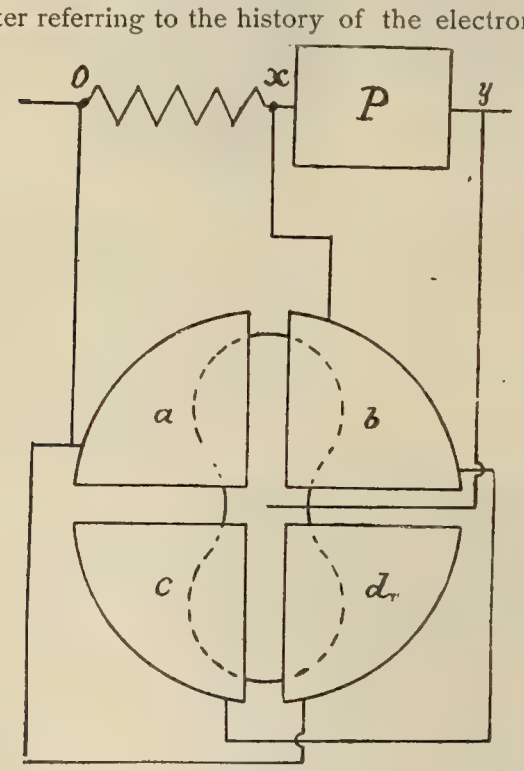


FIG. 1.

method of measuring power developed by alternating currents, the author pointed out that the necessity for taking two readings from which to determine the watts might be obviated by having the quadrants separate instead of connected in pairs, as in the ordinary method. When Joubert published his tests of a Siemens dynamo, Profs. Fitzgerald and Ayrton simultaneously suggested the use of an electrometer as wattmeter. Non-inductive resistances are connected to the transformer, motor or other apparatus in which the power is to be measured, so as to be in series with the apparatus, and on opposite sides of it, and the four ends of these two resistances are connected with the four quadrants. Under these circumstances the deflection of the needle is a measure of the watts. The disposition is shown in Fig. 1. A non-inductive resistance, $o\ x$, is in series with the part of the circuit to be measured, and the quadrants $a\ b\ c\ d$ are in shunt to it, so that their potentials are o and x. The needle is connected to the other side of the circuit to be tested, and is at potential y. If the fall of potential over the resistance is small the

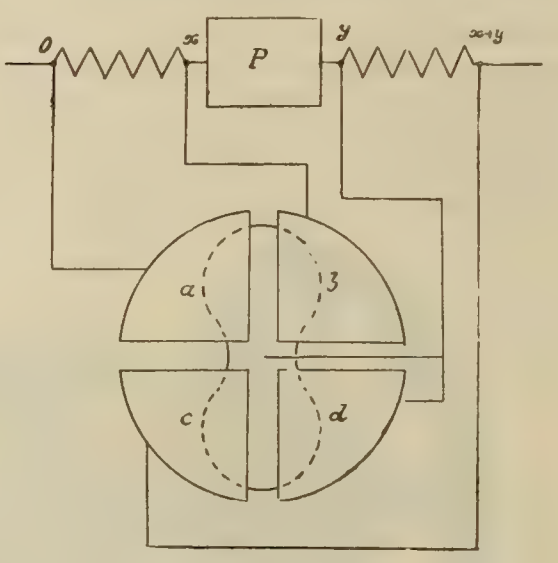


FIG. 2.

instrument is not sensitive—if large, it is not accurate. Prof. Ayrton has, therefore, introduced an accurate method depending on two readings. By using two equal resistances the quadrant electrometer may be arranged to read power directly. This is shown in Fig. 2. The quadrants $a\ b\ c\ d$ are at the potentials o, x and y and $x + y$, respectively. As this arrangement involves an end or a side pull on the needle, another arrangement shown in Fig 3 is better for commercial work. To increase the maximum deflection obtainable so as to make an instrument capable of being read by a pointer, the needle is made in two halves fixed one below the other on the same stem, and, instead of quadrants, semicircular boxes are employed. The needle consists of two half discs, each between pairs of fixed half discs. A metal torsion suspension may then be used, and the needle may have a mirror or index. It can be made to read direct, through an arc of 120 degrees or so. The electromagnetic wattmeter is the

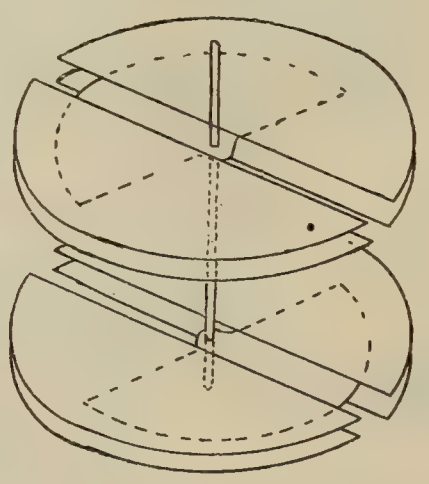


FIG. 3.

most suitable instrument for measuring low pressure powers, but it needs many spare coils to give it a large range. For high pressure work, such as measuring power lost in condensers, the electrometer is more convenient.

KING ANNUNCIATORS AND BELLS.

Improvements are constantly being made by the various manufacturers of electric bells, annunciators, etc., throughout the country. We illustrate below the King Annunciator made by Partrick & Carter Company, Philadelphia.

This is a modification of the celebrated indicating bells made by that company. It is perfect in all its working parts and reliable in every way, and is said to give excellent satisfaction to all who are using them. These annun-

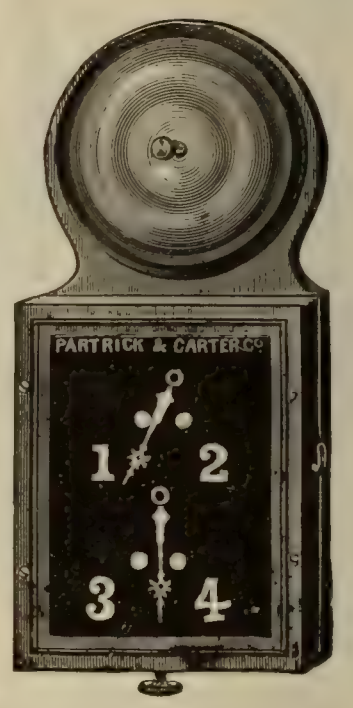


FIG. 1—KING ANNUNCIATOR.

ciators are made in three sizes, of oak and black walnut cases, with glass fronts. The bell is three inches in diameter, and the whole apparatus is extremely compact and serviceable. They are made with four, six and eight calls, either numbered or lettered, as desired.

We also illustrate the King Bell manufactured

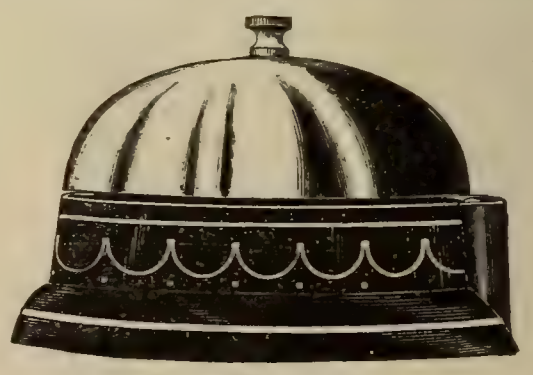


FIG. 2—KING BELL.

by the same company. Fig. 2 is two-thirds the actual size of the bell.

The features of this bell are ease of adjustment, solid iron base and nickel plated gong. This bell is so made that only the gong is exposed. and it can be adjusted before or after being placed in position. The makers claim that it is the neatest, most compact and reliable round bell in the market. It is made only in one size, namely, three inches in diameter.

This company are making a lock attachment to this bell, which locks the hammer so that the bell can not ring until the circuit is closed, no matter

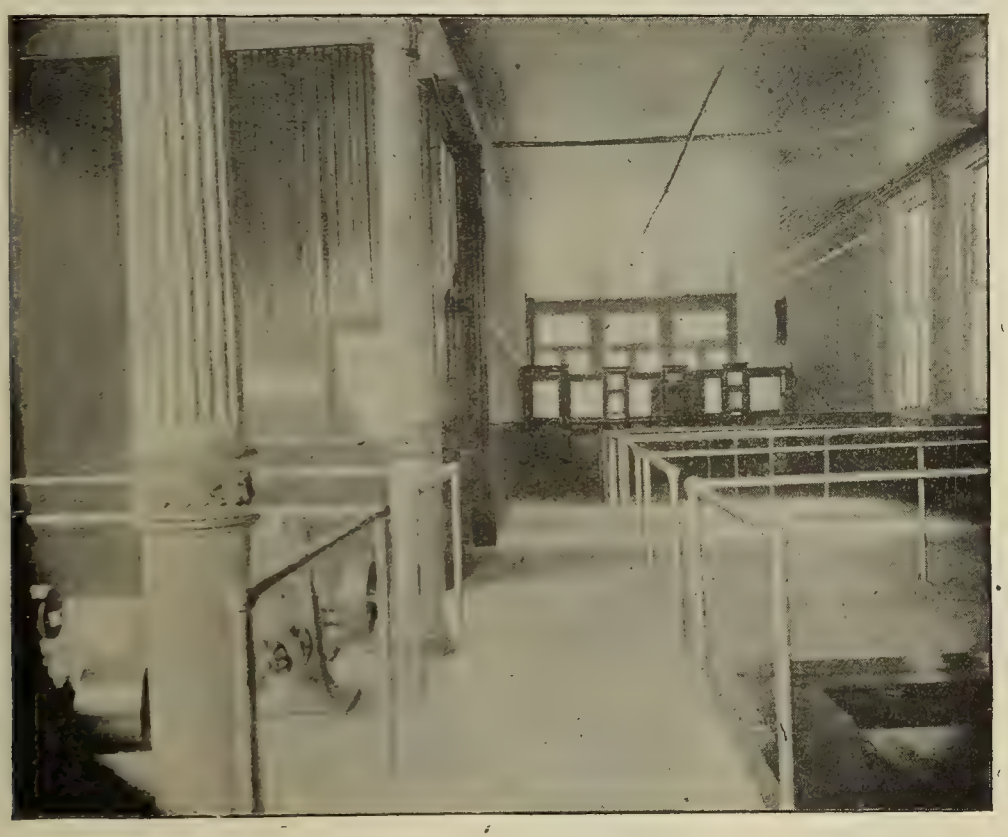
how much it is jarred or shaken. This adjustment renders the bell especially adapted for carriage or railway car use.

INTERESTING MACHINERY EXHIBITION.

We give below an illustration of the establishment of E. T. Copeland & Company, dealers in steam engines and boilers for electric light and power plants, No. 106 Liberty street, this city.

In our issue of January 31st last, we gave an extended description of this place, which was then not yet finished.

Our cut gives a view of the main floor of the establishment, and shows the spaces set apart for offices and exhibits of outside companies or individuals wishing to secure room in this handsome salesroom.



E. T. COPELAND & CO.'S EXHIBITION ROOMS.

The Case engines, made by the Case Engine Company, New Britain, Conn., for which concern E. T. Copeland & Company are the New York representatives, are made in various sizes, with automatic governors, for electric lighting and power use. They are made in the most simple form, compact and strong throughout. The cylinders are of the vibratory type, allowing a direct acting piston rod without joints. The engines are made in such a compact form, that any size desired can be placed on the floor, hung from the ceiling or affixed to the wall, from upright columns, or in fact, placed in any convenient position where economy of space is an object.

E. T. Copeland & Company, also represent the Ball Engine Company, of Erie, Pa., the Leffel Water Wheel & Engine Company of Springfield, Ohio, the firm of E. Hodge & Company, East Boston, Mass., manufacturers of stationary and marine boilers, etc., and the Worthington Boiler Company, New York.

This new establishment is said to be the largest and finest machinery store in the city. It is the headquarters for power and steam appliances, and 3,000 feet of floor space is utilized for the purpose of exhibiting first-class sample machinery in motion.

There are only two or three spaces left, all of the other sections having been quickly disposed of. This is a great opportunity for manufacturers and others, to have their salesrooms and offices in this establishment, and those desiring to secure space should not hesitate to apply at once.

The incandescent electric light has been installed and every convenience has been placed at the disposal of those occupying spaces.

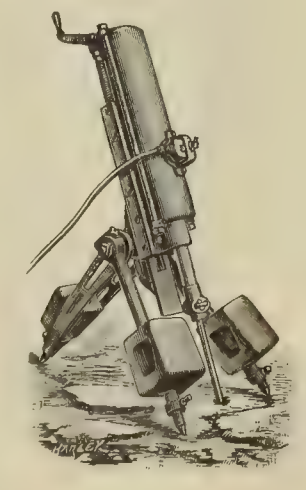
ELECTRIC PERCUSSION DRILL.

The Edison General Electric Company gave an exhibition of their Electric Percussion Drill on March 27th, in Quincy, Mass., which was attended by a large number of quarry owners from different quarries in Massachusetts, as well as by a large number of mine owners from Boston and Canada.

The result of the exhibition was very satisfactory, indeed, and the general opinion expressed by parties well versed in such matters was, that the Electric Percussion Drill is far ahead of the steam or compressed air drill. Two steam drills, working in the same quarry, gave an excellent chance for comparison.

Although the stone in Quincy is exceptionally hard, the Electric Percussion Drill was able to drill a hole 1½″ diameter, at an average rate of 2¾″ per minute, with an expenditure of power less than 4-horse power delivered to the generator. At one time the rate of drilling was as high as 4″ per minute.

Among the special features brought out by this exhibition, were the extreme ease with which the power could be translated to the drill from the generating station, and the great simplicity of the machine itself.



EDISON PERCUSSION DRILL.

The wires were taken from the edge of the quarry direct to the place where the drill was at work, without any intermediate supports being needed. The distance along the wires was 350 feet; the vertical distance between the drill and the edge of the quarry 100 feet.

For the purpose of exhibiting the ease with which the machine could be taken to pieces, and the defective parts replaced by others held in reserve, the drill was several times opened and entirely taken apart; the time required for this being less than three-quarters of an hour.

It must be borne in mind that to do the same thing with a steam or compressed air drill, would require a very much longer time, owing to the fact that the different parts have to fit well together, and the joints have to be well packed. The parts of the Electric Percussion Drill are made according to standard sizes and are interchangeable.

The Edison General Electric Company is said to be the only company which has an electric drill perfected in all details and upon the market; although several other companies have been for some time past, and still are, at work upon the problem. The field for this apparatus is enormous, and the Edison Company already have orders on hand for a great many plants, and are at present rapidly increasing their force upon this class of work.

ELECTRIC BELLS—THEIR CONSTRUCTION AND APPLICATION.

BY THOMAS R. TALTAVALL.

ELECTRIC BELL CIRCUITS.

Sometimes it is desired to ring two bells from one push button. The bells may, for instance, be placed one in the servants' room upstairs and one in the kitchen, while the push button may be

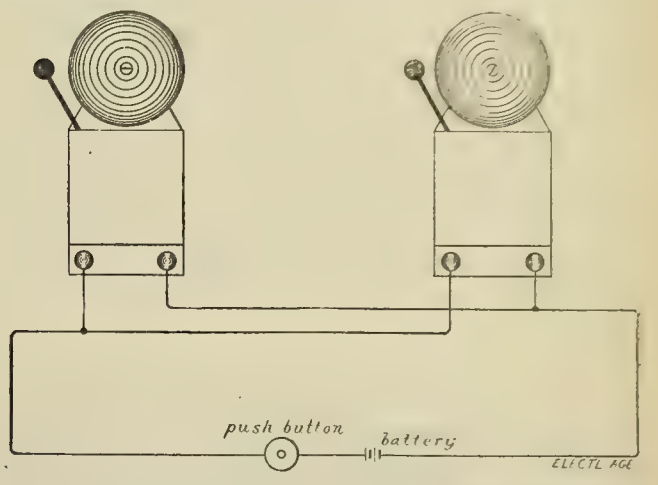


FIG. 1—RINGING TWO BELLS WITH ONE BATTERY.

placed in the sitting room or in any other part of the house. In a business house or factory the push button may be handy to or on the desk, and bells located in different parts of the building, nearest to the persons whom it is desired to call.

As the two bells will be rung at once there might be some doubt as to whom the signal was intended for, if several persons are subject to call. This difficulty can be overcome by prearranging a code of signals which will be understood by those concerned. For instance, one ring might be intended

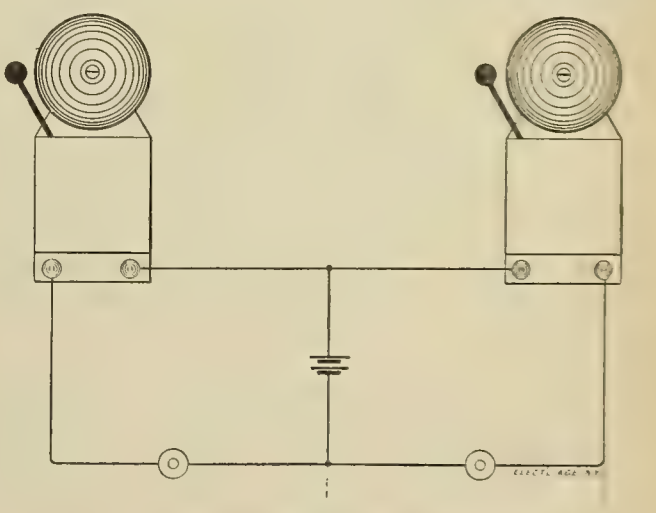


FIG. 2—TWO CIRCUITS AND ONE BATTERY.

for A, and two rings for B, and so on. This idea of course can be extended indefinitely, and a combination of signals may be arranged to indicate different objects or persons.

By making the connections as shown in Fig 1, the one battery is made to ring both bells.

Fig. 2 represents an arrangement where two bell circuits are operated from one battery. Each bell is rung only by the push button included in its own circuit, and each circuit is practically independent of the other, although the current for both is supplied by one battery. By this arrangement there is a saving in battery, and any number of

circuits may be connected thereto to work independently of each other. Under these conditions the battery will be sooner exhausted by reason of the greater demand upon it for current.

Fig. 3 shows a simple method of intercommunication between two points.

The circuits so far considered provide for signaling from only one point in the circuit. The arrangement now under consideration provides for sending a signal to a distant point, and receiving

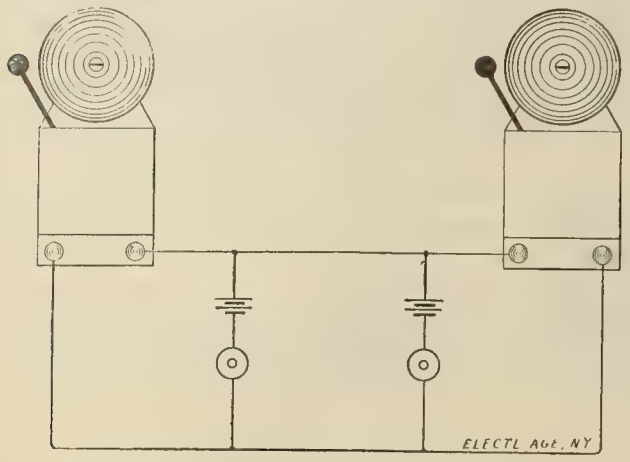


FIG. 3—SIGNALING BETWEEN TWO DISTANT POINTS.

one in return from that point. For instance, the office of a business establishment may signal to the shop, and the shop may signal back to the office, both places being on the same circuit and rung at the same time. Two batteries are required for this arrangement, as well as two push buttons and two bells.

A modification of this arrangement is shown in Fig. 4, and in at least one respect it is superior in its practical operation, for the reason that the home bell is not sounded by the home push button—only the distant bell. The home bell, however, is sounded by the closing of the distant push button.

The push buttons used in this system are different from those we have been considering. The ordinary push button will not answer the purpose in this case. What is needed is a strap key. This consists of a strip of brass usually attached at one end to a block of wood or other insulating material, while at the other end is attached a finger knob of insulating material. Above the strap near the

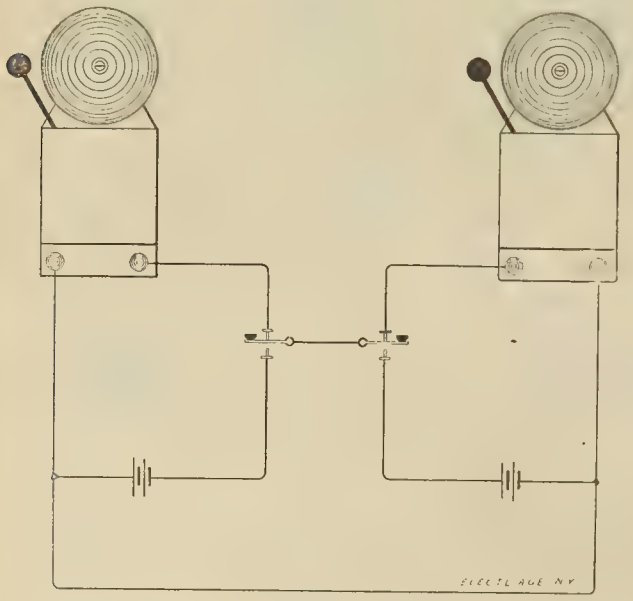


FIG. 4—HOME BELL NOT SOUNDED BY HOME KEY.

knob is a connecting screw with which the strap comes in contact when the pressure of the finger is released from the knob. When the pressure is applied to the key it connects the home battery with the wire leading to the distant bell, and the same movement cuts out the home bell. When the pressure is released, however, the home bell is connected through the home key with the main circuit and is ready for the reception of a signal from the distant end. By tracing out the circuits in the diagram this action will be readily understood.

The effect of these strap keys is to send the signal to the distant bell when we press on the key, and when we release the pressure we place our own bell in such relation with the general circuit, as to be affected by the current sent by the distant key when it is closed.

Both ends are equipped alike, and one is an exact counterpart of the other.

THE WESTINGHOUSE AUTOMATIC CIRCUIT BREAKER.

Street railway men who have operated street cars and have used in their station the ordinary fusible block, and the make-and-break switch, know how difficult it is to keep their switchboard looking well, especially when they have had a number of short circuits on the line. Not only are the safety fuse blocks burned and discolored, but also the portion of the switchboard near the safety fuse is injured, and in addition to the above, the jaws of the switch are partly melted or fused, and the whole presents anything but a neat appearance. In order to avoid this, the Westinghouse Electric and Manufacturing

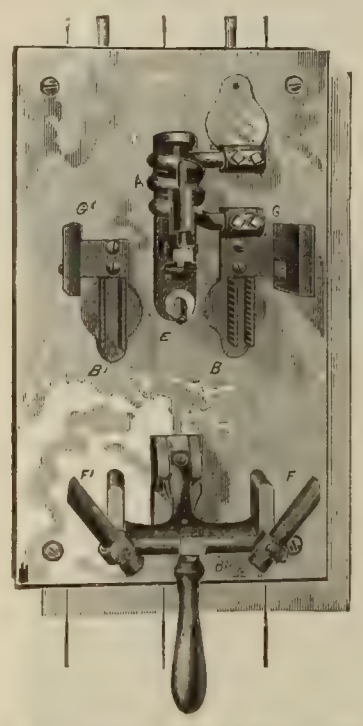


FIG. 1—CIRCUIT BREAKER OPEN.

Company have devised an Automatic Circuit Breaker which breaks the current automatically whenever there is a short circuit on the line, without burning or in any way disfiguring the breaker itself. It has been tested on as high a current as 900 amperes and 500 volts, or a total of 450,000 watts, without in any way affecting or burning the breaker. There should be one of these automatic breakers upon each feeder. The company feel sure that after the device is tried, its advantages will be appreciated.

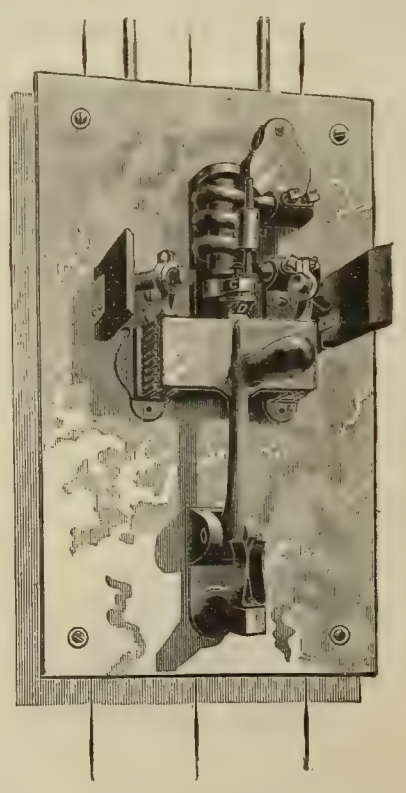


FIG. 2—CIRCUIT BREAKER CLOSED.

In the accompanying cuts, Fig. 1 is a view of the breaker when open, and Fig. 2 represents it closed.

In the following description the letters refer to the corresponding parts in these cuts.

The Automatic Circuit Breakers consists of an electromagnet, A, in series with a double break switch, B, B^1 and B^2.

If a short circuit occurs in the line, the electromagnet will attract its armature, C, and with it the trigger, D, which holds the switch closed, and thereby allow the spring, E, to throw the lever arm out of the contacts. This, however, does not yet open the circuit, as the carbon contacts, F and F^1, carried by the lever arm still touch the carbon plates, G and G^1, at the sides of the switch, and at these carbon points the circuit is finally broken without injuring in the least the metal parts of the switch. The feeder switch should always be opened before the circuit breaker is closed again.

The point at which these circuit breakers will cut out, can be regulated by changing the weight, H, attached to the armature.

The Westinghouse Electric and Manufacturing Company, make two styles of circuit breakers, viz.: one to work on feeders up to 400 amperes capacity (type A), and one to work on feeders from 400 amperes to 800 amperes capacity, (type B). These can be used in connection with any street railway system.

SMALL ELECTRIC MOTOR OUTFIT.

One of the great advantages in the use of electric power is the facility with which it can be obtained and applied in small units, and on account of the portability of the apparatus, electric power is much favored in all classes of work, whether it be heavy or light.

In order to meet the demand for an electric power outfit for such uses as operating small medical coils, toy apparatus, and for small experiments, Messrs. Hainski & Tucker, 921 Broad street, Newark, N. J., have produced a convenient outfit for this purpose, an illustration of which we give



PONY OUTFIT.

herewith. The Pony motor, as it is called, is of the simplest construction, and consequently cannot readily get out of order. It therefore may be handled by a child without any danger of deranging the parts. The power is supplied by one cell of battery, and the whole outfit is remarkable for its simplicity.

There are hundreds and thousands of uses to which an outfit of this sort can be applied, both for business and pleasure, and there is no reason why it should not meet with a very large demand.

Hainski & Tucker are making a specialty of this Pony outfit, and are meeting with very encouraging success.

FOREIGN NOTES OF INTEREST.

Steps are being taken to form a telephone association in London, with the object of securing lower telephone rates and a double wire system.

The old Breton town of St. Vrieux (Cotês du Nord) is to have the first electric lighting station in France, on the Thomson-Houston alternating current system. The generating plant is situated fifteen and one-half miles from St. Vrieux.

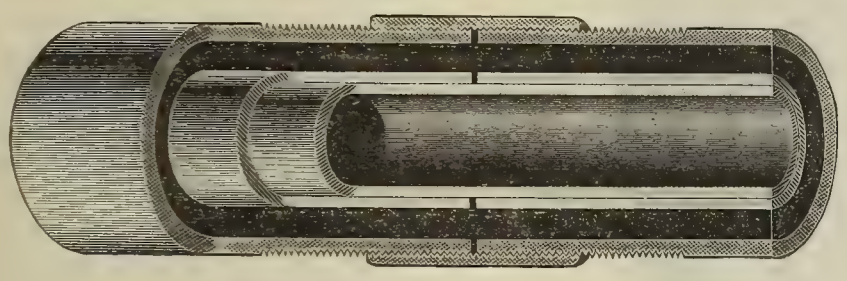
An international electrical exhibition will be opened on the 15th of May next, in Toulouse, France, and will continue until the 15th of September.

Search lights were used with great effect at the scene of the recent disaster at Gibraltar, when the steamship "Utopia" sank, after having struck the ram of H. M. S. "Anson." The search lights of the British fleet, which was anchored in the vicinity, were thrown upon the scene, and greatly aided the prosecution of the work attending the rescue of the unfortunates.

SINGLE DUCT INSULATING CONDUIT.

In order to meet a demand which has arisen for a single duct conduit of cheap, durable and efficient character, the Interior Conduit and Insulation Company, of New York, have adapted their well known insulated tubing to fit telescopically into a wrought iron pipe. The full space between the tubing and the iron is filled in with insulating compound, thus all moisture and gases are absolutely shut out. These pipes are made up into ten-foot sections and when laid are coupled together by suitable wrought iron couplings. These sections of ten feet each are made up in the works, complete and ready for shipping.

In laying, these sections are converted into a continuous duct, having practically no junctions, by employing individual insulated tubes whose



SINGLE DUCT INSULATING CONDUIT.

lengths are the same as the iron pipe sections, but whose external diameter is slightly less than the internal diameter of the iron pipe.

These individual tubes are coated at the moment of laying, with an insulating compound or cement and telescoped into the iron pipe section to the depth of just one half their length in each section. A liberal supply of cementing compound is then placed upon each end of the section to be joined and the ends of the iron pipe brought together firmly by a screw coupling. The insulated iron covered duct thus formed of two complete insulating tubes cemented together and held apart from the iron pipe by a lining of insulating compound, becomes to all intents and purposes as perfect in its continuity as if manufactured in the factory in one unbroken length.

All conduits hitherto employed practically ignore the problem of insulation, thus compelling the use of costly and cumbersome insulation upon the wires themselves, whereas this single duct conduit, as well as the multiple duct system of the same company, provides in the conduit itself without special investment therefor an insulation ample for all purposes, and they are thereby enabled to employ bare copper conductors therein in place of the costly and cumbersome insulations and metallic protections heretofore used for underground work.

This conduit will be found specially desirable for use of arc lighting companies and others employing a series system. It will also be found specially desirable for carrying the feeders of electric street railroad lines; in fact in any place where a single duct conduit of high insulation is required. By reason of its cheapness and the economy of bare copper wires, it is unnecessary to predict a large and ready market for this desirable conduit.

FLOURISHING.—The *Electrical Record*, which constitutes a section of the *American Exporter*, of this city, under the management of Mr. W. H. Fleming, a well known electrical engineer, is growing to be quite a feature of the parent publication. Mr. Fleming covers the electrical field very successfully, and no doubt this department will add to the value and importance of the main publication.

A single line of force, or unit, is that amount of magnetism which passes through every square centimetre of cross section of a magnetic field whose intensity is unity.

Lines of force that have the same direction repel each other, while if they have opposite directions they attract each other.

MAGNETIC VANE AMMETERS AND VOLTMETERS.

The accompanying illustrations represent the latest improvements in station Ammeters and Voltmeters, as brought out by Queen & Company in their "Magnetic Vane" instruments.

The firm do not claim that these "Magnetic Vane" instruments are *absolutely accurate*, but they are quite accurate enough (within one or two per. cent.) for commercial purposes. As they contain no permanent magnets the annoying inaccuracies, due to change in magnetism, which cannot be overcome where magnets are used, are entirely absent. The instruments contain no delicate parts liable to injury, but are of good, solid construction, in consequence being well adapted to usage which station instruments necessarily receive. The voltmeters, as well as the ammeters, can be left in circuit, so they may be fastened permanently on the switchboard, if desired.

The "Magnetic Vane" instruments are designed especially for central stations, isolated plants, marine installations and railway work, and are well adapted for general experimental work.

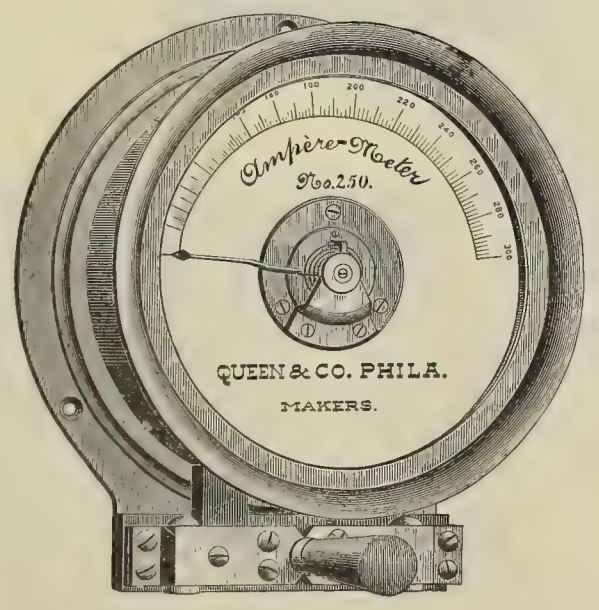


FIG. 1—MAGNETIC VANE AMMETER.

For central stations the large ammeters (Fig. 1) will be found just the thing, as they have fine open dials 8 inches in diameter, and have special



FIG. 2—MAGNETIC VANE VOLTMETER.

cut-out plugs, so they can be left in circuit or not, as desired. They are made to measure currents of any desired quantity, though 500 amperes is the largest size in Queen & Company's catalogues. Smaller ammeters of the same type are suitable for isolated installations, and are so low in price that they can be economically used on the most inexpensive plants. The "Magnetic Vane" instruments have been largely used for marine work by some of the big construction companies, with most satisfactory results.

The Voltmeter (Fig. 2) is intended for electric railway engineering, and will be found a most valuable instrument. It is calibrated up to 600 volts, and has a special short circuit key for rapid work.

Queen & Company have just issued a circular, No. 235, fully describing their Magnetic Vane Ammeters and Voltmeters, and those interested in the subject will do well to send for a copy. It contains numerous testimonials supporting the claims made by the makers.

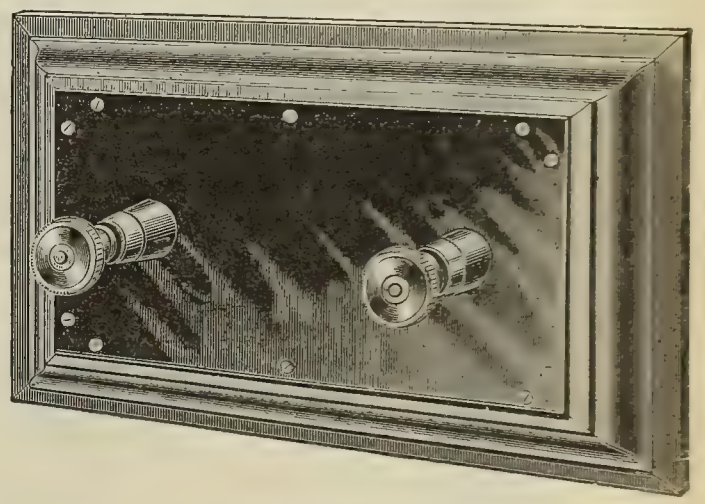
MEGOHM PLATES.

The English Megohm Plates which we illustrate herewith is an instrument of great interest to the electrician.

Megohm boxes made of platinum silver or German silver wire are so expensive as to be a luxury which few electricians, and even laboratories, are able to enjoy, and as a consequence they are compelled to be satisfied with a 1/10 megohm box in the great majority of cases as being the limit of expense that they feel warranted in indulging in this direction.

With the electrician whose duty it is to go about from station to station, or from point to point, making tests as and where they may be required, the objection to the megohm box has not been simply that of expense. The question of ready portability has been a factor in deciding against the very high resistance box, notwithstanding its greater usefulness.

Now, however, with the advent of the English Megohm Plates a thoroughly handy, convenient and reliable megohm resistance is available at a much smaller cost than a 1/10 megohm wire box.



MEGOHM PLATES.

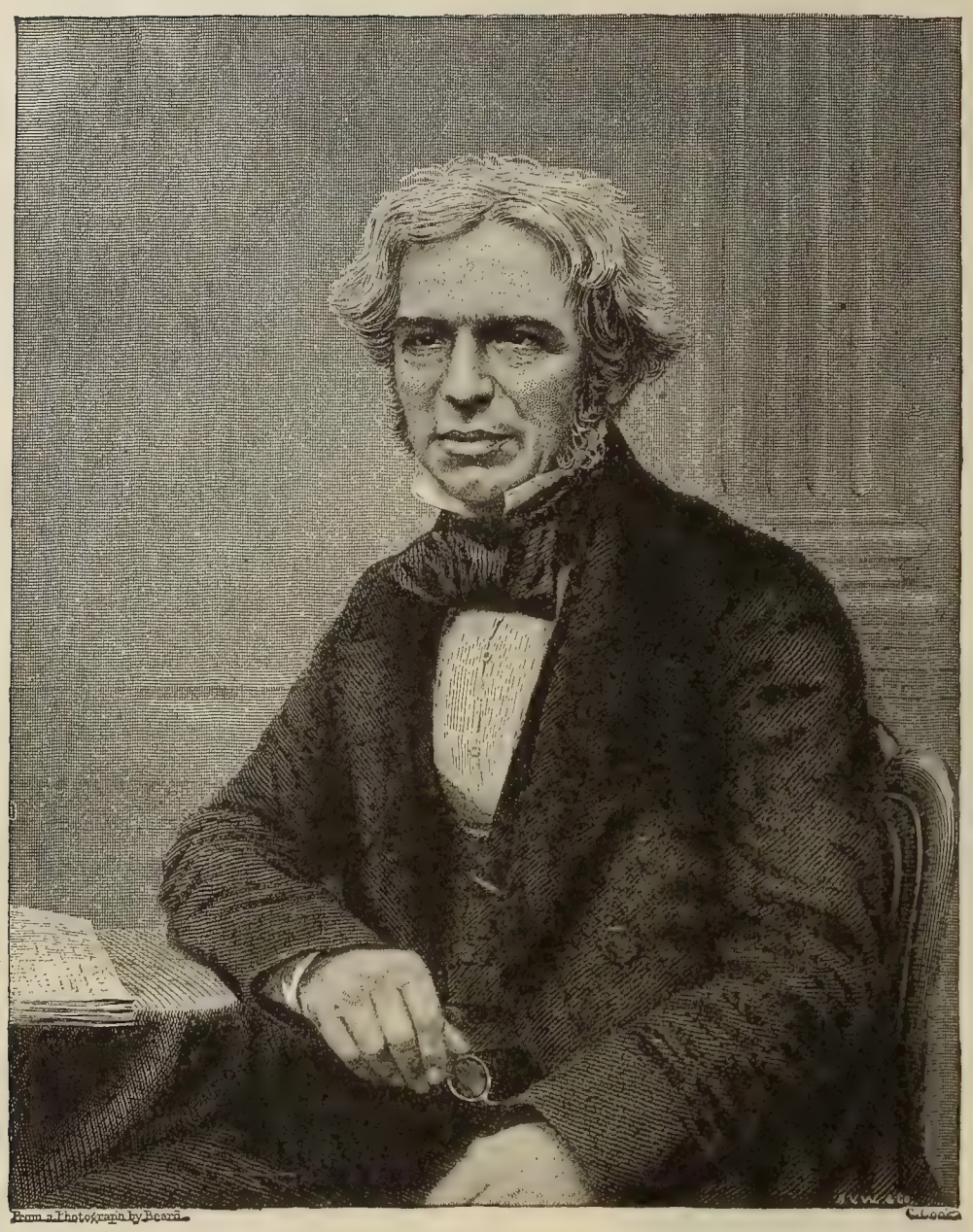
This instrument, though comparatively new in this country, is well known in England, where it has been in appreciative use for a number of years. It consists of a conductor of high resistance material, baked into plates of glass, which thoroughly protect the current from moisture.

The resistance of the instrument is not materially affected by atmospheric changes of temperature.

The employment of this high resistance instrument will permit of the same battery being used in both making the actual test, and in taking the constant, and will thus reduce the opportunities for error that are otherwise apt to arise from the calculation of a battery ratio and from employing low resistance shunts as a consequence of the frequent practice of taking the constant through 10,000 and 100,000 ohms, owing to the expense of wire megohm boxes.

These standards range from 1 to 5 megohms, being calibrated as near to the unit as practicable. The definite resistance is marked on the face of each instrument in legal ohms, but the temperature, not being a factor, is unrecorded.

This instrument is placed upon the market in this country by the E. S. Greeley & Co., 5 & 7 Dey street, New York.



MICHAEL FARADAY.

AN EFFICIENT ELECTRO PLATING DYNAMO.

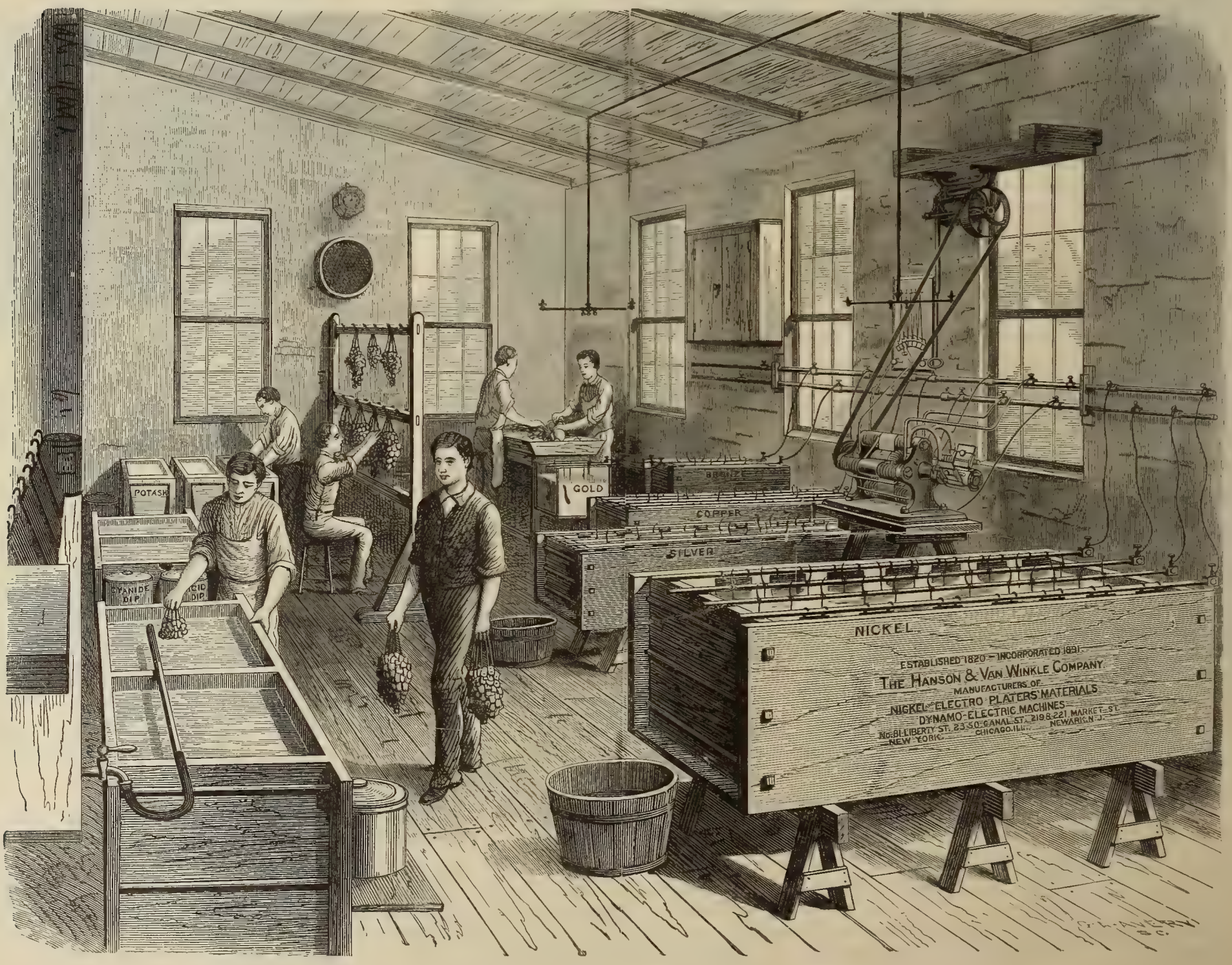
The great invention of depositing metals by means of a permanent current of electricity obtained from steel magnets, an invention founded upon Faraday's great discoveries, was first put into practical operation by Messrs. Prime & Son, at their large silverware works, Birmingham, England, and the first magnetic machine that ever deposited silver on a practical scale, constructed in 1844 by Woolrych, is still preserved at their works in its original position, as a valuable and interesting relic.

Professor Michael Faraday, an excellent photograph of whom is given herewith, made a special visit to see this application of his discovery in practical operation, and expressed great delight at witnessing so early and extensive an application to industrial purposes.

The machine was worked for many years, but was finally replaced by a perfected electro-plating dynamo made by Hanson & Van Winkle Company, 219 and 221 Market street, Newark, N. J.

This firm recently made some important improvements in their dynamos for this class of work, making them as nearly perfect as it seems possible to get them. They were the first to undertake this branch of business in this country, and credit is due them for the strides the application of dynamo electric machinery has made in electro-plating during the past fifteen years; they having contributed a large portion of the advance.

One of the latest improvements in their dynamos is the "Wonder" machine. It is very strongly constructed and allows sufficient circulation of air to keep the parts cool without the use of water. It is made in such a way as to prevent



ELECTRO-PLATING ESTABLISHMENT WITH "WONDER" DYNAMO.

any possible change of current, and with the rheostat can be regulated so as to plate from a single small article to supplying an entire electro-plating establishment with current. This rheostat is a simple and inexpensive resistance coil, which will supply a want long felt by the electro-plater.

Our cut shows a large establishment run by one of these machines. The wood tanks shown in the cut are carefully made from the best kiln-dried stock, securely put together with iron bolts and thoroughly well lined. Each tank is tested before leaving the factory.

The firm, whose factory and offices are at 219 and 221 Market street, Newark, N. J., with a New York office at 81 Liberty street, are constantly on the lookout for improvements and processes relating to this business, and are always endeavoring to reduce the price of electro-plating supplies. They manufacture and keep in stock everything for which there could possibly be any desire or use in this class of trade.

NEW CATALOGUES.

A. B. C.

An extremely beautiful and artistic catalogue has just been issued by the well known firm of Alexander, Barney & Chapin, 20 Cortlandt street, New York. It presents some novel features in this particular line of publications. In the first place the cover itself is an artistic piece of work and unique in its design. It is made of white paste-board with a grained surface, and the back cover is made sufficiently wide so as to lap over the front edge of the book on to the front cover. On the extension of the back cover, at the bottom, is an embossed representation of an incandescent light switch, in gold and black. When the book is closed this switch folds over on the surface of the front cover, on which is represented the two wires of an electric light circuit. The first thought on picking up the book is "turn the switch and open the book." The application of this idea is an extremely unique and interesting one, and the firm deserves considerable credit for their ingenuity.



A. B. C.'S NEW CATALOGUE—DESIGN ON FRONT COVER.



A. B. C.'S NEW CATALOGUE—DESIGN ON BACK COVER.

On the front and back covers are printed two very artistic and appropiate designs in which the letters "A. B. C." figure most prominently. Within the covers we find one of the most complete catalogues of electrical supplies that we have ever seen; not only illustrations of the articles represented therein, but full descriptions of all novelties offered by the firm. The catalogue entire is a masterpiece, both as to typography and design.

It is by a study of such books as these that we begin to realize the enormous appliances used in the art, and it is almost astounding that salesmen of supply houses can keep in their minds the multplicity of devices needed.

We congratulate the firm on their great success in getting up a catalogue different from every other so far published, and in order to do this hard work and considerable ingenuity is necessary. There will undoubtedly be a great demand for the Alexander, Barney & Chapin catalogue.

We give herewith the designs on the front and back covers of the catalogue, which have already been referred to.

CENTRAL ELECTRIC COMPANY.

Catalogue making has come to be an art in itself, and the catalogue of the Central Electric Company, 116 and 118 Franklin street, Chicago, just issued, is an excellent specimen of the highest development of the art. It is one of the largest catalogues yet published pertaining to electrical goods and is profusely illustrated. The paper, illustrations and printing are of the highest class, and show considerable care and time in the get up of the book. Everything dealt in by this well known house is illustrated and described, and at the end of the volume are given the rules and regulations adopted by the New England Insurance Exchange and the Boston Fire Underwriters' Union for electric lighting. The New York Board of Fire Underwriters' rules are also given, and these are followed by tables and other information of extreme value to the practical electrician. A telegraph code is one of the features of the book and it has been prepared for the convenience of the Central Electric Company's customers, with the view to saving expense when the telegraph is used. This will be found of great value to the company's customers, and the concern is to be congratulated on the success of their task in producing such a complete catalogue. The Central Electric Company is an enterprising concern and the catalogue is in keeping with their business methods.

Partrick & Carter Company, No. 125 South Second street, Philadelphia, the well known manufacturers and dealers in electrical supplies, have just issued their catalogue and price list for 1891. It is very complete and illustrates and describes all of the goods manufactured and dealt in by this enterprising company.

NEW BOOKS.

THE ELEMENTS OF DYNAMIC ELECTRICITY AND MAGNETISM, by Philip Atkinson, A. M., Ph. D. 450 pages and 120 illustrations. New York: the D. Van Nostrand Company.

Every electrician and student in electrical science is familiar with those two excellent works by this author: "The Elements of Static Electricity' and "The Elements of Electric Lighting." This latest work, as its title implies, covers a much more extensive field than either of the others. It is such a book that has been wanted for a long time, and it is written in a very clear style and is very comprehensive. The work is entirely devoid of perplexing formulæ, and explains all the technicalities in such plain language that they cannot fail to be understood by the most inexpert.

As a work of reference it will be valuable to electrical engineers, inasmuch as it explains all the main features of electrical apparatus in general, concisely and in a comprehensive manner. The field of the work is necessarily a very large one, but it has been covered in a very successful manner. The electric telegraph and telephone are described, as well as the principles underlying each, Submarine cables and duplex and quadruplex telegraphy receive a goodly share of attention, as also does the subject of electric welding. This work will undoubtedly meet with great favor among electrical students, and we think that it merits room in every electrician's library.

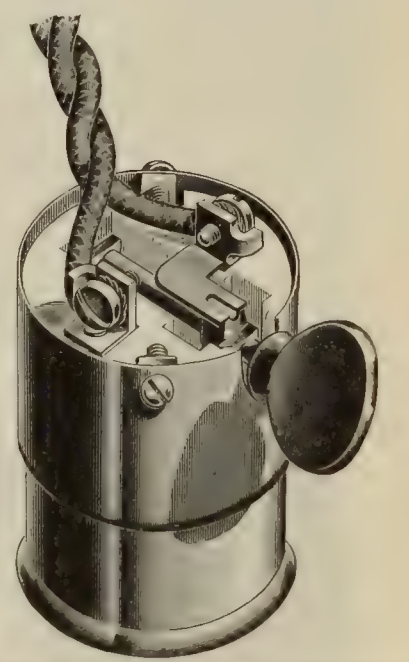
APPLETON'S SCHOOL PHYSICS, by John D. Quackenbos, A. M., M. D.; Alfred M. M. Mayer, Ph. D.; Silas W. Holman, S. B.; Francis E. Nipher, A. M.; Francis B. Crocker, E. M. 540 pages and 408 illustrations. American Book Company, New York, Chicago, Cincinnati. Price $1.20

This book embraces the results of the most recent researches in the several departments of natural philosophy. It covers the electrical field probably more than any other book on physics yet published, and we think that the scholar who masters this section of the work will have a good foundation for the study of electrical engineering. The illustrations used to describe the text, apparatus, etc., are of the simplest character, and there can be no difficulty in understanding the subjects to which they refer. It will be a valuable book for every practicing electrical engineer to have handy on his desk, and we think it deserves to take the front rank in works of this class. Education these days is incomplete without a thorough knowledge of electricity, and such knowledge can be obtained by the conscientious study of this latest addition to school literature.

PRIMARY BATTERIES.—Prof. H. S. Carhart, of the University of Michigan, Ann Arbor, has in course of preparation a book on "Primary Batteries." It is now nearly ready for the press. The plan of the book will be different from any previously published on the subject. A scientific and logical division of the subject matter in accordance with the most recent theories will be attempted. It is not proposed to make a cyclopedia of batteries, but to describe a number of the leading forms under each division of the subject. One of the concluding chapters will be devoted to an account of the testing of batteries. and will be illustrated with numerous curves expressing the results. No pains will be spared by the publisher to make the book attractive and useful.

NEW KEY SOCKET.

We illustrate herewith the interior arrangement of a new key socket just being brought out by the Star Electrix Company, of Philadelphia. This is an improvement on their old style of socket. The body which supports the key mechanism is of one piece of porcelain, which is readily removed from the shell when it is desired to wire the socket to a fixture The key mechanism is exceptionally good, and is guaranteed to carry a fifty candle power lamp without arcing.



A NEW KEY SOCKET FOR INCANDESCENT LAMPS.

The exterior of this socket is the same as that of the well-known make of Electrix sockets heretofore sold by this company. It is made to fit all the standard lamps.

THE BELL TELEPHONE COMPANY.

At the annual meeting of the American Bell Telephone Company, held in Boston, March 31st, the old Board of Directors was re-elected, with the exception that Thomas B. Bailey takes the place of Stanton Blake, deceased. The directors at a subsequent meeting re-elected the old officers.

The annual report shows gross earnings for 1890 of $4,375,290, as against $4,044,704 in 1889; net earnings $2,869,418, as against $2,661,888 in 1889; surplus for the year nothing, as against a surplus of $122,975 the previous year; total surplus $2,151,011.

There was paid in regular dividends $1,463,913, against $1,238,913 in 1890; in extra dividends $750,000, against $600,000. There is reserved $55,505 for depreciation of instruments, and $600,000 for general depreciation. The "long-distance" system is earning a moderate rate on the investment above expenses. Its net earnings last year amounted to $120,600, which were invested in extension of the plant.

The summary of the output of telephones shows that the number of instruments Dec. 20, 1890, was 483,790, an increase of 38,929 over the previous year; the total number of stations is 202,931, an increase of 17,928. The estimated number of exchange connections daily in the United States is 1,438,294 or a total per year of over 450,000,000. The miles of wire on Jan. 1st last were 240,400, an increase of 47,000; of this 27,500 is a gain in mileage underground.

CAUTERY BATTERY.—In our issue of March 28th, on page 185, we gave an illustrated description of the cautery battery manufactured by the Edison Manufacturing Company, Orange, N. J. By an error the old style of resistance used in the regulation of the current was described. The old style has been discarded in favor of the sliding resistance, which is shown in the cut accompanying the original article. It is found possible with the new rheostat to obtain finer gradation of current, besides being easier to handle by the physician when operating on a patient. The adjustable resistance consists of a wire spiral of about 70 convolutions, wound on a hard rubber core. A grooved rod is mounted over this, carrying a traveling contact, and is so arranged that any number of convolutions can be thrown into the circuit, so as to regulate the strength of the current to a nicety. Such a handy method of varying the resistance of the circuit will be readily appreciated by those who know the importance of regulating the current within very close limits.

ELECTRIC RAILWAY NOTES.

The Short Electric Railway Company, of Cleveland, Ohio, have recently closed contracts with the Lincoln Street Railway Company, Lincoln, Neb.,for twenty car equipments and forty standard motors. They will place a large number of the new gearless motors on the Lincoln Lines when this order is filled.

They have also closed a contract with the West End Street Railway Company of Rockford, Ill., for about five miles of overhead construction, three car equipments, six standard motors and a 30 H.P. generator.

The same company have just received their third order from the S. Covington & Cincinnati Street Railway Company. This covers two more 125 H. P. generators, 16 standard motors and 8 car equipments.

Mr. Edward Higgins, of Buffalo, N. Y., and G. W. Atterbury, of Litchfield, Ill., are now connected with the Short Electric Railway Company, Cleveland, Ohio.

NEW LOAN ASSOCIATION.

The Electric Building, Loan and Savings Association, has been organized by employees of the Postal Telegraph Cable Company in New York City,and the following officers elected: President, Albert B. Chandler; Vice-President, F. W. Jones, Secretary, E. D. Butterfield; Treasurer, T. L. Cuyler, Jr.; Attorney, J. B. Sabine.

Directors, J. J. Cochrane, T. J. Cusack, A. M. Kemp, W. H. Baker, C. Shirley, W. Horton Baker, L. P. Cole, George Clapperton, E. G. Cochrane, G. R. Williamson, M. M. Davis, J. A. Logan, T. F. Moran, G. H. Usher, J. H. Emerick.

LEGAL.

The Electric Secret Service Company, 45 Broadway, New York, having purchased all rights, title and interest in the patents of Edwin R. Gill, Jr., for electric signal controlling apparatus, have brought suit in the Circuit Court of Jackson County, Mo., against the Gill-Alexander Electric Manufacturing Company for fraudulently attempting to withhold rights from the Electric Secret Service Company. Pending the trial of the suit an injunction has been granted by the Court, restraining the Gill-Alexander Electric Manufacturing Company from further practicing frauds upon the plaintiff company. The latter give notice that all persons dealing with the Gill-Alexander Electric Manufacturing Company in matters concerning the automatic electric signal controlling apparatus owned by the Electric Secret Service Company, will be held liable for infringement and violation of the rights of the latter company.

ANSWERS TO INQUIRIES.

T. V. F., COLUMBUS, Ohio.—The case is a peculiar one, and it is difficult to say just what the cause of the trouble was. It is quite probable, however, that the edges of the plates touched and allowed eddy currents to circulate. As far as the core of the armature is concerned it makes no difference whether zinc or brass is used.

Preparations are being made to largely extend underground systems in both New York and Brooklyn during the coming season.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, Mass., April 3, 1891.

Fast day was observed by the electrical people generally in Boston Thursday.

Geo. T. Manson, of the Okonite Company, New York, and George Cutter of "the Rookery," Chicago, were in the city this week.

E. T. Copeland & Co., of 106 Liberty street, N. Y., recently sold a66 inch water wheel for the Oakland Mills, of Taunton, Mass., for power use.

Dr. A. F. Mason, General manager of the Simplex Electrical Company, who has been confined to his house with pneumonia, has sailed for Kingston, Jamaica, for the benefit of his health.

The Eastern Electrical Supply and Construction Company has secured the services of Mr. J. Edward Wallace, formerly of 151 Summer street, where he conducted a business of his own. Mr. Wallace takes the position of manager of the company's railway department

Mr. C. E. Bibber, the new general manager of the Consolidated Electrical Manufacturing Company, returned from a New York trip recently with a number of large orders. Business with the company is brisk and they expect to increase their working force to about double the present number of employees. Mr. Bibber has established a down town office, located at 196 Summer street.

SALEM, MASS.—The Essex Street Railway Company denies that it has made any offer or has any idea of purchasing the Beverly and Danvers storage battery road, as has been reported.

LYNN, MASS.—The new factory of the American Projectile Company, on Federal street in West Lynn, is making rapid progress under the personal supervision of Lieut. W. M. Wood, of the Navy, the inventor of the method of electrically welding shells. The brick foundations are being put in for an accumulator plant, and a press and a heavy steam hammer is already in position.

Zeigler Brothers have arrayed the front of their establishment on Federal street with new and very attractive gilt signs, which is indicative of prosperity.

F. E. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., April 3, 1891.

The Central Electric Company are in receipt of a letter from J. Parker & Son, Chicago, in which they state that they have had three Burnley Dry Batteries in constant use for two years, and that they have been successfully operating six 3-inch bells, which upon a test recently made, were working as satisfactorily as when first put in. They report the largest sales yet recorded on this battery during the month of February.

As the sole Western agent for the PaisteE-dison Key Socket, the Central Electric Company have already had numerous large orders for this latest improved socket, which is virtually a 5 ampere Paiste switch, mounted in a handsomely finished shell.

PHILADELPHIA NOTES.

W. R. Griffith & Company have increased the electric plant for the new Kenilworth Inn, Asheville, N. C., by two 300-light dynamos of the Mather type.

Mr. J. G. Biddle, of the firm of Queen & Company, is contemplating a business trip West and Southwest, and will, no doubt, return to this city with many new orders. He is an indefatigable worker.

The Applegate Electric Floor Mat Manufacturing Company, of Camden, N. J., are at the height of success, and this firm report an unusual demand for their electric matting, a very useful and novel invention.

Mr. T. L. Townsend, who is associated with the Partrick & Carter Company, has gone South on a business trip and he will, no doubt, be heard from at an early date, with extensive orders for electrical supplies.

E. T. Copeland & Company, of 106 Liberty street, N. Y., have been appointed selling agents for the Pennsylvania Machine Company, of Philadelphia, Pa., manufacturers of a full line of plain and horizontal engines of every style, as well as portable engines for hoisting, etc.

Clay & Pepper, 1218 North Filbert street, have increased their partnership by the addition of A. L. Register, formerly connected with the railway department of the Thomson-Houston Electric Company. This firm is going extensively into mining engineering and will shortly be ready for business.

Mr. J. W. Parker, electrical and mechanical engineer, 38 South Fourth street, Philadelphia, Pa., has sold two 140 horse power Ball special electric railway engines, three high pressure boilers, and all other necessary machinery to the Schuylkill Electric Railway Company, Pottsville, Pa. He has also sold to the Home Electric Light Company, Tyrone, Pa., two 120 horse power horizontal tubular boilers, one 140 horse power Ball engine, and one 300 horse power heater, steam pump and all other necessary equipment to complete their new steam plant. He has also contracted to move a pair of old 80 horse power Ball engines and boilers to the new location, and to build the new station complete for the Home Electric Light Company. This company will increase their present lighting capacity with 100 arc lamps of 2,000 candle power each. The system to be used has not yet been decided upon.

H. G. G.

NEW YORK NOTES.

The Standard Paint Company, No. 59 Maiden Lane, will on May 1st, move to No. 2 Maiden Lane at the junction of Liberty street.

Mr. J. Brotherhood, of 116 Liberty street, representing the Snow Steam Pump Works, of Buffalo, N. Y., in the short period of his work with this company can be congratulated on the success he is having with this company's goods. These pumps are highly recommended for electric light and power steam plants.

T. G. Roebuck, of the Insulite Manufacturing Company, makers of incandescent key and keyless sockets, 35 Broadway, is having excellent sales of these goods. It was kindly remarked of them last week by a construction company in this city, that they made a socket equal to any in the market, and was highly recommended.

The B. & S. Electric Equipment Company, of 115 Broadway, are having a big sale of their B. & S. Ceiling Rosette Cut-out. This rosette is spoken of very highly in the trade for neatness, convenience and practicability. In a talk with Mr. Birdsall, of this company, in the past week, he reported the sales of these goods up to the output of their factory. They are now arranging to increase their facilities.

The Stewart Heater Company, of Buffalo, N. Y., and 114 Liberty street, New York City, are meeting with well merited success with their Feed Water Heaters. Their approval is verified by the following orders received by this company within a week: Six heaters of 150 H. P. each, were sold to the Barber Asphalt Company; one of 300 H. P. to the Trenton Iron Company; one 1500 H. P. to the Thomson-Houston Electric Company; one 1500 H. P. to the Cleveland City Railroad Company; one 100 H. P. to A. C. McEwen, Jersey City.

Mr. A. A. Knudson, the well known electrician of St. John, N. B., is in this city. Mr. Knudson reports that his street railway plant will be in full operation in a very short time. The Edison system has been installed, and there are at the present time, six cars fully equipped, but the number will be increased very soon. Mr. Knudson is *en route* to Toronto, where he will place an order for Edison dynamos. He has been authorized to double the capacity of the electric light station at St. John, N. B. The Edison Company appear to have full swing in this provincial town.

W. H. Gordon & Co, of 115 Broadway, manufacturers and agents for incandescent switches of any carrying capacity, incandescent sockets of the very best make, also the Ellis Oil Filter, Arc Light Switch, Simplex wires, for underground, overhead and railway construction work, Wirt lighting arresters, and numerous other electric light, power and railway supplies. The above mentioned goods are of the very best make, and are recommended by the best experts in this country for durability, excellence and beauty of finish. Mr. Gordon is meeting with excellent success in the sale of these goods.

E. T. Copeland & Co., of 106 Liberty street, corner of Church, merchants, constructors and factor's selling agents in steam engines, steam boilers, turbine water wheels, etc., are meeting with excellent success in the introduction of their noted Case engines, having placed many of them in prominent establishments in the past few weeks. an account of which we will give in detail in later issues. These engines are attracting unusual attention on account of their compactness, convenience and economical working. Several plants are now being prepared for duty with engines coupled direct to dynamo armature shafts. These engines are particularly suited for use aboard steam yachts and steamboats generally, as they require very little space. Any one requiring anything in this line, will do well to examine these engines before giving orders. It is now possible to equip boats with electric light plants from twenty lamps upwards, as with these engines but little space is needed. They run perfectly quiet.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	$100 00
American Motor Co.			5 00
American Private T'phone (Parent)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bklu.	2,000,000	100 00	115 00
Averell Insulating Conduit.	3,000,000	100 00	5 00
Ball Electric Light.	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone.	15,000,000	100 00	197 00
Boston Electric Light.			105 00
Brooklyn Edison Electric Light.	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light.	500,000	100 00	137 00
Brooklyn Municipal Light.	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 50
Brooklyn City R. R. 5s.	6,000,000		par
Brush Illuminating (N. Y.)	1 000,000	100 00	60 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	8 00
City Electric Street Ry. Co., 6's	200,000		par
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Consolidated Electric Light.	1,929,400	100 00	50 00
Consol Gas & E.L.Co. of West Co 6's	250,000		par
Consol Gas & E. Co. Batavia, 6's.	80 000		par
Daft.	1,000,000	50 00	
Day Ry. Const. Co. Chicago.	10,000,000	100 00	60 00
East River E. L. Co. 6's.	600,000		par
East River Electric Light Co.	1,000,000	100 00	80 00
Easton Elect. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. 5s.	2,000 000		*80
Edison Illuminating.	4,500,000	100 00	80 00
Edison General	14,000,000	100 00	101 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00

Name of Companies.	Capital.	Par.	Price.
Erie Telephone			50 50
Essick Printing Tel	5,000,000	100 00	70 00
Excelsior E. L. Co	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co	4,000,000	25 00	13 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills	50,000		par
Laclede Gas Co	7,500,000	100 00	17 75
Laclede Gas, pref	2,500,000	100 00	50 00
Laclede Gas 5s			*77
Law Telephone			
Long Branch Electric Light	50,000	100 00	75 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		
Manhattan Elec. Light Co. Lmtd. 5's	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co	2,000,000	100 00	
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light			90 00
Morristown L. H. & P. 5s	25,000		*90
Morristown L. H. & P	50,000	100 00	100 00
Nat'l Elec. Co., Wash., D. C	250,000	100 00	
N. E. Telegraph and Telephone			51 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	99 00
Newark L. & P	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
North New York, Lighting	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	102 00
Plainfield, Electric Light	100,000	100 00	75 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Rockaway Beach Elec. Light	50,000	100 00	60 00
Russell Electric Lamp Co. (Boston)	300,000	100 00	90
Saratoga Gas and Elec. Light 6s			*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Shaver Corporation	100,000	1 00	3 00
Swan Incandescent	800,000	100 00	2 50
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L., H. & P. Co	100,000	100 00	95 00
Thomson-Houston Electric Co	10,000,000	25 00	44 00
Thomson-Houston Pref	5,000,000	25 00	25 00
T.-H. Electric Co. 5's Boston	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100,000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Union Switch & Signal Co	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction Co	1,370,000	100 00	2 50
United States Elec. Co			40 00
United States Illuminating	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref	250,000	5 00	6 00
Western Union	86,188,852	100 00	80 50
Westinghouse Electric Co	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref	3,000,000	50 00	50 00
West End, L. (Boston)			22 50
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

It is well known that the New York Bank Note Company manufactures the paper money for a great many countries, sending the bills out in sheets to be signed by the authorized officials. The minting of the gold coins, however, has generally paid royalty to the British mint, while Birmingham makes the silver and nickel coins. It is now reported that Uruguay has about concluded arrangements to have a national coinage for the first time, and that the French mint will secure the contract to strike off $7,000,000 in gold. Previous to this, foreign gold coins have been authorized by the Government and received as follows: eagles, $9.66; sovereigns, $4.70. There is no good reason why the United States should not secure this contract and hold it as against Europe until every republic on this continent has a mint of its own. To a certainty, we should coin their silver and put our trade mark on every piece, as we now put the mint initial on our own money. As an advertising medium for business it is equal, if not superior, to the Electrical Age, the specie being always actually present and part of the transaction. Aluminum will, no doubt, soon replace nickel and copper; it is cleaner, healthier, and in all ways preferable, electricity having made it possible for half dimes and cents. Improvements in its production are the order of the day, and offers a new and extensive proposition for investigation and investment.

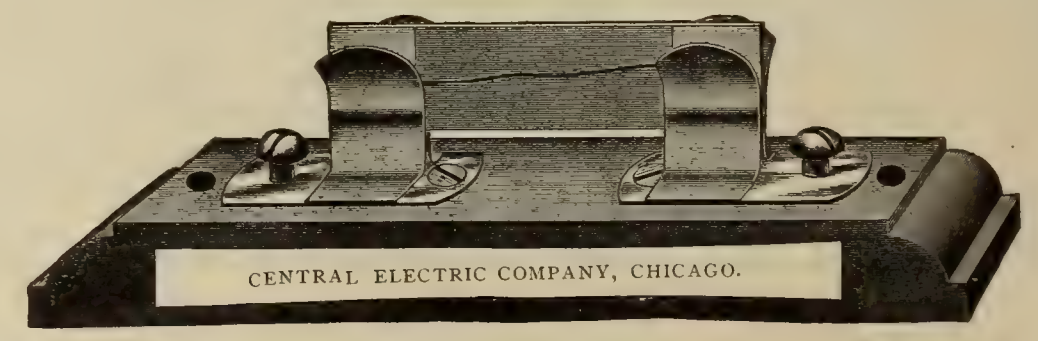
It is estimated that over $600,000,000 are earning from 6 to 20 per cent. in the electrical industries this year, and nearly every plant, be it light, heat, power, science or trade, which was in successful working on the first of January will be greatly increased, many doubled, by December 31st, and the dividends rolling in in corresponding ratio. The stock necessarily kept on hand by a supply and construction company includes so many different articles that the salesman, although having no business beyond his counter, must be an electrical engineer and expert of no mean order, and the capital employed is too much for individuals, or even ordinary firms. The manufacturer who produces these articles, ranging from a tiny screw to a bull dynamo, also requires much wealth in cash or credit. The full fledged system, regardless of its designation or application, calls for still greater capital for introduction and competition, and these, with all other industries directly or indirectly connected with them, if of any considerable magnitude, should always be known to the public in the shape of bonds and stocks. As a rule, all electrical appliances are of such a nature that the people are brought into direct and continual contact with them, and have a right to have an opportunity to be financially interested. The regular quotation of current value serves to establish a credit and enable all to form their own opinions. Send on the details as per list to me. It costs nothing.

That investors are realizing their anticipations may be inferred from the fact that about $32,000,000 interest and dividends will be paid this month, beside which the government pays $5,600,000 on the 4 per cent. bonds; added to which should be some $12,000,000 for state, county, municipal and manufacturing corporations, or nearly $50,000,000. I note Bristol Electric Light Company, 5 per cent.; Edison Illuminating Company, of Boston, 3 per cent.; United Gas Improvement Company, Philadelphia, 4 per cent.; Western Union Company, 1¼ per cent.; Edison Illuminating Company (N. Y.), 1 per cent. and 5 per cent. in stock; Narraganset Electric Light Company, $1 per share; Edison General Electric Company, (6 per cent. quarterly) 2 per cent.; Richmond Light and Power Company, (S. I.) coupons on bonds; Brooklyn Trust Company, 4 per cent. (quarterly). All bonds, I believe, are being honored in due course.

Secretary Ely, of the Stock Exchange, goes to Europe this month and will try and bring back with him a satisfactory and acceptable method of settling days. We bespeak for him a cordial reception and fraternal hospitality. The Western Union should have their "time ball" in operation this week. It will be a great relief to the messenger boys, as it is their guide for lunch. The market is dull, but very firm.

FUSIBLE STRIP AND HOLDER.

The cut shows a very handy form of fusible strip and holder for the same, especially designed to protect telegraph, telephone, and other instruments from damage by lightning, or heavy dynamic currents. By a new patented process the fuse wire is adjusted to blow with any desired current, that in the cut being for a current of 1–2 amperes.



FUSIBLE STRIP AND HOLDER.

When a fuse blows, the strip can be removed and a new one substituted with the greatest facility, the inspector carrying a few of the extra strips in his vest pocket to replace those destroyed. This article is controlled and being placed on the market by the Central Electric Company of Chicago.

LOW SPEED MOTORS.

In many classes of work, low speed motors are preferable to high speed machines, and the field for such is rapidly enlarging.

A consideration of the points of superiority of slow speed machines over those of high speed, will be of interest, and are enumerated as follows:

1. The armature of low speed machines make fewer revolutions than that in high speed motors. In some machines the speed is as low as one quarter.

2. The wear and maintenance of pinions, intermediate shafting and bearings, are avoided, and it is possible to gear directly from the armature shaft to the car axle.

3. The use of larger pinions with larger teeth upon the armature shafting, also saving of room taken up by the intermediate gearing.

4. Saving in oil or grease, on account of the absence of the intermediate gearing.

5. Owing to the low speed of the armature, the life of the commutator and brushes is correspondingly lengthened.

6. There being less centrifrugal force in the armature, the liability to accident is greatly reduced.

7. The slow speed reduces the strain on all parts of the machine, consequently, lessens the liability of breakage.

8. The absence of the intermediate gearing and shafting makes it possible to make a more compact machine, which can be handled to better advantage.

9. Higher efficiency, which means less consumption of coal and less engine and boiler capacity.

Charging Accumulators.—In the shunt dynamo variation in load, causes considerable variation in pressure in the inverse sense. Where constant pressure is required, as in supplying incandescent lamps, compound machines are therefore generally employed, but where intended to run in parallel, and where changes of load are small or the engine governor is not sensitive, shunt machines answer as well. For charging accumulators they are necessary, as if by slipping of the belt or other cause, the pressure falls below that of the opposing electromotive force of the cells, the current runs back into the dynamo, making it run as a motor. This, however, in the shunt machine tends to increase the speed and checks excessive discharge, but if it were series wound the polarity would be reversed, and it would generate current in the same direction as that flowing from the cells, causing a violent discharge to the detriment of both. A shunt wound motor can be run at approximately constant speed with either full load or no load, but care must be taken to avoid such overloading as would bring it to a stand, when by all back electromotive force being done away with, excess of current would injure the armature.

MEETINGS OF SOCIETIES, ETC.

FRANKLIN INSTITUTE.

The stated meeting of the Electrical Section of the Franklin Institute was held on Tuesday evening, April 7th. The following communications were presented: A Suggestion in Arc Lighting, Prof. C. Hanford; Report on the Electric Railway of Buda Pesth, Mr. H. W. Bartel; An Experimental Analogue for Direction of Induced Currents, Prof. L. F. Rondinella; The Effect of Atmospheric Pressure on Batteries, (continued), Prof. Herman S. Hering.

ALTERNATING CURRENT MOTORS.

The rapidly extending use of the alternating current system of electric lighting has created a demand for an efficient alternating current motor, particularly of the class designed for small power, such as the operation of fans, etc. Mr. William Hochhausen, electrician of the Excelsior Electric Company, of 115 Broadway, New York, has designed a motor of this type that is said to give excellent results. The complete machine weighs but 15 pounds. The armature is of the Siemens drum type, and is wound in 16 sections. It is provided with a commutator, and the fan revolves at a speed of 1,000 revolutions per minute.

The motor is self starting and requires little attention. The field magnets are laminated, and there is no heating during the operation of the machine.

BUSINESS NOTES.

Mr. R. T. White, dealer in patented material for street railway tracks, 12 Pearl street, Boston, has made arrangements with the following named parties to represent his business in their respective localities: W. D. Thomas, 141 Bryan street, Savannah, Ga., Southern Agent; D. E. Garrison & Co., Laclede Building, St. Louis, Mo., St. Louis and Southwestern Agents; The Great Western Electric Supply Company, 190 and 192 Fifth avenue, Chicago, Ill., Chicago and Northwestern Agents. Mr. White reports a very active demand for his goods and has some very large orders on hand to fill.

The Page Belting Company, whose works are located at Concord, N. H., with stores at New York, Chicago and San Francisco, reports a very large trade and largely increased business over one year ago. Their Patent Acme Link Belts are having a very large sale, not only for electrical purposes, but for driving fans in large iron manufacturing establishments. The company has issued their catalogue for 1891, containing a full list of all the goods manufactured by them. A copy of this catalogue should be in the hands of every dealer and user of belting in the country.

The Ball Engine Company, of Erie, Pa., manufacturers of the well known high speed automatic cut-off engines, which are so extensively used in electric light and power stations, have just shipped to the Buffalo Electric Street Railway, a 250 horse power cross compound condensing engine, and a 300 horse power triple expansion engine to the Rochester Street Railway, Rochester, N. Y.

The Jenney Motor Company, of Indianapolis, Ind., has just perfected a new plating dynamo of 5,000 watts capacity, and it is claimed to be a very efficient machine.

The Cowles Electric Smelting and Aluminum Company, has removed its offices to Lockport, N. Y.

The Great Western Electric Supply Company, 190 and 192 Fifth avenue, Chicago, have just placed upon the market the "Giant Carbon Battery." This battery is the result of careful experiments by an experienced and successful battery designer, and the company claim that it is the leader among open circuit batteries. It has very high electro-motive force and low resistance, giving a large current. It is simple in construction, and has no parts that can become loose and cause trouble.

E. T. Copeland & Co., of 106 Liberty street, have been appointed general selling agents for W. G. & G. Greenfield, of Newark, N. J., manufacturers of the celebrated engines bearing their name. These engines are well known for substantial make and handsome finish. A full line will be carried on exhibition at the above address.

The Hine Eliminator Company desire to locate agencies. They have other valuable steam devices in addition to their Eliminator. This is a good chance for engineers out of employment. See their advertisement.

"Electricity as a Motive Power," by Count Th. du Moncel and Frank Geraldy. Translated and edited by C. J. Wharton. Whilst electricity is making such rapid strides in this direction, the above book cannot but be of much interest. It contains 113 engravings and will be sent post paid for three dollars, by E. and F. N. Spon, 12 Cortlandt street, N. Y.

In designing dynamos the general rule in regard to speed or number of revolutions of the armature is to make it as great as possible.

The limit of speed of armatures is purely mechanical.

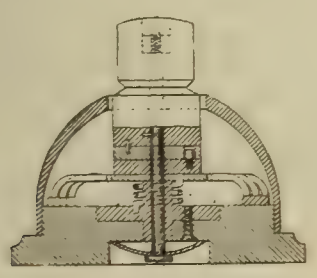
THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS.

ISSUED TUESDAY, MARCH 31, 1891.

449,106. Telephone Circuit and Apparatus. John J. Carty, New York, N. Y., assignor, by mesne assignments, to the American Bell Telephone Company, Boston, Mass. Filed Aug. 16, 1890.

A multiple-station telephone-circuit, a call bell magnet of relatively high resistance at each station included in a branch circuit uniting the two sides of the telephone-circuit, and a generator of electricity for sending calls at each station, adapted when operated to be connected between the two sides of the telephone circuit in multiple arc with the call bell magnet.



NO. 449,188.—ELECTRIC SWITCH.

449,108. Electric Cash Indicator and Recorder. William F. Z. Desant, New York, N. Y. Filed May 9, 1890.

A cash-register having check-preparing mechanism, in combination with electrical recording and indicating devices.

449,125. Elastic Metallic Pole for Electric Wires. Charles A. Lieb, New York, N. Y. Filed Nov. 3, 1890.

A pole having more than one thickness of metal extending longitudinally along its concave side when under strain, to prevent buckling.

449,153. Hanger for Electric Lamps. Horatio A. Foster, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut Filed Aug. 1, 1890.

449,168. Art of Covering Electric Wires. Thomas W. Norman, Boston, Mass. Filed April 29, 1890.

The improvement in the art of covering insulated wire, etc, with lead or other suitable metal, which consists in taking a flat strip or ribbon of the metal, scarfing the edges thereof, feeding the wire and metallic covering strip forward, continuously inclosing or encircling the former in the latter during the forward movement by a series of differential steps, gradually inclosing the covering over the wire, and soldering the meeting scarfed edges of the covering.

449,174. Telegraph-Transmitter. Harry G. Robbins, Minneapolis, Minn. Filed Nov. 29, 1890.

A series of circuit closers adapted to be operated by keys upon a suitable key-board.

449,180. Telephone Sound-Transmitter. Adam E. Schatz, New York, N. Y. Filed March 1, 1888.

449,188. Electric Switch. William White, London, England. Filed Dec. 3, 1889.

Stepped contact-plates having the edges of their steps sloped downward, in combination with correspondingly stepped contact-arms and a shaft moving longitudinally and having a friction head or shoulder.

449,196. Electric Railway Conduit. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company of Connecticut. Filed March 5, 1889.

Transverse yoke and slot-rails with a clamp having clamping-faces engaging the yoke and an insulated supply conductor attached to the clamp.

449,197. Electric Motor Truck. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 31, 1889.

449,206. Electro-Magnetic Device. Moses G. Crane, Newton, Mass. Filed July 16, 1888.

The combination of an electromagnet and its armature pivoted to vibrate back and forth before the poles of the magnet and normally when the magnet is demagnetized, remaining in an intermediate position between its extreme forward and backward positions, combined with a main and a local circuit through the magnet, and a circuit closer in the local circuit, arranged with relation to the armature so that the circuit closer in the local circuit remains open when the armature is in its normal intermediate position and is closed when the armature moves backward beyond the normal intermediate position.

449,209. Electric Fuse. George F. Curtiss, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed June 20, 1890.

In an electric fuse, the combination of the fuse-wire with an inclosing tube having a bore of such diameter that the wire fills the tube with slight, if any, clearance for the purpose of causing the sudden expulsion of the wire when melted.

449,226. Guard for Electric Railway Trolleys. Andrew W. Mitchell, Boston, Mass. Filed June 23, 1890.

A trolley wheel having two arms, each having a flange extending over the wheel and provided with a slit or opening in line with and for the rim or edge of the wheel to project through.

449,227. Electrical Railway System. Samuel F. B. Morse, Brooklyn, N. Y. Filed Oct. 29, 1890.

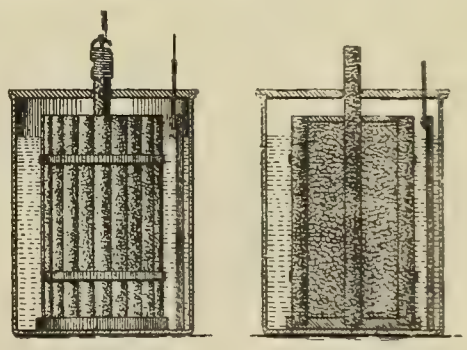
449,236. Electric Arc Lamp. John H. R. Ward, New York, N. Y., assignor to the Universal Arc Lamp Company, same place. Filed Dec. 8, 1890.

449,237. Electric Arc Lamp. John H. R. Ward, New York, N. Y., assignor to the universal Arc Lamp Company, same place. Filed Dec. 8, 1890.

449,238. Electric Arc Lamp. John H. R. Ward, New York, N. Y., assignor to the Universal Arc Lamp Company, same place. Filed Dec. 11, 1890.

449,245. Dynamo-Regulator. Burnett H. Fisher, New York, N. Y. Filed Sept. 15, 1890.

A dynamo consisting of the combination of stationary and movable field-magnets, commutator brushes, and means for communicating motion from the movable field-magnet to the brushes.



NO. 449,299.—GALVANIC BATTERY.

449,249. Electric Cash Register System. Robert E. Nelson, Jr., Columbia, Va. Filed Aug. 21, 1890.

In an electric cash register system, the combination of one or more local cash registers and indicators and a central register electrically connected therewith and adapted to be operated from the local registers and indicators and to operate the local registers and indicators from itself.

449,254. Telephone. William Humans, Cambridge, Mass., assignor to the American Magnetic Electric Company, Jersey City, N. J. Filed July 23, 1885.

A telephone consisting of a permanent magnet whose elements are connected pole to pole to form a case, a diaphragm extending across the open end of the magnetic case and one or more pole-pieces and coils within the magnetic case.

449,258. Method of and Apparatus for Electric Soldering. Almon Robinson, Lewistown, Me. Filed April 18, 1890.

Passing an electric current through the solder to be used, thereby melting the solder solely or principally by the heating effect, which is proportional to its own ohmic resistance, and thereafter applying the melted solder to the joint to be made.

ELECTRICAL PATENTS—Continued.

449,266. Hanger Board for Electric Fixtures, George R. Lean, Boston, Mass., assignor to the Bernstein Electric Company, Portland, Me. Filed June 9, 1890.

449,282. Electric Switch. Horace T. Clark, Bridgeport, Conn. Filed Feb. 25. 1891.

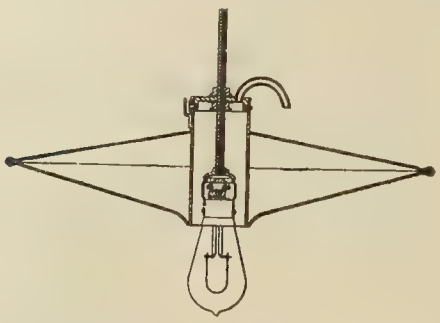
449,288. Regulating Apparatus for Electric Currents. Wilhelm Lahmeyer, Aix-la-Chapelle, Germany. Filed Feb. 9, 1888 Patented in Germany and Belgium.

449,299. Galvanic Battery. Henry P. Stoecker, New York, N. Y. Filed Dec. 4. 1890.

A cathode formed of a series of carbon rods arranged in contact one with the other, and a filling of broken carbon and a depolarizing agent.

449,301. Cut-Out. Charles S. Van Nuis, New Brunswick, N. J. Filed Aug. 18, 1890.

449,302. Electric Contact Protector. Richard Varley, Jr., Englewood, N. J. Filed Nov. 28, 1890.



NO. 449,403.—ELECTRIC LAMP REFLECTOR.

An electric contact protector formed of two discs of flexible material connected together around their edges and having central openings for the electrodes.

449,307. Binding-Post for Electric Wires. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed Dec. 16, 1890.

449,345. Electric Belt. Duane P. Andrus, St. Louis, Mo. Filed Nov. 7, 1890.

449,348. Electric Contact. Otis J. Depp, St. Louis, Mo. Filed Jan. 24, 1891.

449,356. Manufacturing Chains by Electric Welding Processes. Elihu Thomson, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine.

Consists in constructing each link of a chain as a single continuous piece of metal, the ends of which are abutted at the joint of the loop or link, heating the joint and the continuous part of the link opposite by an electric current, and then subjecting the link to pressure in a line transverse to the line connecting the chain and the opposite continuous heated portion.

449,357. Burr Preventer for Electric Welding Machine. Elihu Thomson, Swampscott, Mass., assignor to the Thomson Electric Welding Company of Maine. Filed Aug. 15, 1890.

The combination with an electric-welding apparatus having means for imparting welding pressure to the work, of rockers or segments arranged to engage with the work at the weld and adapted to rock in planes transverse to the general plane including them, a movable support for the rockers, and means for reciprocating them in a line parallel to the welding-pressure.

449,358. Electro-Magnet. Ferdinand A. Wessel, Brooklyn, N. Y. Filed Nov. 19, 1890.

449,362. Electric Switch-Box. James H. Dean, Minneapolis, Minn., assignor, by direct and mesne assignments, to Barron D. Southard, same place, and William Perkins, Armada, Mich. Filed Nov. 4, 1890.

449,375. Pole for Electric Wires. Julius Meyer, New York, N. Y., and Carl Binder, Chicago, Ill. Filed Oct. 3, 1890.

A pole for electric wires, composed of two or more angle pieces of iron or steel that converge from the base toward the upper end, transverse pieces or plates for connecting the angle pieces, a base plate or shoe, and angle irons for attaching the lower ends of the converging angle pieces to the base plate or shoe.

449,400. Insulated Electric Conductor. James D. Bishop, Brooklyn N. Y. Filed Sept. 22, 1890.

An electric conductor comprising a conducting core wound with a paper ribbon, the spiral edges of which are separated by a spiral air space and enclosed within a protective sheath.

449,403. Electric Lamp Reflector. Frank Cooley, Cincinnati, Ohio. Filed Jan. 18, 1890.

449,404. Electric Heating Apparatus. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed Apr. 28, 1890.

The combination of an exposed electric heater and a ventilating fan mounted upon the same support or frame.

449,407. Shade for Electric Lights. James W. Easton, New York, N. Y., assignor to P. Minturn Smith, Plainfield, N. J., and William D. Perry, Brooklyn, N. Y. Filed March 20, 1890.

In a shade for electric lights, the combination of segmental sections provided with outwardly projecting flanges and separators, placed between the flanges, clips inclosing the flanges, and arms connecting the clips and separators with the side rods of the lamp.

449,411. Electric Alarm for Shaft-Bearings. George Hannah, Brooklyn, N. Y. Filed Dec. 24, 1890.

A shaft-bearing having circuit terminals insulated from each other below the normal wearing surface, and an electric circuit connected to the terminals.

449,468. Automatic Electric Weighing-Scale. John V. Davis, Ashland, Ky., assignor to the Automatic Electric Scale Company, same place, Filed May 17, 1890.

The combination, with the scale-beam and its poise, of an electric motor arranged in shunt circuit with a part of the current going through the field-magnets constantly, and a part through the armature, contacts for making and breaking the armature circuit between the points of balance, and gears connecting the electric motor with the poise for adjusting the latter.

449,474. Electric Lighting System. George Gibbs, Milwaukee, Wis. Filed Aug. 14, 1890.

449,490. Guard for Electric Railway Trolleys. A. W. Mitchell, Boston, Mass. Filed Dec. 1, 1890.

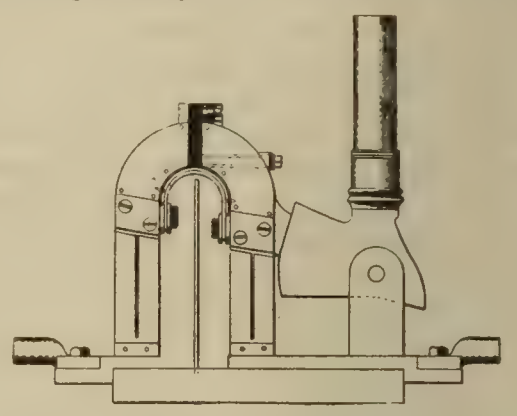
449,569. Automatic Trolley-Catcher for Electric Railways. Byron J. Parsons, Omaha, Neb., assignor to Fred W. Fitch, same place. Filed Aug. 27, 1890.

In a trolley-catcher, the combination, with the trolley and its flexible connection, of a spring-actuated winding cylinder or drum and its holding or releasing mechanism.

449,575. Non-Interference Signal-Box. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed June 9, 1890.

449,576. Non-Interference Signal-Box. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed Oct. 20, 1890.

449,604. Incandescent Electric Lamp Socket. Franklyn A. Weller, Boston, Mass., assignor to William S. Hadaway, Jr., trustee, same place. Filed Aug. 11, 1890.



NO. 449,301.—CUT-OUT.

449,610. Magnetic Separator. Richard R. Moffatt, New York, assignor to himself and Sylvester Chichester, Brooklyn, N. Y. Filed Aug. 25, 1890.

In a magnetic separator, the combination of two rotating drums with a stationary electromagnet or magnets located outside of the drums and having pole pieces or extensions within.

449,611. System of Operating Electric Elevators. William Baxter, Jr., Baltimore county, Md. Filed March 17, 1888.

In an electric-elevator system, in which the motion of an electric motor is transmitted to the car by means of a hoisting pulley, intermediate mechanism and a hoisting-rope, the combination, with the motor circuit, of a switch located upon the car and arranged and operated to reverse the motion of the car by reversing the motor and to stop the car by stopping the motor.

449,639. Electric Railway Signal. Stonewall Tompkins, Knoxville, Tenn., assignor of one-half to Charles E. Vawter, Crozet, Va. Filed Dec. 9, 1889.

Two series of aligned conductor-sections electrically connected into groups, the arrangement being such that each section exists between sections belonging to a group or groups other than its own, and groups in one series being connected with the respective groups of the other series.

449,651. Electro-Therapeutic Syringe. Edwin Bartsch, San Francisco, Cal. Filed June 28, 1890.

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NEW YORK, APRIL 18, 1891.

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ALUMINUM MEDALS.

Following the example of the ELECTRICAL AGE, the authorities of the patent office have struck off aluminum medals to commemorate the centennial of the American patent system, and by so doing have once more exemplified the truth of the familiar saying that "imitation is the sincerest flattery."

By issuing these aluminum medals the patent office authorities virtually acknowledge and applaud the enterprise of the ELECTRICAL AGE in being the first to use aluminum for such purposes, and furthermore, emphasize the appropriateness of such use of the metal. The idea expressed in language is that aluminum typifies the latest triumph in the electro-metallurgical art, and that the production of this important metal on a commercial basis, is therefore one of the fruits of the inventive genius of this electrical age.

The patent office medal is a trifle larger than that of the ELECTRICAL AGE, and the "bird of freedom" is prominently displayed on the obverse side. On the reverse side is an inscription appropriate to the occasion.

The ELECTRICAL AGE sets the pace!

AUTOMATIC SIGNALING APPARATUS.

The logical sequence to every accident is an effort to devise ways and means to prevent the recurrence of similar accidents. Thus, in railroad operations, collisions and other disasters immediately stimulate inventive genius to produce some means of avoiding a repetition of like occurrences. Human beings cannot be absolutely depended upon for the proper performance of certain duties, neither can a machine. One can be used as a check upon the other, however, and if a man fails in his duty through any cause, a machine may be so constructed as to give proper and timely notice of the fact, while on the other hand the machine requires intelligent attention to keep it in working order.

In this line of invention we present on another page in this issue a novel and interesting device, which would seem, on the face of it, to be a great step in the direction of rendering railroad travel much safer than it is at present on most roads.

The invention consists of means and apparatus for automatically signaling a train at any given station on the line by the train despatcher at the directing point, which may be hundreds of miles away from the station at which it is desired to display the signal. This signal, however, is not intended to take the place of an operator. It is rather in the nature of an emergency signal and a check upon the operator who may be engaged in other duties away from his instrument at the all important moment. The apparatus, moreover, automatically returns a response to the despatcher, indicating that the signal has been set, and at the same time a bell is sounded to attract the attention of the operator, who is thereby notified that his immediate attention at the wire is desired.

This invention is flexible in its application, and there are many other important uses to which it can be put. Some of these are described in our article, to which we refer the reader.

ACCUMULATOR CARS WITHDRAWN.

The electric cars which were run on the Fourth avenue line in this city, on the accumulator system, have been conspicuous by their absence lately. They had become familiar objects to thousands of people, and never failed to attract attention, mainly for the reason that there was no visible source or medium for the transmission of the propelling power. This is not the first time, however, that they have disappeared from the road.

The cars have been withdrawn, not on account of any fault with the system, but on account of the legal and financial difficulties in which the operating company is involved. In fact the whole accumulator business seems to be involved in litigation.

Speaking of the experience on the Fourth avenue line, the superintendent of the company says that the experiment was substantially successful, and that when the cars were withdrawn, the storage battery company which operated them, had succeeded in reducing the running expenses almost to the cost of horse cars.

Patent litigation was the chief difficulty encountered by the owners of the Julien storage battery, which was the system used. The Accumulator Company of Philadelphia first sued the Julien Company and obtained an injunction for infringement. Then the Brush Company, which owns broad patents covering storage batteries, brought successful suit. The Julien company thereupon leased the patents of the Brush Company, and the latter corporation has, in turn, brought suit against the Accumulator Company for infringement. The last suit will soon be decided. The immediate cause of the withdrawal of the cars was the exhaustion of the financial resources of the operating company, and the first city of the land can again boast that not one electric car, on any system whatever, is operating within its municipal limits.

THE ACCUMULATOR AS AN AUXILIARY TO THE DYNAMO FOR ELECTRIC LIGHTING.

One of the most important features of the accumulator is its storage capacity of energy which may be afterwards converted into an electric current. In this respect, the accumulator is unique, and it is often compared with a domestic water cistern, from which a supply of water can be drawn at any time.

The use of secondary cells reduces considerably the risk of a total stoppage of current from the dynamo, whether it be for light or power, resulting from the breakdown of any part of the steam or electric machinery.

Secondary cells have also the advantage that where they are used in sufficient numbers to maintain the ordinary number of lamps, they can, in an emergency be used to considerably increase the total amount of current supplied. For example, suppose the dynamo to be able to generate the same amount of current as the secondary cells, the latter can be charged during the day, and both battery and dynamo employed jointly or independently for lighting purposes during the evening.

On another page in this issue, Mr. E. V. Baillard describes an accumulator plant in the Palmer House, Chicago, which is used in this manner, and which, from all reports, is giving excellent satisfaction. At noon the dynamo is started to supply the lights, and charge the accumulators (of which there are 120 cells) at the same time. When the load of lamps equals the capacity of the dynamo, the cells are cut out, and when it exceeds the capacity of the dynamo, the accumulators are switched in and help the dynamo, acting as an auxiliary source of electrical supply. Towards the latter part of the evening, when the number of lights is less, and the load on the dynamo is below its capacity, the surplus current is used to charge the batteries, and this operation is kept up until midnight, when the dynamo is shut down for the night. In this manner the lights are available 24 hours, while the dynamo is run but twelve.

On several occasions the value of the accumulators as a reserve source has been practically demonstrated with the most satisfactory results. The engine was by accident incapacitated from doing service, and the accumulators were called upon to supply the current for all the lights in the hotel, which would inevitably have been extinguished had the dynamo been depended upon entirely.

In cases of emergency, such as these just mentioned, the value of the accumulator is best appreciated, and no doubt the proprietor of the Palmer House would not have been without his accumulator plant on these occasions if he had had to pay five times their cost.

MONTREAL HEADQUARTERS OF THE N. E. L. A.—Probably the Windsor Hotel in Montreal has never before been described and illustrated in an electrical journal. Inasmuch as it has been selected as the headquarters of the National Electric Light Association during the convention in that city next August, it is quite proper to yield a little of our space for the purpose of describing the temporary abiding place of many of those who will attend the convention.

The location and surroundings of the hotel seem to be in entire harmony with the importance of the occasion. There is plenty of room for the easy ventilation of electrical thought and knowledge, and no doubt the health-giving atmosphere of the Canadian metropolis will contribute largely to the success and enjoyment of the meetings.

There is great activity in subway building in this city since the advent of milder weather.

THE WINDSOR HOTEL, MONTREAL.

HEADQUARTERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The Windsor Hotel, Montreal, having been selected as the headquarters for the National Electric Light Association during the convention in that city, next August, it will be of interest to the members of the association and others who intend to be present at the meeting to know something about this model hotel. We have taken the pains to secure all the information available about the hotel, and we are now able to present the following facts and illustrations.



FIG. 1—WINDSOR HOTEL, MONTREAL, QUEBEC, CAN.

Fig. 1 is a view of the exterior of the Windsor Hotel. The building faces Dominion Square, the finest and most central in the city, and it has the reputation of being unrivalled in Canada. It is within one minutes' walk of the Grand Trunk and Canadian Pacific Railway depots. It is in close proximity to Mount Royal Park and the main avenue leading thereto, while it is within easy walking distance of the chief places of interest in the city. The main entrance facing Dominion Square, is on Peel street.

The hotel has accommodation for about 800 guests. Every safeguard against fire is taken and all the rooms are divided by brick partitions. The table and attendance are said to be unsurpassed anywhere on the continent. The hotel has a passenger elevator for the convenience of the guests and electric light is used throughout the building.

A view of the grand dining room is given in Fig. 2. The room is 112 feet long by 52 feet wide, and the ceiling is 27 feet high. It is unique and gorgeous in its decorations and architecture. It is said to be one of the largest and best frescoed dining rooms on the American continent, and as many as 500 people have sat down to a meal at one time.

Fig. 3 gives a view of the rotunda of the Windsor. Here are situated the hotel office, ticket and telegraph offices and cigar and book stands. The rotunda has a dome roof, is lighted from overhead by large skylights and at night is lighted by arc lamps.

The Windsor Hotel was thoroughly re-decorated last year, and contains every improvement conducive to the safety and comfort of the guests. The rooms are large and airy.

The journey from New York to Montreal by rail occupies fourteen hours, from Boston ten hours and from Toronto thirteen hours. The city and vicinity abound in places of interest and pleasure, and no doubt, from the present indications, the Montreal meeting of the National Electric Light Association will be an occasion long to be remembered by those who are fortunate enough to be present. The Montreal people are already stirring themselves to make the occasion a memorable one.

ENGINES FOR ELECTRIC LIGHTING.

Engines used for electric lighting should have automatic governors which "cut off" and thus "expand" in proportion to the load. It may be taken as a rule that engines of the best manufacturers can be worked continuously at three times their nominal horse power with economy, at maximum boiler pressure. Cheaper engines are not strong enough to stand a continual strain of more than twice their nominal horse power. The maximum power given off at any time is clearly proportional to the steam pressure.

It is always safest in practice, to adopt the following method in purchasing a steam engine required for a particular installation. Allow eight sixteen candle lamps per brake horse power, when the engine house is within one hundred yards of the residence; if further off, seven to the horse power, but never less, because by making the leads larger this condition can always be obtained, excepting under peculiar circumstances, which would arise only in the event of great distances intervening between the generation of the current and the place where it is used, when it may be cheaper to light fewer lamps per horse power than to have larger mains.

In making the calculation, consider the maximum brake horse power of the engine one-and-one-half times the nominal horse power, there will then be no chance of falling short of power, and a good reserve of power is obtained by raising the steam pressure slightly when more work is demanded. The boiler should always have a larger nominal horse power than the engine in order to secure a good steam supply, and to allow longer intervals between the fueling. The higher the pressure of the steam, the more is expansion possible, and the greater the economy in coal, since the large amount of fuel required for converting the water into steam, which is rendered latent, is not required a second time for further raising the pressure, and all heat, with a trifling exception, is available for useful work.

Expansion beyond a certain point is best accomplished by the use of two or more cylinders, such engines being called compound. But these engines are not recommended for private installations, unless there is skilled labor, because the simpler the engine the less likelihood of its getting out of order. The same remark applies to all high speed engines, although, in confined situations, these are often indispensable. One hundred revolutions per minute of the fly wheel suffice for all purposes in engines from ten to twenty nominal horse power, and 150 per minute in smaller engines. After twenty nominal horse power the fly wheels turn slower. All these engines come under the designation of slow speed.

DYNAMOS.

There are endless patterns of dynamos in the market, but all those of the best makes give approximately the same efficiency and possess the same qualities generally. The slow running dynamo, say from 500 to 700 revolutions per minute, should be chosen, since there is less vibration and less wear and tear with these than with machines speeded up from 1,000 to 1,500. It is imperative to have solid foundations, and, for the bearings, self-oiling arrangements; nothing answers this purpose better than grease. The machines must be kept perfectly clean, and should not be tampered with. For the mechanism, all that requires attention are the commutator and brushes. Both must be kept scruplously clean, and sparking in any form should be guarded against. All modern machines have the brush holders adjustable and full directions are given for producing the best results. The commutator soon becomes worn by sparking or by too heavy a pressure of the brushes. When much wear takes place, the truth of the commutator becomes destroyed; instead of wearing down equally it gets eccentric, and assumes all manner of shapes. Re-turning in the lathe is then the only cure, but this irregular wear can be almost entirely avoided, in which case the armature need not be removed for turning



FIG. 2—DINING ROOM OF WINDSOR HOTEL.

more than once in three or four years, if as often. If any plates in the commutator are softer than others or contain flaws filled with solder, then nothing will prevent the unequal wear, except by substituting good plates for bad ones. Rolled copper is the best material for commutator plates; it wears evenly, keeps bright and contains no flaws.

It should be well borne in mind that, if the commutator is not kept in good order, the loss of efficiency may be enormous and eventually it will be impossible to use the dynamo. In addition, the least unequal wear causes the brushes to jump, making the light flicker, and the faulty places become worse daily. When faults are confined to one or two plates they are "termed flats."

THE "SECURITY" BURGLAR ALARM.

To protect buildings from the forcible entrance of burglars and others desiring admittance for base purposes, was among the first applications of electricity. Some means of notifying the occupants of residences when an attempt was made to gain an entrance, was always needed and purely mechanical methods were very often a sad failure. Those systems depending on bells rung by cords or mechanical gearing were too easily tampered with and they only lulled the occupants of houses into fancied security, while the intruder ransacked the building with impunity or only awoke them in time to see a knife or other weapon at their throats. Burglars and criminals always found some means to destroy or render useless the majority of mechanical alarms and not until electricity was practically utilized in this direction could people rest in that security due to every one in his own home.

But even in electrical devices tampering was one of the main difficulties to be overcome. Any bell or other alarm that can be silenced by cutting or otherwise injuring the wire is useless, and, of course, it follows that the most important parts of



FIG. 1—ELECTRIC TRAP.

such circuits are the connections or attachments at the windows and doors, the parts most easily reached by those trying to force an entrance.

There is a large number of different styles of springs and traps so arranged that they will ring an electric bell when the windows or doors are opened, but probably none have had the sale or been appreciated more than the "Security Electric Trap" made by the E. S. Greeley & Co., that we illustrate below. It brings the electric burglar alarm and its application down to simplicity itself, so that a complete outfit can be bought for much less money,



FIG. 3—OFFICE AND ROTUNDA OF WINDSOR HOTEL, MONTREAL.

and installed on the premises effectually and understandingly by any amateur electrician, in much less time than is usually required by other systems.

Fig. 1 shows the trap complete and as will be seen, it is small and ornamental. Taking off the

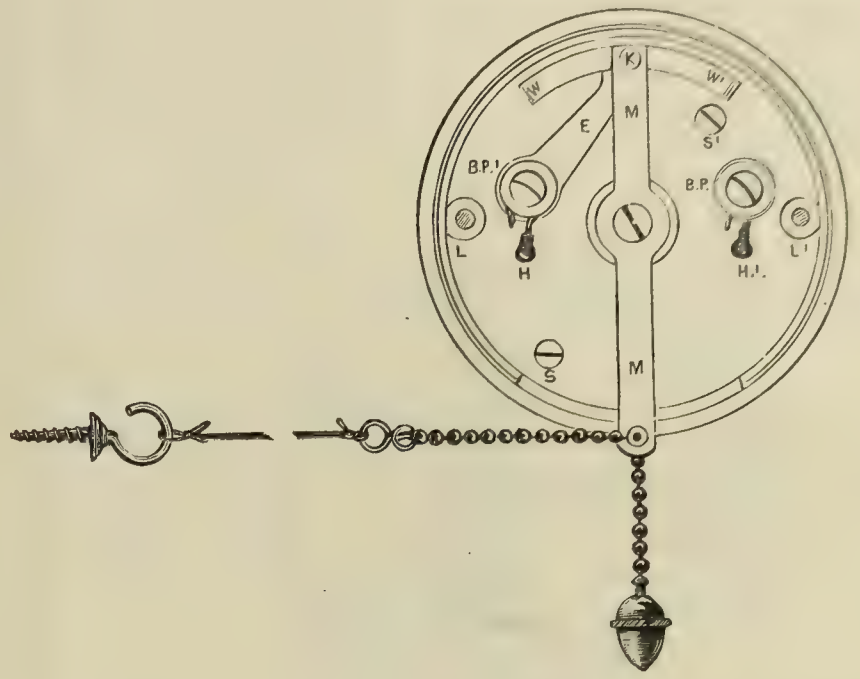


FIG. 2—INTERIOR MECHANISM OF ELECTRIC TRAP.

cover by means of two screws in its face displays the interior as shown in Fig. 2. The trap is shown in an adjusted position, K being the indicator which is now in line with the point that the arrow would occupy if the cover were on. L and L^1 are lugs that are entered by the screws securing the trap cover in place. M is the lever, while W and W^1 are the "trap lever contacts" that effect electrical connection with the "base contact" E when the adjustment is disturbed.

The location of traps is a matter of convenience and judgment to suit the case. In protecting doors and windows generally, where there is no special reason to the contrary, it is usual to locate the trap at a point that will permit the cord attached to the eye in the extremity of the trap lever to be stretched in the most direct line. The general method of connecting the traps and running the wires is shown in Fig. 3. The diagram shows the system applied to an entire house. A single trap in the cellar protects the three cellar windows, one trap on the parlor floor guards the two parlor windows and another the hall door; one on the second floor is all that is needed for the three windows on that floor, the cord passing through a hole in the partition separating the two rooms, and one more trap for the scuttle.

A battery and a bell is needed in all electrical alarm circuits. In the diagram the battery is shown in the garret for convenience of illustration, but it may be placed anywhere most convenient

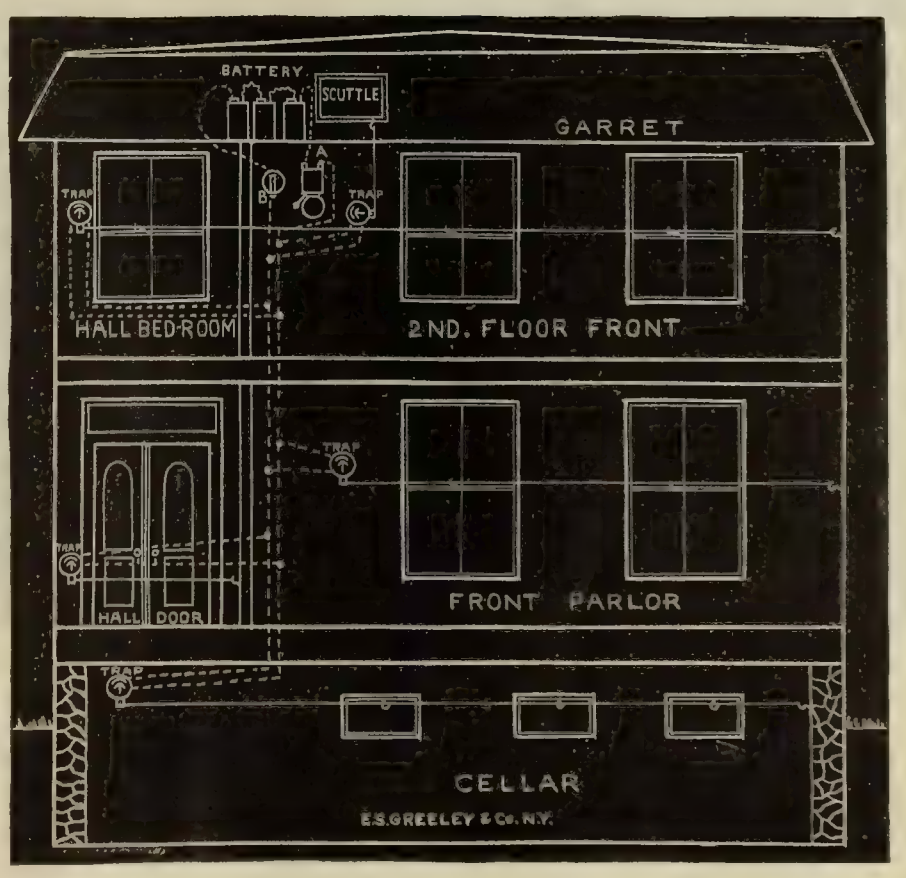


FIG. 3—METHOD OF WIRING AND CONNECTING ELECTRIC TRAPS.

care being taken to have the bell between the battery and the first trap on the circuit. As will be

seen, the wire from the battery is run first to the bell A, and the other to switch B, and thence straight to the last trap, that located in the cellar. The other traps are looped across from wire to wire at the floors where they are located. In the diagram the branch wires to the hall door trap are represented as passing across the door. This has been done simply to secu directness of delineation, as in practice the wires pass along under the carpet or oil cloth upon the floor or around the frame of the door. A hook is fastened to the frame of the opening to be protected and a cord stretched from it to the eye in the trap lever. If the trap is now set properly, with indicator directly over the arrow, any attempt to open the door or windows will, by increasing tension upon the cord, destroy the trap adjustment and ring an alarm by closing the electric circuit through that trap. Unhooking the cord from the window, or any attempt to cut it, will give an alarm by decreasing the tension of the cord. Whether the cord is drawn tighter, slacked up, broken or cut, the effect is always the same: it springs an alarm.

The "Security" trap is practically an automatic electro-mechanical circuit closer having the same relation to a burglar alarm circuit as the push button has to the call-bell system.

It can be made for either open or closed circuit work and is a valuable auxiliary to elaborate systems of burglar alarms. The E. S. Greeley & Co., 5 and 7 Dey street, New York, have sold large quantities of them for the protection of private residences, for which purpose they have proved entirely satisfactory.

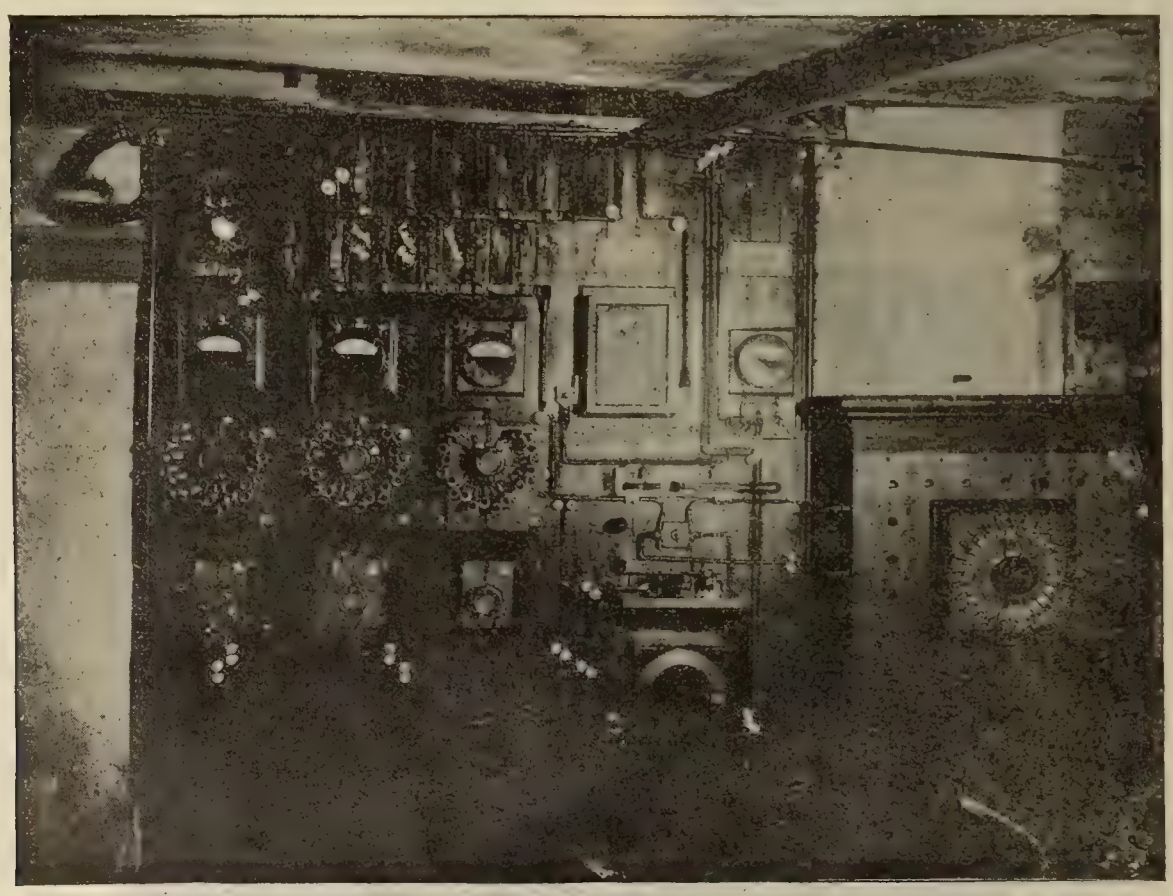
THE PRACTICAL APPLICATION OF ACCUMULATORS.

BY E. V. BAILLARD

A HOTEL PLANT.

The subject of this article is a plant at a hotel which is familiar to every traveling man, the Palmer House, Chicago.

The electric lights in the hotel are supplied by a number of United States dynamos, driven by a 150 horse power Buckeye engine.



ELECTRICAL ACCUMULATORS—SWITCHBOARD IN THE PALMER HOUSE, CHICAGO.

All the dynamos were loaded to their full capacity during the hours of greatest supply, and it was desired to add some lights in various parts of the hotel, notably in the new Turkish baths lately completed. In these the lights were required for the entire twenty-four hours, but the engine was only run from nightfall to a little after midnight, so the Accumulator Company, through their Chicago agent, Mr. William Hood, were called upon to solve the problem. A 250 light dynamo, used for supplying the barber shop lights, (210 16 c. p. lamps) was selected to charge the accumulators and independently connected to a 25 horse power Westinghouse engine. The battery consists of 120 cells of the 15 L type of accumulators, divided in three series of 40 cells each, giving a capacity of 900 ampere hours at a normal rate of discharge of about 100 amperes; 175 additional lights were then put in the halls, elevators, Turkish baths and laundry, thus making a total of 385 lights to be supplied by the 250 light dynamo. All these circuits—the dynamos and battery wires—terminate at the switchboard, herewith illustrated, where any desired combination can be made. A volt meter is arranged so the pressure can be measured at the various points of the system, also the E. M. F. of the battery. Each series of accumulators is provided with a switch by which the number of cells in series and the E. M. F. can be adjusted as desired; also a variable resistance so the current in each series can be varied as desired. An ammeter and a two-way switch are also included in each series, thus making each series independent of the others.

The dynamo has an ammeter and a two-way switch which enables running the dynamo current direct, or to charge batteries and supply lights simultaneously. There is also a pressure equalizer in the main lamp circuit. Between the dynamo and battery is an automatic break switch which breaks the current, whenever through any accident, the dynamo ceases to supply current.

All these switches can be quickly and easily handled, and any combination made, without in any way interfering with the steadiness or continuity of the lights. The combinations which are made each day are as follows: At noon, the dynamo is started and run to supply lights and charge battery at the same time. When the load of lamps is equal to the capacity of the dynamo, the battery is cut out. As the load increases and becomes more than the capacity of the dynamo, the battery is cut in and discharges and helps the dynamo, acting as an auxiliary. When the load decreases toward the latter part of the evening to less than the capacity of the dynamo, the battery is again charged with the surplus.

At midnight the dynamo is shut down and the battery substituted to take care of the lights until noon the next day. In this manner the lights are available for twenty-four hours while the dynamo is only run for twelve hours. By putting the current not needed for the lights into the battery the dynamo and engine can be worked at their maximum out-put whenever running, thereby obtaining the highest efficiency. The switchboard is made up mainly of round and flat copper bars, well taped and painted with P. and B. compound, all held in place by porcelain insulators. Each cell of accumulators is placed on a tray supported on porcelain insulators and placed on battery stands of special construction which enables each and every cell to be easily inspected. The insulation of this plant is very high, measuring way up into the megohms. The service of this plant since it was installed about a year ago, has been highly satisfactory, and Mr. Potter Palmer speaks of it in the highest terms. On two or three occasions when an accident incapacitated the engine, the battery was called upon to supply current for all the lights in the hotel.

On one noteworthy occasion, while the members of a convention then in session at the Palmer House were at dinner, an accident happened in the dining room which would have put out the dining room lights as well as all the others. The battery was promptly switched into these circuits, and although the service then required was over twice that which the batteries were ever intended for, they did the work nobly and without any one noticing any change. Mr. Palmer says he would not for anything be without them. He has had some experience with these batteries before, having a set at his residence on the Lake front which is now nearly four years old, and with which he has never had a fault to find. The cost for repairs for both plants has so far been nothing.

A NEW PRIMARY BATTERY.

That there is a great need for a cheap and efficient primary battery, is quite evident from the number of these batteries that have been invented and put upon the market in recent years. The latest production in this line for public favor, is the battery invented by B. J. Wheelock, No. 18 East 18th street, New York, and it possesses some important and valuable features, which commend it to the careful consideration of those who are looking for a reliable battery, and one that can be maintained at a reasonable cost.

The elements of the cell are zinc and carbon. The carbon is contained in the central porous cup, in which the depolarizing solution is placed, and the zinc is immersed in acidulated water contained in the outer cell. By a patented process the porous cell is treated in such a manner as to give it the right degree of *porosity*, and is, at the same time, rendered indestructible. The depolarizing solution used is non-corrosive, and can be made very cheaply, the formula, however, being a secret. Mr. Wheelock claims his cell is cheaper depolarized than any other of equal power.

The porous cup is entirely closed at the top, only the upper part of the carbon element being exposed. Enough is left projecting to secure a good, firm contact.

The zincs are evenly consumed, owing to the improved method of amalgamation. It is said that there is no local action whatever in the cell when no current is being supplied, and there is consequently no waste of zinc while the cell is not in action. The plates are one-eighth of an inch thick, and will last three months on sewing machine work—that is, from eight to ten hours' work per day.

The carbon connectors are faced with platinum, in order to avoid corrosion, which action is very common and quite difficult to overcome in most batteries. The head of the carbon is soaked in paraffine, which prevents the creeping of acids, salts, etc.

One of the main features of this battery is that it can be re-charged while at work without dismounting the cell or its parts. In the top of the

sealed cover of the porous cup there is a small hole in which is placed a glass funnel. The fluid is poured into the cup through this funnel, and the overflow is carried off through a small tube which is inserted at the side of the porous cup at the proper height. By this arrangement a definite amount of depolarizing solution can be poured into the porous cell when needed, thus maintaining the power of the battery up to its full strength. The fluid in the outside cell as exhausted is renewed in the same manner, and the overflow is also carried off through a similar tube into a receptacle, which is provided for the purpose. The overflow from both the porous cup and the outer cell is drained into one receptacle, which is made in the shape of a fluid-tight and acid-proof tank, which can be easily removed, and its contents disposed of. As the depolarizing solution exhausts, the spent liquid floats on the top, and as the fresh solution is poured in, the exhausted fluids are expelled through the overflow pipe. In this way there is extremely small or no waste of active depolarizing solution. By nice calculation it can be determined how much of the liquid is exhausted in a given time, and all that is necessary is to supply a like amount of fresh fluid, and the old will be expelled in the manner already described.

This battery has an electromotive force of two volts and the resistance is infinitesimal. On a short circuit it delivers a current of 35 to 40 amperes, and one cell is sufficient to run a phonograph. The size of the cell is 3¾ x 10 x 9 deep, and this battery is admirably adapted to domestic uses, such as running sewing machines, motor fans, etc.

The special features of this new battery are: First, the small amount of labor necessary to care for it; second, no local action, no waste, and third, cheapness of the depolarizing solution, rendering the cost of maintenance to not exceed ten cents per day for ten hours' work on a sewing machine.

Mr. Wheelock has also invented a new battery cell, the jar of which is enclosed in a wooden case, the cell and case making one combination vessel. It is perfectly reliable in every way, and the strongest acids have no effect whatever upon the material. This new cell is intended to take the place of hard rubber cells for accumulators, etc., and has been submitted to the severest tests and has stood them all. Low cost will be one of the prime features of this new cell.

Mr. B. J. Wheelock is a practical electrician and has had large experience in primary battery work. He considers that his battery is superior to all others, and he is now about ready to place it upon the market. His batteries have remarkably long life, and Mr. Wheelock is confident that they will supply a long felt want for a reliable primary battery.

The Thomson-Houston International Electric Company have asked for permission to construct and operate an underground electric railway in Berlin. The proposed railway is to be built in an iron tunnel, similar to that of the City and South London Railway.

ELECTRIC ELEVATORS.

The public is now so accustomed to seeing electric motors everywhere supplying power for all kinds of work, that any special application of these machines ceases to excite any extraordinary wonderment. Very many people already appreciate the fact that electric power is unequalled by any other in portability, ease of control, rapidity of establishment, economy both as to cost and space occupied, and in many other respects.

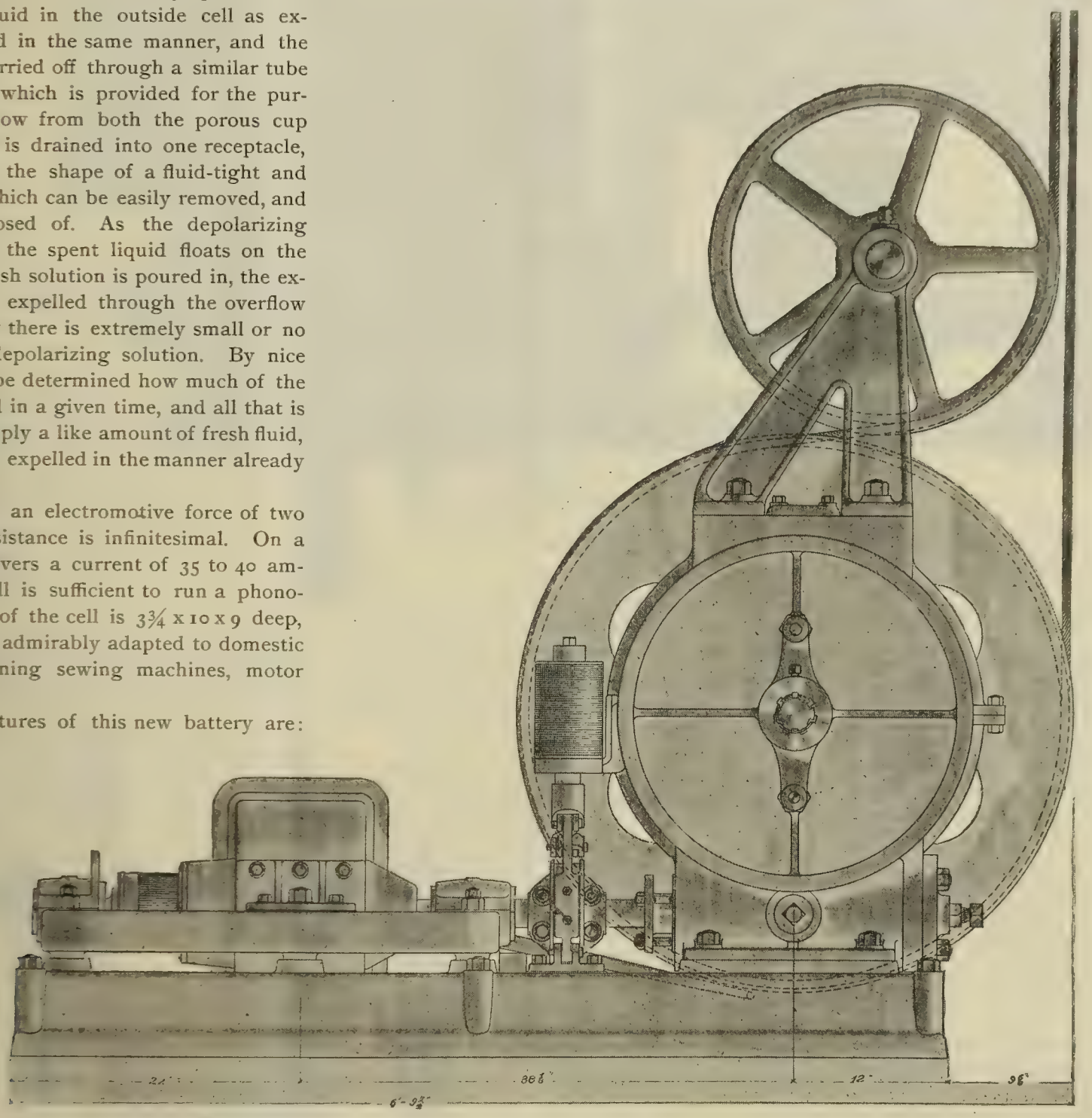


FIG. 1—SIDE VIEW OF MECHANISM OF ELECTRIC ELEVATOR, SHOWING MOTOR AND CABLE DRUM.

It is a decided advantage in any business establishment where power is required, to have no boilers or steam engines to maintain and look after. These are both costly at the beginning and expensive to maintain, and frequently the question of available room is a very important consideration.

In almost every business house, and in many private ones, elevators or lifts are used for passengers and freight. Indeed, this method of transportation from floor to floor has become an imperative necessity in the buildings being erected these days, which are as high as eighteen stories from the ground. In consequence of this, vast improvements have been made in recent years in elevators and the methods of operating them. One of the most important of these is the application of the electric motor.

Granting the assertion that electric power is the most economical, reliable, portable and most easily controlled—which most everyone concedes to be true—the question naturally arises, is it not peculiarly adapted to the operation of elevators? The answer may safely be made, "Yes," for the reason that the electric motor uses only the amount of current required at the moment, under the varying load.

The American Electric Elevator Company, of 15 Cortlandt street, have a system of electric hoisting that possesses many valuable features.

The elevator mechanism consists of the motor, worm gear, drum, electric controller and rheostat, automatic electric brake, electric slack cable stop, and automatic stop device for stopping the car at the top and bottom landings, thus preventing it from traveling too far in either direction. The armature shaft of the motor is coupled directly to the worm shaft, and this coupling is also a brake wheel to which the brake is applied automatically when the current is cut off. This not only serves the purpose of overcoming the momentum of the armature when stopping, but also serves to stop the car and hold it stationary, if through accident of any sort the power current should be interrupted. The worm actuates the worm gear which is attached to the drum shaft. The worm gearing is not shown in our illustration, being entirely enclosed in its cast-iron casing, but its operation is so familiar to every engineer an explanation of it is not necessary here.

The end of the drum shaft has a screw thread cut on it, on which travels back and forth a nut which has wings and which, when it meets with any obstruction, turns with the drum shaft. It is so attached to the operating wheel by means of the wings that it turns the wheel just enough to stop the motor. This device is shown in Fig. 2, as the projection below the main part of the cut, and in Fig. 3 on the left hand side.

Among the recent improvements in this electric elevator machinery is the new automatic brake. This attachment is shown in Fig. 1 on the left-hand side of the worm wheel casing and will be readily recognized by its shape, being a system of toggle-joint levers operated by a pair of solenoids. In Fig. 2, a plan view of the same device is shown —the tops of the two electromagnets with a yoke piece connecting them, being seen at the right hand end of the armature shaft. If by any chance

the electric circuit should become broken, this magnetic brake will instantly act and cause the motor to stop, and the elevator car will be firmly held in place instead of dropping. This electric brake doubly insures safety in case of accident.

Elevator cars provided with the usual automatic mechanical stops are, as a rule, safe in case of a break, or in case they should descend too rapidly, but as almost any piece of machinery is liable to fail in its action, and often at the wrong moment, by the use of this magnetic brake safety is made doubly sure.

Another valuable improvement is the electric slack cable stop. If the car or cage in its descent should be obstructed, the cable would become slack on the drum, but the weight of the slack cable upon the lever under the drum will cause the latter to be forced down, which raises the weight placed at the other end of the lever, instantly breaking the circuit. In Fig. 2 a portion of this apparatus is shown on top of the illustration, and the weight attached to the lever will be readily recognized. Of course it is understood by reference to Fig. 2 that the opposite end of the lever runs under the drum as shown in Fig. 1, and to this end is attached a bar extending the full width of the drum,

Now as already stated, should the cable become slack, it will be understood by reference to Fig. 1 that the effect would be to force down at one end the lever counterbalancing the weight at the other end. This weight holds an automatic switch in place, and when it is raised in the manner already referred to it causes the switch to operate, thereby breaking the circuit. This will cause a stoppage of the motor, and the instantaneous application of the brake, which prevents the cable from becoming slack on the drum.

The rheostat is in an iron box, and may be placed where most convenient.

Fig. 3 gives an end view of the hoisting apparatus. Elevators operated by this machine are free from much of the noise attending the operations of other methods, and there is none of the disagreeable jerking of the car, which is frequently noticed in some of the old systems.

The motors used are of the slow speed type made especially for this service. By using a slow-speed motor it is possible to use the worm gearing as already explained, and yet run the worm at a sufficiently low speed to insure quiet and smooth action. The worm runs in an oil cylinder, and thus is kept constantly and perfectly lubricated.

The parts of this machine are so constructed that the wear is reduced to a minimum. The armature shaft and the worm gear are fitted with the most approved automatic oil bearings, and the worm, which is part of the worm shaft, is made of hard machinery steel, the worm gear being a bronze composition ring which is fastened on a cast-iron web. The effect of this arrangement is that the running contact of the steel on the bronze produce a minimum amount of friction.

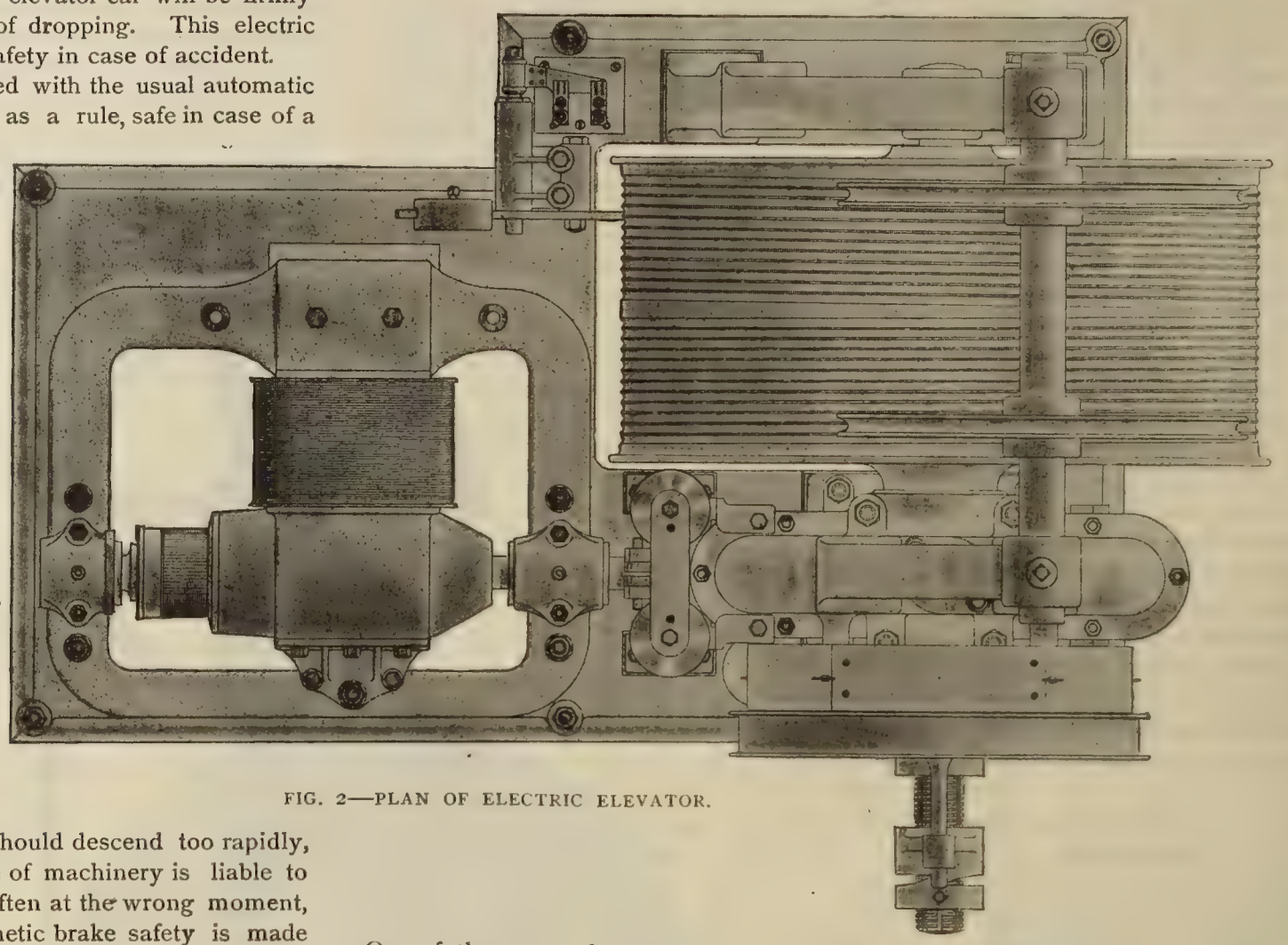
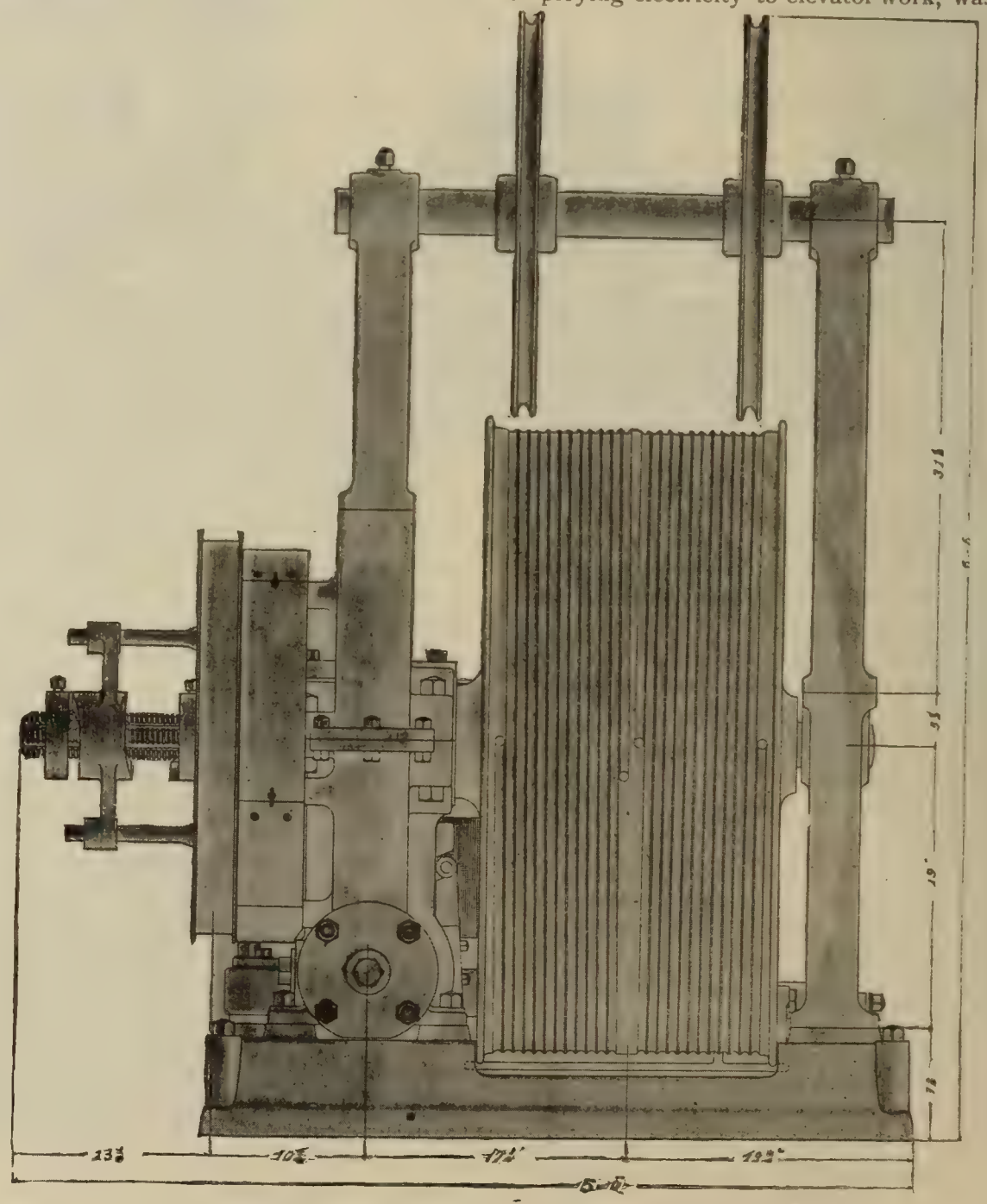


FIG. 2—PLAN OF ELECTRIC ELEVATOR.

One of the great advantages of this system is the fact that a steam plant on the premises is unnecessary. Current can be used from any outside central station, and no skilled labor is necessary for its successful operation. As the motor runs only when the elevator is in actual operation, there is no consumption of current when the elevator is not running. This in itself is a very important consideration, and where current is paid for by meter it represents the minimum cost for maintenance. This system is devoid of all annoyances, heat, smell, etc., which usually accompanies the use of steam power for elevator work.

One of the greatest difficulties encountered in employing electricity to elevator work, was to get a controller which would not flash or spark when stopping or starting the motor, and the controller is one of the best features of the machine illustrated, as the objectionable flashing has been overcome.



FIC. 3—END VIEW OF ELECTRIC ELEVATOR.

In a letter to the American Electric Elevator Company from Messrs. Behr Bros. & Co., No. 81 Fifth avenue, they say that they are very well pleased with their electric elevator, and that it is operated with less expense for power than had been anticipated, their electric power bill for the month of February being but $5.62.

The American Electric Elevator Company are constantly making improvements in their system wherever it is possible to do so, and their machines are constantly growing in favor.

ELECTRIC BELLS—THEIR CONSTRUCTION AND APPLICATION.

BY THOMAS R. TALTAVALL.

ELECTRIC BELL CIRCUITS (*Concluded.*)

It may be desired in some places to arrange several bells in series on one circuit, all to be rung by one push button. Under these circumstances additional battery power should be provided, because the total resistance of the circuit is increased by placing bells in series.

One cell of battery will ring an ordinary electric bell, but two cells will give better results and satisfaction. Three cells for two bells would be a liberal allowance on ordinary house circuits.

Fig. 1 shows a circuit with three bells in series, worked by one push button and one battery. To make such a circuit work, however, the connections of two of the bells must be slightly changed. They will have to be made into single stroke bells instead of vibrating. This is very easily accomplished and can be done by the most inexperienced person.

Reference to Fig. 2 will aid in understanding how this change can be made. This figure will be recognized as the first one used in connection with these articles and it is reproduced here in order to show how easily an ordinary vibrating bell may be changed into one giving a single stroke. Single

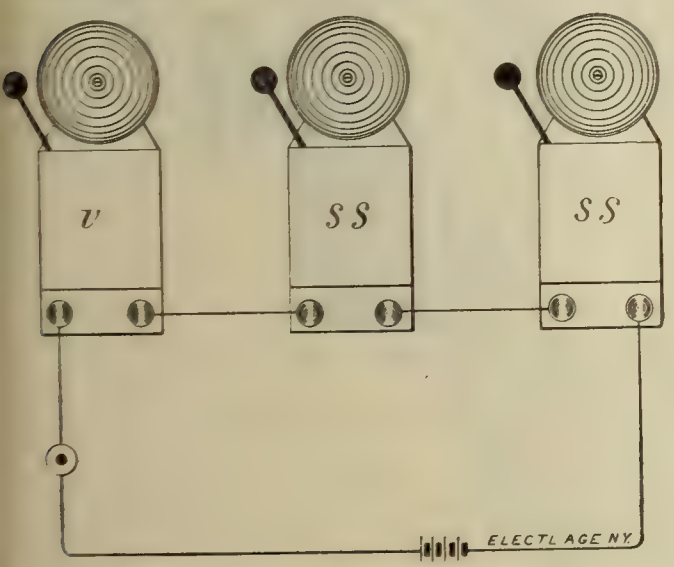


FIG. 1—THREE BELLS IN SERIES.

stroke bells are often preferred to the vibrating ones, on account of the noisy feature of the latter. These will vibrate continuously so long as the pressure is applied to the push button. With a single stroke bell, however, the hammer strikes the bell just once when the push button is closed.

To make the change, disconnect the wire (at the back of the bell) at *e* and connect it with the point *k* (Fig. 2.) This is all that is necessary to change the vibrating bell to a single stroke. The result of this in practice will be that when the push button is closed the hammer will strike the bell once instead of vibrating as it did before. The vibrating bell has this advantage over the single stroke, however: it will attract attention where the single stroke might not be noticed.

Having explained the method of making the change in the connections of the bell itself so as to give a single stroke instead of vibrating, we may now revert to Fig. 1. In this arrangement two of the bells must necessarily be of the single stroke type. If all three bells were of the vibrating class, they would not ring at all, for the reason that the vibration of one bell would interfere with that of the others. By having the first bell (V) of the vibratory type, however, and the others with the single stroke connections, the difficulty is overcome, but in a manner that will naturally surprise an amateur. When we push the button all three bells vibrate!

One would naturally suppose that one bell being of the vibratory kind and the others single stroke, that they would ring in that way, but when connected in series they all vibrate. The reason for this is easily found, although at first it would likely puzzle most people.

In order to understand this peculiar action we will for the moment assume that there is only one bell on the circuit—of the single stroke class. The bell will ring once every time we press on the

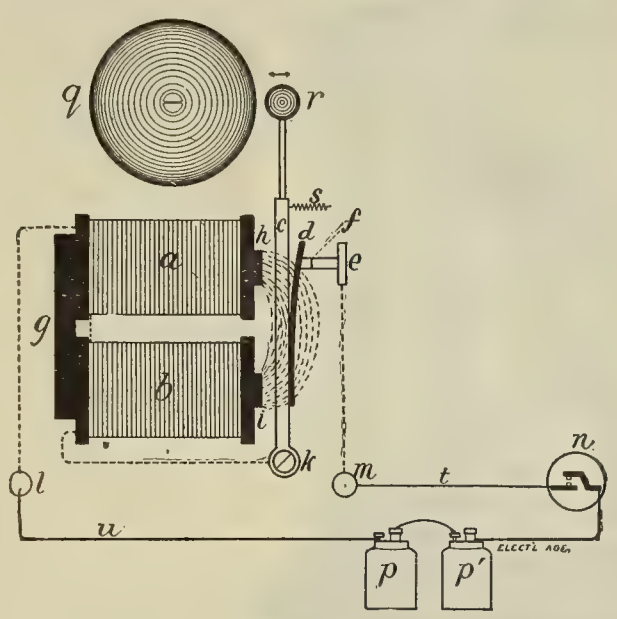


FIG. 2.

HOW TO CHANGE A VIBRATING TO SINGLE STROKE BELL.

push button, and if we close the push button many times in rapid succession the bell will ring with corresponding frequency.

As already stated, the first bell (V) is of the vibrating type and the other two are connected to give single strokes. When the push button is closed the vibrating bell rings and acts as an interrupter for the other bells, which will vibrate with the first bell, because the latter makes and breaks the circuit in rapid succession, as did the push button in the manner just described. The vibrating bell therefore acts in the capacity of a push button in this case for the single stroke bells, and the latter vibrate by virtue of the rapid closing and opening of the circuit by bell V.

All of the circuits so far considered are what is known as metallic circuits—that is one wire carries the current to and through the bells and another carries it back to the battery.

This method is the one adopted when the circuits are confined to one building, or connecting structures a short distance apart. But when we

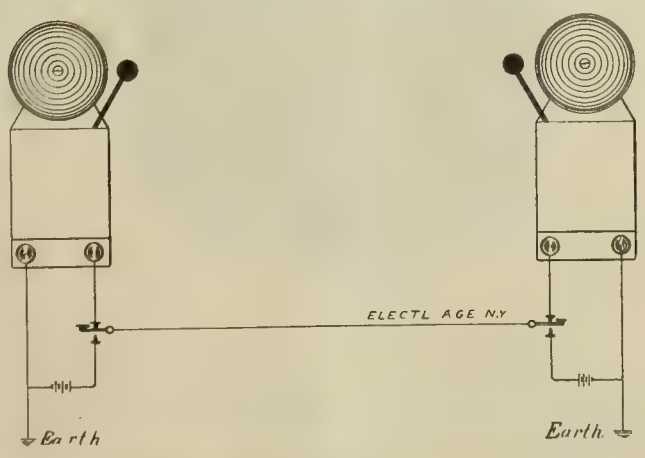


FIG. 3—GROUNDED BELL CIRCUIT.

desire to signal over greater distances, it is customary to use only one wire between the two terminal points, and use the ground, or earth in place of the return wire. The earth fulfills all the requirements of a return wire, and by using it as such we are enabled to effect a saving of fifty per cent. in wire, which becomes an important factor in the equipment of a line of extraordinary length.

The usual way of making the connection with the earth is to wind the end of the wire around the gas pipe. This running into the ground makes an excellent "ground" connection. At both the terminal points the wire is connected in this manner with the gas pipe, thus completing the circuit.

In the absence of gas pipe the next best thing is to bury a copper plate with a large surface in the ground as deep as possible, and have the wire firmly joined to this plate. The main thing is to secure as large a surface contact with earth as possible.

Fig. 3 represents a circuit using the ground as the return. The arrangement provides for signaling between two points in such a way that the home signals produced by the home push button do not affect the home bell, but only that at the distant end. This arrangement is duplicated at the other terminal of the wire, consequently the signals from the distant end affect the home bell but do not operate the distant bell.

This circuit is precisely like the one shown in our last article (Fig. 4) excepting that the ground or earth is used for the return instead of wire as shown in that figure.

What was said in reference to Fig. 4 in the last article applies equally well to the one now under consideration. Strap keys are used in both cases.

The circuit shown in the accompanying Fig. 3 is very simple and convenient for communicating between two points at a moderate distance apart. Indeed, it will answer very well for signaling at long distances.

When the distance between the terminal points is great the battery power must be correspondingly increased by adding more cells, and the magnets of the bells must be wound with finer wire than that used on ordinary bells.

Referring to the wire to be used in running bell circuits, it may be mentioned that a great deal of time and labor may be saved by using the combined double conductors that are now sold by all dealers. The two wires, which are properly insulated from each other, are wrapped together in the braiding. By using double conductor wire both wires may be run at the same time, and one tack serves to fasten both.

(*To be continued*).

THE CARE OF ACCUMULATORS.

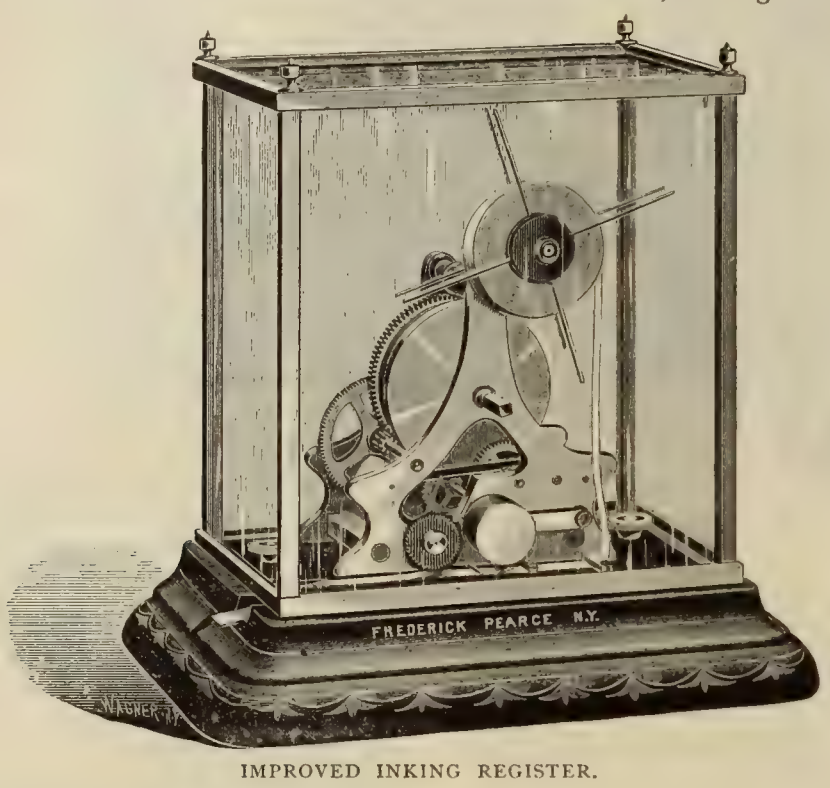
The following directions for the general care of accumulators will be of value to those having charge of such apparatus.

Always charge the cells until they boil well. Never allow the battery to run down till its E. M. F. is below the average of 2 volts per cell. If this should occur when it is known that the charge is not low, an examination of every cell should be made. The acidometers in the cells give an approximate idea of the state of the charge, if they are intelligently observed. Examine the plates every few days by observing their color, and other characteristics. No current meter is of service to measure the charge remaining in the accumulator, since this instrument takes no account of the leakage which occurs before reaching it, nor of local action. As soon as only 25 per cent. of the total charge remains in the cells, the E. M. F. rapidly falls, on further discharge. Precautions should be taken to guard against too large a current flowing when charging is commenced, by inserting a resistance, or by means of an automatic governor; also provision must be made against lamps being injured when they are turned on during charging hours, or the moment charging is completed. The instant any fault is noticed, it should be remedied at once, and any dead cell cut out immediately. Do not charge longer than necessary, but see that all the cells boil well; if any are much behind, observe if there is any obvious cause for this. One hour of over-charging is advisable. Occasionally examine the insulation. Observe that the liquid in the

cells does not become warm during charging. All measuring apparatus should be compared with standard instruments periodically, so as to avoid falling into errors which may prove destructive to the plates. Feel all connections and switches every now and then, to see if they become warm.

AN IMPROVED INKING REGISTER.

Frederick Pearce, successor to Pearce & Jones, 77 and 79 John street, New York, has recently made some improvements in his well-known registers. Our cut below shows his latest improved No. 2 Inking Register, which deserves a few words of explanation.



IMPROVED INKING REGISTER.

The register is made with one or two pens, and when so ordered, it can be arranged for a wide or a very narrow line. Either black oil or aniline ink can be used, making the registration very distinct. It is said to be much more profitable than the embossing register, as the pen can be worked with greater rapidity.

The writing is very pleasing to the eye, and can be seen from quite a distance.

When once the record is made it cannot be removed, which is possible with the embossing register. When required, it can be made to stop on either an open or closed circuit, and the same device obviates the necessity of cutting out the register when the circuit is opened or changed.

Instead of the old style of glass shade with the edge exposed to danger of breaking, a nickel plated metal case has been substituted. If a glass should break it can be replaced at a small cost compared with the expensive glass shade previously used and which would be entirely destroyed if any portion was broken.

The base of the register is made of metal to prevent warping and getting out of line adjustment by any change in temperature. This style of register is considered the best in the market, and is the result of long practical experience in the manufacture of registers of various kinds, and combines the latest improved principles.

FOREIGN NOTES OF INTEREST.

It is said that preparations are being made to erect a telephone line between Berlin and Vienna.

The directors of the Crystal Palace, London, have decided to organize a second Electric Light Exhibition, which will be opened in the autumn.

The question of establishing telephonic communication between Brussels and London is under consideration.

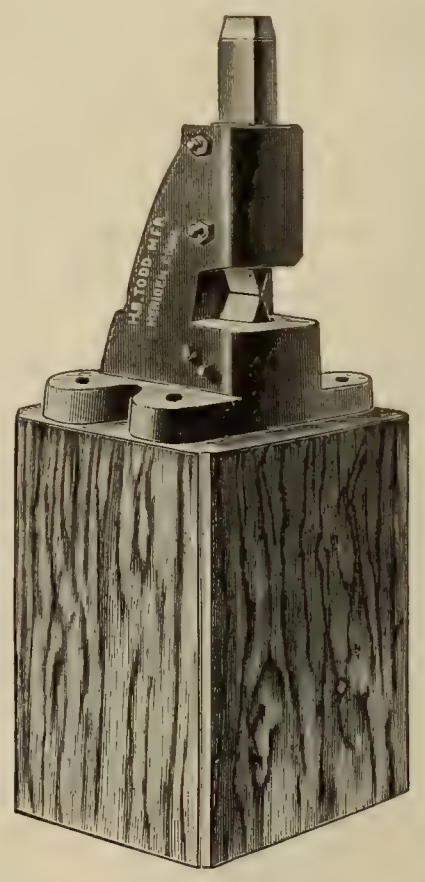
The Campagnie Francaise des Tramways, of Marseilles, France, has adopted the overhead trolley system of electric traction for its new line.

A new copper telegraph wire has just been completed between Calcutta and Bombay, along the line of the Bengal-Nagpore Railway. The total length of this line is nearly 1,300 miles.

IMPROVED METAL CUTTER.

We illustrate below a very powerful metal cutter that will fill a long felt want in a large number of places where it is desired to cut something larger than the largest nippers are capable of cutting. Inquiries for something of this sort had been made for some time, when this metal cutter was designed for this purpose.

The machine consists of a casting of the shape shown in the cut, having a bottom cutter held rigidly in place by the two set screws shown near the base, and a top cutter working up and down through the casting, wear being provided for by the screws and set nuts, as is clearly shown in the engraving.



METAL CUTTER.

In use, the top cutter is raised by the hand and the piece to be cut inserted between the upper and lower cutter, when a blow or two with a hammer or light sledge, on the upper cutter, completes the operation.

It will cut off cold iron one inch in diameter.

The cutting parts are made in duplicate, so that extra ones can be furnished at any time to replace worn out or broken ones. The best of steel is used in their manufacture, and great care is taken in hardening and tempering, so they will last a long time with proper use. When dull the cutter can be taken out and sharpened on an ordinary grindstone.

The machine is bolted on a solid yellow pine block, ten inches square, and eighteen inches high, complete, ready for use.

Mr. Henry B. Todd, 47 Linsley ave., Meriden, Conn., is the inventor and sole manufacturer of this useful device.

A SIMPLE LAMP SOCKET.

Mr. Thomas G. Roebuck has recently invented an incandescent lamp socket to meet the demand for a device of this class constructed as simply and with as few parts as possible. The illustrations given herewith (Figs. 1 and 2) give respectively the interior and exterior view of this socket.

The wiring is very simple. The cap is slipped over the wire pipe, the set screw B is taken

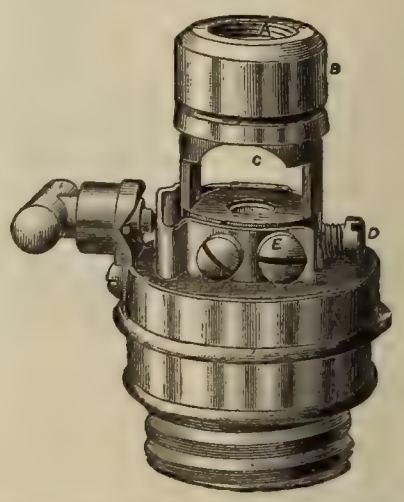


FIG. 1—INTERIOR VIEW OF SOCKET.

out and the insulated screw D is loosened as well as screw E Into the centre tube C one line wire is inserted and held in contact by the screw D. The other wire is passed behind the screw E, by the contact spring shown in Fig. 1. After screwing the nozzle home on the line wire pipe, the set

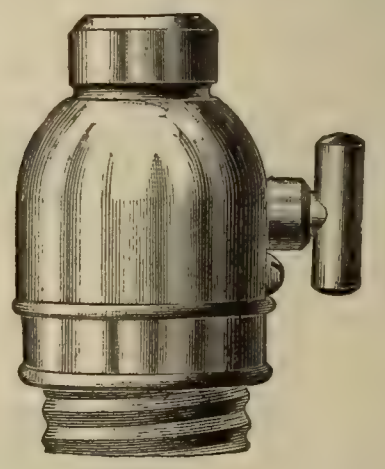


FIG. 2—EXTERIOR VIEW OF SOCKET.

screw is then replaced, which locks at one-half turn of the nozzle.

The simplicity of this socket commends the device to all users and it is already meeting with a large demand. This socket is made to fit the three standard lamps, and is claimed to be the best and simplest in the market. It is made by the Insulite Manufacturing Company, No. 35 Broadway, for which Mr. Roebuck is the sole selling agent.

ANSWERS TO INQUIRIES.

J. R. S.—The method employed for locating faults in electric light conductors in the New York subways, is to test the conductor from point to point until the defect is located between two lamps or two manholes. If the fault is located in the cable itself, the defective section is withdrawn, and replaced by a perfect section.

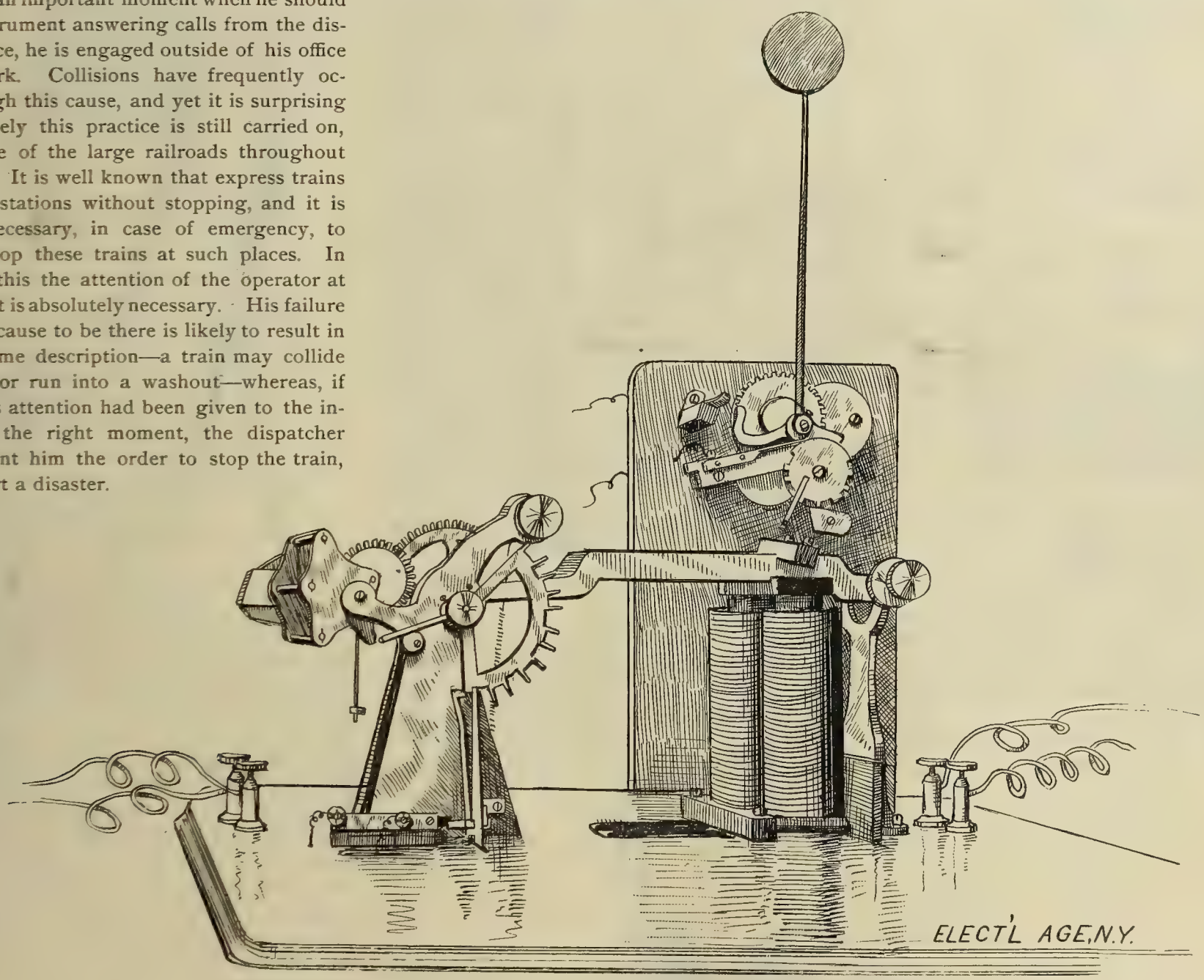
F. C. M.—The best book of the kind is "Electrical Engineering" by Slingo and Brooker, which we can supply you for $3.50.

R. T. asks, What is the difference between an ampere and a coulomb? The difference is one of quantity and time. An ampere refers to a definite current without reference to time duration; a coulomb, however, means the same current flowing during one second of time.

A NEW APPARATUS FOR SIGNALING AT A DISTANCE.

The American people are such liberal patrons of railways, that any new device that will insure greater safety in traveling will always attract attention, irrespective of the profit from exploiting such new invention. The railway people in their own interests may not look so much to the safety of travelers, but their pecuniary interests prompts them to carefully examine any new method of decreasing the chances of collision, and securing from their employees a more vigilant service.

On railroads operated on the telegraph system, much depends upon the telegraph operator. In many places, except in large railway stations, the duties of the operator are manifold. He is required to sell tickets, check baggage, handle freight, and do one-hundred-and-one things besides his telegraph work, and it frequently happens that at an important moment when he should be at the instrument answering calls from the dispatcher's office, he is engaged outside of his office in other work. Collisions have frequently occurred through this cause, and yet it is surprising how extensively this practice is still carried on, even by some of the large railroads throughout the country. It is well known that express trains go by many stations without stopping, and it is frequently necessary, in case of emergency, to signal and stop these trains at such places. In order to do this the attention of the operator at his instrument is absolutely necessary. His failure through any cause to be there is likely to result in a wreck of some description—a train may collide with another or run into a washout—whereas, if the operator's attention had been given to the instrument at the right moment, the dispatcher could have sent him the order to stop the train, and thus avert a disaster.



NEW METHOD OF SIGNALING AT A DISTANCE—AUTOMATIC SIGNALING APPARATUS.

These accidents happen too frequently on our railroads, and the knowledge of this fact has been an incentive to inventors to produce some automatic method of signaling trains at any distant point in an emergency, to circumvent the danger resulting from temporary absence of the operator from his instrument.

Railroads depending upon the telegraph service for the running and controlling of their trains, should be provided with an automatic system of this sort, or provide operators who shall have no other duties to perform outside of their telegraph service. At small stations, usually, there is not enough telegraph work to keep an operator busy, and for this reason it has become the practice to require him to perform other duties.

In the line of automatic signals, we desire to call attention to a new apparatus of this class being placed upon the market by the Burrell Electric Signal Company, No. 54 Broad street, New York.

The device is so simple that the accompanying illustration of the instrument will almost serve to give a full comprehension of the same without explanation.

Its peculiar value for railroad work consists in giving to the train dispatcher, by the use of a different combination of breaks, the control of the instrument at any station, throwing down a danger signal and ringing an alarm to attract the operator's immediate attention in the event of his being engaged in other work. The apparatus in each station is all in a local circuit, and operates without disturbing similar instruments at other stations, and upon the same wire now used for moving trains.

In case it is desired to signal a train at a given station, and the operator's attention cannot be secured by wire, the dispatcher through the instrumentality of a signal box somewhat similar to the call box used on District Telegraph wires, is enabled to communicate with the automatic apparatus in that particular office which throws down the signal, and the desired result is accomplished as effectually as if the operator himself had received the order and stopped the train in the regular way.

The signal box is provided with circuit wheels with calls corresponding to those to which the receiving apparatus at each station is designed to respond. When the automatic signalling instrument is put into operation by the dispatcher, an automatic response is instantly received from the distant station, signifying that the danger signal has been thrown down, and that the alarm bell is ringing to call the operator's attention to the wire.

It is evident, therefore, that whether the operator is at his desk or not, and it is desired to stop the train at any particular station, it can be done by the use of this automatic system as certainly and effectually as by the usual method of signaling.

This seems to be a very valuable application of the device and should attract the attention of railway managers.

There are other fields of usefulness for this apparatus, however, which are perhaps as great as that just described. Applied to the telephone it obviates the necessity of the central system and insures absolute secrecy.

Adapted to fire alarm service it does away with the necessity of arousing other engine companies than those immediately needed. Each engine house being provided with one of these automatic apparatus can be communicated with independently of every other station, in the manner already described with reference to the railway service.

Another important application of the apparatus is for electric lighting plants. By its use such series of lights, as from time to time can be dispensed with, can be extinguished from the central station, thus doing away with a special wire for each series.

The application for the patent for this signaling device was made "Special" as the value of the invention whereby, in the system of torpedoes for harbor protection, any one of such torpedoes can he exploded without disturbing others in the same circuit was apparent to the Government authorities. At this time when the need of harbor protection is being keenly felt this application of the invention is of interest to all.

We are informed that Messrs. Duncan and Page, who are the patent lawyers for the company, have secured for the inventor, patents in all foreign countries where such protection can be obtained.

From the above description of this valuable invention it is evident that it is applicable to many valuable uses other than those described, and having seen the apparatus in operation at the company's office, it would seem to us that the invention is a most important one, and should find extensive use, particularly in the lines above mentioned.

The above illustration was made from the instrument on exhibition at the office of the Burrel Electric Signal Company.

THE CROCKER-WHEELER PERFECTED MOTORS.

In the development of the Crocker-Wheeler Electric Motor, which has reached a high state of efficiency, the little things as well as the important ones, have been as carefully looked after and improved by the company. Even the wire terminals, or binding posts have had much thought and attention bestowed upon them, with the result of a greatly improved and reliable device.

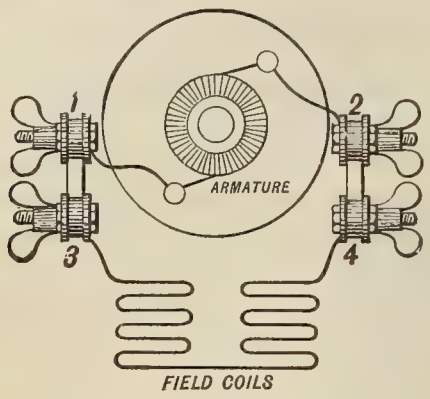


FIG. 1—TERMINAL POSTS.

In the larger motors made by the Crocker-Wheeler Motor Company, four terminal posts are used as shown in Fig. 1, one for each end of the armature wire and one for each end of the field wire. In most cases one terminal of the armature and one of the field can be supplied by one

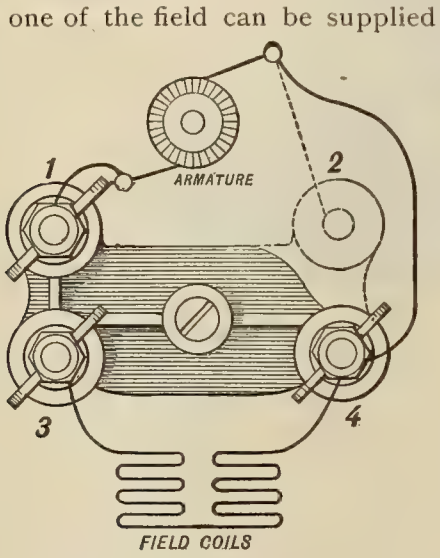


FIG. 2—BINDING POST CONNECTIONS.

outside or connecting wire, provided the other terminals are supplied by separate wires; consequently the first connecting wire may be attached to posts two and four.

In the smaller size motors these binding posts are made as one, as shown in Fig. 2. Occasionally, however, the fourth binding post is put on as indicated by the dotted line, when for special purposes, such as using a reversing switch, it is necessary to have the armature and field entirely separate.

The Crocker-Wheeler Company are constantly on the lookout for improvements in the details of their motors, and this latest of their many good things greatly facilitates the handling of the motor terminals.

Fig. 3 represents a one-sixth horse power electric pump designed by this company. As will be seen from the cut, although on the same base the motor and pump are separate, but they also make pumps and motors mounted on one shaft if preferred.

Since electricity has been applied to driving pumps, there has been more of this kind of machinery used, as a neat and durable electric motor overcomes the cumbersome, expensive and disagreeable features of other sources of power.

This is a new type of suction and force pump especially designed for use with high speed electric motors, for continuous and heavy service in raising water to considerable heights through pipes. It raises the water in a steady and uniform volume, with entire absence of that pounding or "water hammer" accompanying the use of common pumps. It is provided with noiseless rawhide pinion and back gearing to reduce the speed and give sufficient power to the pump to work under high pressure, thus making it capable of raising water from 50 feet to 300 feet vertically, without injury or undue wear to any of the parts.

The motor is the company's latest, most durable and efficient design, and wound for either arc or incandescent light circuits.

By means of these outfits, pumping is done automatically and cheaply without noise, ashes, attendance, dangers, odors, etc. By an automatic attachment to the ordinary float in the tank, the electricity is shut of as soon as the tank is filled, and started again when partially empty, thereby saving the expense of current supply when water is not drawn. This attachment prevents the tank from ever becoming entirely empty, and proportions the current consumed to the water used.

The cost of running at full power continuously is claimed to be very small, being for the one-sixth horse power outfits from one to three dollars per month.

The size we illustrate is capable of lifting 500 gallons of water a day a height of 100 feet, and other quantities a correspondingly greater or less height.

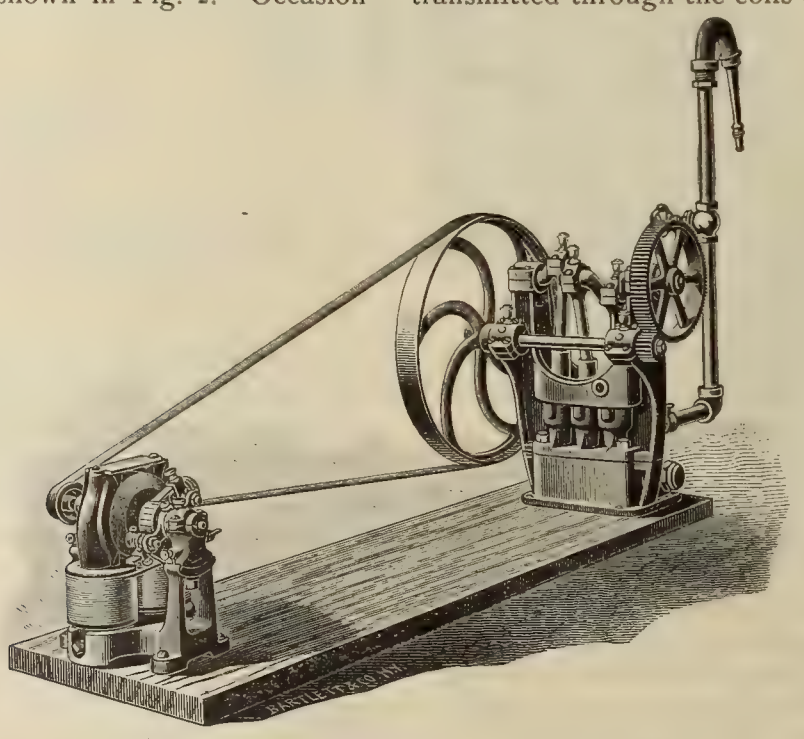


FIG. 3—CROCKER-WHEELER ELECTRIC PUMP.

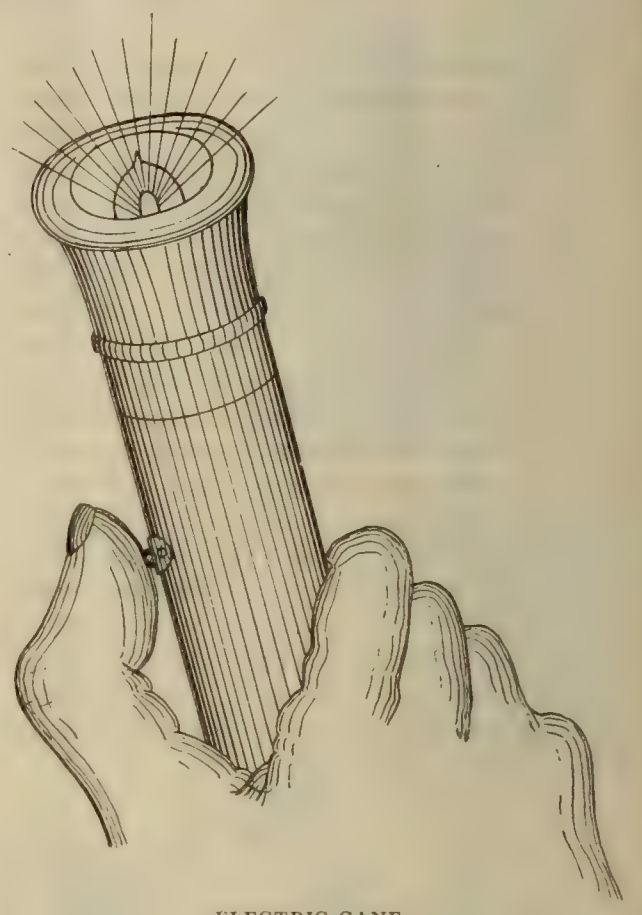
THE BIRTH OF THE DYNAMO.—In 1867 the suggestion was made simultaneously, but independently, by Siemens and by Wheatstone, that a coil of wire rotated between the poles of an electro-magnet might induce a small current, which, when transmitted through the coils of the electro-magnet might exalt its magnetism and so prepare it to induce still stronger currents. This was the beginning of the dynamo of to-day.

The Suburban Rapid Transit Electric Railway Company, of Pittsburg, Pa., intend to run cars constructed expressly for funeral purposes. There are seven cemeteries located along the line of the road and on an average five funerals pass over the route a day.

A NOVEL CANE.

Our illustration below represents an ingenious application of the well-known capsule batteries of the Nassau Electric Company, of New York.

These chloride of silver batteries are said to be the smallest cells made, and as they are dry and require no wiring to connect them together, they are put to a variety of uses, where other forms of batteries would be impracticable. The small cylindrical case containing the chloride of silver is made of zinc and forms one pole of the battery. The other pole is a small silver wire protruding from one end of the case. It will readily be seen that to connect a number of the cells in series, all that is necessary is to place them end to end, putting the silver wire of one cell against the zinc bottom of another.



ELECTRIC CANE.

This is what has been done in the electric-light cane which we illustrate herewith. Four cells are placed end to end in a small tube of cardboard, and inserted in a hollow cane. The silver wire at one end is connected to one end of the carbon filament of a small incandescent lamp placed in the head of the cane, and a small brass strip or spring from the zinc bottom is extended upward to a position where contact with the other end of the carbon filament can be made. When a light is required pressure on the small push-button on the side of the cane (shown in the illustration), closes the circuit and the lamp burns. The head of the cane is solid silver, having a very thick lens fitted in the top, and makes a good reflector for the light. The capacity of a capsule cell is 2.20 amperes with a pressure of 1 volt; and, as the power is constant, the four cells give a pretty light with lamps of from 2 c. p. to 4 c. p. The canes are very handsome and are made in a large variety of styles, of different materials. A number of them were used by a theatrical company in Brooklyn recently, and produced a pleasing effect.

These small batteries are being used for bell outfits, medical batteries, and a number of other electrical devices, among which is an electric alarm thermometer designed to ring a bell at any desired temperature. A large number of these thermometers are being placed in a large hotel in Brooklyn in connection with their fire-alarm annunciators.

We have received a copy of the sixth annual report of the Board of Gas and Electric Light Commissioners, of Massachusetts. It is full of valuable information and statistics regarding these industries in that State.

THE HALLETT LAMP.

The demand for a first rate desk lamp that will throw its light where needed and not affect the user's eyes injuriously, seems to be filled very acceptably by an article being introduced by the Central Electric Company of Chicago, and illustrated in the accompanying cut.

This lamp differs somewhat in shape from the ordinary incandescent lamp, its sides being almost straight, while the bottom, or large end, is as nearly flat as possible. These straight lines are necessary in order to obtain proper reflecting



HALLETT DESK LAMP.

surfaces, and to prevent, as much as possible, uneven intensities of light upon the object. The inside of the butt and the outside of the globe are silvered, and the incandescent filament is actually surrounded an three sides by a mirror reflecting all the light downward. While the lamp may be placed on the level or a little above the level of the eye, no light strikes the eye directly from the lamp, as the silvering is covered and protected by an opaque substance.

The lamp is made to fit any socket, and the new features are covered by strong patents.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, MASS., April 10, 1891.

The days of the telephone girl are numbered. A new invention makes telephone connections automatically.

A Ball engine is being installed in the steamer Mayflower of the Nantasket Line to furnish power for electric lighting.

Permission has been granted to the Boston Electric Light Co. to erect 11 poles on Humboldt ave., and 26 poles on Huntington ave.

W. S. Teeple has entered the employ of the Eastern Electrical Supply and Construction Co., and has just started on a trip through Ohio and the West.

The Holtzer Cabot Electric Co. are preparing to move into more commodious quarters which they have secured on Franklin street. This move is necessitated by their heavily increased business.

Mr. G. T. Coppins, secretary of the Walworth Manufacturing Co., has sailed for Germany and England. The trip is a combination of business and pleasure, and will take Mr. Coppins two months from Boston.

The American Fire Alarm Co. has recently moved its office and factory to 77 Kilby street. Mr. C. F. Blackwell, the president, intends taking a two months' trip to California to look after the affairs of his company in that territory.

The Massachusetts Street Railway Association held its monthly meeting and dinner to-day at Young's Hotel. Fifteen members were present, and Col. J. H. Cunningham presided. A general discussion of street railway topics was indulged in during the dinner.

Mr. J. W. Howard, of Howard Bros., Agent for the C. & C. Motor Co. sailed on the 7th inst. by the Steamer City of Chicago for England on a short business trip. Howard Bros. report business good, with orders on their books for motors aggregating between 30 and 40 horse power in various sizes.

The message of the Mayor vetoing the order passed March 16 granting permission to the West End street Railway Co. to construct and maintain an iron roof over the sidewalk adjoining the Granary burying ground on Tremont street, came up, and the mayor was sustained by a vote of six to five.

Prof. Elihu Thomson corrects the popular impression that the luminosity of arc lamps is due to heated carbon particles. He says that although there is a steady stream of carbon vapor between the carbons, yet the light is nearly all derived from the enormously heated surfaces from which the evaporation takes place.

In the Supreme Court, before Judge Morton, the case of the New England Printing Telegraph Co., *vs.* Henry H. Carter, superintendent of streets, for a writ of mandamus to compel the defendant to grant the company permits to erect poles for its wires in certain streets of the city, came up and it was stated that the defendant would file his answer within ten days, which is the time allowed by the rules of the court. This suit is to be made a test case in which the company will endeavor to ascertain whether the Board of Aldermen of 1890 gave it rights which a succeeding Board could not take away. No time has been fixed for a hearing.

SOMERVILLE, MASS.—Twenty-two thousand five hundred dollars has been appropriated for street lighting for the current year.

NEWBURYPORT, MASS.—The City Fathers have appropriated $10,000 for lighting the streets and public buildings for the current year.

LYNN, MASS.—The marriage of A. L. Rohrer, president of the Lynn Board of Trade, and an electrician at the Thomson-Houston works and Miss Carrie Laura Gould, occurred at the residence of an aunt of the bride April 8th. The bridal party left Lynn for a three weeks' tour in the West.

SALEM, MASS.—It has been reported that Mr. Norcross, of Boston, had purchased the Essex Street Railway at $125 per share. The directors emphatically deny the sale, although there is no doubt that the negotiations are pending. King Upton has been elected general manager of the road, D. N. Cook remaining as superintendent.

BEVERLY, MASS.—Ten thousand dollars was appropriated for street lighting, the matter being placed in the hands of a committee of five, with instructions to substitute arc electric lights for the gas and oil lamps now in use. They are also authorized to contract with the Beverly Gas and Electric Light Co. for supplying the same for ten years.

DOVER, N. H.—At a special meeting of the stockholders of the Union Street Railway Co., it was voted to accept the Act of the Legislature authorizing the road to consolidate with the consolidated Light and Power Company. This will make a strong company, as it has a large water power plant which furnishes light for Dover, Rochester, East Rochester, Gonic, Great Falls, Salmon Falls, Berwick and South Berwick, and also furnishes power for operating the electric cars of the railroad company.

F. E. B.

PHILADELPHIA NOTES.

The following orders for electric cars and trucks have been received by the J. G. Brill Co., car builders, Philadelphia, Pa., during the last thirty days: Sixteen double truck cars for the Spokane Street Railroad Co., Spokane Falls, Washington; forty-six cars for the Columbus Consolidated Railroad Co., Columbus, Ohio, together with their trucks of the Brill Company's No. 7 pattern; ten 16-feet cars and No. 7 trucks for the Los Angeles, Cal., Electric Road; ten cars and trucks for Ottawa, Canada; six cars and trucks for Marion, Ind.; seven cars and trucks for Pottsville, Pa.; fifteen open motor cars and trucks for Cleveland, Ohio.

The J. G. Brill Company report that their new Maximum Traction Pivotal trucks have met with great success. About two months ago one set was placed for trial on the Newark City Passenger Railway, Newark, N. J. It has been in operation ever since, and the president of the road has pronounced it a complete success, and has given an order for forty of them. Since that time orders for sixty of these trucks have been received from different parts of the country.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., April 10, 1891.

Wm. H. McKinlock, president of the Central Electric Company, is a victim of "La Grippe," but expects to be out and around as usual in a few days.

The Pueblo Electric Supply and Construction Company, 312 Santa Fe avenue, Pueblo, Col., have sold and installed a United States Dynamo of 100 lights capacity, in the Artificial Ice Works in that city. They are also engaged in figuring on two or three more plants.

A franchise has been granted to a new electric street railway company in Pueblo, Col. The company has not yet decided which system to adopt for the operation of its line. The electric road now in operation in Pueblo is using the Thomson-Houston system, which is giving excellent satisfaction

Folder 120, issued by Mr. George Cutter, 333 "The Rookery," Chicago, is devoted to the description of the valuable features of Simplex wire, for which Mr Cutter is the Western agent. Mr. Cutter is not at all backward about going forward, as this folder shows. He has adopted the Chinese method of punting in this case and it is necessary to begin at the end to read.

THE LONG DISTANCE TELEPHONE.

The American Telegraph and Telephone Company, better known as the Long Distance Telephone, have removed their Boston office into the new building of the American Bell Telephone Company, on the corner of Milk and Oliver streets. The new office and plant is one of the most complete in the country, and the removal was very successfully accomplished.

That company after two years of experimentation in determining the proper sizes of the wire, insulation, etc., for underground cables to give the best results, have brought the capacity down from .20 to .09 micro-farad. This result is of immense benefit to telephonic transmission. The company are now running 100 wires in two inch lead covered cables.

On the evening of April 4th, the Long Distance telephone service was practically tested at an exhibition given in the office of the Eagle Hotel, Lebanon, Pa. There was a large crowd of business men and others present and they were all delighted with the entertainment. The success of the test exceeded all expectations. Music played in Philadelphia for a concert in Williamsport, was distinctly heard at Lebanon. The exhibition was in charge of Messrs. Curl and Lerch, assisted by Mr. Ingalls, and was in every way a success.

PERSONAL.

Mr. E. S. Mendel has resigned his position as general manager of the Universal Arc Lamp Company, No. 49 West 22d street, New York and Mr. F. W. McClement has been appointed as acting general manager and he will serve in that capacity until further notice.

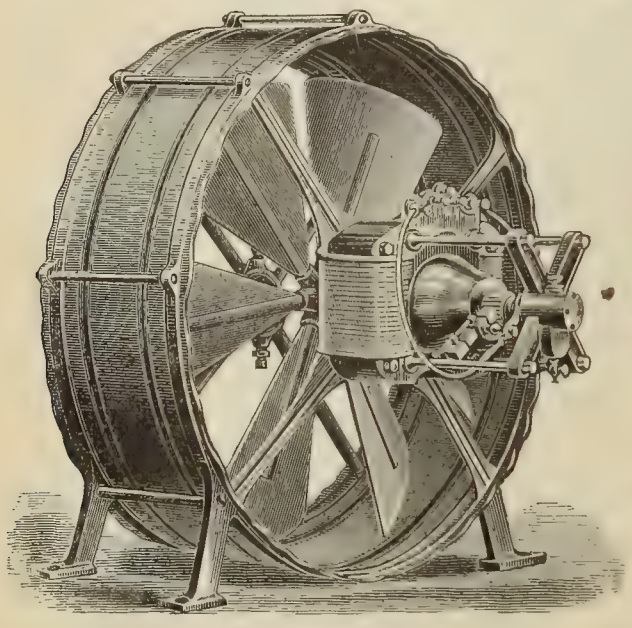
T. H. Grady & Co., 263 Fulton street, Brooklyn, are having an excellent demand and large sales for their Grady Electrical Alarm Clock. It is made in a most convenient form, and is a sure eye opener in the morning to sound slumberers.

FAN AND ELECTRIC MOTOR COMBINATION.

Andrew L. Riker.

The accompanying illustration shows the Combined Wing Fan and Riker Motor, placed on the market by the L. J. Wing Company of 126 Liberty street.

All users of machinery concede that in any machine requiring power it is desirable when possible to obtain a motive power which will be compact, self contained and form a part of the machine to be operated. Especially is this a requisite where the machine to be operated is more or less isolated, as is generally the case with a fan.



COMBINED FAN AND MOTOR.

All these conditions are completely filled by this outfit. Being an electric motor it is necessary only to wire to the motor. This saves the expense of and attention demanded by steam pipes, shafting, belting and the many other objectionable features incident to other conditions.

Each fan is arranged to run at different speeds, is clean, perfectly rigid and moisture proof, and is constructed throughout in the best manner and of the best material obtainable. The fans attain in the smaller sizes a commercial efficiency of 85 per cent. which increases in proportion to the size of the fan.

These outfits have been in use for two seasons with the most flattering results and are now about to enter on their third season with important improvements.

CELEBRATION OF THE PATENT CENTENNIAL.

The celebration of the beginning of the second century of the American Patent System was begun in the Academy of Music in Washington on the afternoon of April 8th.

At the opening there were on the stage: President Harrison, Postmaster General Wannamaker, Secretary of the Interior Noble, Commissioner of Patents Mitchell, and many other prominent persons. Mrs. Alfred Vail, whose husband was associated with Professor Morse in the practical development of the telegraph, occupied a seat in the rear of the stage, and near her sat Mr. D. G. Weems of Baltimore, celebrated through his experiments in high speed electric railroading.

Professor Alexander Graham Bell, the inventor of the telephone, occupied a box with his father, Professor A. Melville Bell, and a party of friends. The Justices of the Supreme Court of the United States filed in upon the stage, and were given seats directly in front of the footlights. Chief Justice Fuller was at the head.

Throughout the audience were many noted inventors, including Dr. R. I. Gatling of Gatling gun fame.

President Harrison opened the celebration with a few appropriate remarks, at the conclusion of which the names of the officers of the celebration were announced. President Harrison was named as president, and among the honorary vice-presidents are: Prof. W. A. Anthony, Manchester, Conn., president of the Institute of Electrical Engineers; Charles F. Brush, Cleveland, Ohio; Thomas A. Edison; Norvin Green, president of the Western Union Telegraph Company, New York; Hon. Gardiner G. Hubbard, president National Geographical Society, Washington, D.C.; Prof. T. C. Mendenhall, Washington, D. C.; Elihu Thomson, Lynn, Mass. and Joseph M. Wilson, Philadelphia, president of the Franklin Institute.

Commissioner Mitchell then made an interesting address, closing with the following words: "Let us hope that the United States, whose place in the vanguard of progress is so largely due to its great inventors, may not now, through indifference to its patent system, fall back in the procession of the nations. Let us hope that an aroused public sentiment, set in motion by this celebration of the achievements of a century, may demand for the patent system and for the office which administers its functions, just recognition of its mighty influence and just provision for its needs as it enters upon the second century of its usefulness."

At the conclusion of Mr. Mitchell's remarks Senator Platt, of Connecticut, made an interesting speech on "Invention and Advancement," and was followed by a few remarks by Justice Blatchford of the United States Supreme Court, on the subject: "Patent Law During the Past Century."

"Epoch Making Invention in America" was the subject of the next address, by Robert S. Taylor, of Indiana.

"In the production of the electric light," said Judge Taylor, during the course of his remarks, "man has come nearer to creation than anywhere else. He has produced upon earth the light of the heavens."

Referring to the telephone, Judge Taylor said, "No man can add a cubit to his stature, but Professor Bell has added many miles to our tongues."

At the night session Secretary of the Interior Noble presided, and in taking the chair made a brief and interesting address, touching particularly on the importance of the Patent Office compared with other bureaus of the department over which he presides. After an address by Senator Daniel, of Virginia, on "The New South as an Outgrowth of Invention and American Patent Law," the meeting adjourned.

Thursday, the 9th, was the one hundredth anniversary of the establishment of the American Patent System, and this important event was commemorated by an excursion to Mount Vernon. Little or no business was transacted during the day. In the evening the Board of Trade banquet was held in honor of the centenary of the American Patent System, and was largely attended.

There were about 200 persons present at the banquet, and the post-prandial exercises consisted chiefly of speeches appropriate to the occasion.

Mr. George Westinghouse was among those present.

The resistance of all electric conductors varies inversely as the area of the cross section. Thus, if a wire with a cross section of say, ¼ of an inch, has a resistance of ten ohms the same length of wire, with a diameter of ½ an inch would have a resistance of 2.5 ohm, the area having been quadrupled. Hence, as the larger wire has four times the carrying capacity of the smaller, the resistance will be one-fourth.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
7-12 WORLD BUILDING,
NEW YORK, April 13, 1891.

The Interior Conduit and Insulation Company, 16 and 18 Broad street, New York, have just made an important announcement to the trade. In accordance with the recent decision of the Board of Trustees of that Company to extend the scope of the business and engage in a general manufacturing business, an option has been secured from the Bergmann Electric and Gas Fixture Company for the purchase of the entire plant and business belonging to the latter company at a price which equals the net cost of the property to the said Bergmann Electric and Gasfixture Company. As the factories of the two companies are adjoining the advantages of such purchase will be apparent. The two factories can be united and operated as one with practically no additional expenditure of money.

A statement of the business in sight for the new factory, which is included in the announcement, is gratifying.

Among these are manufacturing rights under electric railway patents, which have been allowed and will shortly issue, covering a principle practically applied, which is not only far superior to any existing methods, but so much so as to provide an immediate solution of the elevated railway problem. As an additional advantage to the consolidated company, Mr. E. H. Johnson has agreed to execute an option to it on his new electric railway and other patents. This option may or may not be availed of by the company, as the judgment of its Board of Trustees may determine, after a practical trial and demonstration of the merits of the inventions.

Unico H. W. Schenck has secured the agency of the Healy system of ventilating fans, manufactured by the Healy Fan Company, of Bridgeport, Conn. Mr. Schenck will make his headquarters in the new Electrical Exchange Building, corner of Liberty and Washington streets. Mr. Schenck is a well known mechanical and electrical engineer, and has a thorough knowledge of ventilating apparatus. He will make this line a specialty in connection with electrical engineering. He has already placed several orders for the Healy ventilating fans, among which is one to equip the new Clarendon Hotel dining-rooms, Washington street, Brooklyn, with the new vibrating fans suspended from the ceiling. These fans are made similar to large palm leaf fans, and swing backward and forward on a supended arm pivoted in a joint attached to the ceiling. They are of handsome design, and very unique.

The India Rubber and Gutta Percha Insulating Company, Madison avenue and 42d street, with Wm. M. Habirshaw, F.C.V., member of the New York Chemical Society, as supervisor, have their works in Glenwood-on-the-Hudson, N. Y. The company has lately installed themselves in their new offices at the above address, and are conveniently located, as they are within one block of the Grand Central Depot, and handy to all the large buyers and electric light stations in this city. I understand they are receiving large orders for electric light vulcanized india rubber cables, absolutely pure rubber cables, as well as submarine and underground wires and cables. They also make cables for every use in naval work, bell wires and pliable cables for search lamps. Mr. S. C. Field, the manager of the Hudson avenue office, will always be found ready to supply all information regarding this company's wires and cables.

The Banner Contract of the year for Magnesia Sectional Covering has been closed by Robert Keasbey, 58 Warren street, New York. He has just sold 35,000 feet, or six and a half miles of Magnesia Sectional Covering, to be applied to all

of the steam pipes in the buildings of the Kings County Farm at St. Johnland, L. I. This is said to be the largest order for pipe covering that has ever been given out in this country. A large order has also been placed by the same house with the Field Engineering Company, for Magnesia Covering to be used in the large steam plant of the Buffalo Electric Railway, and one for the Cross Town Electric Railway Company. A good order has also been filled going to the Corning Electric Light and Power Company, Corning, N. Y.

The New York Carbon Works, 18 Cortlandt street, Mr. Henry Mueller, General Manager. Their factory in Newark, N. J., has been lately fitted out with all improvements for the manufacture of carbon plates, etc. They have been most successful in producing battery carbons, and these goods have been adopted by the leading battery manufacturers throughout the United States, particularly here in the East. Mr. Mueller, I believe, is not generally known. He started in a small way in Hudson avenue, near 14th street some years ago. The growth of his business demanded larger quarters, when some few years since he secured the premises now occupied by the company's large factory in Newark, N. J., and he is now one of the largest producers of carbons in this country.

A few days ago a section of the Fourth avenue tunnel of the New York Central road was experimentally lighted by electricity. The portion so lighted extended between Eighty-sixth and Ninety-sixth streets, and the lamps were placed less than a foot above the ground. There are forty Edison incandescent lamps, and the results of the experiment do not seem to lessen in the slightest degree the difficulties sought to be overcome. Indeed, the engineers say that they are never sure about the danger signals on account of the brilliancy of the electric lights. It is said that the electric light is so dazzling that the block signals are lost to sight entirely. It is thought that the electric light will be abandoned for such use.

J. Jones & Son, No. 602–604 West 22d street, manufacturing electricians, have lately given a large number of estimates on special machinery, tools, etc. This firm, as we noted some time since, purchased the factory of Chapin & Thompson and their business connections, and are prepared to fill all orders for machinery and electrical apparatus. Mr. J. Jones, Sr., was associated for several years with Frederick Pearce at 79 John street, and as a practical mechanic and engineer he has no superior. The younger member of the firm is following in his father's footsteps, and has the supervision of the business under his care. He will be found thoroughly capable to give estimates on the finest class of electrical apparatus and machinery required.

Mr. Durfee, of the Carr Metal Company, Fall River, Mass., called at the ELECTRICAL AGE office last week. He reports great success in the sale of the celebrated zincs of which that company are the manufacturers. These goods include zincs for gravity, Leclanche and all forms of batteries. This zinc is composed of an alloy of zinc and mercury only, and can be furnished any size or shape desired. Its use affords an increase of electromotive force and a decrease of internal resistance in any cell. Every one interested in batteries should use these zincs.

C. C. Sibley & Co., No. 416–418 West 26th street, are manufacturing contractors for electric lamps, dynamos, motors, switches, railroad, telegraph and electrical supplies generally. A call upon this firm this week resulted in finding them in an active state of business. They are manufacturing goods for two of the principal houses of New York and Brooklyn, including lamps, sockets, switches, arc lamps, etc., in large quantities. This firm is prepared to contract for any quantity of electrical goods for electrical supply houses and dealers.

The Engineering Equipment Company, 73 Cortlandt street, have taken the agency of Albert and J. M. Anderson, of Providence, R. I., for the latter firm's line material, including the well known Boston trolley arms, insulators and all other materials for the equipment of electric roads which are manufactured by Messrs. Anderson. The Engineering Equipment Company will remove during April to the new Central Building foot of Liberty street, where they have secured elegant quarters for the exhibition of their goods, drafting rooms and general offices.

The new Electrical Exchange Building, corner of Liberty and Washington streets, which was lately finished and opened to the public, is one of the handsomest structures in this city. There is plenty of light and air to each floor. The offices are all large and convenient and many large concerns have secured sales and exhibition rooms. The Thomson-Murray & Co., Electric Railway Builders, have already moved into handsome offices, and the McCreary Electrical Specialty Company, as well as many others, have opened offices in this building.

The new factory of the National Electrical Manufacturing Company, at Milford, Conn., is one of the most complete of its kind to be found in the country. It is equipped with all of the latest improved machinery, designed for the purpose of manufacturing electrical goods of every description, and is kept busy up to its full capacity to meet the large call there is for the goods of this company. The offices of the National Electrical Manufacturing Company are at 14 and 16 Vesey street, New York, where they keep a large line of electrical goods of every description.

Messrs. W. H. Bird and Geo. H. Sloane, who have just established what is know as "Diamond S," a new open circuit battery, with headquarters at 624 Atlantic avenue, Boston, Mass., are in New York making the acquaintance of the electrical trade. These gentlemen manufacture what they state is one of the best open circuit batteries extant and the demand for their goods is on the increase. The price of their cells is reasonable. They possess long life, quick recuperation, low internal resistance, no creeping salts, etc.

The McCreary Electrical Specialty Company, 18 Cortlandt street, has just received a large order from London for a general line of their specialties, to the value of over $1,000. The order includes six hundred reflector shades of one size. This company is bringing out several new specialties for the incandescent system. They will, after May 1st, make their headquarters on the second floor of the new Electrical Exchange Building, Liberty and Washington streets, and will occupy rooms numbered with their lucky number, 306.

W. H. Gordon & Co., of 115 Broadway, are placing large orders for their Star Electrix incandescent sockets, as well as switches of from five to fifty amperes capacity, Ellis Oil Filters, Simplex Wires and Cables, Wirt Instruments, and numerous electric light and railway specialties. Their handsome advertisement appearing in the advertising columns of our paper, will be hailed with delight by our readers this week.

The Barriett Electric Company, 10 Cedar street, are taking large orders for their small electric motors and fan outfits, and the trade will do well to investigate the various lines of these motors designed for light and power before placing orders. The company has just brought out a new one-quarter horse power motor of very handsome design, and one that should be seen to be appreciated.

The Hunt Engineering Company, of 238 Washington street, Brooklyn, are already receiving orders for their new 200 ampere switch. The fuse feeder switch is made in a very convenient form, and is very efficient. The company are now working on a new catalogue showing a full line of their snap and feeder switches, the H. E. Westinghouse sockets, cut-outs, and numerous other specialties, the inventions of the engineers of this company.

Messrs. Woodbridge and Turner, the well known electrical engineers, have secured handsome offices in the *Times* building, where they will be pleased to see representatives of companies and individuals desiring estimates for construction work on electric railways. These gentlemen have installed plants on some of the largest electric railways in this country, and their name is synonymous with electric railway progress.

Mr. F. W. Knight, af the Thomson Electric Welding Company, Lynn, Mass., is installing an electrical welding plant at the factory of the Excelsior Electric Company, corner of Raymond and Willoughby streets, Brooklyn. This will be a regular jobbing plant, and will have the capacity to weld metal of any kind 2½ inches in diameter. Aluminum can be perfectly welded by this method.

Among the callers at the ELECTRICAL AGE office last week, was Mr. Henry Schwindt, manufacturer of the well-known closed cell pocket battery and special medical batteries, at No. 610 Eighth avenue.

Mr. J. R. Burdick, representing H. W. Johns Manufacturing Company, No. 87 Maiden Lane, was a caller at this office during the past week.

The Engineering Equipment Company, 73 Cortlandt street, contractors for steam and electric materials, Underwood cotton leather belting, and sole agents for the patent Indurated Fibre Pipe for electric subways, etc., and other engineering goods, will make their headquarters in the new Central Building, Liberty, West and Washington streets, on or about May 1st.

Mr. F. Achelis, president of the India Rubber Comb Company, and the Goodrich Hard Rubber Company, 9 and 11 Mercer street, sailed for Europe lately and will return about the first of August. He will be missed very much in his business. His house is said to maintain the largest factories in the world for the manufacture of hard and soft rubber goods.

The ELECTRICAL AGE Office this week was favored with calls from R. B. Corey, of New York City, William H. Bird and George H. Sloane, of Boston, Mass.; P. H. Alexander, of Alexander, Barney & Chapin, and Chas. D. Shane, of the Edison General Electric Company and H. D. Stanley, of Stanley & Hall, New York City.

The American Standard Electric Light Company, has opened show rooms and a factory at 106 Liberty street. They are said to control the patents of several lines of dynamos and arc lamps. Mr. L. M. Shute is vice-president and general manager, and the outlook of the company is very propitious.

The Himmer & Anderson Dry Battery Company, manufacturers of the celebrated Restorable Dry Battery Cell, electric clocks and novelties, 20 Vesey street, will on May 1st, move to new and larger quarters at 123 Chambers street.

The Field Engineering Company, 15 Cortlandt street, contractors and builders of Electric Rail way plants, will remove to the new Central Building, Liberty Washington and West streets, on or about May 1st.

A press dispatch from Philadelphia on the 9th inst., stated that the formation of a gigantic copper trust has been begun in that city, which in extent and importance promises to eclipse everything in the trust line.

G. Stewart Hunter, with the Bishop Gutta-Percha Company, 420-426 East Twenty-fifth street, stopped in to see us on his way from Montreal. He speaks well of trade, and had a very successful trip.

The Indurated Fibre Company, for whom the Engineering Equipment Company are sole agents, will make their headquarters in the Central Building, Liberty, West, and Washington streets.

Bridgeport Machine and Tool Works, Bridgeport, Conn., E. P. Bullard, proprietor, making the manufacture of machine tools for electrical manufacturers a specialty, will make its headquarters in the new Central Building, Liberty, West and Washington streets.

The Safety Insulated Wire and Cable Company, 234 West 29th street, Mr. L. T. Requa, manager, lately furnished some 12,000 feet of wire to the Edison Illuminating Company, for the New York Central railroad for experimentally lighting the Fourth avenue tunnel. This tunnel, as is well known, has received considerable attention lately on account of its gloom and danger to public travel. The Edison Company will bring it out of darkness into daylight.

Mr. Charles L. Eidlitz, 10 West 23d street, electrical engineer and contractor, is fully equipped for wiring for the incandescent light, both in and out of doors. He has been associated for years with the largest companies installing plants in this section, as well as in all of the leading cities in the Union. He has lately secured the agency for the Card Electric Motors, and has installed two of them on the Brooklyn Bridge, where they are giving excellent satisfaction. He is prepared to install these motors of any size, from one-eighth horse power up. Mr. Eidlitz is now making a specialty of fan motors.

VULCABESTON.—The H. W. Johns Co., 87 Maiden Lane, N. Y., have become celebrated through this line of insulating material. The Thomson-Houston and other large electric companies are using this material in large quantities on their dynamos and motors, also for their electric railway systems. It is composed of asbestos and rubber, which are thoroughly combined, making a very reliable compound. To go into the details of manufacture of this article is unnecessary, as the recommendation of the H. W. Johns Company, is enough to satisfy any person of its good qualities. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	$100 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	7 50
American Private T'phone (N. Y.)..	50,000	100 00	98 00
American Telegraph and Cable....	14,000,000	100 00	82 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co....	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	115 00
Averell Insulating Conduit.	3,000,000	100 00	4 00
Ball Electric Light.	2,000,000	100 00	
Bay Shore Elec. Light (L. I.).	8,000	50 00	
Bell Telephone.	15,000,000	100 00	198 00
Boston Electric Light.			105 00
Brooklyn Edison Electric Light..,	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light..	500,000	100 00	137 00
Brooklyn Municipal Light.	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 50
Brooklyn City R. R. 5s.	6,000,000		par
Brush Illuminating (N. Y.).	1,000,000	100 00	60 00
Brush Swan E. L. Co. of N. E....	2,000,000	100 00	20 00
Brush Swan (Ithaca).	50,000	10 00	8 00
Burrel Electric Signal Co. (N. Y.).	500,000	20 00	5 00
City Electric Street Ry. Co., 6's....	200,000		par
Commercial Cable Co.	7,716,000	100 00	108 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Consolidated Electric Light.	1,929,400	100 00	50 00
Consoli'd Elec. Storage Co.(N.Y.)..	3,000,000	25 00	7 00
Consol Gas & E.L.Co. of West Co.6's	250,000		par
Consol Gas & E. Co. Batavia, 6's....	80 000		par
Consolidated Gas Co. Batavia.	100,000		
Daft.	1,000,000	50 00	
Day Ry. Const. Co. Chicago.	10,000,000	100 00	60 00
Direct U. S. Cable Co. (Ltd.).	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	80 00
Easton Elect. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. 5s.	2,000 000		*80
Edison Illuminating (N. Y.).	4,500,000	100 00	80 00
Edison General	14 000.000	100 00	99 50
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Erie Telephone			50 00
Essick Printing Tel.	5,000,000	100 00	60 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.).	500,000	100 00	
Excelsior Electric Co., 6's.	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	13 00
Hackettstown Elec. Light (N. J.).	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.).	100,000	100 00	
Hunt Engineering Co. (Brooklyn)..	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited.	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s...	500,000		*99
Jamaica & Brooklyn Road Co.	197 480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Laclede Gas Co.	7,500,000	100 00	18 50
Laclede Gas, pref	2,500,000	100 00	4800
Laclede Gas 5s.			78
Law Telephone	400,000	100 00	
Long Branch Electric Light..	50,000	100 00	78 00
Lincoln E. L. & P. Co. (Ills) 5s.	50,000		
Manhattan Elec. Light Co. Lmtd 5's	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)..	60,000		par
Metropolitan T. & T. Co.	2,000,000	100 00	
Mount Morris 6s (N. Y.).			*95
Mount Morris Electric Light (N.Y.)	500,000	100 00	90 00
Morristown L. H. & P. 5s (N. J.)...	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
N. E. Telegraph and Telephone....			51 00
N. Y. and N. J. Tel. and Tel 6s.	1,500,000		par
N. Y. and N. J. Telephone Stock...	2,535,000	100 00	99 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler) ...	100,000	100 00	
North American Phonograph.	6,000,000	100 00	20 00
North New York, Lighting.	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		par
Postal Telegraph.	10,000,000	100 00	30 00
Passaic, Electric Light.	15,000	100 00	92 00
Paterson, Electric Light.	100,000	100 00	
Peoples' Elec. Light (Trenton).	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1 000,000	100 00	102 00
Plainfield, Electric Light	100,000	100 00	75 00
Richmond L. H. & P. (S. I.).	150,000	100 00	60 00
Richmond L. H. & P. 5's.	150,000		*90
Rockaway Beach Elec. Light.	50,000	100 00	60 00
Russell Electric Co. (Boston).	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s...			*86
Saginaw Elec. Light & Pr. Co. 6's ..	50,000		par
Shaver Corporation	100 000	1 00	3 00
Swan Incandescent.	800,000	100 00	2 50
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
Thomson-Houston Electric Co.	10,000,000	25 00	47 00
Thomson-Houston Pref.	5,000,000	25 00	25 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers 6's.	100,000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.).	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power.	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	2 50
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Western Union	86,188,852	100 00	81 50
Westinghouse Electric Co.	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston).			21 75
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

Hello! Hello!! Hello!!! Central, please connect me with the Editor-in-chief of the ELECTRICAL AGE, quick, will you? I want to catch the paper, just going to press. Hello! Mr. Editor, I have just seen an aluminum medal issued by the United States Patent Office or its representative in the persons of the committe having in charge the celebration of the Centennial Anniversary of the birth of our world permeating and widely honored national characteristic of invention, application and distribution in security of possession by law and protection. The first aluminum medal, as is well known by some three thousand people of distinction in the electrical community who have one, and all of our hundreds of thousands of readers, was issued by the ELECTRICAL AGE at the meeting of the National Electric Light Association at Providence, last February, and it is almost compulsory on the management of the ELECTRICAL AGE to acknowledge the honor conferred by the adoption of its conception, and a proud privilege to be followed by one of the most important departments of the Government. The inventors home adopting your precedent secures a position which stamps this journal as being "clear to the front" in all matters germane to its columns. It is emblematical of the advanced facts as set forth weekly in every department of the paper and eminently proper that the people should be advised of it. The medal issued to commemorate the birth of the Patent Office is somewhat larger than yours, otherwise, to all intents and purposes, a fac simile. I hear of several aluminum companies on the tapis and want all the information on their financial propositions if possible ahead of all competitors. Hope I'm in time. Good bye.

Tax Commissioner Coleman in his replies to the interrogations of the Senate Law Committee, the other day trenched on financial facts, which require prompt action and equitable adjustment on the part of New York's law makers. He reports after intelligently directed investigation, that many of the most important industrial corporations had voluntarily wound up their affairs in this state, and reincorporated in New Jersey. During 1890, there was no less than $320,000,000 of capital organized in our sister state, of which fully 20 per cent is represented by companies whose business, with the exception of an office and local adviser, is carried on in this city. The reason given for this state of things is the method and quantity of taxation. The taxes assessed here amount to $1,727,318,188. The laws of New Jersey are more liberal; money required for the business is not forced into idleness, and this is so well understood by investors that a majority, even of those who reside here, have come to acquiesce without murmer, while our friends in other states approve with much applause. Kentucky is too far, and West Virginia too young to satisfy managers of capital; Connecticut seems to have killed the goose which laid her golden egg, and just at present all roads in this vicinity lead to Jersey. If her servants will let well enough alone for a few years, she will realize that a smaller per cent. on a larger amount will prove that the nimble dime is of more value than the sluggish dollar. The day has gone by when the mere fact of a company being incorporated under the laws of New York, adds to its value or highly colored chromos attract the purse as well as the eye.

To "be sure you're right, then go ahead," is exemplified in the Burrell Electric Signal Company whose system has been under scientific test and study for a long time, and eventually reached electrical perfection. The patents were granted last February, and the company organized April 2d, under the laws of New Jersey, (the regular course of all good things now), with a capital of $500,000 in $20 shares, as will be seen by referring to the list of stocks and bonds in today's issue of the ELECTRICAL AGE. The officers are Charles H. Denison, president; Samuel J. Burrell, treasurer; William C. Joy, secretary. New York offices are at 54 Broad street, where intending investors can see the system at work. The law end of the business is under the immediate supervision of the well-known firm of Dickinson & Thompson, 1 Exchange Place, Jersey City. A small amount of treasury stock which in no manner differs from the other shares is being sold at $5 per share, the right being reserved to increase the price without notice. There are no bonds or debts of any description. Trains will not even attempt to pass each other on single tracks where this system is employed. This is one of the few opportunities to invest in a good safe security at bottom figures, where your money can be doubled and quadrupled in a very short time, while, at the same time it will be earning a fair dividend on the par value of your shares.

Stock exchange seats have stiffened lately; only a few weeks ago memberships sold as low as $16,500—the lowest for a great many years. Memberships now are bringing $20,000. One of the active listed securities which would soon have become of interest to us as an electric security is alleged to have passed under a decision of the Illinois Supreme Court through the several stages of "La Grippe" and Pneumonia with the usual result—death. When the ambition of man or men ceases by law at a given point, even justice demands that the law should forever maintain the man or men and their heirs in that position. On the other hand we hear the Postal Telegraph Company is absorbing the Michigan Telegraph Company, which was organized by Ives & Farnsworth in 1883, with a capital of $50,000. They built a line to Toledo and sold out to the Bankers & Merchants Company, which failed. In 1885 Ives & Farnsworth organized a new Michigan Telegraph Company and constructed lines to Grand Rapids and several other cities. It has since acted as a connecting line for the Postal Telegraph & Cable Company.

MEETINGS OF SOCIETIES.

INSTITUTE OF ELECTRICAL ENGINEERS.

The Fifty-ninth meeting of the American Institute of Electrical Engineers will be held on Tuesday evening, April 21st, at eight o'clock, at the Institute's rooms, No. 12 W. Thirty-first street. A paper will be read by Mr. Alexander S. Brown, of Boonton, N. J., entitled "The Electric Extraction of Aluminium." The paper will be illustrated with electric lantern slides. A paper will also be read by Mr. N. D. C. Hodges, editor of *Science*, on a new "Theory and Practice of Protection Against Lightning."

The annual and general meetings of the Institute will be held in this city May 19th, 20th and 21st.

THE ELECTRIC CLUB.

A number of friends of Mr. Samuel Insull, second vice-president of the Edison General Electric Company, have requested him to be a candidate for president of the Electric Club, at the annual election, which takes place Thursday, April 16th.

THE MOSSMAN CODE.

The abbreviation of long hand writing has been reduced to a science for the benefit of those who have much writing to do, and who have no knowledge of shorthand. Mr. Mossman has just produced a work on this subject, which is both simple and complete. Every one having writing to do should possess a copy. The rules for abbreviating are easily learned, and by the use of this system of abbreviated longhand much time and labor can be saved.

BUSINESS NOTES.

While all New York City is suffering from "La Grippe," it is in order to state that Okonite has the strongest grip noticed in electrical circles. Business is good with the International Okonite Company.

One of the most prominent electrical supply concerns in New England is the Pettingell-Andrews Company, Boston. Nothing but careful financiering, general good management and brains could have made them so, but then these qualities are possessed by each individual member of the company.

An elementary treatise on the Voltaic Accumulator, by Emile Reynier, translated by J. A. Berly, brings together, summarizes, explains and classifies the notions, theories and inventions relating to Secondary Batteries and reviews the principal applications. Fully illustrated. Price three dollars, postage prepaid. E. & F. N. Spon, 12 Cortlandt street, New York.

The Lackawanna Electric Light Company, of Taylorville, Pa., with offices at Scranton, Pa., have secured the charter and franchise of the South Side Electric Light, Heat and Power Company of Scranton, by purchase. This charter and franchise covers every street, avenue and alley on the south side of the city. There are no electric lights in that section, and there is not even gas in one-half of it. A plant of 3,000 incandescent lamps and about 300 arc lights it is thought would be sufficient to cover this portion of the city at the present time, and the chances are that very soon a demand for a larger plant would be realized. The south side of Scranton is the manufacturing portion of the city. It is growing very rapidly and it is somewhat remarkable that it should be devoid of electric light. This is a good chance for capitalists to invest in an enterprise which would certainly yield liberal returns, as there is great demand for the light.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS.

ISSUED TUESDAY, APRIL 7, 1891.

449,655. Telegraphy. Frank Anderson, Peekskill, N. Y. Annie L. Anderson, Gilbert H. Anderson and Homer Anderson, administrators of said Frank Anderson, deceased. Filed May 31, 1890.

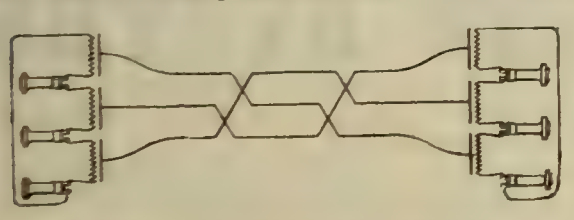
A telegraphic transmitter having raised Morse or equivalent characters on a movable part, in combination with a pivoted transmitting-arm located at right angles to the direction of motion of the movable part, and electrical connections whereby the characters are accurately reproduced electrically.

449,660. Automatic Switch for Electric Motors. William Baxter, jr., Baltimore County, assignor to the Baxter Electric Manufacturing and Motor Company, Baltimore, Md. Filed Oct. 21, 1887.

An electromagnet affected by the circuit through the switch-lever of a combined hand-switch and automatic cut-out, for disengaging a locking device.

449,661. Electrical Hoisting Machine. William Baxter, jr., Baltimore County, assignor to the Baxter Electric Motor Company, Baltimore, Md. Filed Mar. 2, 1888. Renewed Oct. 31, 1890.

The combination, in an electric hoisting-machine, of an electric motor, a hoisting shaft and drum, a worm upon the armature-shaft and a worm-wheel operated by the worm to rotate the hoisting-drum, a metallic supporting frame provided with bearings for the armature-shaft and drum-shaft, and with an oil-trough, closed at its farther end, arranged beneath the worm-wheel, the worm being inserted in the trough and the armature shaft extended into its nearer end to rotate it therein.



NO. 449,679—MULTIPLEX TELEPHONY.

449,662. System of Operating Electric Elevators with Landing Switches Only. William Baxter, jr., Baltimore County, assignor to the Baxter Electric Motor Company, Baltimore. Md. Filed Apr. 20, 1888. Renewed Oct. 31, 1890.

An electric circuit connected normally through the armature of a motor and a series of landing-switches provided with contacts for controlling the course of the current in the circuit.

449,672. Train Signal. Hugh J. Finn and John A. Garner, Kansas City, Mo. Filed Nov. 14, 1890.

An electric bell circuit for communication between different parts of a train.

449,679. Multiplex Telephony. William W. Jacques, Newton, assignor to the American Bell Telephone Company, Boston, Mass. Filed Dec. 1, 1890.

The combination with three or more line wires of a telephone system at each end, of an equal number of Muirhead condensers and an equal number of telephone loops, each of the line wires being connected with a separate armature strip in the condensers and each loop connected with two conducting strips in the condensers.

449,685. Electrical Switchboard. John B. Lyon, Brooklyn, N. Y. Filed Nov. 20, 1890.

449,690. Non-Interference Electrical Signaling Apparatus. Abraham Newman, Brooklyn, N. Y. Filed Feb 28, 1890.

449,709. Propelling Mechanism for Electric Motor Cars. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Dec. 11, 1890.

The combination, in an electric-motor car, of the armature of the motor axially mounted and directly connected with the car axle, with a hanger frame pendulously suspended from the car axle, the field-magnet frame independently supported upon the hanger frame, and means for adjusting the field magnets with reference to the armature.

449,715. Electric Arc Lamp. Elihu Thomson and Edwin W. Rice, jr., Lynn, Mass. Filed April 9, 1885.

The combination, in an electric lamp, of an illuminating pencil or electrode, a feed regulating or controlling mechanism of any suitable construction for lifting the carbon when it is moved in one direction and for releasing the carbon when moved in the other direction, so that the carbon may be fed by gravity, a guide tube inclosing the pencil and moving with the feed-controlling device, and a propelling weight or follower resting on the end of the electrode and moving in the guide tube.

449,719. Electric Search Light. Barton B. Ward, New York, N. Y. Filed Aug. 21, 1890.

449,721. Electric Connector. George K. Wheeler, Chicago, Ill., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 26, 1890.

449,726. Process of and Apparatus for Separating Ores Magnetically. Clinton M. Ball, Troy, N. Y., and Sheldon Norton, Hokendauque, Pa. Filed June 30, 1890.

The process of separating iron or its crushed ore from impurities and concentrating it, consisting in passing the ore and gangue through consecutive magnetic fields and at the same time impressing upon it differing degrees of tangential inertia in the consecutive magnetic fields.

449,752. Electric Motor Car. Harold P. Brown, New York, N. Y. Filed May 26, 1890.

The combination in an electric motor car, of an electric motor having a revolving shaft furnished with a driving pulley, the car axle furnished with a pulley and a rope connection between the motor and axle, and a rope-tightener pulley around which one loop of the rope connection passes

449,753. Pole for Overhead Systems of Electric Railways. John N. Brownlee, Detroit, Mich. Filed Nov. 28, 1890.

In a pole, the combination, with four upright bars arranged in pairs, constituting opposite sides of the pole, of a series of cross-braces, each constructed with arms integrally united at the centre, each brace located between the four upright bars and uniting all four bars.

449,759. Time Stamp Actuated by Electro-Magnets Warren B. Martindale, Kenosha, Wis. Filed Dec. 15, 1890. Patented in England, France and Germany.

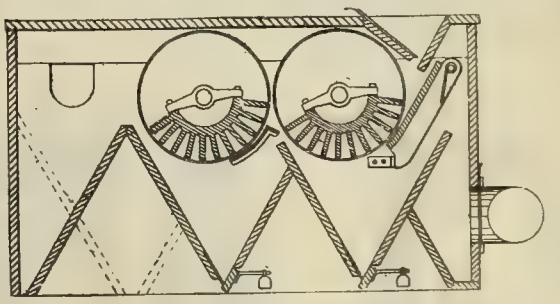
449,766. Ammeter or Voltmeter. Harold C. Shubert, Chicago, Ill., assignor of one-third to Warren B. Martindale, Kenosha, Wis. Filed Oct. 31, 1890.

449,767. Cut-Out. Alfred T. Tregurtha, Everett, assignor of one-half to Henry A. Clark, Boston, Mass. Filed Feb. 25, 1889.

449,774. Commutator for Electric Motors. Henry Duenner, Boston, Mass., assignor of one-half to Frederick Bleiler, same place. Filed October 16, 1890.

In a dynamo-electric machine, the combination of a longitudinally-movable brush-carrying spindle with a pair of ways insulated from the spindle and from the adjusting screw, and with a cross-head carrying a binding-post insulated from the ways, and the adjusting screw, and in conducting relations with the spindle.

449,780. Circuit-Breaker for Incandescent Electric Light Systems. Friedrich Muller and James G. Greene, Elizabeth, N. J. Filed July 23, 1890.



NO. 449,726—APPARATUS FOR SEPARATING ORES MAGNETICALLY.

An electric lighting system comprising a circuit having a number of incandescent lamps connected in multiple arc and a circuit breaker having two breaking points, one of which is controlled by an electro-magnet in a lamp circuit and the other by a manually-operated circuit-restoring device.

449,792. Electric Railway. Edward M. Bentley, New York, N. Y. Filed Jan 30, 1888.

The combination, in an electric railway having a suspended conductor, of a vehicle, a contact device adapted to travel along the conducter, and an intermediate connection between the vehicle and the contact device, having a shifting attachment to the latter.

449,797. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 15, 1888.

In an electric railway, the combination of two railway tracks and a conduit structure having two slots arranged parallel with and between the tracks, connecting devices for uniting two railways and conduit structures into an integrale structure, whereby one portion cannot shift laterally with respect to the other, and an insulated conductor arranged below each of the slots.

449,829. Auxiliary Fire Alarm and Extinguisher System. Eason L. Slocum, Pawtucket, R. I. Filed Jan. 14, 1889.

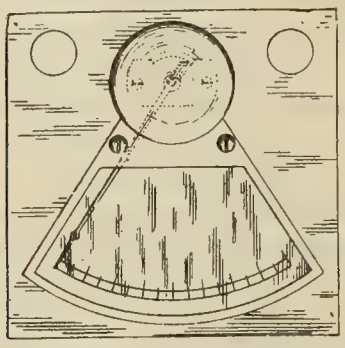
ELECTRICAL PATENTS—Continued.

449,832. Bell. Arthur F. Stanley, New York, N. Y. Filed May 29, 1890.

As an article of manufacture, an electro-magnetic hammer for electric bells, consisting of an armature, a stem and a perforated hammer-disc stamped in one flat integral piece of iron or steel, in combination with a peen of other metal, attached thereto.

449,836. Method of Electric Welding. Elihu Thomson, Swampscott, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed July 11, 1890.

Welding rods, bars, or wires of copper or similar material by causing heavy currents to traverse the joint to be welded and applying end pressure or force tending to move the pieces to be welded toward one another, producing an expansion or upset of the metal in the parts thereof, beyond those which require to be upset in order to produce a butt



NO. 449,766—AMMETER OR VOLTMETER.

weld, and applying the hammering, rolling or other compressing operation to such additionally expanded or upset parts.

449,843. Electric-Car-Stopping Device. George Blanchard, Waterville Me., assignor of one-half to Sophia G. Webber, same place. Filed Oct. 16, 1890.

A locking device for the motor gears of an electric car, in combination with a movable stop for holding it out of engagement and a magnet for withdrawing the stop.

449,847. Electrical-Dental Engine. Frank F. Eggers, San Francisco, Cal. Filed Dec. 10, 1890.

An electric motor journaled within the frame of a dental bracket and connected directly with the driving shaft.

449,886. Trolley Support for Electric Cars. Frank Robinson and Percy W. J. Lander, Bangor, Me. Filed Jan. 12, 1891.

449,889. Electric Valve-Controller. George E. Turner, Marion, Ohio. Filed Aug. 12, 1890.

The combination, with a sliding valve and its stem, the latter provided with two lugs, of a wheel having a zig-zag rim located between the lugs, and an electro-magnetic apparatus for imparting a step-by-step movement to the wheel.

449,897. Telegraphy. Robert G. Brown, Brooklyn, N. Y., assignor to the Standard Multiplex Telegraph Company, New York, N. Y. Filed June 27, 1887.

The combination, with a synchronous trailer and segments connected in pairs, of a transmitting magnet and armature, a main battery connected through the armature to the first segment of the pair, a receiving-relay, and a connection to the second segment of such a pair, and a shunt and resistance around the receiving-relay.

449,902. Support for Electric Lamps. James W. Easton, New York, N. Y., assignor to P. Minturn Smith, Plainfield, N. J., and William D. Perry, Brooklyn, N. Y. Filed June 19, 1890.

449,903. Lightning-Arrester. James W. Easton, New York, N. Y., assignor to P. Minturn Smith, Plainfield, N. J., and William D. Perry, Brooklyn, N. Y. Filed Aug. 14, 1890.

A solenoid, plunger and a swinging electrode clamp pivoted below the coil of the solenoid.

449,921. Electric Cut-Out. Alfred T. Tregurtha, Everett, assignor of one-half to Henry A Clark, Boston, Mass. Filed April 17, 1890.

449,923. Electrical Typewriting Machine. Edward F. Youngs, West Camp, N. Y. Filed May 26, 1890.

449,943. Insulator. Louis McCarthy, Boston, Mass. Filed Jan. 16, 1891.

An insulator comprising a bell or case adapted to hold a series of sheets of mica, a metallic-supporting piece placed therein, and a series of sheets of mica surrounding the piece and adapted to insulate the same from the bell or case.

449,977. Supporting-Post for Electric Conductors, William A. Stern, Alleghany, assignor of one-half, to I. H. Silverman, Pittsburg, Pa. Filed May 31, 1889.

A metallic post for supporting electrical conductors, having a sleeve or covering of insulating material covering part or all of the body thereof.

449,990. Automatic Railway-Signal. Calvin W. Wilhelm, Mauch Chunk, Pa. Filed September 23, 1890.

In an automatic railway signal, the combination with a series of stations, each having a single battery, of a signal setting device and a releasing device, the releasing device at adjoining stations being connected with the batteries and with each other, and a series of circuit closers intermediate the signal stations.

450,000. Electric Lamp for Street Lighting. Hiram H. Carpenter, Chicago, Ill. Filed Feb. 19, 1891.

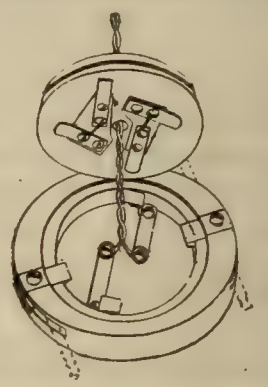
A portable electric lamp and post with secondary batteries ocated within the post.

450,068. Electrical Lock. Heinrich Grefen, Oberhausen, Germany. Filed May 19, 1890.

450,074. Electric Railway, Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Original application filed May 29, 1889. Divided and this application filed Sept. 18, 1890.

450,101. Cut-Out. Jacob S. Gibbs, Hartford, Conn., assignor to the Perkins Electric Switch Mfg. Company, same place. Filed Feb. 11, 1891.

A cut-out consisting of a base bearing pole pieces the inner ends of which project at an angle with the plane of the



NO. 449,767—CUT-OUT.

base, and a cap bearing conductors, the ends of which project at a similar angle with the ends of the pole-pieces upon the base.

450,103. Electrolytic Apparatus. Ernest A. Le Sueur, Ottawa, Canada, assignor of one-half to Charles N. Waite, Newton, Mass. Filed Feb. 27, 1890.

An electrolytic cell having a vegetable parchment diaphragm located below the positive electrode, whereby the diaphragm is preserved from contact with the gases formed at that electrode.

450,104. Electrolytic Cell. Ernest A. Le Sueur, Ottawa, Canada, assignor of one-half to Charles N. Waite, Newton, Mass. Filed Oct. 14, 1890.

450,105. Carbon Electrode for Electric Batteries, Ernest A. Le Sueur, Ottawa, Canada, assignor of one-half to Charles N. Waite, Newton, Mass. Filed Oct 14, 1890.

An electrode for an electrolytic cell, consisting of a number of pieces of rough carbon cut to equal lengths and having rough uncut sides, and a metallic backing in which the carbon pieces are embedded at one end.

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NEW YORK, APRIL 25, 1891.

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DESERVED AND APPRECIATED HONORS.

The electrical fraternity have especial cause for congratulation in the generous recognition they have received in the organization of the American Association of Inventors and Manufacturers in Washington, on the occasion of the recent celebration of the Centennial of the American Patent system. Electricity is represented by a greater number of individuals among the officers of the new Association than any other science, and while every one concerned with electricity, directly or indirectly, should feel proud of the honor of being identified with a profession that has received such special recognition, it is, after all, no more than the science of electricity is entitled to. No one doubts that it is the leading force in the world to-day, and likely will be for a long time to come; it is therefore entitled to first honors. Electricity has unquestionably done more to lift the world into a higher plane and into the light of greater knowledge than any other discovery or force. What would the world be without the submarine cable, the telegraph, the electric light, the telephone and the electric motor? Without these it would indeed be in the dark, and happiness and wealth would not be so easily attained. While electricians naturally feel that their profession is one deserving special recognition, they are none the less proud of the compliment paid them by the appointment as officers of the new association some of the representative men in the world of electricity.

The Association may be assured that all the energy that the word electricity implies will be applied to its welfare by the representatives of electrical science and industries who were elected to fill official positions.

ELECTRICAL ACTIVITY IN MONTREAL.

There is every indication that electrical matters have received a thorough awakening in Montreal since the decision to hold the next meeting of the National Electrical Light Association in that city. There is unusual activity in the electrical industries in that city and, no doubt, much of the energy is due to the anticipation of the surcharge of electricity the city will receive next August.

Our Montreal friends deserve to be complimented on the activity and energy shown in connection with the development of electrical enterprises in their midst.

We understand that several electric light plants are contemplated or in course of construction, and that a strong popular sentiment in favor of electricity has been created. As showing the progress being made in electrical development and improvement, it is worthy of mention that the telephone wires are being placed under the surface of the ground.

It is interesting to note the real live activity in electrical circles in Canada, and we trust that the leaven will work all through the Dominion, as it surely will in time.

Our Canadian friends will learn a good deal about electricity next August, and after that we may look for a whole-souled boom in that direction throughout that country.

PRIMARY BATTERIES.

One would think that since the practical generation of electric currents by dynamo machinery that the old primary battery would have fallen out of sight, but the recent activity among inventors, shown in their endeavors to produce a reliable battery, indicates that their field of usefulness is not over. There certainly must be a large field for a primary battery or there would not be as many new productions as there are at the present time.

There have been some remarkable changes in the form and elements of the cell since Volta's discoveries in 1786, but they all involve the same principle as his *Crown of Cups.*

Some have been designed for special open or closed circuit work; to give a high electromotive force with a small current, or *vice versa*; or to give both a constant electromotive force and a constant current. The endeavor has been to produce a cell giving a high constant current at a high constant potential, but until recently the ideal primary battery free from polarization, and having a constant potential and low internal resistance, seemed like a will-o'-the-wisp. The latest inventions in this line, however, have attained remarkable results, and there is much promise for the future of the latest examples of primary batteries for domestic use.

A cheap, powerful and constant battery is needed for sewing-machine, fan and other small motor work, and lighting small incandescent lamps for one's desk or table; and along these lines of usefulness the primary battery has the entire field to itself.

There is great activity in the electrical department of the patent office, as may be inferred from our patent record this week.

THE ELECTRIC CLUB'S PROSPERITY.

We congratulate the New York Electric Club on the splendid showing made in the report of the retiring president, Gen. O. E. Madden, as to the financial condition of the club. To wipe out a deficiency of over $7,000 and create a balance on the other side of the ledger, to the extent of $3,600 in two years is a task that requires considerable financial and executive ability. No theorist could accomplish such a result; it requires a practical business man to safely guide an institution of this character through such difficulties, and the members of the club should congratulate themselves on having as fellow members men of such ability. The new officers enter upon their duties with everything in their favor. The club has a surplus fund, and a large and increasing membership, and, judging from the individual character of the new officers, there is every reason to suppose that both of these features of the club will be augmented during the ensuing year.

PROGRESS IN ELECTRICAL AFFAIRS.

Our readers cannot fail being impressed with the wonderful activity and development of electrical enterprise as graphically depicted from week to week in the ELECTRICAL AGE. Something new is constantly being produced and the ideal is being approached closer and closer. The new applications of electric energy are multiplying with great rapidity, and it requires considerable reading and study to keep up with the times. We illustrate this week several new and interesting applications of electricity in the form of light and power, besides other decidedly novel inventions, all of which go to show that electricity is man's most faithful servant, and if it is still in its infancy, as many aver, it is the most vigorous infant the world has ever seen.

THE TELEPHONE IN JAPAN.

We illustrate elsewhere in this issue two pictures reproduced from photographs of the telephone exchange in Tokio, the capital of Japan. No doubt many of our readers will be suprised to learn that this modern invention has such a foothold in a country whose people are so unlike our own. Yet it is well known that Japan is rapidly becoming modernized and possessed of the habits and enterprise of the English speaking nations. Our pictures are excellent ones of this far off exchange, and, as will be seen, show the interior and exterior of the building. The building is an attractive structure and the interior view, showing the switchboard and female operators, is quite American.

POOR QUALITY GLASS FOR LAMP BULBS.

The lamp bulbs of a certain incandescent lamp factory in this country have of late been the cause of much complaint and dissatisfaction among users. The glass used is evidently improperly annealed, and the trouble experienced is that as soon as the light is turned on the bulb cracks, and away goes the lamp. There has been so much complaint concerning these otherwise excellent lamps that the makers have been obliged to call in several carloads of these goods in order to make amends. Self-preservation would suggest that this is the best course to pursue, and it is to be regretted that the reputation of any good article should be jeopardized by the use of inferior material in its manufacture.

England, we believe, is the first nation to adopt the use of range finders in connection with guns used in defence of the coast.

A MODEL ELECTRIC PLANT IN A HOTEL.

Thousands of tourists who have experienced the delights of tarpon fishing, boating and shooting in and about Florida waters, will be very much interested in the following description and illustration of the electric light plant recently installed in the Tampa Bay Hotel, Tampa, Fla., by the Eureka Electric Company, of 18 Broadway, New York.



TAMPA BAY HOTEL, TAMPA, FLA.

In every way possible, the comfort and convenience of the guests, as well as that of the employees, have been studied, and every care taken to make this a model hotel plant in all respects.

A number of novelties in electric lighting have been introduced, and a special feature in connection with this plant is an incandescent night lamp; one being placed in each of the principal bedrooms, and so arranged that the occupant can keep it burning all night at such a degree of brilliancy as desired, making it more convenient than gas, and especially desirable in case of sickness, when pure air is of such importance.

All ceiling lights are placed as high as possible, in order to give a better distribution and a more subdued light. The fixtures are arranged for clusters of electric lights, set within a few inches of the plaster, and backed by mirror reflectors. These clusters are controlled by switches set on the casings of the doors, so that a guest may both enter and leave a room while it is lighted.

The music room, dining room and ladies' parlor are very brilliantly lighted. On the ceiling at one end of the music room is a five-point star composed of fifty lamps; at the other end of this room is a large dome, around which there are two circles of lights, 30 in one and 20 in the other, while on the wall back of the stage hangs a 30-light crescent—the emblem of the hotel.

In the ladies' parlor, 70 lights are arranged around the room, studding the cornice, and 20 lights are set in the circle of the dome.

The main dining room, which is roofed with a high dome 60 feet in diameter, is lighted by 245 lamps, all but 40 of which are arranged in three circles around the dome; 133 in one circle, and 36 in each of the other two. The remaining lights (40) are placed on double side brackets around the room.

The total hotel plant consists of 2,500 lights of 16-candle power each, distributed as follows:

Main Building	1,700	Lights
Dining Room	500	"
Kitchen and Servants' Quarters	200	"
Outside Lights and Power House	100	"

The power house is a separate building about 300 feet from the hotel, in which are located the boilers, engines and dynamos. There are three Babcock & Wilcox boilers of 105-horse power capacity each, and two Logan boilers with a capacity of 60-horse power each; three 110-horse power high speed engines made by the Taylor Manufacturing Company, cylinders 13″x15″, and revolutions 270; steam pressure, 90 lbs.; five Loomis automatic incandescent dynamos of 500 lights capacity each; and the switchboard controlling the entire plant.

The foundations for engines and dynamos are laid on a substantial sub'base of concrete, andbuilt of hard burned brick and Portland cement. The durability and firmness of the foundation will be appreciated when it is known that on a test, a nickel was balanced on edge on each of the three engine cylinders, and the vibration occasioned by throwing on and off a full load, was not enough to disturb it.

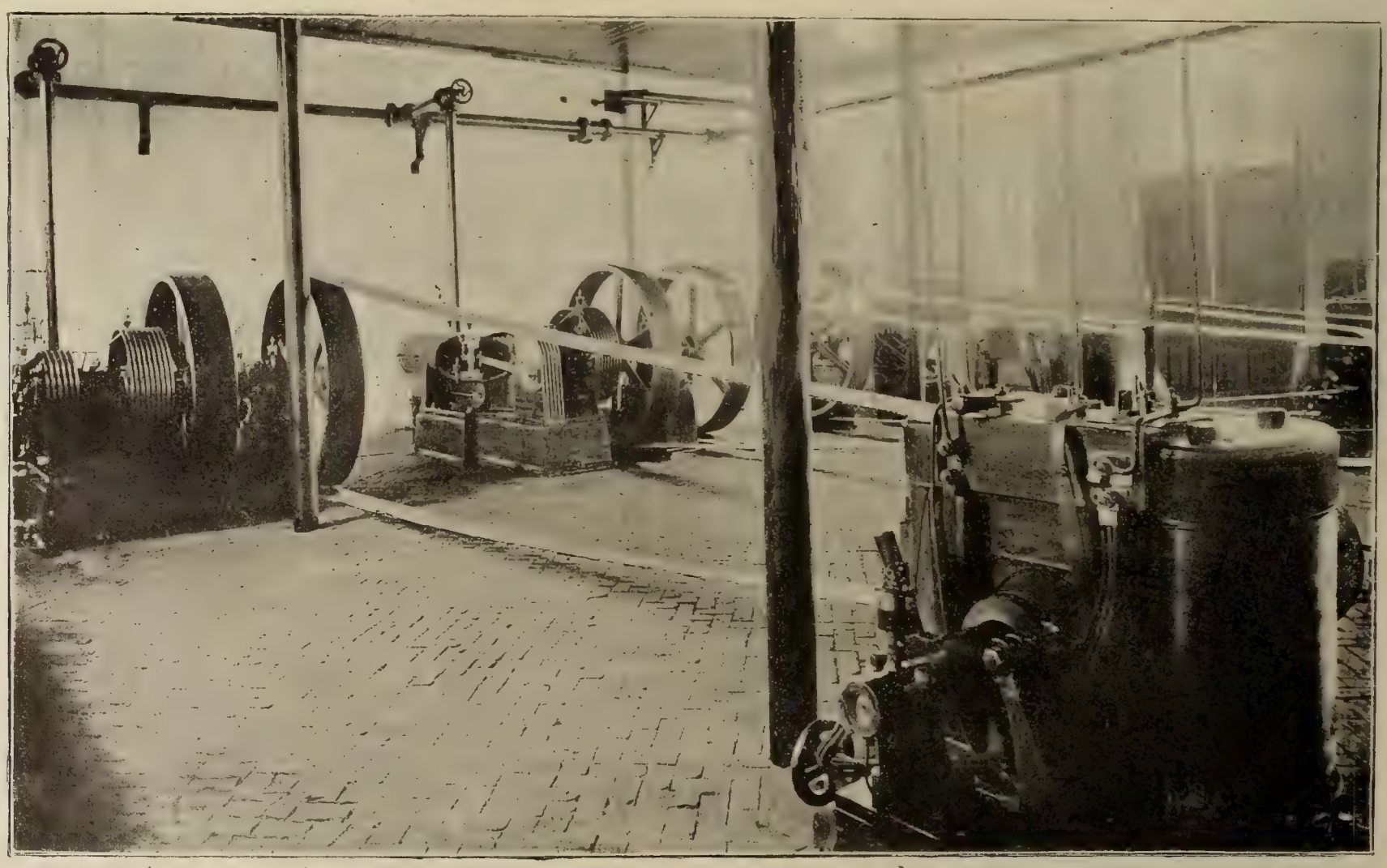
The dynamos are arranged to run either in multiple or singly, using a very unique method invented by Mr. Osborn P. Loomis, and covered by patents. On the top of each dynamo is placed a transfer switch having three contact points, to run the dynamo in multiple, singly, or to cut it out altogether.

The arrangement of "bus" bars and cables is such that when running machines in multiple, the output of one machine passes through the series coils of the next, and by the use of the switches on top of the dynamos, any two or more machines may be run in multiple. Any dynamo can be cut either in or out of multiple, without, in any way, changing the voltage.

No rheostat or other regulating devices are used by the Loomis system, as the dynamos are absolutely automatic and require no hand regulation.

The connections from dynamos to switchboard are made by soft drawn bare copper bars run through porcelain insulators.

The switchboard, which is made of mahogany, contains five Loomis ampere meters, one Loomis automatic ground detector, one direct reading Weston voltmeter, one 7-point voltmeter switch, and twelve plug circuit switches.



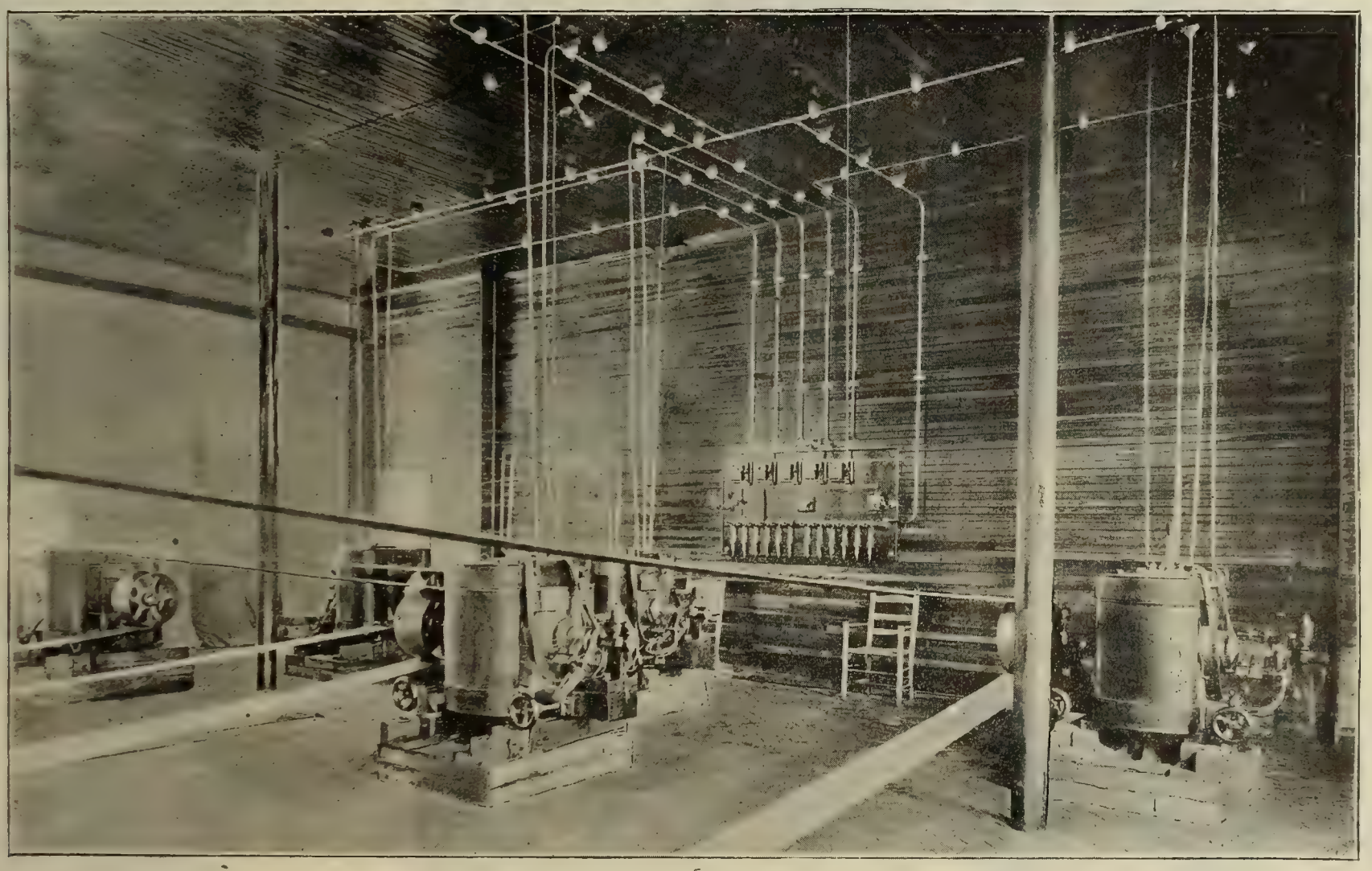
TAMPA BAY HOTEL—ELECTRIC LIGHT PLANT.

The cables from the switchboard to the hotel are run underground in a special conduit, and consist of six circuits of 4/0 cable. The "drop" between dynamos and the farthest lamp, with full load, is 8%, and the difference in potential between any two lamps does not exceed one volt.

Besides the lighting plant, the Eureka Electric Company has installed all the electric bells; furnishing a 400-drop annunciator, made of mahogany and beautifully carved. The wiring has been done in such a manner that at any future time, telephones can be substituted for call bells.

Grimshaw white core wire has been used throughout for electric lighting, and, including the bell work, over 60 miles of wire have been used in the installation of this plant.

The Tampa Bay Hotel is the only fireproof hotel built for the season or tourist travel in the United States and is most sumptuous and liberal in its appointments, accommodations and furnishings. It was designed by J. A. Wood, of New York, architect of several other season resort hotels both North and South.



TAMPA BAY HOTEL—SWITCHBOARD AND LOOMIS DYNAMOS.

LONG DISTANCE TELEPHONY IN EUROPE.

When the City and South London Railway was inaugurated, says the London *Electrical Review*, schemes for similar undertakings were advanced in Austria-Hungary, Germany, and Belgium. By a peculiar coincidence, the successful completion and commencement of the London-Paris telephone service has caused, with one exception, the same continental countries to advance projects of a like nature—in the case of telephony. One scheme is for the establishment of telephonic communication between Berlin and Vienna, and another for a similar connection between Ostend and London.

In German official circles it is announced that the German and Austrian Governments have arrived at an understanding regarding the institution of a telephone service between Berlin and Vienna, which is to be effected before the termination of the present year. Berlin is already connected as far as the town of Zittau on German territory, and in order to complete the proposed Berlin-Vienna line it will only be necessary to extend the service from Zittau to Reichenberg, and from Reichenberg to Vienna, *via* Prague.

In Belgium the large commercial and financial firms are asking whether it would not be advisable to establish telephonic communication between Ostend and London by means of a submarine cable from the former to Dover, and from the latter town to London by a land line. The Post and Telegraph Department is already considering the question, but, before any definite action is taken, the working of the Paris-London line will be closely watched, so that the Belgians may profit by the experience which will accrue through the operation of this service. It is believed that notwithstanding the great expense incurred in bringing the Anglo-French telephone line to a successful issue, the service will, seeing that 10 francs ($2) is now charged for three minutes' conversation, be commercially successful.

It is proposed either to ask the English and French Governments to grant permission for a trial to be made to speak from Brussels to London, *via* Paris, or to allow of a supplementary circuit to be joined to the Calais-Dover cable, whilst Brussels would be connected with Calais by an overhead line, or to lay a cable from Dover either to Ostend, Nieuport, or to La Panne. Four towns are particularly interested in the provision of direct communication with London. These are Antwerp, Ghent, Verviers (which have daily business relations with Manchester, London, Birmingham, Liverpool, and Glasgow), and lastly Brussels. It is estimated by the Belgian Post and Telegraph Department that the cost of establishing the service could be covered.

If the proposed Brussels-London line be successfully carried out, a telephonic service is projected between Holland and Belgium, This would place Antwerp in direct communication with Rotterdam and Amsterdam, and Amsterdam with Paris *via* Brussels.

THE AMERICAN ASSOCIATION OF INVENTORS AND MANUFACTURERS.

One of the main objects of the public commemoration of the Patent Centennial in Washington, on April 8, 9 and 10, was successfully accomplished on the afternoon of the 10th. The organization of "The American Association of Inventors and Manufacturers" was effected, and the following named officers elected:

President, Dr. R. J. Gatling, of Hartford, Conn.; First Vice-President, G. G. Hubbard, of Washington, D. C.; Second Vice-President, Thos. W. Shaw, Philadelphia; Third Vice-President, Prof. Wm. A. Anthony, Manchester, Conn., President of the American Institute of Electrical Engineers; Fourth Vice-President, Hon. Benj. Butterworth, of Ohio; Secretary, Prof. J. E. Watkins, Washington, D. C.; and Treasurer, Marvin C. Stone, Washington.

Included in the Board of Directors are Charles F. Brush, of Cleveland and David G. Weems, of Baltimore.

The objects of the association are the promotion of progress in the useful arts; the diffusion of practical, scientific and legal information respecting inventions; the encouragement of favorable and the discouragement of unfavorable laws respecting property in patents; the co-operation of foreign inventors for reciprocal regulations under foreign patent systems, and the proper, just and adequate protection of the rights of American inventors authorized by the Constitution of the United States.

The "grip" is no respecter of professions or trades, and the electrical fraternity has contributed its quota of victims. Many of the lights of the first and lesser magnitudes in the electrical firmament have been disabled temporarily by the common malady, but, as far as we know, there have been few or no fatal results. This fact cannot well be attributed to the electrica condition of the patient, but rather to the fact that because he is concerned in electrical affairs he has the will force or resistance necessary to conquer all obstacles. The "grip" is an unknown quantity and it is gradually being eliminated.

Charging Accumulators.—When a dynamo is charging the storage cells, the E. M. F. on the wires is raised at least ten per cent., and this may cause injury to, or may break the lamps. This rise of pressure is of no consequence, when charging ceases before lighting hours, but in general there is no certainty of this being done. Therefore, measures have to be taken to keep at all times the E. M. F. within the proper limits on house mains.

THE TELEPHONE EXCHANGE IN TOKIO, JAPAN.

The progressive spirit of the Japanese is well-known, and they are fast adopting the methods of Christian countries. Electricity is rapidly coming into favor in that country, and in some of the Japanese cities the electric light is as familiar to the populace as it is in our cities and towns.

In our issue of March 14th last, we published some intelligence from our correspondent in Tokio, Japan, which bore abundant evidence of the enterprise of the people in that country in the matter of electric lighting.



FIG. 1—EXTERIOR VIEW OF THE TELEPHONE EXCHANGE, TOKIO, JAPAN.

Many young Japanese are studying electricity, and no doubt Japan will, before many years have elapsed, show very creditable progress in the knowledge and application of electricity in all its branches.

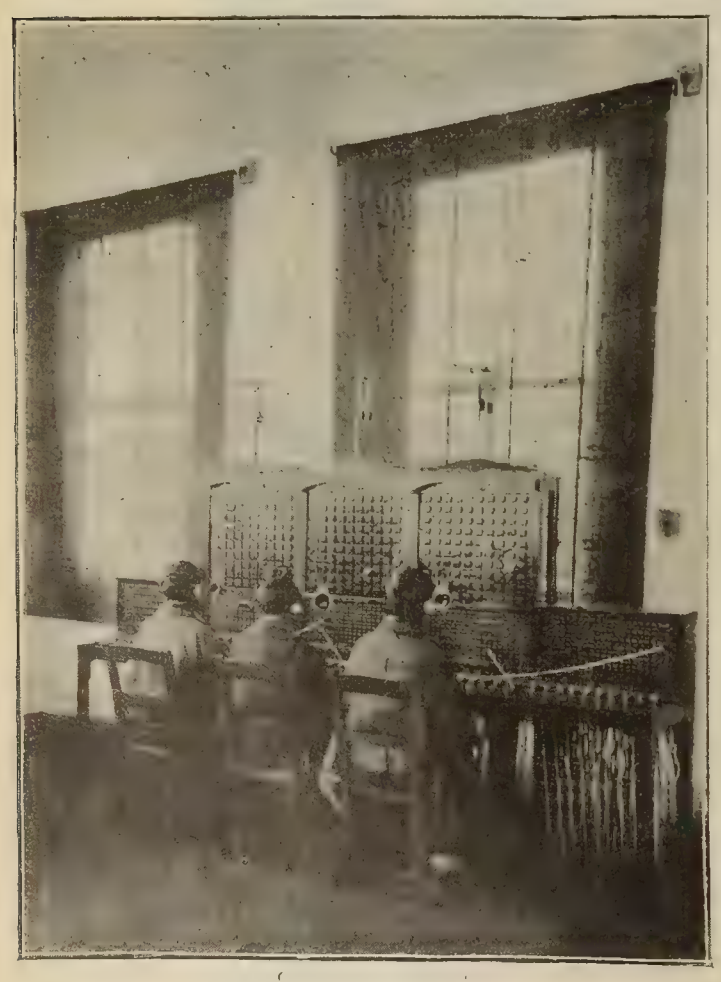


FIG. 2—SWITCHBOARD, TOKIO, EXCHANGE.

The telephone in Japan is a rapidly growing institution. The people of Tokio, the capital, are now familiar with the telephone, and its usefulness is being more and more appreciated.

In the city of Tokio the telephone exchange is one of the milestones marking the advancement of eastern ideas and inventions in Japan. Our correspondent has sent us photographs of the Tokio exchange, giving exterior and interior views of the building.

Fig. 1 shows the exchange as it appears from the outside. The building, it will be noticed, is one story in height, and no part of it is used for any other purpose than that of the telephone service. It is substantially built, and in its architecture it is hardly what a person living in Christian countries would expect to find in Japan. But architecture, as well as everything else in Japan, is undergoing a metamorphosis, and the exchange building in its design we see is more in keeping with the modern invention of which it is the centre and heart. The only thing about the locality that is suggestive of the Occident are the Japanuse characters on one of the gate posts. The building is well situated for the purposes for which it was erected, being located handy to the business district of the city. There is plenty of light, the lack of which is severely felt in many of our own exchanges.

Fig. 2 shows the switchboard, at which are seated three young Japanese women to answer calls. Either through the characteristic modesty of Japanese women, or the embarrassment and oversight of the photographer, we are deprived of a view of the faces of these young women. The board, as will be seen, is divided into three sections, and is equipped with all of the latest improvements for facilitating telephonic correspondence.

This exchange, our correspondent states, is growing rapidly, and the system is working with admirable success and satisfaction.

Our view shows but one side of the room. The room is a very large one, and airy, and it is evident that the Japanese appreciate the value and importance of air and room in such establishments as the one under consideration.

Particular attention is paid to the stringing of the telephone lines in Tokio. This work is done in the best manner possible, and the finished appearance of the pole outside of the exchange building, as seen in Fig. 1, shows that the builders of the lines knew how to do their work in a substantial manner. There are now 266 Telephone subscribers in Tokio.

With real electro magnets there is always lateral leakage.

ELECTRIC BELLS—THEIR CONSTRUCTION AND APPLICATION.

BY THOMAS R. TALTAVALL.

ANNUNCIATORS.

It is but a step from the electric bell to the annunciator.

An annunciator is a piece of apparatus included in a bell circuit on which there are several push buttons, and is for the purpose of indicating the location from which a call comes.

Annunciators are employed for a variety of purposes. In hotels they are used for indicating the number of the room from which a signal is sent. By pushing the button in a room, the bell on the annunciator rings, and at the same time, a drop

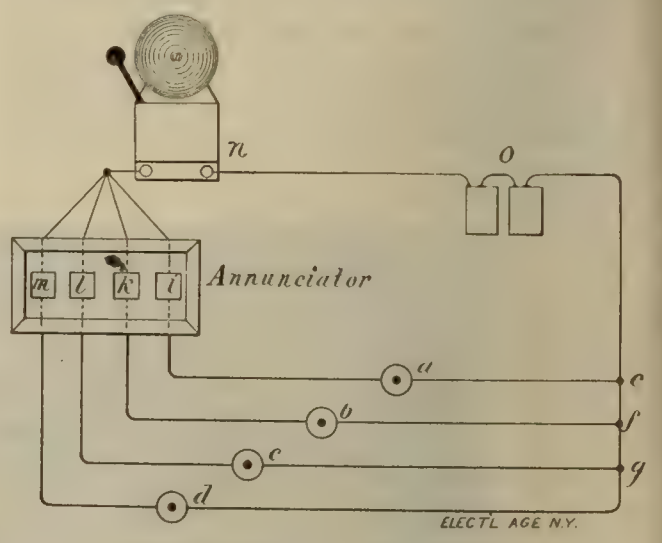


FIG. 1—ANNUNCIATOR CIRCUIT.

or a needle on the face of the annunciator is operated, revealing the number of the room from which the signal was given. Annunciators may be used in the same manner in houses, factories, etc.

Fig. 1 shows the general arrangement of annunciator circuits. The annunciator shown has four drops. There are four push buttons included in the system and as many independent circuits. There is one push button for each circuit, and the push buttons may be placed in any room in the building and in any desirable position, the diagram, (Fig. 1) being intended merely to show in as clear a manner as possible, the connections, without reference to the relative locations of the parts.

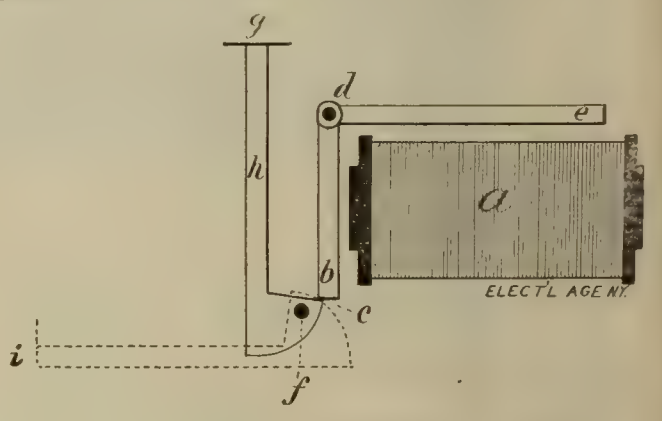


FIG. 2—DETAILS OF ANNUNCIATOR DROPS.

In planning an annunciator circuit, some few things should be remembered.

First, there should be as many drops or needles on the annunciator, as there are to be push buttons.

Second, one battery is sufficient to operate the entire system; this may embrace two wires or 200.

Third, each push button must have an independent wire running directly to its proper drop or needle on its annunciator.

Fourth, a common return wire may be used, as it saves a good deal of wire, particularly if the distance between the push buttons and annunciator is great.

Referring to Fig. 1, it will be noticed that there are four push buttons *a*, *b*, *c* and *d*. The circuits are run in the following manner:

Starting from the battery *o*, run one wire to take in the push button farthest away from the annunciator, and at the same time, run it as near

as practicable to the places where the other push buttons are to be located; then run the wire to any one of the drops on the annunciator. Next carry the wire to the bell, thence to the opposite pole of the battery; we will thus have a complete circuit. Now to run the second circuit, *c*, for instance, make the connection with the first wire run, at *g*, and run the wire to the push button *c*, thence to the drop *l*, and from there to the bell where the first wire is connected. The balance of the circuit to the battery is completed by the original wire, which is used as a common return.



FIG. 3—DROP ANNUNCIATOR.

Let it be borne in mind, that that portion of the first circuit from the point *n* on the bell to *e*, including the battery, is used as a common return for all the circuits.

Push buttons *b* and *a* are connected to the original wire at *f* and *e*, respectively, in like manner, and the wires run to their proper drops on the annunciator; then to the common connection on the bell.

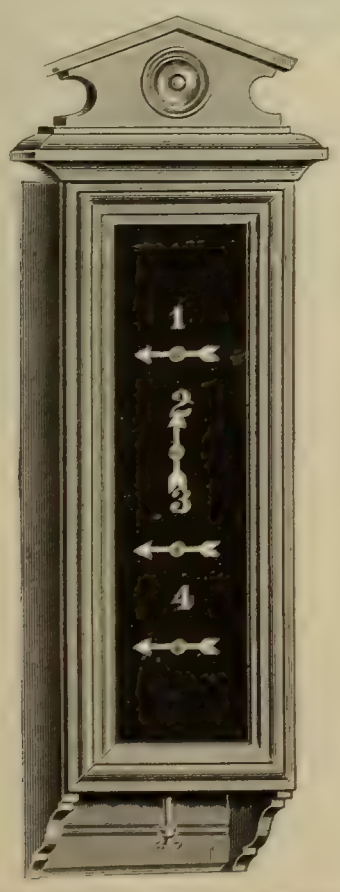


FIG. 4—NEEDLE ANNUNCIATOR.

It is evident that when any one of the push buttons is closed, the circuit will be completed through the drop to which that particular wire is connected, and the location of the push button so operated will be indicated on the annunciator. Closing push *d* will of course cause the drop *m* to act; *c* will drop *l*, *b* will act on *k* and *a* on *i*.

Now we will consider the drop itself in detail. The rest of the circuit is simply a duplication of the ordinary call bell circuit, as described in preceding articles.

Fig. 2 shows the general construction of a drop as used in annunciators. *a* is an electro-magnet (one spool) of the ordinary type; *b* is the armature which is bent at *d* so as to form a right angle, the other arm of which is indicated at *e*. The armature is pivoted at *d* so that when the current passes through the magnet the armature *b* is attracted toward the pole, while the arm *e* by the same influence is raised. *e* is somewhat longer than the arm *d*, being in consequence, heavier than *b*. As soon as the current ceases, the weight of *e* causes the armature *b* to return to its normal position. In this application the action is similar to that of a retractile spring; *h* is a movable lever pivoted at *f* and is held in an upright position by the end of the armature arm *b* at the point *c*. When the current flows through the magnet, it draws the arm *b* towards the pole, thus unlatching the lever *h* which by gravity drops to the position shown by the dotted outlines.

At the upper end of the lever *h* is attached a flat piece of metal *g* with its flat surface facing upward. To *g* is attached a card bearing the room number, or other proper designation, and as the lever falls to the position shown by the dotted outline, the card on *g* is presented at the proper opening in the glass front of the annunciator case, in the position shown at *i*. After the location of the signal has been noted by the attendant, the lever *h* is restored to its upright position by a little handle which is usually provided at the side of the annunciator case. As the lever *h* is approaching the upright position, the cam arrangement at the base, presses the armature *b* slightly toward the pole of the magnet, and when the lever reaches its upright position the armature *b* assumes its normal position and at the same time locks the upright lever *h* into position. The lever can only be released by the passage of the current through the magnet, which draws the armature toward the pole, thus unlatching the lever.

All annunciator drops are not constructed on this plan. The one shown is just a sample. The general principles, however, are the same in all, the differences being mainly in the details of construction.

The needle indicator is practically constructed in the same manner, but in the place of the drop a needle is so arranged as to point to the number of the room sending the signal.

Referring to Fig. 1, the four squares shown on the annunciator *m*, *l*, *k*, *i*, would be filled with the number on their respective drops when the corresponding push buttons are closed.

This illustration, of course, is only intended to give a general idea of how the circuits are run to annunciators.

Some annunciators have drops running up into the hundreds. The bell usually forms a part of the annunciator case, but it is shown independently in the diagram in order to give a better understanding of how the circuits are run.

(*To be continued*).

FOREIGN NOTES OF INTEREST.

A Nürnberg firm advertises that it is prepared to deliver cables for high tension electric currents up to 10,000 volts.

It has been decided to arm the sea front at Portsmouth, England, with guns to which range-finders will be fitted. It is also proposed to fire them by electricity.

The City and South London Railway on Easter Monday, carried 25,000 passengers.

It is proposed to lay an underground telephone cable between Munich and Berlin.

PHOTOMETERS.

Photometric measurements up to about 6 to 10 per cent. are very easily made, and the apparatus required is of the most simple character. A greater accuracy is only to be obtained by carefully screened instruments or the use of a dark room, together with considerable practice and training.

The two most simple photometers are those of Bunsen and Rumford. The essential part of the former is generally a piece of white paper with a grease-spot. When this is brightly illuminated

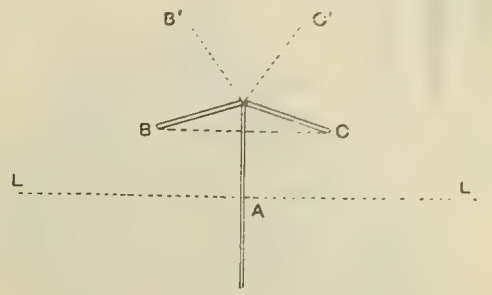


FIG. 1.

on one side, the grease-spot seen from that side appears to be darker than the rest of the paper. Seen from the other side, it appears brighter. In the former case, the difference in tint between the spot and the surrounding paper is practically the same from whatever angle it is seen; but in the latter the spot appears brighter as the eye is brought into a line with the light behind it. It would seem at first as though the grease-spot would disappear when the illumination is the same on both sides. But it is clear that the light falling on the paper screen is affected in three different ways—reflection, absorption, and transmission; and it is the absorption which introduces the difficulty. In practice it is usual to arrange

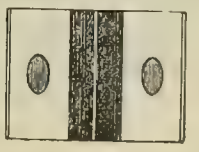


FIG. 2.

two mirrors inclined at such an angle that the two sides of the screen may be seen simultaneously. Then, whatever may be the relation between the reflection, the absorption and the translucency, it is sufficient to adjust the screen until the reflected images appear to be identical.

The plan of the arrangement is shown in Fig. 1. *a* is the screen, *l l* the axis of the light, or the line joining the two sources of illumination; *b* and *c* are two mirrors, in which reflections of the screen appear as if at b^1 and c^1. The projecting sides of *b* and *c* throw a shadow on the screen. Fig. 2 shows the appearance of the reflections, the two images of the grease spot being separated by the shadow. In order to avoid this a prism has been used. Two images of the screen *a* (Fig. 3) are seen through the prism *b*, as shown by the dotted lines. The images are, however, necessarily very much foreshortened. In either case the arrangement is symmetrical, and the images are equally inclined to the eye.

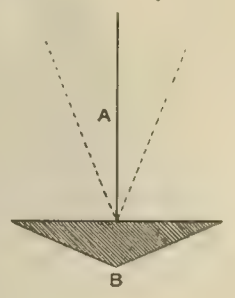


FIG. 3.

For ordinary laboratory work the screen is enclosed in a blackened tube, which shuts out all stray light; and this tube is mounted upon a carriage sliding or running on wheels on a graduated bar. A pointer for reading the scale is covered by a hinged door, in order that the observer may not be biased while making an adjustment.

If the scale be visible there is always a temptation to look at it and to make the reading approximate to a previous one, or to some preconceived value.

The illumination varies inversely as the square of the distance of the screen from the light. If the screen is found to make a balance when it is situated at 25 inches fron one end of a 100-inch bar, the lights being 100 inches apart, one is nine times as powerful as the other, the screen being,

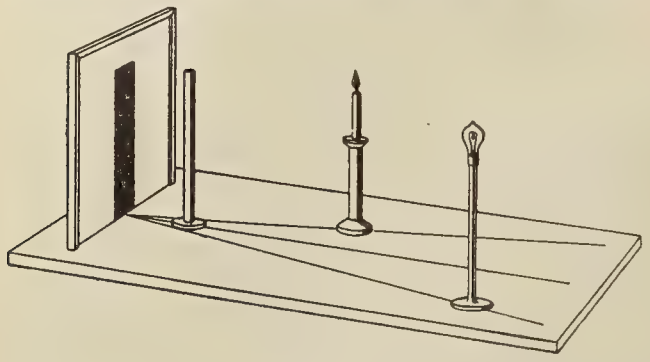


FIG. 4.

of course, nearer the lesser light. If a balance was found at 20 inches, the ratio of the lights would be as 16 to one, or as the square of 80 is to the square of 20.

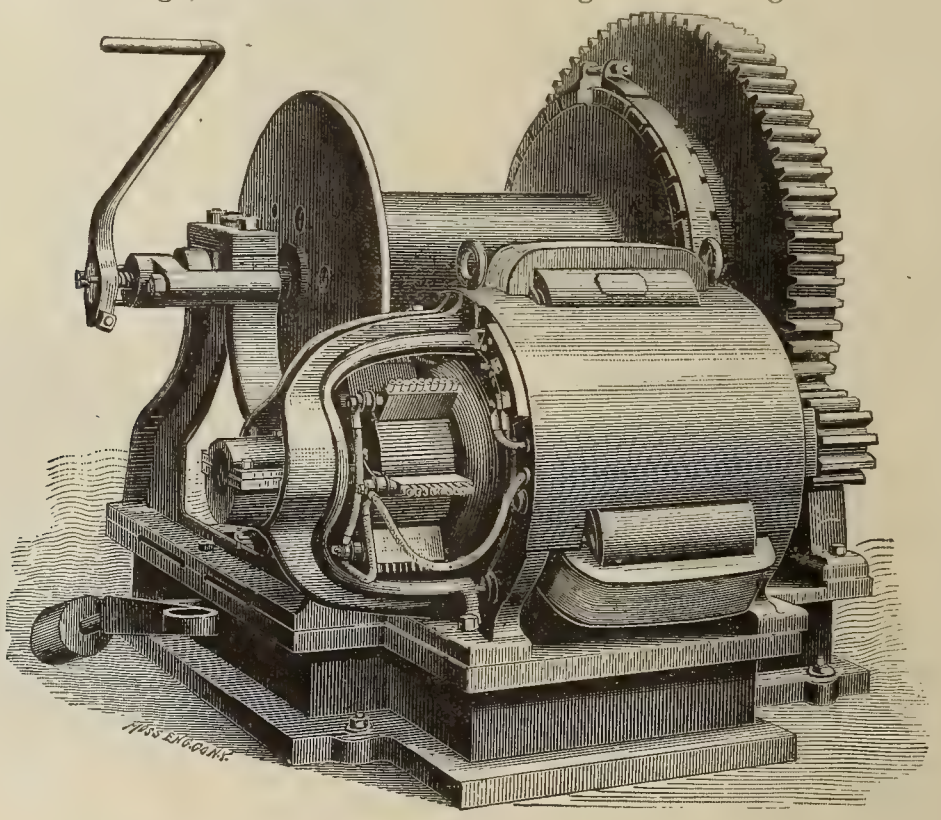
The Rumford photometer is not so common as the Bunsen, but it possesses several important advantages. It consists of a screen and a rod (Fig. 4). The two lights to be compared are so arranged that they cast two shadows side by side upon the screen. The distance of the rod from the screen does not affect the calculation, and it should be so arranged that the shadows exactly meet without overlapping. The two tints to be matched falling next to each other, a considerable degree of accuracy is possible, and the observation does not depend on the angle at which the screen is seen, nor are any mirrors or restricted view necessary. A modification of this is the Bouguer or Foucault photometer, in which the rod is replaced by a partition, which allows one side of the screen to be illuminated by one light only. The partition is capable of adjustment, by which the junction of the shadows may be arranged. The screen is translucent, and may be made of opal glass or paper.

PERRET SINGLE REDUCTION ELECTRIC HOIST.

The introduction of the Perret slow speed multipolar motor a year or so ago, marked a new era in the history of electric power, and the remarkable success attained by this motor has resulted in overthrowing the very general opinion which at that time prevailed, that slow speed multipolar motors were impracticable. These motors have since been applied to almost every conceivable kind of work requiring single reduction or direct gearing, and have proved a decided success in every instance.

We illustrate herewith an electric dock hoist brought out several months since by the Elektron Manufacturing Company, of Brooklyn, N. Y. This is a piece of machinery where single reduction is particularly desirable on account of the saving in space, noise, friction and consumption of current. The motor is a 15 horse-power Perret Multipolar, making 450 revolutions per minute, geared by a gun-metal pinion to a 38″ gear on the drum shaft of hoist. The drum is 1 ft. in diameter, giving a speed on hoisting rope of a little over 200 ft. per minute.

The motor is shunt wound and drives the gear wheel at a constant speed, which may be increased, if desired, by the introduction of resistance in the field circuit. By depressing the hand lever the hoisting drum is forced against a friction device revolving with the gear wheel, and lifts the load, its speed varying with the pressure on the lever. To lower the load the foot lever is depressed and the hand lever raised. The whole machine is very compact and simple and is built to stand rough dock usage. The motor is water-proof and has all the latest improvements.



PERRET ELECTRIC HOIST.

EXHIBITION OF PRIMARY BATTERIES.

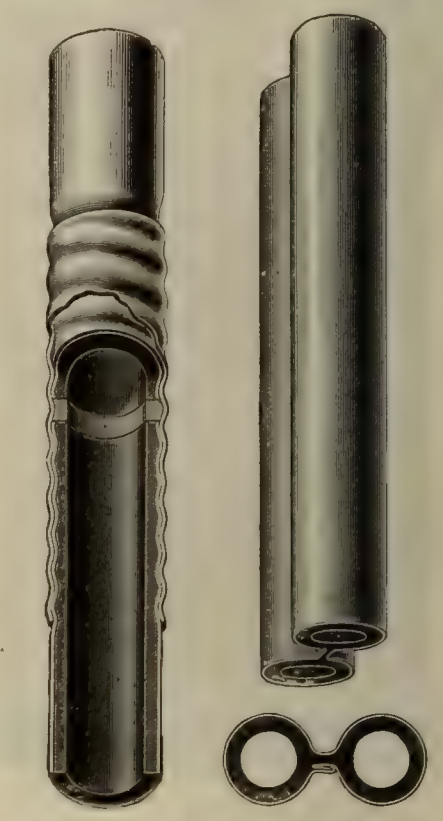
Mr. Chas. J. Hubbell, the inventor of the Hubbell primary battery described in our issue of February 21st last, gave an exhibition of his batteries April 17, at 13 Park row. There was a two-cell battery running an Edison phonograph; eight cells working a C. & C. motor fan, and a number of 13 c. p. lamps lit to nearly full incandescence by eight-cell batteries. A complete battery of eight cells, including the case, did not take up much more space than two ordinary gravity cells. The eight-cell battery attached to the C. & C. motor had an E. M. F. of fourteen volts after being short circuited through an ammeter for fifteen minutes. The current was eight amperes during the first five minutes the cells were on the ammeter, then went to 8.25 and stopped at that point during the balance of the test. The other eight-cell batteries gave fifteen volts and eight amperes. The cells had been in use several hours before being tested.

A large number of gentlemen called during the day to witness the performance of the battery. Among these were several well-known financiers and insurance officers.

The resistance of copper wire increases .21 per cent. for each degree F. as the temperature rises.

A NEW FORM OF INTERIOR WIRE CONDUIT.

Hardly a week passes but that we are called upon to illustrate some article of manufacture or electrical appliance designed and placed upon the market by the enterprising and energetic Interior Conduit and Insulation Company, of 16 Broad street, New York. We illustrate in this issue a new form of their well-known Interior Conduit. The Company has been frequently called upon to furnish a metal-covered tube for decorative purposes, extra protection against mechanical injury, absolute fire proofing and protection against the delterious action of cement.



NEW FORM OF WIRE CONDUITS.

Fig. 1 illustrates the perfection of the metal-covered tube. The company's well known interior tube is drawn through a die and an outer covering of either brass, steel or iron drawn upon it fastened and securely sealed by an ingenious lapping of the seam. The tubes are joined together by their well known screw couplings. In order to guard against any liability of moisture or condensation providing a leak to the outer covering of the tube, a pliable washer is inserted between the two abutting ends of the tube, as shown in the illustration, Fig. 1.

Fig. 2 illustrates two separate tubes covered with one piece of metal drawn on as the one above described. This double tube will be made in sizes one-quarter and five-sixteenth inch inside diameter. It will be found very useful as a substitute for moulding, and will be used largely for exposed work. It is needless to say that both of the above tubes may be highly polished or finished in any color metal.

PERSONALS.

Mr. J. H. Williamson, of the Manufacturer's Advertising Bureau, Liberty street, has the heartfelt sympathy of his many friends in the loss of his wife by death.

Mr. Wm. B. Vansize, Patent Lawyer and Electrical Expert, has moved to the new Edison Building, No. 44 Broad street, N. Y.

AN EXPLANATION.—In our last issue we gave Mr. Thomas G. Roebuck the credit of being the inventor of the Insulite lamp socket described and illustrated therein. On seeing this statement Mr. Roebuck hastened to our office to explain that he is not the inventor of this valuable device, but that all honor for the same is due to Mr. Alfred Swan, of England. It was through inadvertance that Mr. Swan's name was omitted in this connection, and Mr. Roebuck's substituted therefor.

TIMING AND DATING STAMPS.

We illustrate below some very ingenious labor and money saving machines placed on the market by the Automatic Time Stamp and Register Company, 71 Sudbury street, Boston, that will be appreciated by bankers, brokers and those having charge of a large number of employés, as a rapid and reliable means of recording the time and date of all transactions.

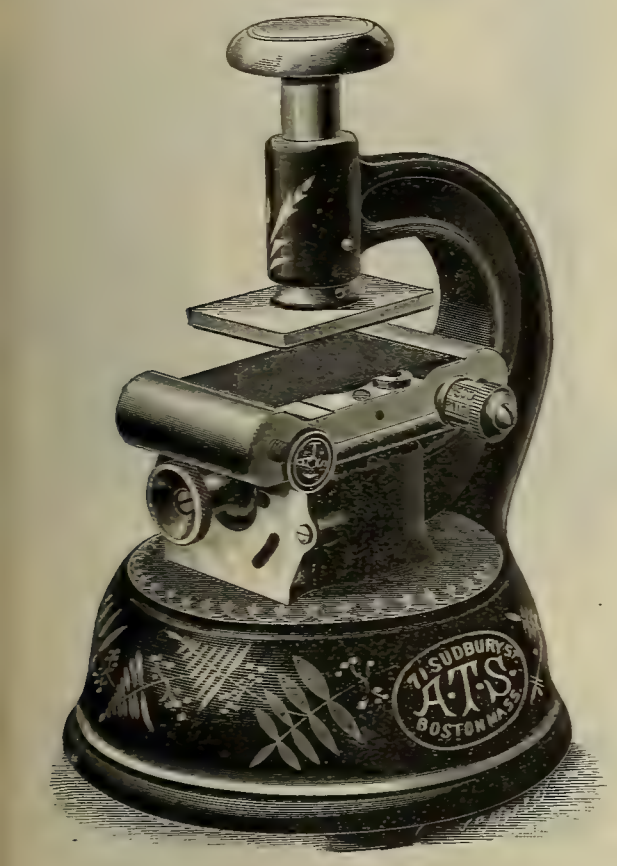


FIG. 1—TIMING AND DATING STAMP.

Fig. 1 shows the form as designed for bankers and brokers, notaries, attorneys and general office use, and it prints at one impression the name and address of the owner, the character of the transaction, the hour and minute at which the transaction occurred, the day of the month, the month and the year, as is shown in Fig. 2. The clock used in this stamp is made by the Seth Thomas Company, is double jewelled, and is a good time-keeper.

The instrument itself is well made and perfectly reliable in its operation. It is handsomely finished in nickel plate and enamel, and is an ornament to any desk.

A unique application of this timing and dating stamp is seen in our other illustrations which show a simple and effective method of recording or registering the time, attendance or performance of employés. The Automatic Time Stamp and Register Company is introducing the system in a large number of establishments in which the arrival and departure of employés is a matter of moment. Every large corporation that employs a timekeeper knows by experience that no matter how careful the timekeeper may be, trouble is continually caused by the disputes about the non-registration of the time of employés.



FIG. 2—STAMP RECORD.

The Employés Time Register, an illustration of which is given herewith, makes no mistake, is always on time, and continually on duty. Having neither friends to favor or foes to punish, it dispenses equal justice to all. It does the same work whether the employer is present or absent, and it benefits both the employer and employé, because the latter's time of arrival and departure are made a matter of record by his or her own act, and consequently, disputes with reference thereto, are entirely prevented. It stands a silent sentinel noting the hours of work done, reliably and automatically, without drawing a salary from its employer, but on the contrary adding to his profits the savings effected by its unceasing vigilance and faithful service.

In this system a card delivering machine is used in conjunction with another machine which receives the cards and imprints upon them, the exact hour and minute, the day, the month and year of their reception.

The card delivering machine shown in Fig. 3, is a locked box or receptacle of thin metal, mounted on a wooden base, in which the cards, consecutively numbered, with a weight upon them to hold them down, are placed. The box is hung upon pivots at its upper end, so that it may be

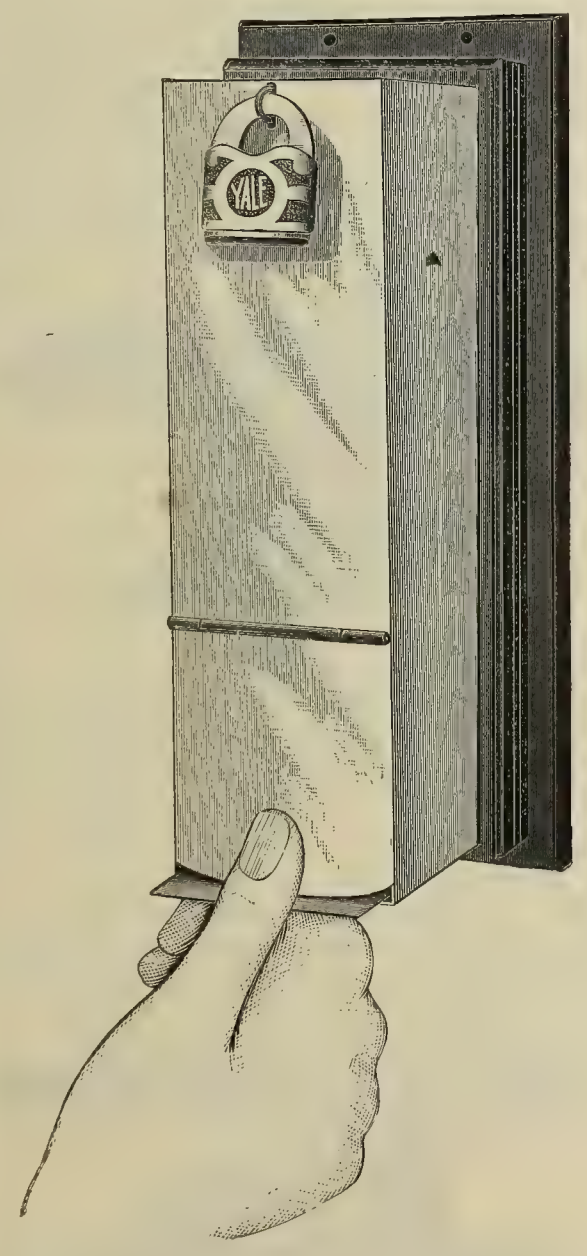


FIG. 3—CARD DELIVERY MACHINE.

bodily pushed or pressed inward against a spring strong enough to force it back against a stop as soon as the inward pressure ceases.

At the bottom of the box in front is a slit just large enough to allow one card to pass out at a time, while directly opposite is an opening which permits a thin piece of metal to enter, and, by pressing against the bottom card whenever the box is pushed or pressed inward, shoves it forward through the front slit into the grasp of the operator as shown in the cut.

The card-receiving and printing machine, Fig. 4, consists of an iron box or case, hinged upon its back, in the top of which is a card-receiving slot; and it has a door on its front side, in the upper part of which a circular piece of glass is fixed. This box contains an automatic timing and dating stamp, so constructed and arranged that the hands and face of the stamp clock are visible through the glass in front.

The end of the lever for operating the stamping platen is shaped like a hook, and is carried through the box door in order that the stamp may be easily worked from the outside of the box.

The employé, wishing to register his arrival or departure, presses the card-delivery box inward and pulls out a card. Upon it he writes his name and then drops it into the slot in the top of the receiving box. The card being now supported in the proper position to be printed, the employé gives the stamp operating hook a sharp, quick pull, which imprints the card with the date, hour and



FIG. 4—CARD RECEIVER AND PRINTING MACHINE.

minute as shown in Fig. 5, and causes it to fall to the bottom of the box, from whence it can only be removed by unlocking the door.

If the system is properly used, the consecution of the numbers on the cards and the time imprints will coincide exactly, and a failure to do so will indicate that a card has been taken from the delivery box and, instead of being immediately deposited in the receiving box, as it should have been, has been withheld for a time for some purpose.

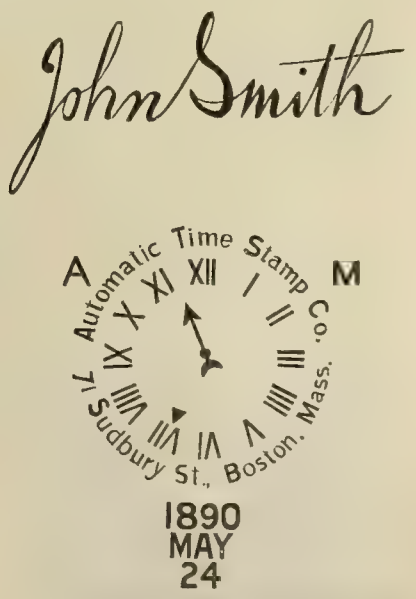


FIG. 5—EMPLOYEES TIME RECORD.

The cards are made especially for the service, and are furnished in packages of one hundred consecutively numbered.

No dynamo, whether it be shunt or series-wound, ought ever to be short-circuited; but in the latter case the danger of total destruction is greater; therefore it is a good plan to introduce a "cut-out" in the field magnet circuit, which will open the circuit if the current becomes excessive.

BARBER SHOP ELECTRIC INDICATOR.

Mr. S. P. Watson, of Brooklyn, N. Y., has invented and patented an indicator for use in barber shops, which is very convenient for all who patronize such establishments. It consists of a frame having a glass twenty-six inches square, on which are painted in a circle numbers from one to fifty, and a pointer pivoted at the centre of the circle, which in its circular movements directs attention to the numbers on the glass. At the rear of the frame is an electro-magnet, which in addition to ringing the bell, operates the pointer on the dial by means of a pawl and ratchet movement to which the pointer is attached.

Connected with the apparatus, which may be placed in any convenient position so that it can be seen by all in the room, are as many push buttons as there are barber chairs. Each push button may be placed in any convenient position so that it can be easily rung by the barber. When a customer

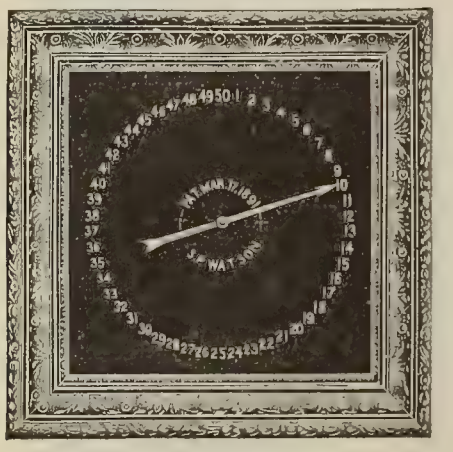


FIG. 1—DIAL OF BARBER SHOP INDICATOR.

enters the shop he will be given a check, the number on which corresponds with one of the numbers on the dial. This check indicates that when the pointer on the dial reaches that number, the holder's turn has come to occupy the chair. For instance, supposing a person receives check No. 25 and the pointer on the dial indicates No. 20, it is evident that four other customers are to come before No. 25. As the chairs are vacated the bell is rung which notifies the holders of the checks in their proper turn.

One of the advantages claimed for the use of this apparatus is that the holder of a check does not lose his turn in case he should absent himself from the shop for a few minutes. In warm weather the customer can, after getting his check, remain out of doors if he so chooses—he simply has to keep his eye on the register, which usually may be seen from the sidewalk, and when his number is reached he comes in and takes his place in the vacant chair. This invention will also avert the disputes which frequently occur in barber shops as to who is entitled to the next turn. The holder of the check knows beyond all question when his turn has arrived, and there is no room for dispute or doubt. It will moreover, save the barber himself considerable embarrass-

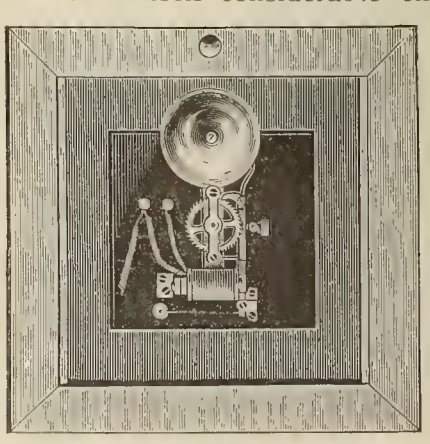


FIG. 2—MECHANISM OF INDICATOR.

ment and possible ill-feeling which is likely to result when he is called upon to decide these misunderstandings, as each barber after serving a customer touches a push button located in front of his chair, which rings the bell, moves the pointer on the dial ahead one number, and calls for the customer holding the check with the corresponding number to that pointed to.

Fig. 1 gives an illustration of the dial and frame, and Fig. 2 is a rear view showing the mechanism. The apparatus is extremely simple and has been in operation for some time in two of the largest barber shops in Brooklyn, at 76 Sixth Avenue and 106 Seventh Ave., owned by R. Neuman. The customers of the establishments speak highly of the machine, and say it is a great convenience.

The simplicity and low cost of the apparatus commend it to general use in barber shops and no doubt it will very soon pay for itself in averting ill-feeling and facilitating work in such establishments. That portion of the public requiring the services of the barber will no doubt appreciate this invention.

REVOLVING DISPLAY STANDS.

The success and satisfaction that has attended the sale of the turntables for displaying goods, introduced by Frederick Pearce, 77 and 79 John street, New York, successor to the firm of Pearce & Jones, is an endorsement of their worth and value for this purpose. Turntables of different forms can be seen everywhere, in windows, glass cases, and on counters, displaying all kinds of goods to the best advantage.

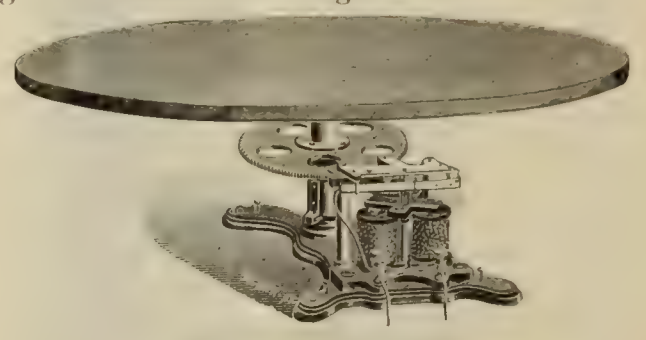


FIG. 1—DISPLAY STAND.

As will be seen from our illustrations, there is no winding up of clockwork; no expensive springs to renew, and no necessity of support from the top. They can be made any height; and, as the mechanism is simply an electric motor, it runs steady and uniformly.

Fig. 1 shows one of these useful mechanisms. It consists of a table of stained black walnut, directly geared to the armature shaft of the motor by means of a cog wheel.

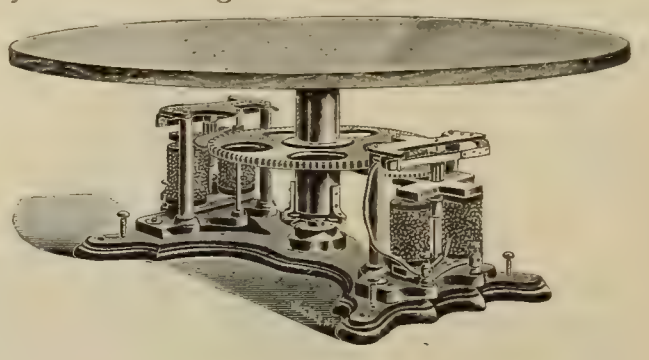


FIG. 2—DISPLAY STAND DRIVEN BY TWO MOTORS.

Fig. 2 shows the same style of table driven by two motors, and is capable of carrying 150 pounds, with but four cells of battery.

The tables are made in any shape, form or height to suit the requirements of the class of goods to be displayed.

Fig. 3 shows the motor used to revolve the table. The armature is of the shape of a Greek cross, and is made of one piece of metal. Its shaft, as will be seen, is placed in a vertical position, at the upper end of which is a small cog-wheel, which engages with a larger one. As the armature revolves, the motion is transmitted through the gearing to the turntable. The motor, while very simple in its construction, is very serviceable and reliable. There being so few parts in its construction, it is not easily put out of order, and as long as the battery power is provided the motor may be depended upon to do work satisfactorily.

The turntable makes two revolutions in one minute, and the total running expenses for one year of the style shown in Fig. 1, is at the average rate of two cents per day for ten hours.

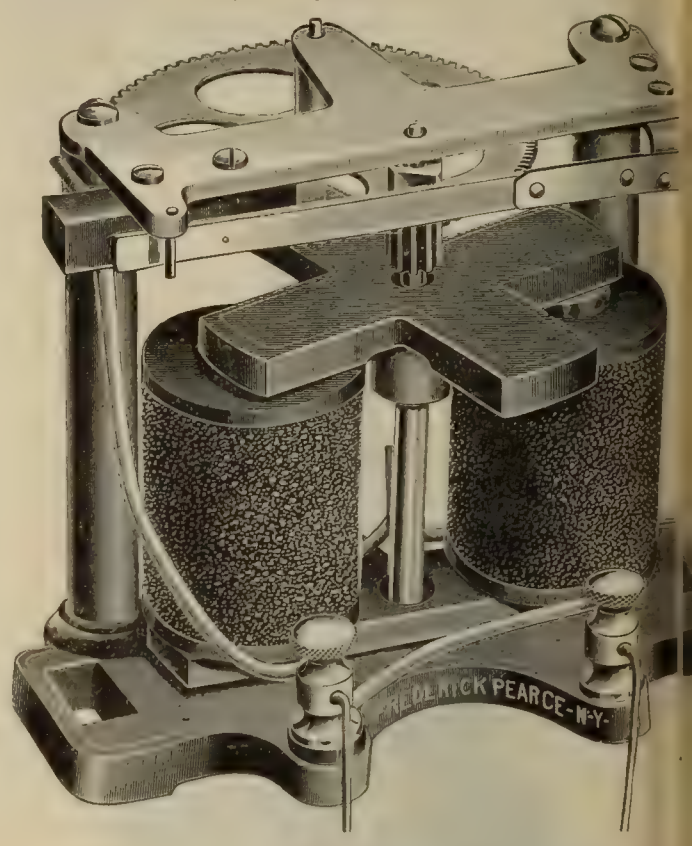


FIG. 3.

ELECTRIC MOTOR FOR REVOLVING DISPLAY STANDS.

The circuit breaker of the motor is so arranged that the electric contact part is off-set from the shaft or pinion, leaving the eccentric or circuit-breaking lever device free to oil, which is deemed an improvement essential to the nominal friction and great economy.

The motor has been improved to a point where it requires a person of very little mechanical and electrical ingenuity to set it up in proper working order.

By coupling up two of these motors in multiple, very even and steady power is obtained.

The increase of running expenses due to the increase of motors, is in direct proportion to the number of cells added, and not to the weight added, which proves the fact that the greater the weight turned the greater the economy.

ANSWERS TO INQUIRIES.

H. R., Wellsville, Ohio, asks: "Will you please tell me what is the cause of the sulphating in accumulators, and what is the remedy for the same?"

Sulphating in accumulators can to some extent be prevented by the addition of a small percentage of sodium sulphate (Na_2 SO_4). The sulphate can be decomposed by a considerable increase in the charging electro-motive force. Discharged cells should not be allowed to stand idle for any length of time, as sulphating rapidly takes place. The sulphate is probably a combination of the lead sulphate (Pb SO_4) and the monoxide. It is a hard, white substance and is very troublesome. It is insoluble, non-conducting and adhesive, and when it is removed or falls from the plate, it usually carries with it some of the active material.

WILLIAMS, Toledo, O.—"Please inform me how the carbon filaments in the Edison lamps are attached to the platinum wires. There is a discussion here as to the method employed."

The method employed by Edison of joining the carbon filaments of his incandescent lamps to the platinum leading-in wires is somewhat different from the methods usually employed. The flat ends of the carbon are mechanically gripped by the platinum, and the junction is made electrically perfect by a small coating of copper deposited electrolytically. Electrical continuity is in this way secured, but during subsequent working of the lamp there is a tendency towards the disintegration of the copper, which is sometimes deposited upon the inner surface of the bulb as a thin metallic film.

C. C., Fond-du-Lac, Wis.—Electrical engineering, we think, is the best profession to take up at the present time, as new developments and applications in electrical science are constantly being made. The field is a large one, and we think there will be room for electrical engineers to apply their knowledge to good advantage for a good many years to come. As to obtaining a good position after a four year's course, it is not within our province to say. The chances are, however, that a position will not be hard to find.

We have just received a copy of the argument of Everett W. Burdett, Esq., attorney of the Massachusetts Electric Lighting Association, against the proposed bill to enable cities and towns to own and operate gas and electric light plants for municipal purposes in that State.

POCKET FARADIC BATTERIES.

We illustrate below two pieces of apparatus which will be found very useful and convenient to those having use for a medical battery.

Fig. 1 represents the Nassau Faradic battery. Its dimensions are 6 inches by 3½x1½, and it is designed to provide what has long been needed, namely, a Faradic battery sufficiently small to be carried in the pocket, but at the same time possessing all the strength and other



FIG. 1—FARADIC BATTERY.

advantages of the large and expensive office batteries. It involves no trouble or danger in its operation, and it is so simple that a child can use it without danger of getting it out of order. It is operated by a Nassau capsule, which is a dry, close-sealed battery, requiring no handling or attention of any kind. It is always ready for use, and found equally well adapted for the physician and family use.

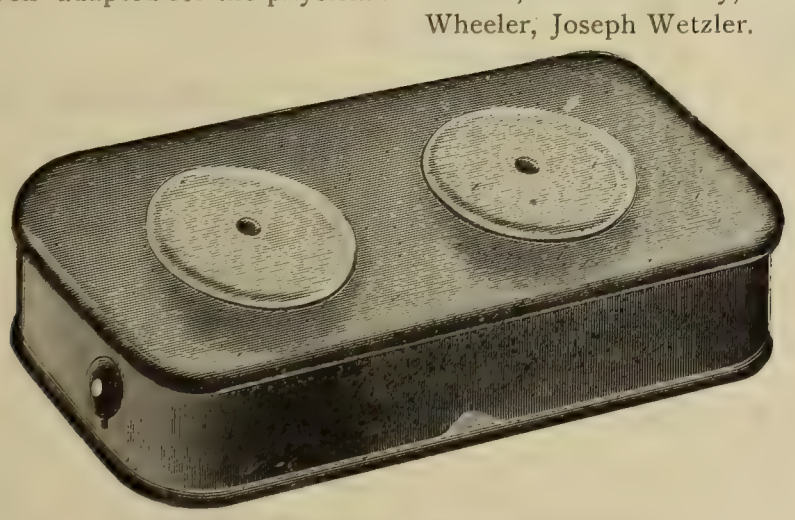


FIG. 2—"MIDGET" FARADIC BATTERY.

The induction coil of this pocket battery is constructed on an entirely novel principle and will be found to give surprising results. It is said that it gives at least twice the strength of any other coil of the same dimensions. It is provided with a very accurate and convenient appliance for regulating the strength of the current. This is indicated by an index scaled from 0 to 20 degrees. This index is shown at the left of the battery case.

When the capsule is exhausted, it can be returned to the manufacturer of the battery and exchanged for a new one at a slight cost.

Fig. 2 is an illustration of the "Midget" Faradic battery, which is little more than half the size of the battery above described. The cut shows the exact size and the dimensions are 3½ inches by 2 by ⅞. This unique battery marks a new departure in this line of goods, and produces results which would appear incredible to most persons at first sight.

The "Midget" gives a current of high therapeutic value, and is especially adapted for the treatment of rheumatism, neuralgia, headache and other local affections, as well as for all cases where the use of an electric current of low intensity is desired. The current is applied in the simplest and most convenient form to the required spot, which is done by placing the box on the part affected and touching the button shown at the left of the case. It is also furnished with conducting cords and metallic handles so that the current may be applied in the usual way if desired. As with the Nassau battery, the "Midget" is operated by a capsule cell, the same as the one described above.

The use of the capsule battery has opened up new and valuable fields of application which could not have been well explored had it not been for the invention of this little battery.

These handy little apparatus are manufactured by the Nassau Electrical Company, No. 112 White street, New York, which concern has gained a high reputation through the manufacture of goods of this class.

CLUB AND SOCIETY NOTES.

NEW YORK ELECTRIC CLUB ANNUAL MEETING AND ELECTION.

On Thursday evening, April 16th, the annual election of officers of the Electric Club, New York, was held at the club house, No. 17 East Twenty-first street.

The following officers were elected for the ensuing year:

President, Samuel Insull; Vice-presidents, Charles W. Price, Erastus Wiman, W. L. Candee, Edward Weston; Secretary, S. L. Cole; Treasurer, George, M. Phelps. Board of Managers, H. L. Shippey, P. H. Alexander, T. C. Martin, C. E. Stump, E. F. Peck, E. E. Bartlett, Dr. J. B. De Lery, H. D. Cheever, Chas. D. Shain, Joseph Barre, C. O. Baker, Jr., H. D. Stanley, J. H. Herrick. Committee on Membership, Charles Dutton, C. H. Barney, Geo. T. Manson. S. S. Wheeler, Joseph Wetzler.

The following letter was posted in the rooms of the club, before the balloting was begun:

NEW YORK, N. Y., April 9th, 1891.

C. W. PRICE, Esq., care of the Electric Club.

MY DEAR SIR:—I must decline to stand for the office of president. I fully appreciate the honor of renomination, but I cannot spare the time the position calls for. I have had my turn at the wheel for eighteen months; I shall be glad to see some other fellow take it. I hope the club will unite upon a good man, whoever he may be, and I will help him all I can. Sincerely yours,

O. E. MADDEN.

The financial statement of operations during the past year shows that the receipts were $38,730.69, which, added to the balance on hand at last report, makes a total of $39,786.85. The disbursements during the year were $38,318.73, leaving a balance on hand March 31st, 1891, of $1,468.12.

Of the receipts, $1,600 was derived from life memberships.

The membership on March 31st, 1891, was 308, divided as follows: 167 active, 124 associate, 17 life.

In the report of President Madden for the past year is given a brief history of the club from its inception up to the present time. It started with twenty-five members.

On October 31st, 1889, there was a deficiency of $7,339.47, and at the present time there is a surplus of $3,677.54, showing a gain in that time of $11,017.01. This is a gratifying showing, and every member of the club should feel personally proud of such a record.

President Madden says in his report: "The new members which the Club has gained since the reduction made January 22d, 1891, and the number of applications which are coming in daily, under the temporary waiver of one-half of the initiation fee, not only demonstrate that price is an important factor, but give bright hopes for a brilliant and prosperous future for the club, which can only be attained by a large membership."

ST. LOUIS NOTES.

The Western Electric Supply Company of this city went into the hands of a receiver a short time ago.

The power house of the Washington avenue electric line is rapidly approaching completion and will, it is expected, be ready for business in about sixty days. It will be one of the largest and best equipped in the country.

The St. Louis Cable and Western line which was the pioneer cable road of St. Louis, has obtained a franchise authorizing it to use electricity and will make the change this season. As it has a conduit already laid, this would seem a good opportunity to try the Wheless or some other conduit system.

April 12th was the eighth anniversary of the opening of the Belleville, Ill., Telephone Exchange. It started with twenty-four subscribers. It now has 180 subscribers, and under the efficient management of Mr. E. A. Woelk, who has had charge since the opening, its service is highly satisfactory and its financial condition excellent.

An electric line between East St. Louis and Belleville is now an assured fact. It will be a single track and with switches and sidings will be about eleven miles in length. Powerful motors of the high speed type will be a prominent feature of this line. A local paper says that sixty miles an hour is to be guaranteed. With light grades and few stops, thirty or forty miles an hour should be easily attainable and would make it a very popular line.

It is announced that the work of changing the Bellefontaine Street Railway line into an electric road will begin this month. The road now extends out Eleventh street to the water tower in the northern section of the city. It has a franchise to extend its line out Florissant avenue, to the Bellefontaine Cemetery, and it is expected the extension will be built this season. The Thomson-Houston system will be used.

Two other lines running to the northwestern section of the city, the Cass avenue and the Union lines will also change to electricity this season. It is expected the work will be begun in a few weeks.

THE HERMAN INSULATING JOINT.

One of the simplest and neatest insulating joints for combination electric and gas fixtures is the Herman Insulating Joint, which we illustrate herewith.

The joint consists, as, show in Fig. 1, of two flanges, recessed to admit an insulating rubber ball. A hole through the ball affords a passage for gas, or if desired to cut off the gas from the fixture, the

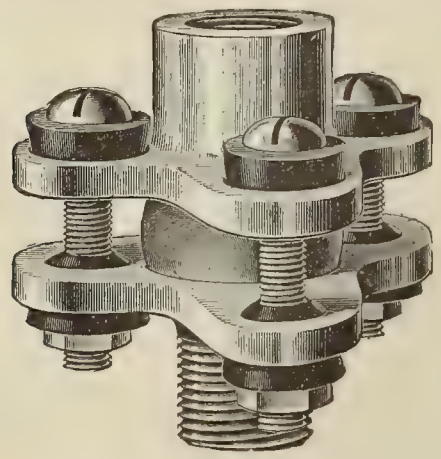


FIG. 1—INSULATING JOINT.

ball can be placed with the hole cross-wise thus making a perfectly gas-tight joint. The connecting bolts are insulated in half round hard rubber washers. The interior of the joint can be readily seen in Fig. 2.

The flanges are interchangeable and any required combination of male or female threads can be made by substitution.

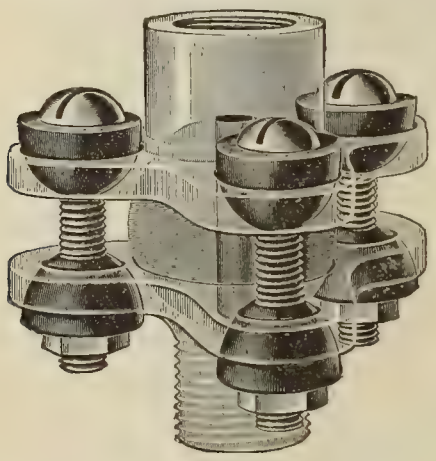


FIG. 2—INTERIOR VIEW OF INSULATING JOINT.

The joint, although occupying a very small space, allows plenty of room for the passage of wires, and can be attached with the tools usually carried by a wireman.

The manufacturers claim that it has the advantage over any in use in that it admits of the perfect alignment of the fixture, as it can be adjusted to any angle within ten degrees.

This joint is manufactured by the Electrical Supply and Construction Company, 947 Liberty street, Pittsburg, Pa.

GENERAL NOTES.

At Greenville, S. C., the Greenville Gas, Electric Light and Power Company has been organized with a capital of $55,000.

An electric light plant is soon to be erected at Ashville, Ala.

A company has been incorporated in Nashville, Tenn., to operate an electric light plant in that city.

A complete electric welding plant, for the purpose of welding truss rods and general car work, is to be installed at the works of the Pullman Palace Car Company, Pullman, Ill. A large Thomson welder of the universal type will be used.

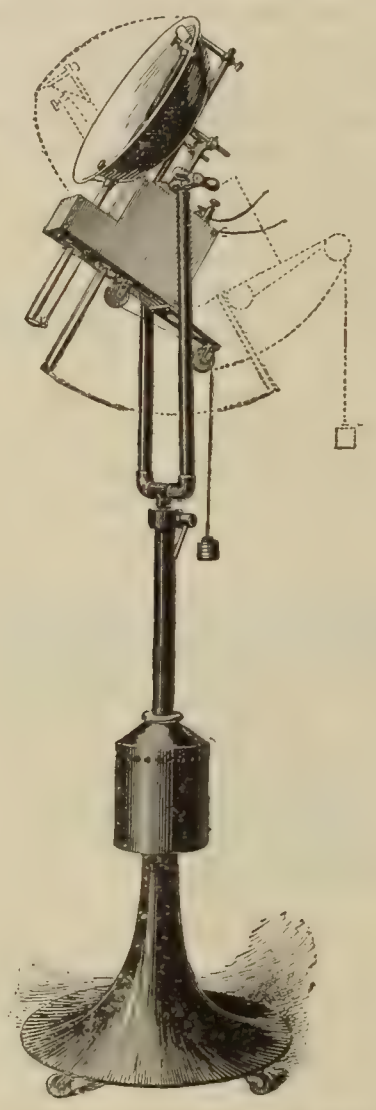
CATALOGUES.

The Aluminum Brass and Bronze Company, of Bridgeport, Conn., have just issued a neat little pamphlet containing letters from superintendents and electricians of various electric railways throughout the country, testifying to the merits of Silicon Bronze Trolley Wires for electric railways. Excellent satisfaction seems to be the sum and substance of all the letters.

ELECTRO-CALCIUM LIGHT.

The Scott Electrical Manufacturing Company, 26 Liberty street, New York, offer a specially designed automatic electric focussing arc lamp for stage lighting effects, to take the place of the lime or calcium lights, the latter being bulky, expensive to operate, and not adapted to produce the brilliant effects which are possible with this lamp.

The lamp works on any direct or continuous low potential current; is free from danger in handling; is portable, total weight of the apparatus being only fifty pounds; it can be worked automatically wherever placed, from the switchboard on the stage.



ELECTRIC FOCUSSING ARC LAMP

The lamp is mounted on an iron stand, has a telescoping rod for raising it to any height desired, a set screw holding it firmly at such height. It can also be placed at any angle, and burns from below the horizontal to the vertical, by means of pulleys and graduated weights which regulate the automatic feeding of the carbons.

The Chicago Opera House uses these lamps.

Albert Aronson, manager of the New York Casino, will instal eight of them and has ordered two of them for the Tremont theatre in Boston, for the Casino Company, now playing there. The Auditorium in Louisville, Ky., have also placed orders, besides many other large theatres throughout the country.

The lamps are usually wound for from sixteen to twenty amperes. The rheostat can be placed on the stand, if so desired. The lamp can be adapted to any form of apparatus for stage effects.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., April 17, 1891.

The Pittsburgh Reduction Company, 95 Fifth avenue, Pittsburgh, Pa., state that they have produced and sold 13,166 pounds of aluminum during the month of March.

The Central Electric Company, with their usual enterprise, have just secured the general Western agency for the New York and Ohio Company's lamp made at Warren, Ohio. This is the celebrated Packard lamp that is so favorably known among consumers, and is considered by practical men to be one of the very best incandescent lamps yet produced.

R. D. Nuttall & Company, manufacturers and dealers in electric and railway supplies and repair parts for all systems, 179 to 189 Grand avenue, Allegheny City, Pa., have issued a new catalogue of the goods dealt in by this firm. The company is well equipped for this class of work in all its branches, and are prepared to quote prices on anything in their line on application.

The new American ammeter and voltmeter lately described in these columns as one of the Central Electric Company's new specialties, are now ready for delivery. They are put up in a handsome box with a handy carrying strap, and present an elegant appearance. The published price list shows the instrument to be so low that every one connected with an electric plant of any importance can have one.

The Solar Carbon and Manufacturing Company, of Pittsburg, Pa., has received among other large orders, one for six tons of carbon 3″ in diameter by 3″ long to go to Switzerland. This company is putting in more machinery with a larger capacity. They are making carbon for arc lamps, which the Westinghouse Company have tested, and claim it superior in many respects to the Vienna carbon. These carbons are used entirely in the Ward lamps.

In the 300-page illustrated catalogue issued this year by the Central Electric Company, considerable space is devoted to the well-known Okonite and Candee wires, cables, tape and other specialties made by the International Okonite Company, New York, and for which this concern is the general Western agents. The improved Candee wire, by the way, is meeting with splendid success, and is highly commended by those who have had experience in its use, for electric light construction and electric railway feeder wire.

The rapidly increasing business of the Chicago branch house of The B. F. Sturtevant Company, of Boston, has necessitated its removal to new and much larger quarters at 16 South Canal street, where an entire new building furnishes ample accommodations for the large stock of blowers, exhausters, heating and ventilating apparatus, portable forges and steam engines. This branch will remain under the energetic control of Foss & Noble, and will form headquarters for the trade in the Middle and Western States. The stock will be greatly increased in order to provide for immediate shipment in all cases, and a corps of experienced engineers will be maintained for estimating upon and installing plants for heating, drying, ventilating, etc.

ADDRESSES WANTED.

The Secretary of the New York Electrical Society will be greatly obliged if the following members, who have made a change of residence, will send their new address to him at No. 534 Temple Court, New York City.

J. Egan.	Solomon C. Wood.
H. B. Niles.	Geo. A. Folsom.
J. W. McLogan.	J. H. Emerick.
C. H. Wright.	C. E. Hart.
B. F. Robertson.	J. Randolph Hard.
H. C. Doherty.	Alex. McKinnen.
Harry Cetty.	R. Teichman.
Chas. G. Wickley.	K. A. Mitchell.
John A. Cabot.	Geo. Arnold.
G. A. Groenbeck.	G. W. Gardiner.
W. B. Fisher.	Alfred Holcomb.
Albert E. Dobbs.	R. A. Mitchell.

J. H. Longstreet.

The intensity of telephonic effects depends chiefly upon the thickness and diameter of the diaphragm, the intensity and form of the magnetic field and the induction coils.

THE INCANDESCENT LAMP.*

BY THOMAS G. GRIER.

Incandescent lighting is now merging into a second decade of commercial life, and any neglect on the part of the electrical fraternity to fully understand the importance which the incandescent lamp plays in this growing industry is suicidal to their interests.

The subject is entirely too large to treat comprehensively in a limited article, but a few points will be brought forward that, it is hoped, will promote discussion and bring forth valuable information from the members of the club.

Though ten years have hardly passed since incandescent lighting has been an acknowledged possibility, the birth of the lamp has been recorded for nearly half a century. Platinum wire heated to incandescence seems to have been the earliest form of the incandescent lamp and was experimented with even as recently as 1885. In 1845, we read of experiments with carbon sticks and pencils enclosed in glass globes, that were either filled with some non-active gas or had the air exhausted and the carbon surrounded by a vacuum.

The march of invention at last, in 1879, reached a point at which the public was assured that a new era of artificial illumination would be upon them, and so authoritative was this assurance that gas stocks all over the country declined in value. It was not, however, until the year 1880 that any definite information as to the electrical properties of the incandescent lamp was determined and in 1881 incandescent lighting was no longer a laboratory phenomena, but was merging into an industry, the proportions of which at the present day are hardly realized.

The Franklin Institute of Philadelphia, in view of the vast advance in the application of electrical science to commercial uses, discussed the advisability of holding an electrical exhibit, and in the fall of 1884 the desire and anticipation of the members of the Institute were accomplished.

The limited knowledge and the absence of any reliable data on incandescent lamps led the Institute to invite the manufacturers of incandescent lamps to place samples of their lamps in the hands of an impartial committee of experts for a comparative test. These results were published in September, 1885, and from the official report a few results have been compiled.

Five different manufacturers submitted their lamps, some submitting several batches of different voltages. The lamps were tested for duration or life, and before placing on test their initial efficiency per spherical candle-power was determined.

The following tabulated data is of six sets of lamps:

Make.	Average Life.	Voltage.	Initial Efficiency per Spherical c. p.	Loss in c. p. per cent.
Weston	454 hrs.	111	3.63	50
White	274 "	50	4.08	?
Woodhouse & Rawson,	290 "	55	5.56	33
Stanley	430 "	96	3.92	37
Stanley	294 "	44	3.45	34
Edison	1026 "	97.9	4.48	35

From the results as given in the table, it will be seen that the greatest depreciation in candle-power was 50 per cent. and the least 33 per cent. This, however, cannot be taken for any comparison as the life of the lamps showed such a great disparity. The depreciation of the Edison lamps, which proved the superior in the test, was 35 per cent.

These results are looked upon to-day as of little practical value except as historical record, but they have taught us that lamps are a delicate matter to handle, and whether a lamp is a lamp of value depends on many circumstances. These results were a valuable round added to the ladder of knowledge, and it is hoped that experiments of a like nature, yet of more practical value, will be made in the near future for the benefit of the incandescent lighting plants and the men interested in incandescent lighting.

Since 1884 many other makes of lamps have come on the market, and knowledge gained by experience has both improved the quality of the lamps and cheapened the process of manufacturing. (In 1884 lamps were advertised 16 c. p. $3.00; to-day from 40 cents to 60 cents may be taken as an average price).

Six years now have passed since the Franklin Institute experiments, and we are almost as much in the dark as in the earlier days of the industry.

*Paper read before the Chicago Electric Club, April 20th, 1891.

The question of life seems to be the most important factor to be considered from the central station point of view, and to meet this desire various manufacturers frequently guarantee the average life of their lamps. Those guaranteeing the longest life and at the same time proving their guarantee, usually get the majority of the business.

From time to time we hear of some remarkable lamp whose life has run into the thousands of hours, and often have I heard the veracity of a man's statement questioned when he has given some facts in regard to long-lived lamps. In my own experience I can relate of a lamp burning from seven to ten hours a day for six years, which would mean a minimum life of 13,000 hours. Yet, to make this statement off-hand to the general public, and even to the electrical fraternity, it would be received with doubt. There is not, however, the least trouble in making an incandescent lamp for any desired life. The life of a lamp depends upon the efficiency at which it is burned.

John W. Howell, in 1888, published a statement based upon the experiment of the Edison Company, which covered five years of time, and the use of thousands of lamps. In this statement he says the life of a lamp burned at two watts efficiency was practically zero; at three watts per candle it was 1,000 hours; at four and three-fourth watts per candle-power it was 16,000 hours This at once shows that the question of life is merely a question of circumstances and may or may not be advantageous. He also stated in the same paper, that the candle-power of any lamp depends upon the efficiency at which it is burned. An Edison lamp gave five candle-power when run at 6.7 watts per candle-power and when the efficiency was increased to 2.66 watts, the candle-power was increased to twenty. This variation depending upon the electromotive force operating the lamps.

These statements show that the Edison lamps follow a law. All makes of lamps follow this same general law, each having its own especial curve, and it is this curve that gives the average quality of the lamp.

The object of an incandescent lighting station is to produce light. It is necessary to develop electrical energy, but it is the lamp that transforms this electrical energy into light. The electrical energy represents the dollars of the investor and operators of the station, and it is most important that it should be used with the greatest economy to obtain proper reward for the investor.

This must needs bring into the question the lamp used: the life, the cost and the efficiency being the three considerations.

To bring the matter to a point at once we will assume conditions which are perfectly feasible and within the bounds of possibility. First, we will consider that a lamp burning at 4½ watts efficiency will depreciate but a minimum for the first 1,000 hours. We will consider this lamp and the cost of operating it. A lamp at 4½ watts efficiency and 16 candle-power burning for 1,000 hours, would require a total expenditure of electrical energy of 72,000 watt hours. This at one cent for 50 watt hours would be $14 40 for the current and adding 50 cents for the cost of the lamp would make a total cost of $14.90 for burning this lamp 1,000 hours. The efficiency of another lamp is 3½ watts per candle-power. We will not say how many lamps will have to be replaced in the 1,000 hours, but just assume that the efficiency of 3½ watts per candle power is maintained throughout the 1,000 hours. The total expenditure of energy on this basis will be 56,000 v att hours, which will cost, at the rate of one cent for 50 watt hours, $11.20. Adding 50 cents to this for the cost of the first lamp, makes it $11.70, leaving a difference in favor of the 3½ watt lamp of $3.20, which, of course, will have to be used to a certain extent in replacing the lamps, but allowing that a 3½ watt lamp will maintain its efficiency for 333 hours, we will merely have to pay $1.00 additional for replacing lamps and have a net saving of $2.20. This, though an assumption, is not distorted, for lamps from 3½ to 4½ watts efficiency are on the market, and yet, many a station is being operated with lamps of a worse efficiency than 4½ watts and they wonder why it is that their dividends are smaller than those of other plants. It is the incandescent lamp that will make or break the dividend-paying record of the central station and it should be considered with the utmost care. The assumption has been made and the question been analyzed.

The lack of actual data makes it necessary to assume and analyze the question as it has just been done. However, the London *Electrical Review* has published some facts which will be analyzed as this assumption has been, and will show immediately the advisability of maintaining efficient lamps on a circuit even though their life be short.

The facts published by the London *Electrical Review*, were an account of a test on Edison-Swan lamps and the results were presented in tabulated form, giving the initial candle-power, the initial efficiency and the total watts used on the lamp. A test of 1,000 hours duration was started and at the end of each 100 hours, observations were made as to the candle-power and the total energy, the efficiency of the lamps being computed and placed in the table. This table is presented to you in this article with the deductions drawn from the data as given. The first four columns of the data as furnished by the *Electrical Review*, the other columns are deductions drawn from the first four columns.

TABLE B.

Hrs.	C. P.	Watts per c. p	Total watts.	Average of each 100 hours.		Cost figured on the basis of 1 ct. for 50 watt hours.	
				Average C. P.	Average total watts.	Cost for each 100 hours.	Cost of 16 C. P. at each 100 hours.
0	19.3	3.34	64.46				
100	18.8	3.45	64.86	19.05	64.66	$1.293	$1.08
200	17.2	3.79	65.19	18.00	65.03	1.300	1.16
300	15.6	4.10	63.96	16.40	64.57	1.297	1.26
400	15.2	4.17	63.38	15.40	63.67	1.270	1.32
500	14.8	4.29	63.49	15.00	63.44	1.265	1.35
600	14.4	4.38	63.07	14.60	63.28	1.264	1.38
700	14.1	4.50	63.45	14.25	63.26	1.265	1.42
800	13.3	4.68	62.24	13.70	62.85	1.257	1.47
900	12.4	4.90	60.76	12.85	61.50	1.230	1.53
1000	12.0	5.00	60.00	12.20	60.38	1.207	1.56

Column seven shows what the customer pays each 100 hours for the lamp he is using. Column eight shows what he pays for each 16 candle-power of light he gets for each of the 100 hours. These figures are computed upon the average of the observations, that is: for the first 100 hours the average candle-power produced is taken, and so on, for each succeeding 100 hours. The cost of the electrical energy used in the estimate is one cent per 50 watt hours, the prevailing price at the present day.

The potential in these experiments was constant, the same as any ordinary central station endeavors to maintain. The resistance of the filament increases as the lamp continues to burn and the total energy used, when the potential is constant, decreases and the lamp takes less current to a small extent than when it starts to burn. The relation of the candle-power to the total energy shows, though less energy is used as the life continues, that the economy of the lamp is greatly lessened because the light produced decreases (due to the depreciation of the filament and the discoloration of the glass) in a much greater proportion than the total energy.

As the light decreases in a much greater proportion than the energy, which is what we pay for, the light being the result, however, that we desire, it is easy to see that we are paying more for our light as the lamp continues to burn.

If we wish to maintain a constant candle power throughout the entire life of a lamp the electromotive force would have to be raised as the filament increased in resistance; the discoloration of the glass and the depreciation in the quality of the filament also makes an additional increase in the electromotive force necessary; the current is maintained up to what it was at the start and even increased, thus the energy required to produce a constant supply of light would be constantly increasing and therefore the cost of the light constantly increasing as the life of the lamp continued.

Dr. Philip Atkinson of Chicago, in a recent lecture in which he advocated the economy of the renewals of incandescent lamps at much shorter intervals than the usual practice, unfortunately gave as the reason that the filament's resistance was reduced the longer the lamp was used, whereby the current is increased, while at the same time the luminosity is decreased.

He is wrong in regard to the resistance of the filament and the increase of current, for the incandescent lamp as it grows old takes less current whenever the potential is constant.

Attention is called to Dr. Atkinson's reasons so that others may not be misled by his incorrect premises, even though they may have been used to prove an assumption that is supported by facts. There is nothing so detrimental to a cause as false and incorrect premises.

The financial results in table "B" are very clear and plain, and any one would say at a glance, allowing that a 16 candle power lamp costs fifty cents, that it would not cost the consumer a cent more for light if he bought a new lamp at the end of 900 hours, for the saving in current would pay for the lamp; that much is apparent. However, the following table makes the matter clearer and more closely defines the line of the most economical life of the lamp. The lamps are assumed in this table to cost the con-

sumer fifty cents ; the cost of the current is taken from the table just previous to this.

TABLE C.

Number of Hours to Burn.	Cost of current for 16 c. p.	Cost of Lamps.	Total cost Current and Lamps for 1000 hours.
Lamps replaced every 100 hours..	$10.80	$5.00	$15.80
Lamps replaced every 200 hours..	11.20	2.50	13.70
Figured on a basis of 1,200 hours and reduced to 10-12. Lamps replaced every 300 hours.....	11.66	1.66	13.32
Figured on a basis of 1,200 hours and reduced to 10-12. Lamps replaced every 400 hours.....	12.05	1.25	13.30
Lamps replaced every 500 hours..	12.34	1.00	13.34
Figured on a basis of 1,200 hours and reduced to 10-12. Lamps replaced every 600 hours.....	12.68	.83	13.51
Figured on a basis of 1,400 hours and reduced to 10-14. Lamps replaced every 700 hours.....	12.81	.71	13.52
Figured on a basis of 1,600 hours and reduced to 10-16. Lamps replaced every 800 hours.....	13.05	.62	13.67
Figured on a basis of 1,800 hours and reduced to 10-18. Lamps replaced every 900 hours.....	13.30	0.55	13.85
Lamps replaced every 1,000 hours,	13.55	.50	14.05

The result of the above compilation shows that for this grade of lamp at the price of current and price of lamp assumed, that though the lamp will last 1,000 hours, it is better to throw the lamp away at the end of 400 hours and use new ones. Seventy-five cents per lamp will be saved every 1,000 hours by replacing the lamps every 400 hours instead of keeping one lamp in 1,000 hours.

If the lamps were cheaper and the currents the same or dearer it would be cheaper to replace the lamps still oftener than 400 hours. If the current was but half of what is assumed in the compilation, that is, if the current cost but one cent for 100 watt hours it would be cheaper to replace the lamps every 700 hours ; cheaper by about seventeen cents, for every 1,000 hours.

It is not a question of the life of a lamp alone that should determine what lamps should be used, but also the efficiency of the lamp, cost of current and price of lamp.

A mathematical equation should be formed taking all these factors into consideration before the matter should be decided by the central station. Reliable data on the majority of the makes of lamps is not obtainable, and it has been necessary to treat the matter from assumption and from analyzing such data that has been published ; but even from mere assumption it is without doubt an assured fact, except when the current is extremely cheap, that an efficient, short lived lamp is preferable to an inefficient long lived lamp.

In making this mathematical equation the end in view is to determine the efficiency at which the sum of the costs of power and lamps is a minimum, and in order to do this the rate of variation of life of a lamp with its efficiency should be known. This variation would have to be given by the manufacturer.

To give this equation in the shape of the formula we will assume symbols to represent the various factors.

Let A = the number of watt-hours required by a 16 c. p. lamp, A÷16 would represent the efficiency per c. p.

" B = the life of the lamp at A÷16 efficiency.

" Y = the cost of a 16 c. p. lamp.

" X = the cost of a watt-hour delivered at the lamp.

The value of A and B must be ascertained from the manufacturer.

Y is the price that has to be paid for the lamp.

To obtain the cost of a watt-hour, or X, delivered at the lamp, the mean current at the station must be determined. As the wires and devices have been figured for a certain loss for maximum current, the energy in transmitting the mean current would bear the same ratio to the percentage, figured for the maximum load, as the mean current does to the maximum current. This amount of energy must be subtracted from the total energy developed and the remainder will give the amount of energy used in the lamps. The total operating expenses, less the cost of the lamps, divided by the total watt-hours delivered at the lamps will give the cost of one watt hour.

The cost of operating a 16 c. p. lamp for an hour would be the cost of a watt hour multiplied by the number of watts required by 16 c. p. lamp, or X×A.

The proportion of cost for replacing lamps would be the price of the lamps divided by the life, or Y÷B.

The most economical point to run the station would be when the sum of the renewals and the cost of the energy is a minimum or expressed in a formula, when (Y÷B) + (X×A)= a minimum.

To give an example of this we will assume conditions. Let cost of lamp= 50 cents, efficiency A÷16 = 4 watts, or A=64 watts ; let X = $.00016, an average cost of electrical energy, (being .8 of a cent for 50 watt-hours), and the life of lamp 1,000 hours, and substituting these values in the formula we have,

$.50÷1,000 + .00016 × 64 = ?

or $.0005 + $.01024=$.01074.

Another lamp costs 60 cents; its efficiency is 3 watts or A = 48 watts. X = the same as in previous case, $.00016, and the life of lamp 300 hours, substituting these values in the formula, we have,

$.60÷300 + $.00016 × 48 = ?

or $.002 + $.00768=$.00968.

The result shows that a lamp costing sixty cents and having a life of only 300 hours with three watts efficiency makes the operating expenses of the station less than if the lamp was only 50 cents and had a life of 1,000 hours with 4 watts efficiency ; in fact the 3-watt lamp is cheaper even though the 4-watt lamp cost but one cent and had a life of 10,000 hours, for the cost of the energy alone, for the 4-watt lamp is in excess of the sum of the cost of lamp and energy in the case of the 3-watt lamp. The question is governed very much by the cost of the energy.

The incandescent business has grown upon us so rapidly that we have been unable to keep up with the vast advance, and the public has been suffered to remain in dense ignorance on this, one of the most important subjects of the present day. In fact, not only has the public been allowed to remain ignorant, but the great majority of central station men have had no opportunity whatever, of gathering such data together that would enable them to fully comprehend the important part the incandescent lamp plays in their business, and wherein lay vital considerations.

The renewals have always been considered the bugbear of the central station, but the waste of energy has seldom received the slightest notice.

The success or failure of electric light central stations as a dividend earning investment, is of the utmost moment to the agents, manufacturers of electric light apparatus, and others who desire to promote the business. It is necessary for the success of those desiring to promote the electric light business that the electric light central stations make money. For the electric light central stations to be financially successful, those operating them should be convinced of the importance of using efficient lamps and of renewing them as soon as their efficiency materially depreciates.

The bugbear that exists in the minds of many central station men that it is the cost of renewal of lamps that represents the great expense should be eradicated, and the question of waste of energy so demonstrated that they cannot avoid seeing the advisability of efficiency rather than long life in the lamps they are using.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, MASS., April 17, 1891.

The New England Telephone and Telegraph Co. is constructing a metallic circuit between Exeter and Portsmouth, N. H., and Newburyport, Mass. When completed, all these cities will be in direct telephonic communication with Boston.

Mr. A. E. Davis, who has represented *Electric Power* in Boston for some time past, has been called to a position with the paper in New York. He is succeeded by Mr. Francis W. Sprague, 2d. who is a lawyer by profession, and will make an able representative of the paper.

Letters received by the Simplex Electric Company from the president, Dr. Mason, who is in Jamaica to recover from the effects of his recent tussle with "la grippe," and pneumonia, report that the Doctor is rapidly recovering. The business of the company is excellent, and orders are being received for their wire from all parts of the world.

The Gould and Watson Co., appear to be doing considerable business with their mica insulation. The Thomson-Houston Electric Co. have just placed a large order with them for insulators, etc., and J. F. Porter, of New York, has sent in a very large order for his tree insulators, of which the company are sole manufacturers. They report business very brisk and improving.

The Committee on Cities recently gave a continued hearing on the question of taxing corporations for the use of the streets of the city. E. W. Burdett appeared for the Boston Electric Light Co. He said that other cities were not handicapped by such taxation ; that it was unjust. He explained the method adopted by the governments of Berlin, Paris and other European cities in regard to corporations.

The first grand ball of the employees of the New England Telephone and Telegraph Company was given at Odd Fellows' Hall the evening of April 15, about 200 couples being in attendance. Among the guests were the following officials of the company : President, Thomas Sherwin ; General Manager, Joseph N. Keller ; Assistant General Manager, W. J. Denver, and Treasurer, William R. Driver. It was a highly enjoyable affair.

The Pettingell-Andrews Co. are doing an immense business with their electric railway supplies. Among orders recently received by them, was one from the Springfield Mass., Electric Street Railway Company for all the feeder wire necessary to equip their road ; one from the Newburyport, Mass., Electric Railway Company for a full line of supplies, including all feeder wire, trolley wire, insulators, pins, arms, etc., to be used by them, and another from Derry, N. H., for thirteen or fourteen miles of wire. The company is also figuring on a number of large contracts. The K. W. goods still continue in good demand.

At the New England Conservatory of Music there is on exhibition a recent invention called the Electric Clavier. Mr. Frank W. Hale, the inventor, gave an explanatory lecture the other evening. A piano was placed upon the stage, and its workings were clearly defined. By means of an electric arrangement which can be attached to any upright piano, a bell signal will be given as soon as any error occurs, so that instead of pupils practicing away for hours, and never being perfectly sure whether they were right or not, this little bell will indicate the slightest deviation from a correct touch. It is like practicing with a faithful conscientious teacher always near, ready to correct the slightest error.

The reputation of the Armington & Sims high speed engines is increasing, and the prices of the same are decreasing in like proportion. These engines are well known throughout the country as most efficient for the supply of power in electric light and power stations, and all the company's agents furnish and erect complete steam plants in a thorough and satisfactory manner. The Armington & Sims Engine Company build over one hundred different sizes, including Standard, Compound, Vertical, Three Cylinder Compound and heavy engines for manufacturing purposes, ranging from ten to one thousand H. P. The company's works are in Providence, R. I., and were one of the centres of attraction during the recent convention of the National Electric Light Association.

PORTLAND, ME.—The Portland Street Railroad Co. has awarded the contract for equipping the Deering line with electricity to the Thomson-Houston Co. The system to be used will be the same as that adopted by the West End Street Railway of Boston. The motors will be of a larger type, however, known as the new single reduction gear motors, with a single gear wheel driven by a single pinion. The road will be in running order by June 1st, and it is said that if the line is as successful as anticipated, important extensions of the electric system will follow in the near future.

LOWELL, MASS.—The Bradbury Storage Battery Co. has been organized here by the election of the following officers : President, E. W. Lovejoy ; Vice-president, F. W. Puffer ; Secretary, F. J. Stone ; Treasurer, P. B. Randlett. Directors to act with the above officers are S. K. Dexter, E. S. Ross, J. Y. Bradbury.

NEW BEDFORD, MASS.—The stock of the People's Non-Explosive and Sanitary Gas Co., organized

here last summer to make Gen. Eugene De Beauharnais non-explosive gas, has been absorbed by several gentlemen opposed to the recent raise in electric light rates and they have organized under the old charter with a capital of $100,000, as the People's Gas Co. F. E. B.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOMS 7 — 12, "WORLD" BUILDING.
NEW YORK, April 18, 1891.

Mr. Geo. F. Card, of the Cincinnati Edison Company was in town last week.

Mr. James H. McGraw, Managing Editor of the *Street Railway Journal*, New York, has just returned from a three weeks outing in Florida.

Mr. E. H. Cutler, Manager of the Elektron Manufacturing Company, Brooklyn, has been confined to his home for several days through an attack of the "grip."

As we go to press we are in receipt of a dispatch from Minneapolis stating that the power house of the St. Paul and Minneapolis electric street railway system was burning.

The following named persons called at the ELECTRICAL AGE office during the past week: George W. Walker, of the Walker Electric Company, 50 Broadway; Allen R. Foote, Washington, D. C.

Mr. W. J. Cook, vice-president of the Maguire Manufacturing Company, Chicago, is in town, as are also J. M. Atkinson, of the Westinghouse Company, Chicago, and Thos. P. Lowry, president of the Minneapolis and St. Paul electric street railway systems.

The Walker Electric Company, 50 Broadway, are having a big sale of their ampere and voltmeters, as well as their recording ampere meters. I am informed that they are practically overwhelmed with orders, and the future of the Walker instruments is assured.

The Peckham Street Car Wheel & Axle Company, of Kingston, N. Y., Edgar Peckham, president and general manager, with offices at 45 Broadway, are placing large orders for their trucks on the principal electric railways throughout the United States, also with the leading electric car builders.

The Niles Tool Works have taken the entire first (ground) floor in the new Electric Exchange building. This company makes fine tools and machines of all kinds for electrical work. Their present address is Liberty and Church streets, and their new quarters are in the most elegant part of the new building.

J. H. Dale, 90 Fulton street, makes a specialty of refitting and preparing incandescent sockets and other electrical instruments. He is also manufacturing incandescent specialties in the line of portable switches, keys, etc., in any quantity. He also makes to order any line of goods required for the trade.

H. M. Hawkesworth, formerly president and general manager of the United Electric Traction Company, and the Daft Electric Light Company is now associated with Dr. J. C. Barron in the Carpenter Steel Works of 35 Broadway. This company is manufacturing castings, etc., for dynamos, motors, and general electrical apparatus.

Mr. C. A. White, of the Echo Watchman's Clock Company of Boston, Mass., was in town last week. He reports that these clocks are giving great satisfaction, and there are hundreds of them in use. The demand for them is increasing all the time, and the company's facilities of production are taxed to their utmost. The apparatus is very efficient and is thoroughly reliable.

For draughtsmen's materials, architect's and engineer's supplies, as well as Helios paper for blue printing and instruments of American, English, French and German manufacture, the house of Messrs. Keuffel & Esser, 127 Fulton street, N. Y., has become noted. They are said to be the largest producers in this country of this line of goods. Their stock is the most complete, and their prices cannot be lower.

The Standard Underground Cable Company is about completing an order for 5½ miles of sixty-conductor cables, No. 14 B. & S. gauge, for the Postal Telegraph Company, which is being laid along Broadway, from their main office in New York City. The company has just closed a contract with the New York Fire Department for half a million feet of No. 14 wire, in cables of from three to twenty conductors, and the company report an increase of 25% in business over last year.

The Goubert Feed Water Heater Company, of 32 Cortlandt street, lately took an order for an 800 horse power heater for the new Edison station, New York City. They have just delivered two 1,200 horse power heaters to the Edison Illuminating Company, of Boston, and are delivering 1,000 horse power heaters to the City Manufacturing Corporation, of New Bedford, Mass. These are a few of the orders for large heaters of this company's make.

Patterson, Godfried & Hunter, Centre and Walker streets, are carrying electrical and general manufacturing supplies in large quantities, and are prepared to receive orders at the lowest market prices for screws, machine tools, hard rubber, imitation hard rubber, sheet rod and tube metal, and all varieties of specialties used in manufacturing dynamos, motors and other electrical apparatus. This company is now preparing a very voluminous catalogue which will illustrate and describe the thousand-and-one lines of goods they carry in stock.

Mr. Louis Walsh has resigned his position with the Crosby Electric Company, and has accepted one with the electrical supply house of Alexander, Barney & Chapin, No. 20 Cortlandt street, New York. He assumed his new position on April 15th, and will have charge of the battery and carbon department of the firm. Mr. Walsh is personally known to the electrical trade throughout the entire country, and the above enterprising firm is to be congratulated on securing his services. Mr. Walsh has already been heard from since he assumed his new duties, and it is to be expected that the battery and carbon departments of "A. B. C." will from this time forth become one of the most important departments of the concern.

The Engineering Equipment Company have become Eastern agents for the well-known Habirshaw wires, cables and cores. The Habirshaw Flame-Proof wire is attracting considerable attention, especially as the new Underwriter rules require its use. Now that the India Rubber and Gutta Percha Insulating Company, who manufacture exclusively the Habirshaw wires, have secured a new and fine factory at Yonkers, the output of this wire will be increased materially by the facilities afforded by the new works. As the Engineering Equipment Company advertise in this issue their offices will be found, from about May 1st, in the "Central Building," No. 143 Liberty street, city, but the stockroom for Habirshaw wire and Underwood belts will be continued at No. 73 Cortlandt street, which has been the temporary office of this new company.

Messrs. Taylor & Son, 39 Dey street, manufacturers of Taylor's Primary Battery for motors, electric lighting and household use, have been making some tests of their battery and a Lugo motor for the Third Lighthouse Department. It is the intention of the lighthouse authorities to revolve the lights on the lightships by a reliable motor, and tests are being made with a view to determining the best machine for this work. With one charge of Taylor Depolarizing Solution the Taylor battery ran the Lugo motor seventy-six hours and developed one-fifth horse power constantly, at a cost for the solution of but twelve cents. The firm have recently improved their depolarizing solution powder and at the same time reduced its cost. The demand for the battery is constantly increasing, and as it is becoming known its important features are more and more appreciated.

Messrs. Truex & Vail have sold to E. G. Bernard & Company, electrical engineers, of Troy, N. Y., an accumulator outfit for installation in the residence of Mrs. Howard Hart, at Troy. This plant consists of twenty-seven 23 M. cells, with the necessary switches and apparatus, and will be complete in every particular.

Among the recent accumulator sales reported by Messrs. Truex & Vail are twenty 15 M. accumulators for the Pennsylvania State College, and thirty-two 23 M. accumulators for private installation in New York City. They report quite an active demand for the Walker meters, both direct reading and recording.

Messrs. Truex & Vail, of 44 Broadway, sole selling agents for this section of the Walker Electric Company's goods, accumulators, Edco motors and dynamos, are placing some large orders in their various lines. These gentlemen are so well known, that there is no doubt of their success.

The latest new thing brought out by Alexander, Barney & Chapin, 20 Cortlandt street, is the "Fibrous Dry Battery." This battery is a radical departure in its construction from other forms and the opinions of experts and the results shown by careful tests fully demonstrate its being a first-class dry battery. Its features are constancy, efficiency, durability and entire adaptability to the requirements of a strictly first-class dry battery. It is claimed for this new cell that its life is longer than that of any dry battery on the market. Its voltage is 1¾ volts, and it delivers a current of 4 amperes, which it maintains constant. Mr. Louis Walsh, formerly with the Crosby Electric Company, and now in charge of the battery department of "A. B. C." is going to give his entire attention for a while to the introduction of this new battery, and make a special run on it. He says all the energy he can command will be put behind the battery, as it is worth pushing hard. The battery was expected to be out on the market about this time.

The Stratton Separator Company, of 32 Cortlandt street, whose separators are so largely used in electric light and power steam plants, are continuing to have a large demand for their goods. The Edison Illuminating Company, of Brooklyn, N. Y., are using four 12-inch, and six 5-inch separators, and have just given an order for two more for their increased plant. The Buffalo Street Railway Company, of Buffalo, N. Y., are installing six 5-inch separators. The Stratton Separator Company also lately furnished the Syracuse Electric Light Company, of Syracuse, N. Y., with one 8-inch, and one 3-inch separator. They are building four 9-inch separators for cruisers nine and ten which are now being built by the Columbia Iron Works and Dry Dock Company, of Baltimore, Md. The Stratton Company have just delivered a two inch separator to the Citizens' Illuminating Company, of Brooklyn, and two 10-inch separators are being installed in the Edison Illuminating Company's plant in Boston.

The Woodbridge & Turner Engineering Company has been organized as successors to the firm of Woodbridge & Turner, with Wm. S. Turner as President, Geo. A. Bell as Vice-president, and J. Lester Woodbridge as Secretary and Treasurer. The Company will occupy offices at 47 *Times* building, this city, and to it will be turned over all new business of the firm, together with their entire

stock of tools, supplies, apparatus, etc. It is their purpose to extend the scope of the business of the the firm in electric railway and electric light engineering. The company will conduct a consulting and constructing engineering business. They will furnish plans, specifications, and estimates, supervise construction and enter into contracts for the equipment of electric railway and electric light plants in full or in part, including steam plants, line construction, track building, generators, motors and cars. It is the purpose of the manager to retain the high standard of the workmanship in all departments which it has heretofore been the endeavor of Woodbridge & Turner to sustain.

It pays to get up a fine catalogue. The supply house of Alexander, Barney & Chapin, 20 Cortlandt street, the other day received from a certain electrical house the following observation with reference to the artistic "A. B. C." catalogue recently brought out: "It is magnetic and not to be resisted. It will cause us to order goods we neither need nor want." Whether this concern needed the goods or not, they sent in a good plump order the next day.

The firm of Alexander, Barney & Chapin, after very laborious and costly experiments, have at last brought their "Alexite" to about the ideal state of perfection as an insulator. They now claim that it is absolutely fire-proof, water-proof and acid proof, and its insulating qualities are of the highest degree. We saw some samples of these goods on their tables a few days ago, and as far as appearances went the articles seemed to possess all the qualities the firm claims for the material. Alexite can be made of any color or combination of colors, to match papering and painting. Some of the specimens were remarkably successful imitations of marble of various kinds, white and dark. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	$100 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	7 50
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 50
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln.	2,000,000	100 00	115 00
Averell Insulating Conduit	3,000,000	100 00	4 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	206 50
Boston Electric Light	1,500,000	100 00	105 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5s	6,000,000		par
Brush Illuminating (N. Y.)	1 000,000	100 00	60 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	5 00
City Electric Street Ry. Co., 6's	200,000		par
Commercial Cable Co.	7,716,000	100 00	106 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Consolidated Electric Light	1,929,400	100 00	50 00
Consoli'd Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Consol Gas & E.L.Co. of West Co.6's	250,000		par
Consol Gas & E. Co. Batavia, 6's	80,000		par
Consolidated Gas Co. Batavia	100,000		
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	80 00
Easton Elect. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. 5s	2,000,000		*80
Edison Illuminating (N. Y.)	4,500,000	100 00	80 00
Edison General	14,000,000	100 00	95 25
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Erie Telephone			49 00
Essick Printing Tel.	5,000,000	100 00	50 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	13 50
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Laclede Gas Co.	7,500,000	100 00	18 00
Laclede Gas, pref	2,500,000	100 00	48 50
Laclede Gas 5s			*79
Law Telephone	400,000	100 00	
Long Branch Electric Light	50,000	100 00	78 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		
Manhattan Elec. Light Co. Lmtd 5's	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	2,000,000	100 00	
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light (N.Y.)	500,000	100 00	90 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Cordage			87 00
Nat'l Cordage, pref.			103 50
Nat'l Lead Trust			19 00
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
New England Butt Co.	100,000	1,000 00	1,000 00
N. E. Telegraph and Telephone			51 50
N. Y. and N. J. Tel. and Tel 6s	1,500 000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	99 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
North New York, Lighting	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	102 00
Plainfield, Electric Light	100,000	100 00	75 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	60 00
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s			*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100 000	1 00	3 00
Swan Incandescent	800,000	100 00	2 50
Standard Ug'd Cable Co.	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
Thomson-Houston Electric Co.	10,000,000	25 00	47 00
Thomson-Houston Pref.	5,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers 6's	100 000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	2 50
United States Elec. Co.	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000 000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Western Union	86,188,852	100 00	81 50
Westinghouse Electric Co.	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			22 50
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

At the meeting of the Mexican Telephone Company, held at the Astor House in this city on the 15th of April, the following gentlemen were elected officers and directors: Robt. Colgate, President, New York; W. H. Harrington, Secretary, Boston; W. French Smith, Treasurer, Boston; O. P. Dexter, Boston, and James H. Dawson, of Kingston, Mass.

The Direct United States Cable Company, it is reported, will very soon reduce the price of messages to Australia 50 per cent., practically making the rate $1.23 per word, and for press messages 55 cents. With the new departure and their adoption of a constitution, the business outlook is so bright that without doubt dividends to the Cable Company will be increased by the larger volume of business at the lower rates. Australia has been for some time a very large customer for our electric goods, ranging from dynamos and cars to lamps and bells.

Col. Webster's "Huckleberry" Bill, to permit the use of the trolley beyond the Harlem, has passed the home stretch in Albany, and there is little doubt this year will see the electric railway in full swing, and its bonds and stock regularly quoted in the ELECTRICAL AGE. If the article in the New York *Times* on the subject is correct, it will not be all plain sailing for the next corporation asking for similar concessions. It is intimated that after the votes were cast the other side of the understanding was found to contain a big leak. Well, every road has its day *and the "Huckleberry" is having a merry one.*

The shareholders of the Norwalk and South Norwalk Electric Light Company met with a very serious loss the other day by fire. The plant consisted of their engines and boilers and six arc and incandescent dynamos. The loss is estimated at about $25,000, insured for $3,000. The capital of the company is $65,000. Chas. Olmstead, is President, C. E. Dustin, Treasurer, and J. H. Hoyt, Secretary. We are always sorry to hear of electric misfortunes. The Elizabeth fire will cost the New York and New Jersey Telephone Company several thousand dollars, and in Albany, fire has, I believe, burned for a third time a costly switchboard, the last representing over $20,000. All could have been saved by a few dollars' worth of Marten's fireproof paint, as I have seen proven where the current from 70 arc dynamos has failed to more than tarnish a switchboard in this city.

The electrical interests involved in the illumination of the railway tunnel in New York City affects every tunnel of any magnitude in the United States. Leaving life out of the question, the loss of property, payment of damages, delays of traffic and consequent loss of dividends are avoidable. The question simply resolves itself into which is the most economical? Apparently the decision concluded upon here, will become the law of the land and extend with the growth of the population and its requirements. If the same amount of traffic was handled in the long tunnels and snow sheds of the West as calls for attention in New York, the investment would without doubt prove unprofitable without our present knowledge and practice of ventilation and illumination. Electrical power companies with their devices should be able to either blow through or suck out smoke as fast as made; conduit companies should construct passages through a tunnel, above or below as might be the most convenient, to permit the delivery of a blast of air at any desired point, probably the centre, or with orifices at several points sufficiently large to admit of the removal in that manner. Nature makes the fog, saturates the air with moisture until its specific gravity sinks it into the tunnels, and I do not advise the expending of a single dollar to drive or pump it out until we can pump that part of the East River below the bridge dry, fog included, and store it in that part above the bridge. The foggy days in the year where tunnels exist are very few, but man makes the smoke and carries it into the tunnels at considerable cost to the shareholders. Now comes the time when electricians through their corporations are called on to take charge of it and temper the illumination to a degree which will enable engineers to plainly see and understand their signal lights. Joint action is necessary to the accomplishment of this work and in its aid every railway (and for that matter steamship) corporation should put where each one of their engineers and signal men can read it, a file of the ELECTRICAL AGE that they may keep up with the times. Send me the names of your "home stations" with a name or number, and I will mail the paper there; between the new advertisements and the descriptive articles they will learn of every improvement as it is completed, and $3 per copy per year for a weekly teacher will prove an A1 gilt-edged big paying investment.

BUSINESS NOTES.

Mr. T. F. Wetherbee has been appointed general agent of the Westinghouse Machine Company, for the State of Durango, Mex., with headquarters at the City of Durango.

ELECTROLYSIS.—A practical treatise on nickeling, coppering, gilding, silvering, the refining of metals and treatment of ores, by means of electricity. By H. Fontaine. Translated from the French by J. A. Berly, C. E.; 256 pages with 34 illustrations; price $3.50. E. & F. N. Spon, 12 Cortlandt street, New York.

A proposition is being submitted by promoters to capitalists to organize a stock company with a capital of $100,000 in $5 shares, to enable South Dakota to make a respectable exhibit at the World's Fair. Senator Pettigrew is alleged to be the father of the movement. This plan might well be followed by other States, as it will equalize any loss that may accrue. The young blood of the newer States will then have an opportunity to compete before the world and let us know what they are doing.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS.

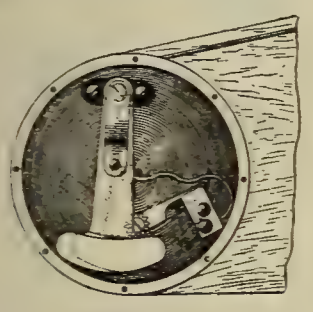
ISSUED TUESDAY, APRIL 14, 1891.

450,153. Trolley for Electric Railways. Arthur S. Hickley, Richmond, assignor of one-half to John C. Schaffer, Indianapolis, Ind. Filed April 14, 1890.

The connection with a trolley wheel, of a lubricating wheel, the edges of which are formed of felt or other absorbent material, and which is provided with a central cavity containing a lubricant.

450,159. Multiple-Fuse Cut-Out. Arthur W. Jones, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 6, 1890.

A safety fuse apparatus, consisting of a pair of fixed contacts, a fuse carrier having movable contacts co-operating with the fixed contacts and provided with a manual operating device, and a continuous strip of wire of fusible material engaged in sections by the movable contacts, so as to bring successive portions of the wire into connection with the fixed contacts.



450,173—ELECTRIC SWITCH FOR ELECTRIC RAILWAYS.

450,163. Non-Sparking Clamp for Trolley Wires. Charles A. Lieb, New York, N. Y. Filed Nov. 28, 1890.

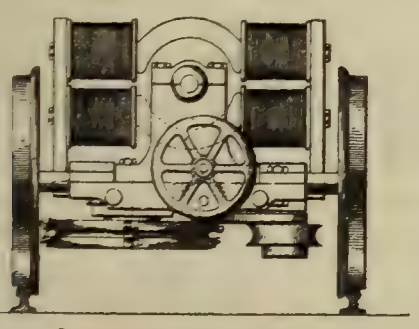
A flexible current-conveying device attached to the holder of a trolley wire at such places as the points of attachment do not come in contact with the trolley.

450,164. Electric Railway Wire Support. Charles A. Lieb, New York, N. Y. Filed Dec. 10, 1890.

A clamp for an electric wire, having intersecting jaws and upwardly extending parts adapted to abut against each other, to limit the grip of the holding surfaces.

450,172. Electric Switch for Electric Railways. Frank Mansfield, New York, N. Y. Filed Nov. 18, 1890.

In an electric railway switch, the combination with a swinging pick-up lever and a shaft, of a switch-box secured to the shaft so as to turn therewith, and a branch conductor leading from the main through the switch-box to the lever and provided with contacts within the switch-box for making and breaking the circuit in response to the movements of the lever.



450,189—ELECTRIC-MOTOR CAR.

450,173. Electric Switch for Electric Railways. Frank Mansfield, New York, N. Y. Filed Nov. 18, 1890.

In an electric switch, the combination, with a swinging lever for operating the switch, of a switch-box or plate moving in fixed relation with the lever and provided with a fixed terminal, a pivoted contact arm mounted upon the switch plate eccentrically to the centre of movement of the same and adapted to engage the terminal when moved to one limit of its movement, connections intermediate the switch plate or box, and the pivoted contact arm for moving the latter upon its pivot as the switch plate or box is rotated.

450,182. Light-Signal System. Bernice J. Noyes, Boston, and Howard F. Eaton, Cambridge, Mass. Filed April 5, 1889.

An electric circuit including a central station and several light-signal stations, each station containing a light-signal and magnet for effecting its operation, also a normally wound return signal transmitter and a magnet for releasing it, and also an individual call switch for rendering operative both of the magnets, and the central station containing a circuit controller for the individual call switches, and a return signal receiver and a circuit controlling device for the light-signal operating magnets.

450,189. Electric Motor Car. Francis A. Pocock, Scranton, Pa., assignor of two-thirds to Elmer H. Lawall and Rufus J. Foster, both of same place. Filed July 3, 1890.

A horizontally revolving motor-driven grip-wheel having a circumferential groove to engage the cable and from which groove the cable is capable of being dropped at the will of the engineer to run the car on a branch road.

450,206. Mechanism for Carrying Wires Through Conduits. Ferdinand A. Wessel, Brooklyn, N. Y., assignor of one-half to August Giese, same place. Filed Sept. 24, 1890.

In a wire-threading device, the combination of a shank with a self-clamping carriage rigidly fastened thereto, and another clamping carriage which runs on the shank; and with a contracting spring or springs for drawing the carriages toward each other.

450,219. Dynamo Electric Machine. William F. Collins, New York, N. Y., assignor to the Waddell-Entz Electric Company, same place. Filed Feb. 18, 1890.

In a dynamo electric machine or motor, a field magnet consisting of a single coil of wire wound upon an iron core and a plurality of pole pieces or horns connected with each end of the same extending around the coil, the poles or horns of each set extending past a plane cutting the axis of the coil at right angles, in combination with a ring armature, within which the field-magnet is located.

450,221. Instrument for Measuring Electric Currents. Henry H. Cunynghame, Frederich L. Rawson, and Otway E. Woodhouse, London, England. Filed April 1, 1887. Patented in England.

In electrical measuring instruments, the combination of an electromagnet having oppositely arranged poles, an armature between the poles, the horizontal axis of which corresponds to that of the electromagnet, a torsional spring connected with the armature, and means for increasing and decreasing the torsion of the spring.

450,228. Printing Telegraph. Pliny H. Fisk, New Richland, Minn. Filed Oct. 17, 1890.

450,239. Non-Interference Signal Box. William H. Kirnan, Brooklyn, assignor to the Gamewell Fire Alarm Telegraph Company, New York, N. Y. Filed Aug. 18, 1890.

In a signal apparatus, the combination of a magnet adapted to be connected in the signal circuit, a circuit controller and a motor therefor, a detent for the motor, means for tripping the detent, operative only while all the instruments on the line are at rest, a switch moved by opening the alarm box from a cut-out contact to a contact connected to the magnet and circuit controller, a lock for the switch and means for releasing and restoring the switch at the close of the signal.

450,242. Trolley Wire Support. Charles A. Lieb, New York, N. Y. Filed Nov. 14, 1890.

A support for an electric wire consisting of a cross bolt, a threaded metallic piece through which the cross bolt passes, and insulating material between them.

450,245. Fire Alarm and Telephone System. Samuel W. Ludlow, Madisonville, Ohio. Filed July 12, 1890.

The combination, with a telephone circuit and a telephone apparatus, of means for automatically operating the generator upon an outbreak of fire, and mechanism for raising the switching lever, so that the telephone transmitter may be switched into the line wire to convey any audible sound agreed upon as an alarm, to the operator at the telephone exchange.

450,260. Thermostat. William F. Singer, Carthage, assignor of one-half to Gilbert L. Haviland, Syracuse, N. Y. Filed July 29, 1890.

A thermostat having two independent bottoms held normally in position by fusible plugs, spring arms carrying contact points, through which the circuit is maintained, and posts or supports for the arms connected with the bottoms.

450,272. Telegraph Relay. Robert O. Wickes, Troy, N. Y. Filed Dec. 8, 1890.

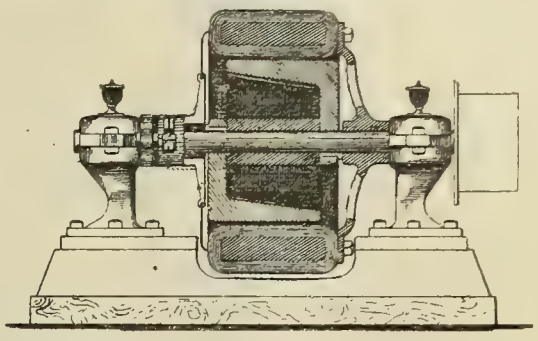
A telegraph relay consisting of the combination of a magnet whose yoke is provided with a screw, a pinion provided with an internal screw thread rotary upon the screw, a gear wheel engaging with the pinion, means, such as a handle, for turning the wheel, a helical spring surrounding the screw and supporting the magnet, an armature for the magnet carried by a pivoted lever, which is provided with electric contact normally in open circuit with a local battery, the magnet being in circuit with a distant battery, a retractile spring holding the armature away from the magnet, a spindle provided with a set screw and connected with an insulating thread which terminates the last named spring, and an indicating finger mounted upon the handle and pointing to numbered divisions arranged in an arc of which the centre is the centre of the wheel.

450,285. Galvanic Battery. Walter A. Crowdus, Memphis, Tenn., assignor to Jo. W. Allison, trustee, same place. Filed Oct. 3, 1890.

The combination, with a battery cell having a metallic trough in its bottom, of a conductor leading from the trough to the exterior, a bath of mercury in the trough, and an electrode with its bottom portion immersed in the mercury, whereby the mercury forms an electric connection between the electrode and the metallic trough.

450,294. Insulator. Charles A. Lieb, New York, and Erwin Lavens, Brooklyn, N. Y.; said Lavens assignor to said Lieb. Filed Dec. 8, 1890.

An insulated supporter for electric wires consisting of a metallic casting having arms provided with holes for the attachment of wires integral therewith, and an insulated eye bolt or like device held by the casting.



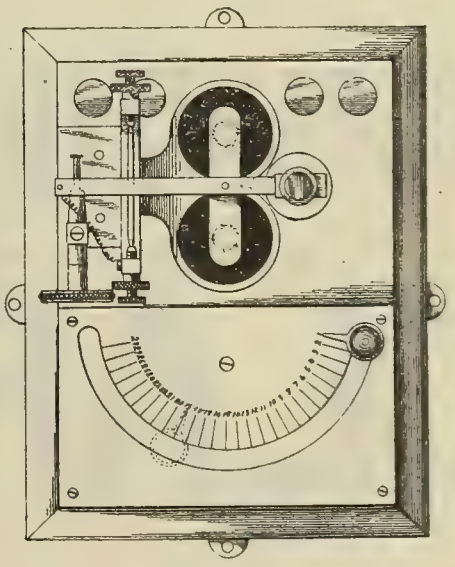
450,219—DYNAMO-ELECTRIC MACHINE.

450,304. Art of Making Filaments for Electric Lighting. Silvanus F. Van Choate, Boston, Mass. Filed May 31, 1890. Patented in England.

The process of building up a filament or base by electro-plating from a liquid solution composed of alcohol, iodine, and aluminum.

450,319. Rheotome. George E. Pragnell, Brooklyn, N. Y. Filed April 12, 1890.

The combination, with a rheotome or interrupter, of an electromagnet, an armature, a strip of spring material on the armature but insulated therefrom, an electric circuit, and a lever contacting with the strip of spring material of the armature at one end and having an adjustable screw at the other end contacting with the metal of which the armature is formed.



450,272—TELEGRAPH RELAY.

450,354. Porous Cell for Galvanic Batteries. William Burnley, North East, Pa. Filed Oct. 21, 1890.

The combination, in a porous cup for galvanic batteries of a shell of pasteboard or wood veneer bent into a cup shape and having its upper end saturated with paraffine wax, cards, or other suitable fastenings for holding the edges of the shell together, and a seal or bottom securedin the lower end, and small holes through the sides of the shell.

450,358. Auxiliary Mouth-Piece for Telephones. William N. Marcus, Philadelphia, Pa. Filed Feb. 10, 1891.

In an auxiliary mouth-piece for telephones, the combination, with a socket-plate for attaching to a telephone-box, of a rigid bent tube passing through the socket-plate and capable of rotation therein, having a collar rigidly fixed thereon, the socket-plate being arranged to press against the collar to secure frictional bearing for the tube.

450,359. Receiving-Telephone Support. William N. Marcus, Philadelphia, Pa. Filed Feb. 10, 1891.

A bracket support for a telephone receiver.

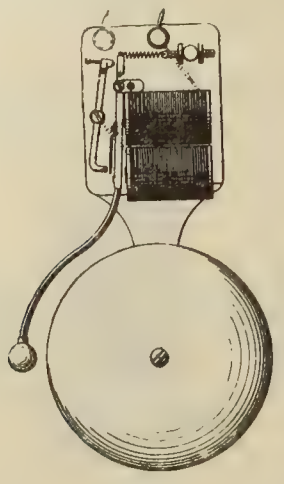
ELECTRICAL PATENTS—Continued.

450,367. Insulation of Armatures for Dynamo-Electric Machines. Rudolph Eickemeyer, Yonkers, N. Y. Filed Aug. 28, 1890.

An armature drum or core for dynamo-electric machines clothed on its face with an inner layer of narrow insulating material laid-diagonally from end to end, and an outer layer of similar material laid diagonally but reversely to the inner-layer,

450,384. Electric Wire Insulator. Daniel A. Bertolette, Norristown, Pa. Filed Dec. 12, 1890.

An electric wire insulator, consisting of a body, grooves at either end of the body, and outwardly, downwardly and inwardly inclined lips adapted to protect a section of the body between the grooves from becoming wet.



450,319—RHEOTOME.

450,390. Electric Time Call. Richard Varley, Jr., Englewood, N. J. Filed Nov. 18, 1890.

An annunciator-board having contact strips in combination with separate check-holders and circuit-connections, and circuit closing checks adapted to be placed on the holders to close the electric circuit by contact with the same and with the strips.

450,395. Game Apparatus. Edwin S. Boynton, Brooklyn, assignor to McLaughlin Brothers, New York, N. Y. Filed Nov. 1, 1890.

A game apparatus consisting of a player's permanent magnet, having widely separated poles, and two or more players' pieces having special forms, as that of fishes, for example, each piece having affixed to it a permanent magnet with widely separated poles, some having the north pole and others the south pole the more conspicuously exposed,

450,426. Electrical Apparatus for Reproducing Sounds. Jules E. Roulez, Paris, France. Filed Oct. 9, 1890. Patented in France.

A microphonic or other similar electric apparatus with a membrane or diaphragm of semi-conducting material, having one terminal conductor connected to it, in combination with one or more insulated blocks to which the other conductor is connected, these blocks being also of semi-conducting material and secured to and supported solely by the membrane.

450,441. Automatic Switch for Electric Motors. Fenner E. Whipple, Philadelphia, assignor to Thomas H. Dallett and George A. Dallett, both of Cheyney, Pa. Filed Oct. 13, 1890.

The combination in an electrical switch, of a pair of sheaves, a belt passing around the same, and a switch-closing plate carried by the belt.

450,458. Electric Signal. Robert H. Gruschow, Chicago, Ill. Filed Nov. 21, 1890.

In an electric signal, a push-button provided with a projection, a connecting strip, and contacts and a case provided with flexible metallic strips, connected by wire conductors with a battery.

450,466. Fire Alarm and Telephone System. Samuel W. Ludlow, Madisonville, O. Filed Oct, 25, 1890.

By the operation of a thermostat a train is released and switches operated to connect magneto and alarm bell to subscriber's usual telephone apparatus, whereby the central station is signaled, and the continuous ringing of the bell near subscriber's transmitter indicates fire.

450,489, Trolley-Guide. William E. Jackson, Jr., Augusta, Ga. Filed Nov. 14, 1890.

The combination, with the trolley pole and wheel, of a guide or finder pivoted to the pole below the wheel and provided with an armature, an electromagnet on the upper end of the pole, normally holding the guide or finder depressed, and means for throwing the guide or finder upward upon the release of the armature.

450,541. System of Electrical Distribution. Charles J. Van Depoele, Lynn. Mass. Filed Sept. 19, 1890.

In a system of electrical distribution, a chemical c unter-electro-motive force device between the leads of a supply circuit, a commutator to the segments of which the elements of the device are connected, a working-circuit in connection with the commutator, a stationary brush or brushes bearing upon the commutator, and means for changing the relative position to the elements of the device of the stationary brush or brushes, whereby the potential of the current supplied to the working circuits will be varied.

450,542. Reciprocating Electric Railway Motor System. Charles J. Van Depoele, Lynn, Mass. Filed Sept. 19, 1890.

In a reciprocating electric railway motor system, the combination, with the vehicle to be driven, of a source of defined rising and falling current moving therewith, a reciprocating motor concentric with the axle thereof and having a plurality of motor-coils, each provided with a movable magnetic piston directly connected thereto, and means for supplying the defined currents to the motor-coils in succession.

450,543. Electro Magnetic Reciprocating Engine. Charles J. Van Depoele, Lynn, Mass. Filed Dec. 29, 1890.

An electro-magnetic reciprocating engine comprising a magnetic shield or envelope, motor-coils within the envelope, a magnetic piston adapted to be reciprocated within the motor-coils, and magnetic extensions from the envelope toward the interior of the coils.



450,239—NON-INTERFERENCE SIGNAL BOX.

450,544. Pulsating Current Electric Motor. Charles J. Van Depole, Lynn, Mass. Original application, filed May 26, 1890. Divided and this application filed Dec. 29, 1890.

The combination, with a source of continuous and pulsating currents, of a motor having a closed circuited armature encompassed by an inducing-coil in circuit with the source of pulsating current and field magnets of constant polarity reacting upon the poles induced in the armature.

450,551. Electric Switch. Frederick Adam and John Knapik, St. Louis, Mo., assignors to Blattner & Adam, same place. Filed Nov. 13, 1890.

The combination, in an electric switch, of a stem, a pivoted switch bar thereon, a pivoted arm on the stem actuating the switch bar, the bar and arm being adapted to be moved relatively one to the other, and a single bent spring constructed and arranged to act in the direction of its length, and to throw the pivoted arm to its extreme positon.

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NEW YORK, MAY 2, 1891.

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NOTES.

It will interest our business friends to know that we propose hereafter to make the first issue of each month of a special nature, to be characterized, as this issue is, by colored advertising pages. This innovation will, no doubt, be much appreciated by those of our friends who are interested in this particular department of the ELECTRICAL AGE. These colored pages will be attractive, and will also relieve the monotony of constant black and white. One of the desires of the ELECTRICAL AGE is to avoid sameness or anything that implies sameness. We want to avoid ruts and reach out after novelties. That is what our friends want and that is what we propose to give them. We are open to any suggestions from our friends in the line of novelties and improvement in the make up of our paper. Our desire is to please our friends, and of course that can be best accomplished by knowing what their desires are. In order to learn these they must be expressed.

The paper read by Mr. Alex. S. Brown, before the Institute of Electrical Engineers, April 21st, on the subject of the production of aluminium by electricity, was an exceedingly interesting one, and greatly enjoyed by those who were fortunate enough to be present. The paper gave a history of the development of the processes of extracting the metal, and described the various methods now in use for producing it on a large and paying basis. A full abstract of the paper with illustrations, will be found elsewhere in this paper, and no doubt will be found very interesting.

There is a genuine ring to the report that comes from Berlin to the effect that the Tramways Company, of that city, have decided to substitute electric cars for all of its horse-cars, and what makes the announcement all the more interesting, is the fact that a prominent American system is to be adopted. Our Berlin friends on several occasions before, have shown their enterprise in electrical matters, and this latest move brings this quality out in strong relief against the timidity and sluggishness of other continental countries.

Electrical engineers have of late directed their attention to low speed electric generators and dynamos, and have taken up the multipolar machine as giving the greatest power from the least number of revolutions. Multipolar dynamos and motors are rapidly growing in favor, and while excellent results are obtained from their use, they are not as well known as machines of the ordinary type. The writings on the subject are fragmentary and scattered, involving time and labor to find when wanted. We print in this issue the first installment of a paper on the design of multipolar dynamos, by Mr. W. B. Esson, an English electrician of repute, which no doubt will be interesting to American electricians.

If the theory advanced by Mr. N. D. C. Hodges, as to the cause of the damage and destruction of buildings when struck by lightning, and the method proposed to avert such damage is correct, that gentleman's discovery will properly rank as one of the most scientific and useful in the history of electricity. His reasoning seems to be correct, and it will be interesting to note the result of a practical test of his system of protecting buildings from damage by lightning. If he is right, then there will be no excuse for allowing property to go unprotected from lightning's destructive power. It is well to be prepared at all times for the unexpected, and lightning certainly possesses, more than anything else that we know of, a good deal of the element of uncertainty. It may, or may not strike ones property, and very frequently the lightning rods in vogue at the present time are no better than none at all. A reliable method of protection against damage to property by lightning is something very much desired, and if Mr. Hodges has discovered a means of accomplishing this result, his name will become intimately linked with that of the immortal Ben Franklin.

The value of street railroad shares is beginning to appreciate after the onslaught on this class of property brought about by the absurd and baseless stories set afloat in different quarters touching the undesirability of electric power on street railroads. Sober second thought has revealed the unreasonableness of such stories, and capital is rapidly regaining confidence in electricity as a motive power. As an evidence of this it is interesting to note that the Committee on Cities in the Massachusetts Legislature has reported a bill authorizing savings banks in that State to purchase shares in street railway companies under certain conditions. When savings banks feel safe in investing their funds in such property, it augurs well for the property. These institutions, of all others of this nature, must necessarily exercise the greatest care and judgment in their investments, and the properties they invest in is generally of the best and most reliable kind.

"When are we to have electric light for our houses, as convenient and as cheap as gas?" is a question that is frequently propounded by householders. When are we to have these things, is indeed an interesting question, and one which electricians are as eager to answer as the householder is to have answered. It is a problem that thousands of people are hoping to see successfully solved some of these days, and one to which many electricians are devoting much time and thought with a view to its solution. All recognize the fact that it is one of the greatest fields ever presented for development and, very naturally, is a prize worth striving for. The people are looking for the day when they can have electric light in their homes. The great question is, how can it be supplied economically on a small scale—that is for the lighting of a small or moderate sized dwelling? Will the primary battery solve the problem? Many look in this direction for the answer, and it is quite evident that there are many electricians who share in the same hope, judging from the numerous batteries of this class that have of late been brought forward for public recognition and favor. Will the storage battery meet all the demands? This is another system that has many earnest advocates. Neither of these two systems, however, has yet been proved to possess all of the qualifications necessary to fill every demand in domestic lighting. The labor necessary for the proper care of batteries is a feature that must be reduced to a minimum, and it is interesting to note the improvements being made in this direction. The consumption of zinc is another point that is being carefully developed. Zinc is a comparatively expensive material at the best, and unless we get a full return of its energy in the shape of light or power, the primary battery cannot successfully compete with other illuminants. The dynamo, on account of its cost and expense of maintenance, of course, is out of the race for small work. The question still remains unanswered, but it may not always remain so. It is in the nature of things to suppose that the problem will be successfully solved some day. It may require some system radically different from those looked to at the present time for the revelation of the secret, but success is bound to come.

Electric motors are coming into extensive use in the shoe factories in the East, on account of their cleanliness, economy of space and maintenance. This form of power is far preferable to steam power, for the reasons mentioned and many others, and the little electric motor is making friends very rapidly in every quarter and in all sorts of business establishments. The field of its application is unlimited, and its future is more promising than that of any other tangible property we know of.

A case is before a Boston Court which possesses much interest to electric light station operators. The Edison Electric Illuminating Company, of Boston, are the defendants in a suit brought by a manufacturing firm in that city to compel the Edison Company to supply the plaintiff with electricity. The electric company refused to furnish the electricity, whereupon the plaintiff appealed to the gas commissioners who ordered the Edison Company to supply the manufacturing concern with electricity. This not having the desired effect, the plaintiff petitioned for a writ of mandamus, and the defendants demurred on the ground that the writ was not the proper remedy. The court, however, decided that the defendant is incorporated for the purpose of furnishing electricity, and the writ of mandamus must issue unless the court can be convinced that such is not the case. The trial of the case is therefore to be held, and it will be interesting to note the outcome.

OVERHEAD WIRES IN NEW YORK.—At a meeting of the Board of Electrical Control, April 23d, Mayor Grant told the representatives of the various electric lighting companies who were present, that he was having prepared a list of poles that were now standing in opposition to the order of the Board, and that all of them must come down. An extension of ten days was allowed the companies to remove all the poles that stand in streets in which there are subways.

ELECTRICITY IN THE PRODUCTION OF ALUMINIUM.

On April 2, 1889, Mr. Charles M. Hall, of Oberlin, Ohio, secured patents for a process of reducing pure aluminum. In this process alumina is dissolved in a fluid bath composed of aluminum fluoride and potassium fluoride, with, perhaps, an addition of lithium fluoride, this bath then being electrolyzed by means of an electric current conveyed to a carbon-lined furnace through an anode of some non-carbonaceous material. In electrolyzing this bath, the containing vessel is made to serve the purpose of the negative electrode. In another patent Mr. Hall claims the use of a bath composed of alumina dissolved in compound fluorides of aluminium with alkaline earthy metals, and in still another patent, the use of a bath composed of alumina dissolved in the fluorides of aluminium, calcium and sodium, these materials being obtained by melting together aluminium, fluoride, fluorspar and kyrolite. With this latter bath a carbon anode can be used without the bath being affected by its disintegration.

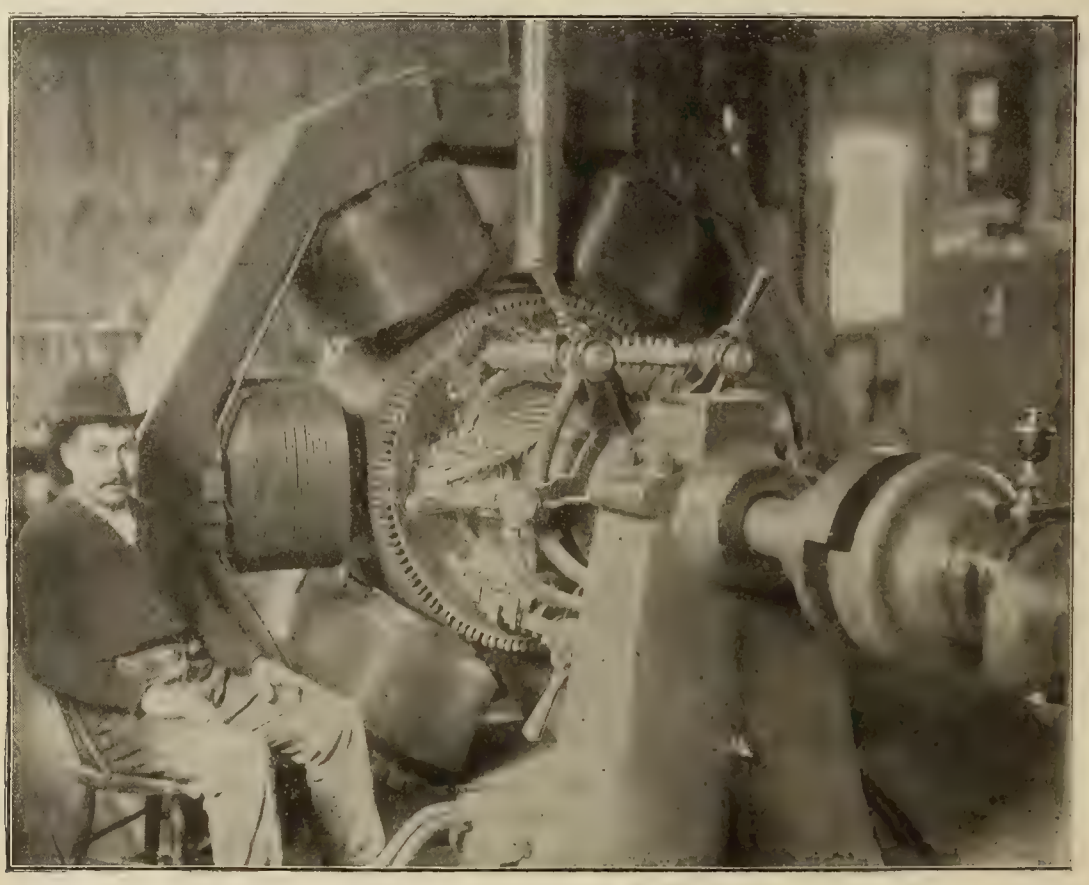


FIG. 1—OERLIKON DYNAMO AT BOONTON, N. J.

The Hall group of patents is now controlled by the Pittsburg Reduction Company, of Pittsburg, Pa., which has had its metal on the market since March, 1889. The plant has a daily capacity for producing about 300 lbs. of metal, the selling price of which was $2.00 per pound, until the early part of March last, when it was reduced to $1.00 per pound for commercially pure aluminium, of a guaranteed purity of 97 per cent. The reduction in price, considered in conjunction with the limited amount of pure metal produced, would appear to confirm the generally received impression that while the pure metal is specially adapted to the manufacture of articles of art and ornament, it is not displacing tin, platinum, silver, etc., to anything like the extent its admirers have supposed it would. The fact is, aluminium as a pure metal is not designed largely to supplant other metals in the arts and manufactures; it is to its alloys that we must look to redeem the inflated reputation of the pure metal.

. . . . . .

The electrical smelting process of the Messrs. Cowles, of Cleveland, Ohio, was the first to secure a commercial footing in this country. These gentlemen have taken out a series of patents covering their process, and they have exhibited very commendable energy and perseverance in establishing a market for their products.

. . . . . .

Perhaps I may not unprofitably consume a moiety of your time by explaining that the furnaces used at the company's extensive works at Lockport, are rectangular and oblong in shape, comparatively shallow, and are composed exteriorly of walls of fire-brick or metal, lined with pulverized charcoal or other form of carbon or similar material, of electrical conductivity inferior to the ore to be smelted; this material being generally previously saturated with lime water to increase its resistance to heat. At each end of these furnaces are inserted rods of carbon which, passing through the walls and linings are brought very nearly into contact within the body of the furnace, and being connected to suitable wires or cables coupled to the dynamo, constitute the positive and negative electrodes. The charge consists, ordinarily, of a mixture (in different proportions) of an electrically resisting material—such as electric light carbon—and the ore to be reduced; though (in cases where the ore itself has sufficient electric resistance) the carbon is sometimes dispensed with. The charge fills the furnace and presses against the sides and ends of the electrodes which project into the furnace. When a current of electricity is passed, the electrodes are so adjusted as to form an arc, and the current then flows from the sides and ends of the electrodes through the broken resistance material, which, of course, becomes incandescent, and the intense heat developed by this incandescence reduces the ore; the metal flowing to the bottom of the crucible and being subsequently tapped or dipped out when the charge is consumed. The gases liberated in the operation pass out through openings in the fire-brick cover of the furnace. From the character of the apparatus and manufacture or operation described, it will be obvious to you that the reduction of the metal is (as claimed by the Cowles Company) accomplished by means of heat generated by the passage of an electric current through a mass of high resistance material, and that if the chemical effect of the current assists the reduction at all, such utilization is entirely accidental and unsought. Neither aluminium nor any other metal is produced on a commercial scale by this process *as pure metal.*

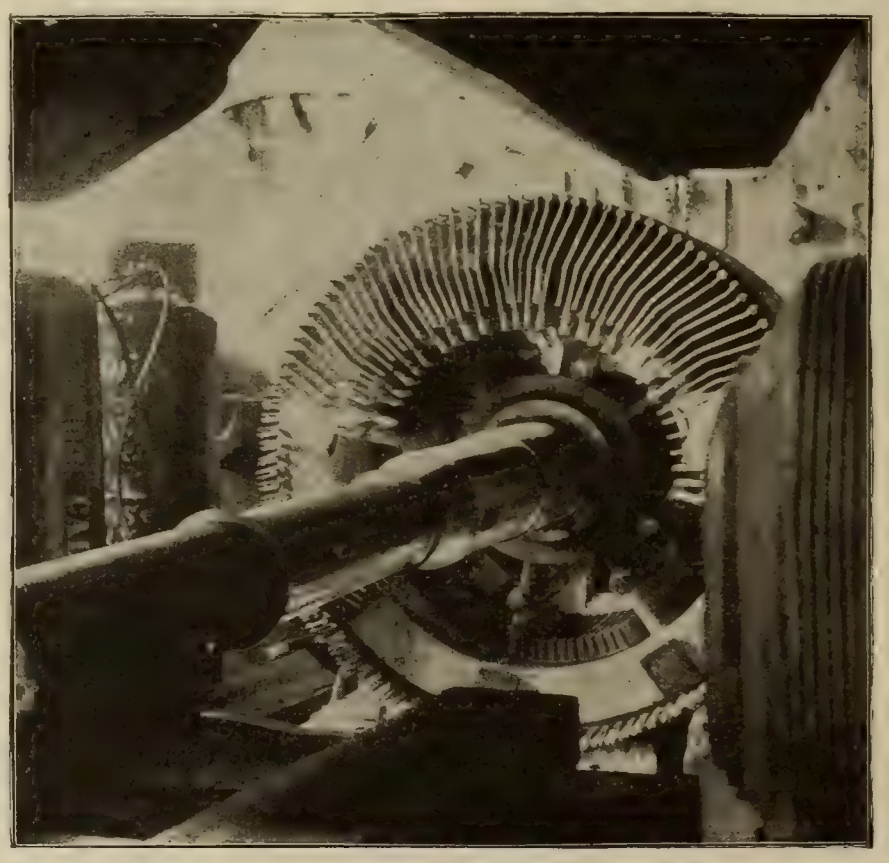


FIG. 2—ARMATURE OF OERLIKON DYNAMO.

The principal rival to the Cowles process for producing aluminium alloys is the Heroult process, which reduces aluminium and other metals from their refractory ores in the presence of another alloying metal and is contradistinguished from the Cowles process mainly by the fact that it operates exclusively—or at least almost entirely—by utilizing the chemical or electrolyzing action of the current. This process is the invention of a young French electrical engineer named Paul L. T. Heroult. In 1886–7 he secured French, English and other European patents, covering several processes for the extraction of aluminium, silicon, boron, etc., from their ores, both as pure metals and in the form of alloys. On August, 14, 1888, he secured a United States patent No. 387,876 for the process of preparing aluminium bronzes and their alloys, and it is understood has pending in the Patent Office a series of applications covering other parts and features of his inventions. Though the Heroult processes have been very little discussed or even described in print, and are therefore almost wholly unknown to the public, their commercial success abroad has been far greater than has attended any other aluminium process, and while those owning the American patents seem as yet to have done little in the way of exploiting them, the success of a small plant put into operation at Boonton, N. J., for private demonstration purposes, in April, 1890, has been such as to give it rank among the prominent aluminium processes in this country. Having had exceptional facilities for studying the workings of this plant during the past four months, I might be pardoned—especially as so little is publicly known of it—for describing it at length, but as I particularly desire in this paper to direct your attention to the electrical apparatus used at Boonton, by way of illustrating the great power and value of the electric current in metallurgical operations, it will suffice here to say that the patents of this young engineer, having first been acquired by Swiss

* Abstract of paper read by Alexander S. Brown before the American Institute of Electrical Engineers, New York, April 21, 1891.

capitalists, were afterwards bought by the celebrated syndicate which, under the name of the Allegemeinen Electricitats Gesellschaft of Berlin, substantially controls the entire electrical field in Germany. This syndicate, after carefully examining all other processes then known, invested ten millions of francs in the Heroult process, and are operating very extensive works, which obtain their power from the falls of the Rhine, at Schaffhausen. There they produce not only pure aluminium and all its alloys, but also alloys of silicon and other metals. Those works are supplied partly with dynamos of the type I wish especially to describe to you, and partly with dynamos of 600 electrical horse-power, a complete description of which I regret I am not able to place before you at this time, as they would interest you. These machines weighing over fifty tons each, revolve horizontally ; they have 24 pole-pieces with collectors over 12 feet in diameter, and were especially designed for economical work.

To give you a comprehensive idea of the method employed by Mr. Heroult in manufacturing aluminium and its alloys—and so far as electrical apparatus is concerned, there is little difference between his and the Cowles process—it will be best to describe the electrical plant and crucible separately.

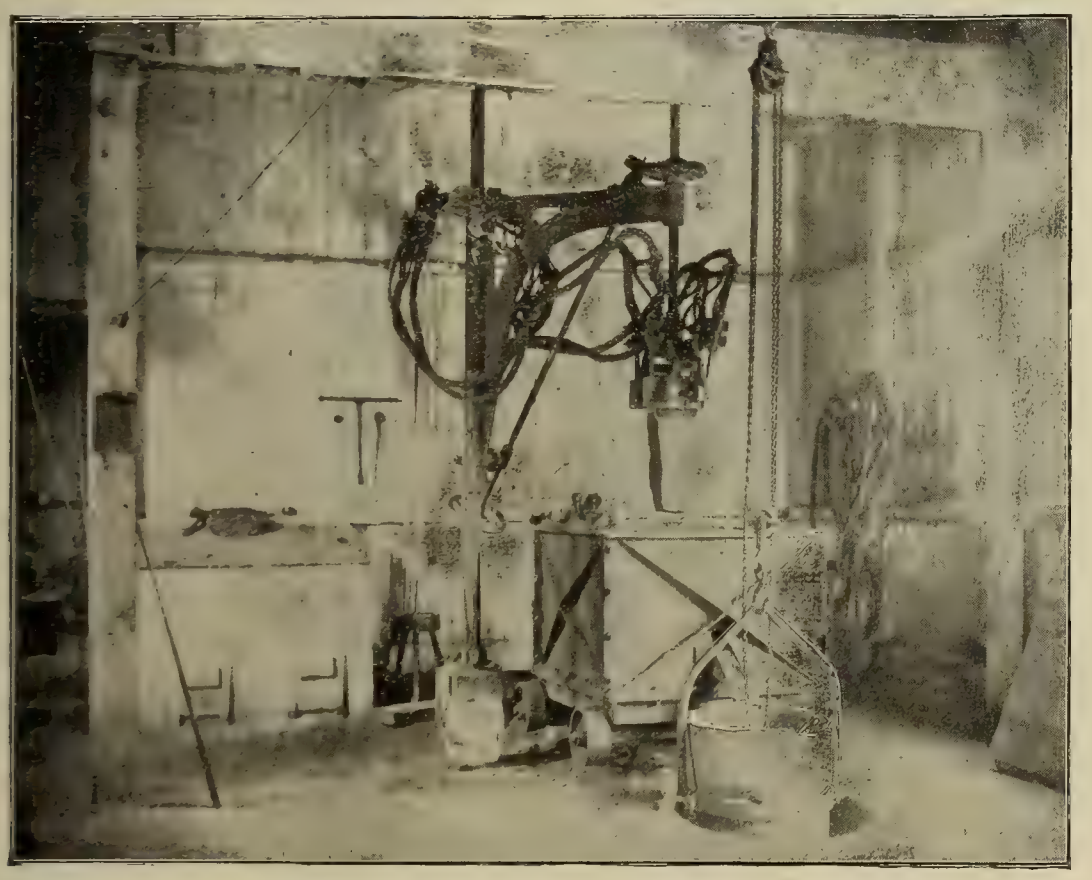


FIG. 3—HEROULT CRUCIBLE USED IN ALUMINIUM EXTRACTION.

In the electrical apparatus the most important feature, of course, is the dynamo which generates the current. This machine was designed by Mr. C. E. L. Brown of the Oerlikon Works, Zurich, specially for electro-metallurgical work and is the only one of its kind in America. It weighs, complete, over 19 tons, and when driven at 220 revolutions generates a current of 35 volts and 3,500 amperes. The general appearance and design of the machine is very well shown in the following illustration (Fig. 1). It is, as you will observe, a six pole machine : having an armature of the Gramme ring type, and the current is taken off commutators at either end, by 72 brushes. The armature is 39 inches in diameter, and the shaft, (including its clutch), is 11 feet 7 inches long. The commutators, are each 19 inches in diameter and 20 inches long, each commutator containing 60 segments weighing 13 lbs. apiece, or a total of 780 lbs. for the segments for one commutator alone. The core of the armature consists of a very large number of sheet iron discs clamped together in a frame of aluminium-bronze. About ⅜ of an inch from the outside edge of the core, 120 holes pass from one end to the other, through each of which passes a copper wire ½ inch in diameter. These wires, which of course are thoroughly insulated from the core, form part of the winding. The remainder of the winding is composed of copper bars ¼ of an inch thick, 31 inches long and 2¼ inches wide. The shape of these bars and the interior appearance of the armature can readily be seen in the illustration (Fig 2). This photograph was taken about six months ago, while the armature was being repaired in consequence of an accident. Though as previously mentioned, the works at the Rhine Falls are in part equipped with much larger dynamos of 600 electrical horse-power, it has been found that they do not give nearly as economic results as the other dynamos of the kind I have attempted to describe. This latter type is also in universal use at Mr. Heroult's own works at Froges, France. At the time a friend visited the Schaffhausen works last summer, one of these 150 horse-power machines had been running without a moment's intermission five months, and another nearly four months. Though rated at 150 horse-power by the Swiss makers, the same machine in this country would be rated at over 200 horse-power, and would be driven at much greater velocity. In actual work they are frequently run up to 300 revolutions, and though it sometimes happens in practical operations that heavy short circuits occur, there is hardly any perceptible sparking at the brushes, even when the current rises to 8,000 or more amperes. The indicator attached to two of these machines (coupled in series) at the Rhine Falls has frequently recorded 25,000 amperes without any evidence of the short-circuiting appearing at the brushes.

At the Rhine Falls, at Froges, and at Boonton, these machines are coupled directly to turbine wheels arranged upon horizontal shafts. The frame to which the field magnets are attached is a solid casting, weighing alone over nine tons. The field magnets are excited by a smaller dynamo driven by belting from a pulley on the main shaft. This smaller machine was also designed by Mr. C. E. L. Brown; the armature being similar to that of the large machine, except that it has but one commutator. This exciting machine is run at 60 volts and 120 amperes, and its performance is worthy of all praise.

At Boonton the bus wires are 8 in number; 4 positive and 4 negative; each wire being square and having a cross-section of one inch. They are, in fact, rolled copper bars, uninsulated, because the low potential of the current requires no special insulation. An ammeter is placed in the main circuit by a simple arrangement, for the guidance of the workman who specially looks after the crucible. The distance from the dynamo to the furnace, (which is situated in another room), is only 14 feet. The 4 positive wires pass directly to the clutch which holds the anode, and the 4 negative wires pass from the ammeter back to the dynamo.

The crucible (of which Fig. 3 gives a good representation, together with the method now in use for raising and lowering the anode) is composed of a strong iron box which has a deep lining of carbon, previously ground very fine, mixed with sufficent tar and thoroughly compacted on the bottom and around the sides of the containing iron box. After the furnace is thus re-lined, the carbon is baked in order to drive away the tar and harden the lining. You will see that the position of this crucible is directly the reverse of those used by the Cowles Company, and that the carbon crucible itself actually forms part of the electric circuit. Unlike the Cowles process Heroult's is a continuous process ; the reduced metal being tapped from the bottom of the crucible while the machine is merely stopped or slowed down for a few minutes. The interior dimensions of the crucible varies with the ore to be reduced, and the size and character of the anode used. Ordinarily, it has an interior depth of about 22 inches and a clear space of 6 inches between the walls and exterior surface of the anode. The electric current passes into the crucible through the suspended carbon anode, the vertical position of which is controlled by an attendant who lowers it from time to time to preserve an approximately constant distance between the bottom of the anode and the surface of the molten bath in the crucible. The anode usually dips several inches into this molten bath and in practice the intervening space between its bottom and the surface of the molten metal, is kept at about an inch by the attendant who, by watching the needle of the ammeter, is enabled to maintain the electrode in its proper relative position without difficulty. In order to get as perfect a contact as possible, between the furnace and the cables leading therefrom back to the dynamo, the cables are firmly clamped to a large block of zinc, which projects from the rear of the furnace and is kept cool by water circulating in pipes around which the zinc is cast. While, properly speaking, the crucible has no top, as a rule plates of carbon imbedded in dry alumina spread over the top of the crucible, are so adjusted as to fit close to the anode in order to retain most of the heat. The mouth of the crucible is formed of slabs of carbon built up funnel shape. The hearth or floor is pierced by a tap hole, which is kept closed by a plug of carbon or fire clay, and is opened from time to time to allow the molten metal to run into a carbon-lined ladle, from which it is cast into ingots.

There are a few distinctive but not important differences between Heroult's method of making alloys and reducing pure metals simply. In making alloys, the base alloying metal is first melted in the crucible by the current, or molten metal is poured into the furnace, to form a liquid metallic cathode. This is usually simply and economically accomplished by throwing pieces of the metal—copper, for instance—into the furnace, seating the anode upon them and passing the current. At first the current is very unsteady, arcs constantly forming between the copper and the anode, but when the copper is entirely melted (and it takes but a very few minutes to melt 200 or 300 pounds) the ore to be reduced is added in sufficient quantities to form a bath, and floats on top of the molten copper. The anode having been raised so as to leave a space of about an inch between its bottom and the molten copper, the current becomes steady and the operation is established. Thereafter the ore is introduced in small quantities, at frequent and regular intervals, until the

desired percentages of aluminium or silicon contained in the alloy have been secured. This percentage can be regulated entirely at will up to about seventy per cent. of reduced metal. No external heat is used, and the process is absolutely continuous at the will of the operatives, which are special features of the Heroult system. The passage of the electric current through the bath, serves not only to keep the copper in a fluid state and to melt the ore, but also electrolyzes and decomposes the latter. It is a point of careful regulation in the Heroult process to maintain only sufficient heat to keep the bath fluid, since any further expenditure is not only useless but lessens the output. The oxygen from the reduced metal combining with the carbon of which the anode is composed is burnt with the production of carbonate oxide gas, which escapes from the crucible around the sides of the anode and at the feed hole. The product is withdrawn at intervals by tapping the bottom of the crucible as in ordinary smelting. Each time the metal is tapped, a sample is carefully preserved for accurate analysis, to determine the percentage of contained aluminium.

It is well known that pure aluminium can be drawn out into the finest wire or into tubes; rolled into plates, stamped into medals (similar to those distributed at the recent Electric Light Convention*) beaten into the finest foil, etc. It has an elasticity similar to that of silver, and a tensile strength of about 26,800 pounds per square inch. The addition of 6 per cent. of copper, however, increases the tensile strength to that of wrought-iron, and a slight percentage of silicon raises its strength to 90,000, though at the expense of other qualities.

SOME POSSIBLE MODIFICATIONS IN THE METHODS OF PROTECTING BUILDINGS FROM LIGHTNING.†

I would thus formulate what seems to be true,—that a conductor which can be easily dissipated by a lightning-discharge protects the building to which it is attached between two horizontal planes, the one passing through the upper end of the dissipated conductor, and the other through the lower end; and it is this one point that I would urge upon the consideration of the Institute.

I have taken the time of the Institute to tell how I reached this conclusion; but, as must always be, I reached it by making some false digressions. So far as I know, therefore, a conductor such as I have here—a conductor made of light copper ribbon, so that 75 feet of it will weigh only a pound, and made in sections two feet long, which shall be tacked to the building from its ridge-pole to the foundation, the joints being made of low conductivity by the insertion of insulating washers—will protect the building. The conductor will be destroyed by the discharge. Its destruction can take place even against a plastered wall without injury to the wall; but no other harm will occur so far as the conductor extends in a vertical direction. There is no need of the conductor following the shortest course to the ground. There is no need of providing a good earth connection. I can see no difference between the two ends of the metallic ribbon. You do not attempt to make a good connection at the top with the dielectric, and I do not see why you should attempt to make a good connection at the bottom. In no case on record of the protecting influence of dissipatable conductors has this protecting influence depended upon there being a good earth connection. Of course, the ribbon should not be boarded over. Free gun-powder burns harmlessly enough, but it causes damage when burned in a confined space; and the dissipatlon of a conductor presents similar phenomena.

It would not do to run such a conductor as I suggest here part way down the building, and then make it turn up again before its final descent to the ground, as in such a case there would probably be a line of disaster from the point where the upward turn began.

Doubtless numerous improvements can be suggested, but letting this stand as the main point of what I have to say,—that a dissipatable conductor protects,—it may be of interest to consider why it protects. But here you will understand perfectly well that while I can offer certain explanations which seem fairly plausible to me, it is not in the nature of things that I should have gotten at the whole truth.

In order to destroy a building in whole or in part, it is necessary that work should be done; that is, energy is required. Just before the lightning-discharge takes place, the energy capable of doing the damage which we seek to prevent exists mainly in the column of air extending from the cloud to the earth in some form that makes it capable of appearing as what we call electricity. We will therefore call it electrical energy. What this electrical energy is, it is not necessary for us to consider; but that it exists there can be no doubt, as it manifests itself in the destruction of buildings.

The problem that we have to deal with, therefore, is the conversion of this energy into some other form, and the accomplishment of this in such a way as shall result in the least injury to property and life. Lightning-rods were introduced with the idea that the electricity existing in the lightning-discharge could be conveyed around the building which it was supposed to protect, and that the building would thus be saved. The question as to the dissipation of the energy involved was entirely ignored, naturally; and from that time to this, in spite of the best endeavors of those interested, lightning-rods constructed in accordance with Franklin's principle have not furnished satisfactory protection. The reason for this is apparent when it is considered that this electrical energy existing in the atmosphere before the discharge, or, more exactly, in the column of dielectric from the cloud to the earth, reaches its maximum value on the surface of the conductors that chance to be within the column of dielectric; so that the greatest display of energy will be on the surface of the very lightning-rods that were meant to protect, and damage results, as so often proves to be the case. The very existence of such a mass of metal as an old lightning-rod only tends to produce a disastrous dissipation of electrical energy upon its surface—"to draw the lightning," as it is so commonly put.

Having cleared our minds, therefore, of any idea of conducting electricity, and keeping clearly in view the fact that in providing protection against lightning we must furnish some means by which the electrical energy may be harmlessly dissipated, it seems clear why it is that the use of sufficient energy to dissipate a pound of copper, leaves not enough to do harm to other objects around.

THE BOSTON TROLLEY.

Of the different methods of conveying the electric current to car motors, the overhead wire, with its accompanying trolley, seems to be the means most favored by street railway companies adopting electricity as a motive power. There is no doubt that the trolley has come to stay, at least until some method equally as satisfactory is devised. One of the most successful inventions in this line is the Boston Trolley, made by Albert & J. M. Anderson, 21 Hamilton street, Boston, which we illustrate herewith, and a description of the construction and distinctive merits of which will no doubt interest our readers.

The base, Fig. 1, is so constructed as to give the pole an easy side movement, with sufficient motion to either side of the car, while the powerful mainspring keeps the wheel on the wire. Both side and main springs are adjustable, and of such proportions that they do their work without liability of setting or breaking.

The base mechanism lays flat on the top of the car, giving it a neat appearance, and allowing it to run under low bridges.

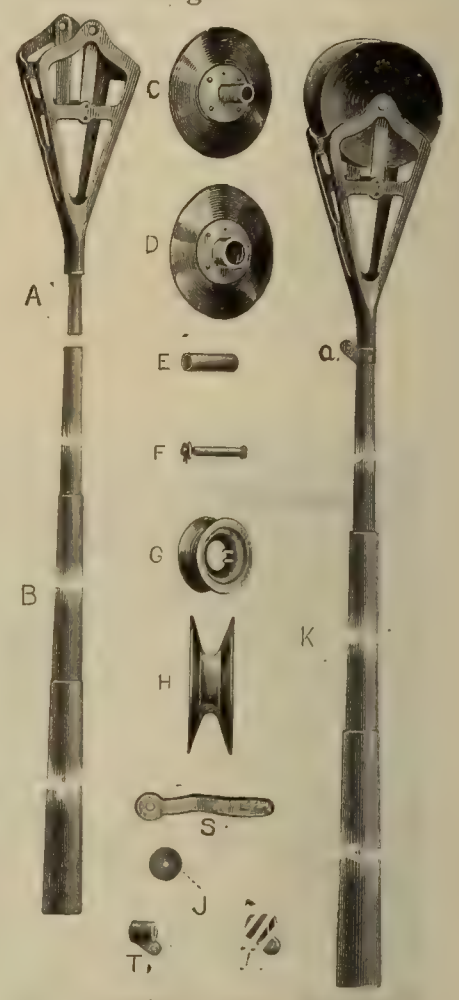


FIG. 2—TROLLEY AND ITS PARTS.

Owing to the peculiar method of hanging the mainspring to the rocker-arm, the tension against the trolley-wire is equalized, and is practically the same in all its positions, from vertical to horizontal, and the wheel will follow the wire at either extreme.

The Trolley Wheel and Pole is shown in Fig. 2. The wheel has a loose contact ring which can be replaced at small cost when worn out. The bearing in the wheel consists of a non-conducting removable bushing, which can be easily replaced.

The current is carried by contact springs on the hub of the wheel, thus avoiding arcing between the wheel and pin, and, it is claimed, giving more durability to the bearing than can be obtained in any other way.

The frame holding the wheel is made of steel, light and strong, tapering in form to prevent catching in the span, or pull-off wires.

The pole is of steel tubing, 1½ inches in diameter at the base, and 1 inch at the top. It will not bend under the work, but if accidentally bent, can be straightened cold. It is made of the best material that can be obtained and constructed in a first-class manner. It is neat in appearance and it is claimed that it will neither catch in nor jump the wire.

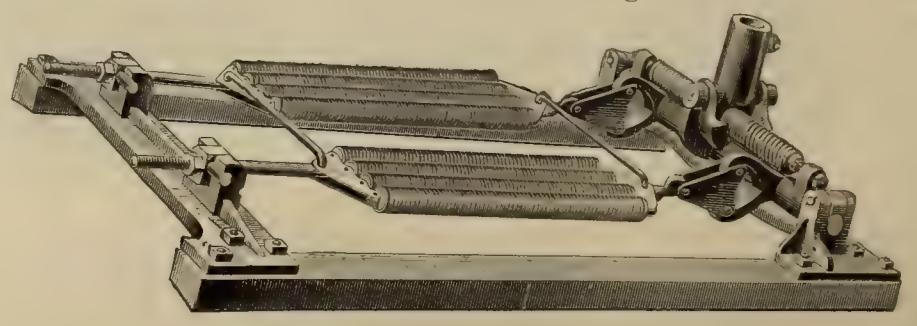


FIG. 1—TROLLEY POLE BASE.

*ELECTRICAL AGE Aluminium Medals.

† Abstract of paper read by N. D. C. Hodges before the American Institute of Electrical Engineers, April 21, 1891.

AN IMPROVED TRAMWAY RAIL.

Recognizing the fact that the progressive men in the street railway business are interested in the most substantial equipment for the track, the Tramway Rail Company, of Pittsburg, Pa., after several months of experimenting, now call attention to several advantages which they claim the steel rails and other equipment manufactured by them possess, the construction of which is shown in the accompanying engravings.

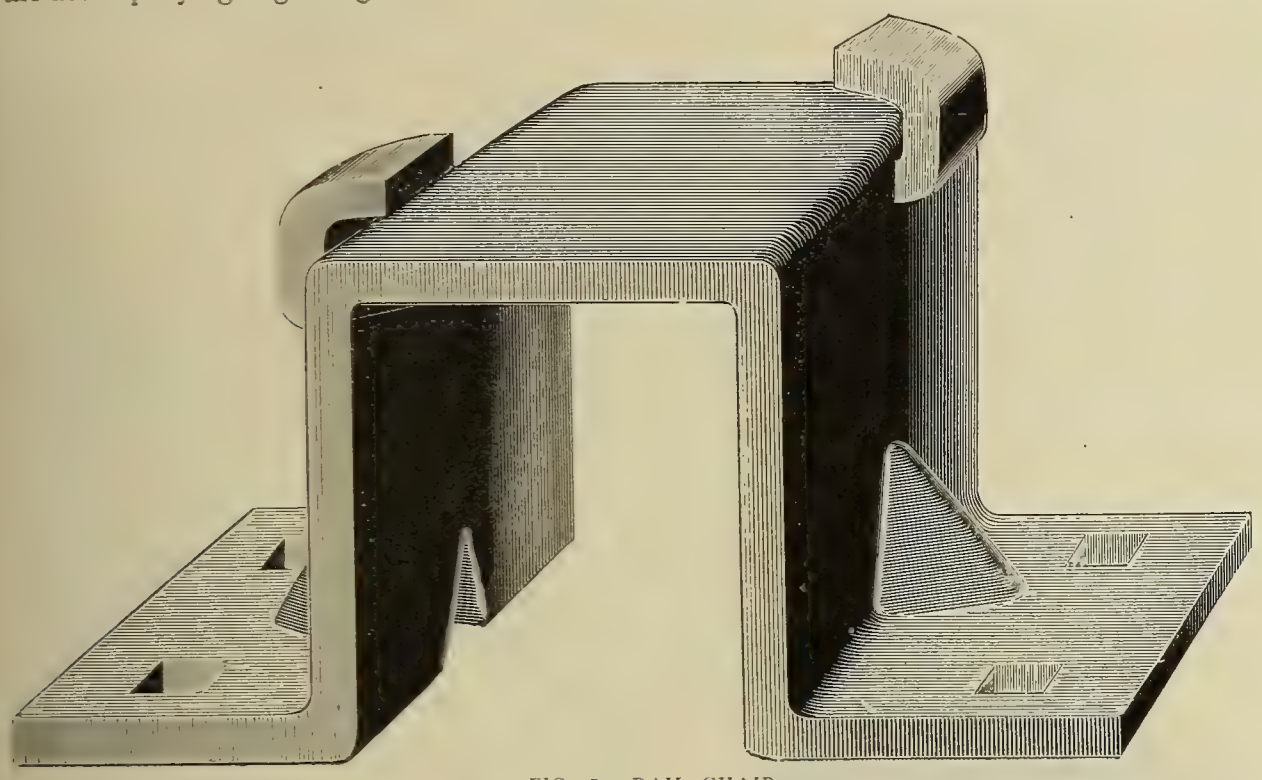


FIG. 1—RAIL CHAIR.

The rails, rolled after generally approved patterns, differ in important points. They are so constructed that the initial wear comes directly over the centre of the web, thus from the first utilizing the maximum vertical stiffness of the rails. The tram, which is sufficiently heavy for street traffic, is low enough to clear the wheel flange, after severe service. By skillful rolling, extra wide bottom flanges are furnished which afford the rail an unusually firm seat. The fish plates, which are all after the channel bar pattern, are of unusual thickness, and made to fit perfectly the curves of the rail channels.

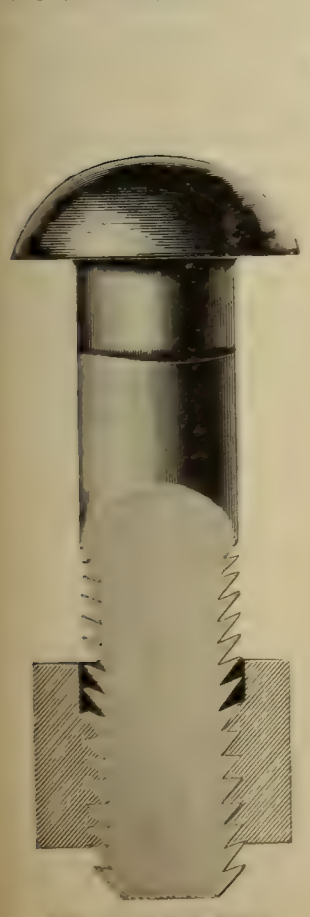


FIG. 2—GRIP BOLT.

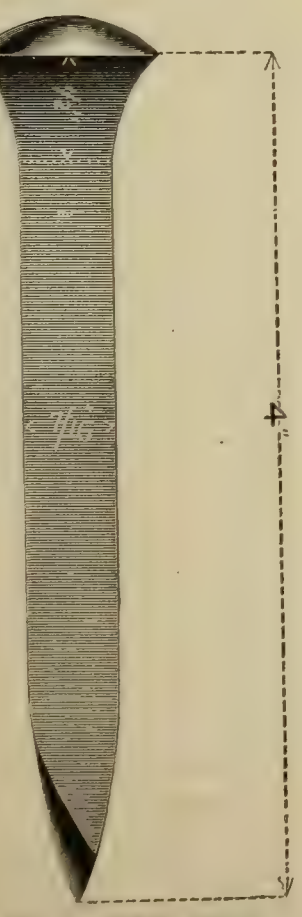


FIG. 3—STEEL SPIKE.

By the use of the "patent grip bolt," a step toward perfection is made in joint construction. Under a strain, the bolt thread, which is turned to a fine edge, five degrees less than a right angle to the axis of the bolt, is forced out so as to fill completely the thread of the nut, thus lessening the liability of loose joints. Both the head of the bolt and the nut have large bearing surfaces, while the latter, which is cut away at the corners, permits easy adjustment.

The chair is made of $\frac{5}{16}$-inch forged steel. It requires no bolts, and by the construction of the lugs does not project beyond the rail flanges, thus offering the least obstruction in paving. The lugs are the ends of a steel bar, 1¼ inches by ½ inch, thrust diagonally through the chair just beneath the top, and bent up so as to clasp the rail flanges. The bar, being placed in positon while red hot, obtains a firm hold upon the chair top when it shrinks by cooling. The lugs, not being directly opposite each other, due to the diagonal direction given the bar, allow the chair to be clamped upon the rail at any point.

The spike used by the company is the patent "Goldie steel spike," which can be twisted and bent without breaking. The point is so constructed that in driving the head is thrown toward the rail, and at the same time prevents the turning of the spike. The gently flaring head fits snugly into the hole punched into the chair flange and yet can easily be withdrawn. Evils due to inaccurate blows of the spike maul are done away with by the round head.

An improved joint box of tough steel is furnished when desired for enclosing the joint. It permits easy access to the joint without endangering the soundness of the surrounding roadbed, and requiring no lid, it is not a source of accident.

The rails and equipment of the Tramway Rail Company are handled by the Electric Merchandise Company, of Chicago, the latter having been appointed agents for the West and Southwest.

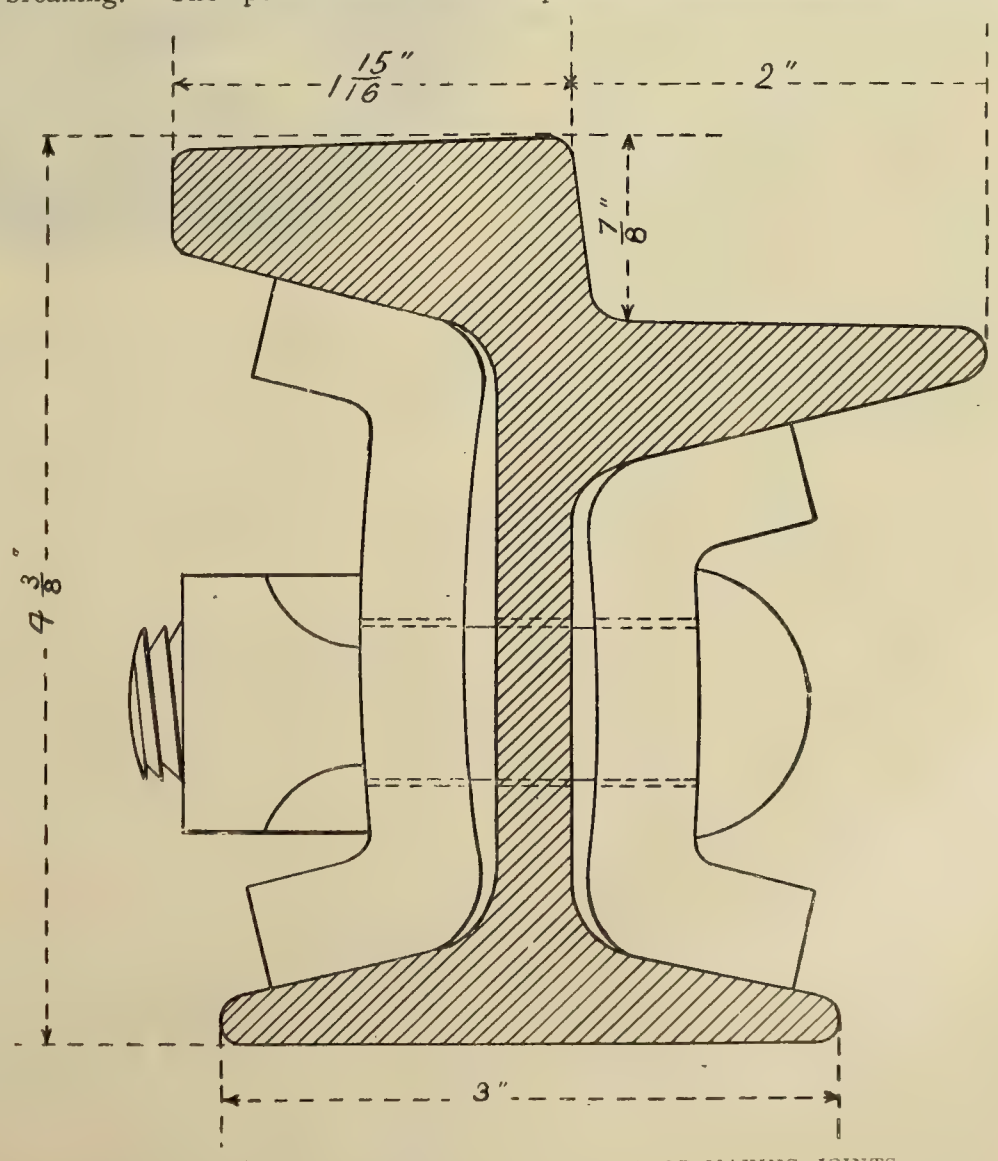


FIG. 4—SECTION OF RAIL SHOWING METHOD OF MAKING JOINTS.

ENGINEERING SCHOOLS.

In an introductory lecture delivered at Cambridge, England, last January, by J. A. Ewing on "The University Training of Engineers," Mr. Ewing refers to American engineering schools in the following language:

In America we find a number of highly organized and admirably conducted engineering schools, forming in some cases an integral part of universities; in others standing alone. In some respects they follow the Continental pattern, but with a difference. If I were to select one for special reference it would be the Massachusetts Institute of Technology. Workshop instruction is given "as an adjunct to the theoretical treatment of professional subjects;" and there is a superbly equipped engineering laboratory for which new rooms covering 15,000 square feet were provided less than a year ago. The work of this school is spoken of in the highest terms, and the fact that it has now 900 students, bears witness to the estimation in which it is held in the United States. The Massachusetts Institute carries the college training of engineers to a degree of elaboration which we are perhaps disposed to deprecate; but it seems to me to avoid the most serious fault in the Continental schools.

AMPERE TURNS.—The following is the rule for calculating the amount of exciting power that is required for an electromagnet pulling at its armature, in the case where there is a closed magnetic circuit with no leakage of magnetic lines. Take the square root of the pounds per square inch; multiply this by the mean total length (in inches, all round the iron circuit; divide by the permeability, and finally multiply by 2,661; the number so obtained will be the number of ampere turns.

NOTES ON THE DESIGN OF MULTIPOLAR DYNAMOS.*

Though comparisons have frequently been made of the capabilities of machines having two poles and those having a greater number, I am not aware that the design of multipolar dynamos has yet received systematic treatment in any communication, or that a very satisfactory basis for comparison of the two types has up to the present been suggested. A perusal of the notes scattered about in technical journals, proceedings of societies, and text-books shows that the ideas on this subject are of the vaguest character, their expression having a most uncertain tone, and generally manifesting some erroneous notion. It is with a view of clearing the ground a little, and inducing some expression of correct ideas from members present, that these notes are brought before the Institution.

1.—PREVENTION OF SPARKING IN MACHINES GENERALLY.

In the paper which I submitted for your consideration twelve months ago, attention was directed to certain empirical formulæ relating to the armature loads for direct current machines. From the data furnished by a large number of examples, some of which were given in the paper, an expression for the load which could be safely carried by armatures without causing sparking was obtained; this expression, though admittedly of an arbitrary character, having been proved by my own experience, and that of my colleagues, to have been of some service. In that paper the term "ampere turns" was employed to denote the product of the number of conductors on the exterior of the armature and the current carried by each, and I am afraid this may have led to some confusion; at least, so it appears from the discussion. In order that there shall be no misunderstanding in the present case, I shall call this product, quite irrespectively of the number of poles, the *volume* of current carried. The volume is therefore the total current flowing parallel to the armature shaft, independently of direction and whatever the number of poles, and it is obtained by multiplying the couductors on the exterior of the armature by the current flowing in each; or, considering the exterior winding as a copper cylinder, it is the total current flowing in it parallel to the axis.

In his paper on "Armature Reactions," read here last year, Mr. Swinburne had worked out the limiting load from a theoretical point of view, and those who were present will remember that to obtain the results given in his paper the author assumed that the brushes were placed almost close to the polar tips. So far as the practical consideration of the subject goes, it matters little, I think, whether this is strictly accurate or not, because, while moving the brushes back from the tips increases the ampere turns producing the cross field, the magnetic resistance of the cross circuit is at the same time increased, due to the interposition of an increased air gap. For the moment, however, it will be assumed that the brushes are somewhere near the pole tips—in their vicinity, let us say—and that the only conductors concerned in producing the cross field are those covered by the pole pieces. This is sufficiently near the truth for our purpose. Under these circumstances the magnetizing force in ampere turns producing a cross-field is, of course, $\frac{v\,\varphi}{360}$, where v is the volume and φ the angle embraced by each pole piece in degrees. Call l the length of the air gap, measured from the surface of the armature core to the polar surface, and $\imath$ the induction per square centimetre which would be produced in the gap due to field magnets alone. When a current flows in the armature the field is weakened at the pole tips nearer the brushes, and strengthened at those farther from them. Imagine that the armature is loaded so that the forward induction under the nearer pole tips is just balanced by the cross induction, and we have $\frac{v\,\varphi}{360} = 2\,l \times .8\,\imath$, assuming that the components of the cross circuit, other than the air gap, have no resistance. According to this equation with a value $v = \frac{576\,l\imath}{\varphi}$,* the forward and cross induction at the pole tips would be equal, the field would be *nil* at the brushes, and the machine being unstable, any increase of current would at once cause great sparking.

The above expression gives what might be called the theoretical load limit, on the assumption that no field is required for reversing the current in the sections as they pass the brushes, but it need scarcely be pointed out that in practice the volume is always much under what would be given by the formula. In the nature of things, one expects in the dynamos of different makers a considerable variation in the relation which the actual load bears to the limit above indicated, and such differences undoubtedly exist; but while one finds, on examining a large number of machines, several under, in few cases are there any having for v a greater value than half that given by the equation.

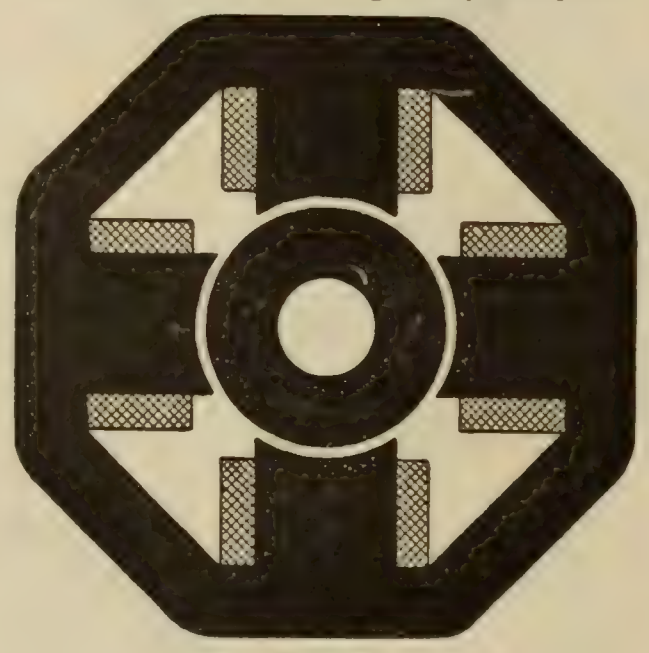


FIG. 1.

This large margin must be considered in the light of a safety factor, for it would be folly to build machines the commutators of which would be liable to ruin by an occasional increase of current over the normal. No one expects machines to stand in continuous working, a current of 50 per cent. over their normal output, for the rise in temperature would then be excessive; but, from the sparking point of view, this increase in a well-designed machine ought to make but little difference to it. Generally, the relation existing between the volume, gap dimensions, and induction in the best machines is expressed approximately by the equation,

$$v = \frac{288\,l\,\imath}{\varphi} \qquad (1)$$

which gives, I consider, a very good rule for use in practical work. According to this, the working volume has about half the value expressing the absolute limit, this relation indicating the margin of safe working dictated by practice and experience. The formula expresses, in fact, an empirical relation which has a certain degree of flexibility. But with such a large margin it will be readily perceived that the strict accuracy of our assumption about the position of the brushes is of trifling importance, as is also our assuming that the whole of the magnetizing force of the cross-field is spent in the air gap.

It is easy to translate the above expression into the form I previously used for cylinder armatures. Call r the radial depth of the armature core, w the width of the pole piece, and $\imath_2$ the induction in the core. The induction, $\imath$, in the gap is $\frac{2\,r\,\imath_2}{w}$; and substituting for $\imath$ its value, we have

$$v = \frac{576\,r\,\imath_2\,l}{w\,\varphi}. \qquad (2)$$

Taking the induction in the armature core at from 17,000 to 18,000 C. G. S., per square centimetre, and inserting an average value of φ we get for bi-polar Gramme-wound machines the expression

$$v = \frac{r\,l\,85{,}000}{w} \qquad (3)$$

which I had used for some time, and which was given in my last year's paper. This is only a rough approximation, for, as Mr. Swinburne has pointed out, to be quite accurate, the angle should appear in the denominator as in 1 and 2. The simplest form the expression can take is given in 1. This contains nothing but the length of the air gap, the induction in it, and the angle of the pole-piece. It will be observed that it takes no notice of the diameter of the armature or of the number of poles. So far as the sparking limit is concerned, it gives a rule which may be employed in designing machines of any size and with any number of poles.

2. THE RELATION OF v TO THE DIAMETER OF THE ARMATURE.

But besides taking care that the armature load does not approach the sparking limit, we must provide ample surface for getting rid of the heat generated in the conductors. The first thing to be settled in designing a new machine is what the amount of heat shall be; or in other words, we must fix the ratio which the energy appearing at the terminals shall bear to the total electrical energy produced. Having settled this, sufficient radiating surface must be allowed to prevent too great a rise in temperature—a point to which due consideration has already been given.

The principal factors which determine the relation of the volume to the diameter of the armature are efficiency and temperature. It will be seen that the equation (1) gives no direct information respecting the diameter for a given volume, and as long as $\imath$, l, and φ remain unchanged, the tendency to sparking would be the same whatever the diameter. But it is not so with the heat generated or the temperature rise, for assuming v and l to be related as shown, the smaller the diameter, the greater would be the temperature. To carry a given volume we must have, consistent with the waste of power permissible, a certain section of copper; and this copper should be disposed so that a cooling surface is provided sufficient to keep the rise in temperature within the specified limit, while the gap, being of sufficient length to prevent sparking, should have only the dimensions necessary for accommodating the conductors and allowing of proper clearance.

Through the kindness of members of the Institution and others, who have liberally supplied me with figures, I have been able to ascertain the nature of the relation between the diameter and volume existing in all the best known machines, from the smallest to the largest sizes. The figures refer to both cylinder and drum-wound armatures, and include machines with two, four, six and

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* Paper read by W. B. Esson before the Institute of Electrical Engineers, London, April 9, 1891.

*I have pointed out to Mr. Swinburne that the equations $A = \frac{10\,b\,g\,B_a}{\Theta^2\,r}$ and $A_2 = \frac{10\,B_a\,r\,R\,l}{w^2}$ which he gave last year on p. 266 of his reply, ought to be $A = \frac{5\,b\,g\,B_a}{\Theta^2\,r}$ and $A_2 = \frac{20\,B_a\,r\,R\,l}{w^2}$ respectively. In looking over his paper and reply Mr. Swinburne finds other slips which he will probably correct as discussion on the present paper proceeds.—W. B. E.

eight poles. Though I am not at liberty to publish the data in full, the general results are given. There is not so much agreement between the dynamos of different makers in respect to this relation as might have been expected, and for v we have all kinds of values, ranging from 200 to 1,000 times the diameter of the armature in centimetres. If full advantage of the length of the air gap were taken, and the thickest possible conductor used in each case, the diameter, to give a uniform temperature for all sizes, would be about proportional to the square root of the volume, but there are several reasons why this proportion should not obtain in practice. With this relation the ratio of the stray to the useful field would increase with the diameter, thus entailing an extravagant expenditure of energy in producing the requisite gap induction. Again, while the total field through the armature would increase simply as the diameter, the volume carried would increase as the *square* of the diameter, this being at variance with the well-established rule that the total field through the armature increases rather than diminishes relatively to the volume as the size is increased. It will be understood, of course, that precisely the same result is arrived at whether we consider the volume fixed and endeavor to find the best diameter, or consider the diameter fixed and seek for the best volume. It is simply a question of obtaining the most economical construction, having regard to cost of materials, efficiency, prevention of sparking, and temperature limit, though the figures at my disposal show estimates of the relative values of these factors to be by no means uniform.

Though the relation lacks definiteness to some extent, I find in the data of a large number of machines indications sufficiently pronounced to justify us in regarding the volume carried by the armatures of two-pole dynamos as proportional to the diameter for all sizes. In designing cylinder machines the value of v may be taken as 400 times the diameter of the armature in centimetres, while for drum armatures the volume is obtained by multiplying the diameter by 600.* The cylinder armature has for a given volume a larger diameter, because of the influence of the interior wires. These being heaped inside to one and a half or twice the depth of the exterior winding, also being longer, a larger diameter is required for a given volume, both from efficiency and temperature considerations. Necessarily, the relations here given are not of a hard-and-fast character, and may be varied considerably. But whatever the proportion adopted, it is absolutely essential that the sparking limit already considered, be not too closely approached.

In machines having four and six poles the same average relation between the volume and diameter holds in practice for both cylinders and drums. In the calculations which follow these figures will therefore be adopted.

3. OUTPUT OF DIRECT CURRENT ARMATURES.

If we call N the total number of lines of force entering the armature from all the poles, however many, and n the number of revolutions per second, the average E.M.F. generated in each conductor is, of course, $N\,n\,10^{-8}$. If C be the total current flowing, each conductor will carry with the sections coupled in the ordinary way $\frac{C}{p}$ amperes, p being the number of poles. The electrical work due to each conductor, is $\frac{C}{p} \times \frac{N\,n}{10^8}$; and the total work, $\frac{w\,C}{p} \times \frac{N\,n}{10^8}$, where w is the number of conductors, counted all round the exterior of the armature. The quantity $\frac{w\,C}{p}$ is what we have called the *volume*, and we get for the total electrical output in watts the expression,

$$W = N\,n\,v\,10^{-8} \qquad (4)$$

which is quite independent of the manner of coupling up the armature sections. It will be evident, I think, that with the same relation existing between v and d for two, four and six poles, the output of an armature of given diameter and length, running at the same speed, is quite independent of the number of poles. It matters not whether N be furnished by two poles only, or by four poles of half the angular width provided its value remains unaltered.

The volume, then, may be expressed in terms of the diameter. The quantity, N, may be expressed in terms of the diameter $\times$ length of the armature. Taking an induction of 5,000 C.G.S. units per square centimetre in the air gap—a very usual figure—and assuming that the fraction of the armature circumference covered by the pole pieces $= 2.25\,d$, we get, calling L the length of the armature in centimetres, $11{,}250\,d\,L$ as the total number of lines of force entering the core. Call this, in round numbers, $12{,}000\,d\,L$. Substituting for N and v their values, the output becomes for cylinder armatures

$$W = .048\,d^2\,L\,n \qquad (5)$$

and for drum armatures

$$W = .072\,d^2\,L\,n \qquad (6)$$

This applies to all direct-current machines, whether bi-polar or multi-polar; though it will be

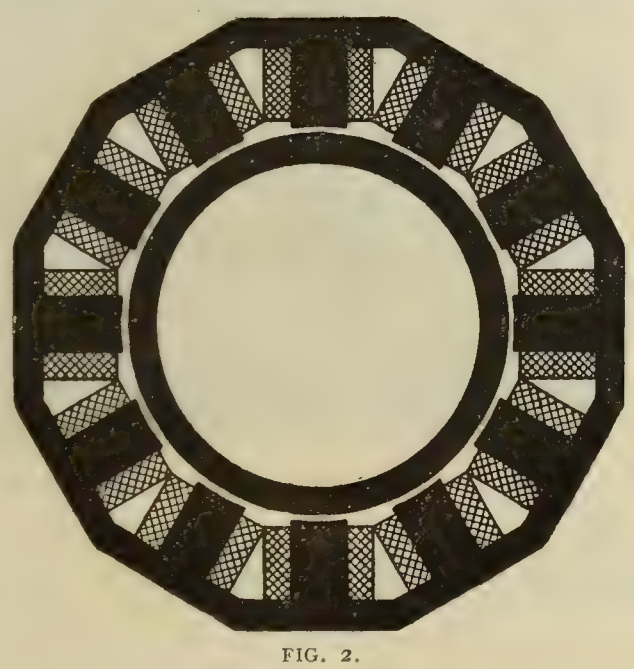


FIG. 2.

understood, of course, that the induction in the gap may be greater or less than what has been assumed. In that case the coefficients .048 and .072 would be altered, without changing, however, the form of the expression.

4. OUTPUT OF ALTERNATING-CURRENT ARMATURES.

The armature loads for alternators, though producing a cross magnetization, as in direct current machines, raise no considerations, of course, as regards sparking. But on account of the greater proximity of the poles, and the greater stray field resulting, it is desirable to make the layer of copper on the armature core as thin, and the air gaps as short, as possible. As a consequence, probably, of the increased ratio of stray to useful field, the induction is less in the gaps of alternating than in those of direct-current machines. Here it will be assumed that the virtual induction is 4,000 C.G.S. units per square centimetre, meaning that this represents the induction to which the resultant E. M. F. is due. The impressed E. M. F. is greater than the resultant, and the induction due to the field magnets alone is greater than 4,000; but what I am dealing with is the field resulting from the inter-action of the magnet and armature fields; it is the field to which the resultant E.M.F. $= C\,R$ is due, this and the current being coincident in phase. Usually the poles cover a fraction of the circumference $= 1.5\,d$, the value of N for alternators being then $6{,}000\,d\,L$. About half the circumference being covered with wire, under usual conditions of temperature and efficiency we have for v a mean value of 400, which gives for the product of mean resultant E.M.F. and mean current $= .024\,d^2\,L\,n$. In some cases, as in the Westinghouse machine, the conductors cover more than half the circumference, and v is therefore greater. But here, on account of the differential effect produced on the separate wires of the same section, the added turns have nothing like a proportionally increased value, and the expression will give approximately the value of the product of mean resultant E. M. F. and mean current, even in these machines. Assuming that the E. M. F. is a sine function of the time, to get the watts we must multiply by $\frac{\pi^2}{8}$, which gives us, therefore, as the output of the alternator

$$W = .0296\,d^2\,L\,n \qquad (7)$$

or rather over 40 per cent. of the work done by a drum-wound direct current machine having an armature of the same external dimensions. Some comparisons have been made of the output of direct and alternating machines of the same weight, but these, in the nature of things, must be misleading. The two types are quite unlike in their proportions, as Figs. 1 and 2 show, and no one would think of making them the same. Fig. 1 represents the magnetic system of a four-pole direct and Fig. 2 that of a twelve-pole alternating machine of the same output; and while it will be observed that the iron parts—core and yoke rings—are much heavier in the former, it will be noticed that the copper in the magnet coils is much heavier in the latter. In fact, though the iron in the alternator is only 55 per cent. of that in the direct current machine, the copper required is no less than 250 per cent. It is difficult, then, to understand what useful purpose is served by comparisons such as I have alluded to.

To be continued.

IMPROVING COAL COMBUSTION.

One of the greatest expenses in connection with the generation of electricity is the cost of fuel that produces the energy. Dynamos as constructed at the present time are very efficient, giving out in electrical current a very large percentage of the mechanical energy given to it. But it is a well known fact that but a small percentage of the potential energy of coal is utilized in mechanical energy in the best steam process, and until the larger portion of the mechanical energy of the coal can be transferred directly into electricity, the fuel will be the first consideration in both lighting and heating by electricity.

Since Dr. Siemens converted the coal into gas with his expensive and peculiarly constructed furnace, producing from one ton of coal as much heat as had heretofore been produced from seven, gas has been looked upon by some as the ideal fuel. For a long time scientists have been looking to water gas for a solution of the problem.

One of the latest processes is that of Mr. Richard N. R. Phelps, combining both the Siemens and water gas processes, and which, if as efficient as claimed, will revolutionize the present methods of effecting the combustion of coal, and secure great saving to all consumers.

Mr. Phelps claims for his process: The utilization of coal to its greatest extent instead of allowing the products of a partial combustion to escape through the smoke stack; i. e., a perfect combustion and smokeless flame; the reduction of the wear and tear on the furnace; an even distribution of heat; a clean and expeditious combustion; a saving of labor; a gas furnace adaptable to steam boilers, glass furnaces and the like, as well as to metallurgical purposes; a high degree of heat resulting in a more rapid steaming of boilers, and heating of metal and glass furnaces and the like; a continuous flow of gas, easily regulated and producing much or little heat as may be required; which heat may

* In 7, and paper the number given was 37. This I now amend as above. W. E. B.

e concentrated or diffused; a fire which may be stantly extinguished without loss of fuel from par-lly consumed carbon remaining after the fire is t out; a pure flame possessing desulphurizing operties which must produce a superior quality metal treated by it, and the utilization of the vast ountains of coal dust now accumulated and daily cumulating, and which only encumber the ound.

Even one-fourth of the gain in the efficiency aimed will make it possible for consumers to lverize lump coal, pay the royalty asked by the vners of the process, and still greatly reduce the st of their fuel.

These facts, which are of interest to electric light tion managers, are taken from the Scranton (Pa.), *uth*, and if the facts are correct the invention is e of great value.

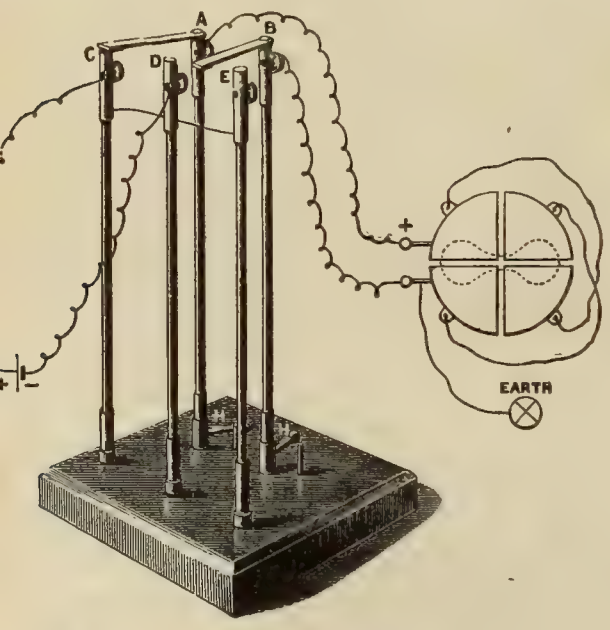
AN ELECTROSTATIC COMMUTATOR.*

The electrostatic commutator here shown is a mple apparatus, of small capacity and high insula-n, for effecting all the ordinary connecting opera-ns with electrometers.

It consists of five insulating rods, three of which, D, E, are fixed; A and B are fitted into brass sockets the baseboard with spring washers, so as to be pable of turning about a vertical axis by handles, H. At the top of each fixed rod is a binding-screw, ped with platinum, and having a slightly convex rface of contact.

The rods A, B, carry contact springs with corre-onding hollows at their rubbing ends, so that hen the handle is moved the spring slides on and ops into place easily.

The screws C and E are connected permanently gether by a wire.



ELECTROSTATIC COMMUTATOR.

A and B are the quadrant terminals; D, and either or E, are for the test wires. This method of con-cting prevents all possible chance of short-circuit-g a cell under test. By sliding the springs on to nd D, the quadrant in connection with A becomes and that joined to B is —. We may reverse by ding the springs to D and E respectively.

The electrometer quadrants are connected to-ther by joining A to C and B to E—in which posi-n the springs should always be left after a test. In intermediate positions the quadrants are com-etely insulated. When very high insulation is quired, some dessicating arrangement may be em-oyed. With a slight modification of the handles, place might be found for this commutator inside e electrometer case itself, the handles being en-ely outside, below the base.

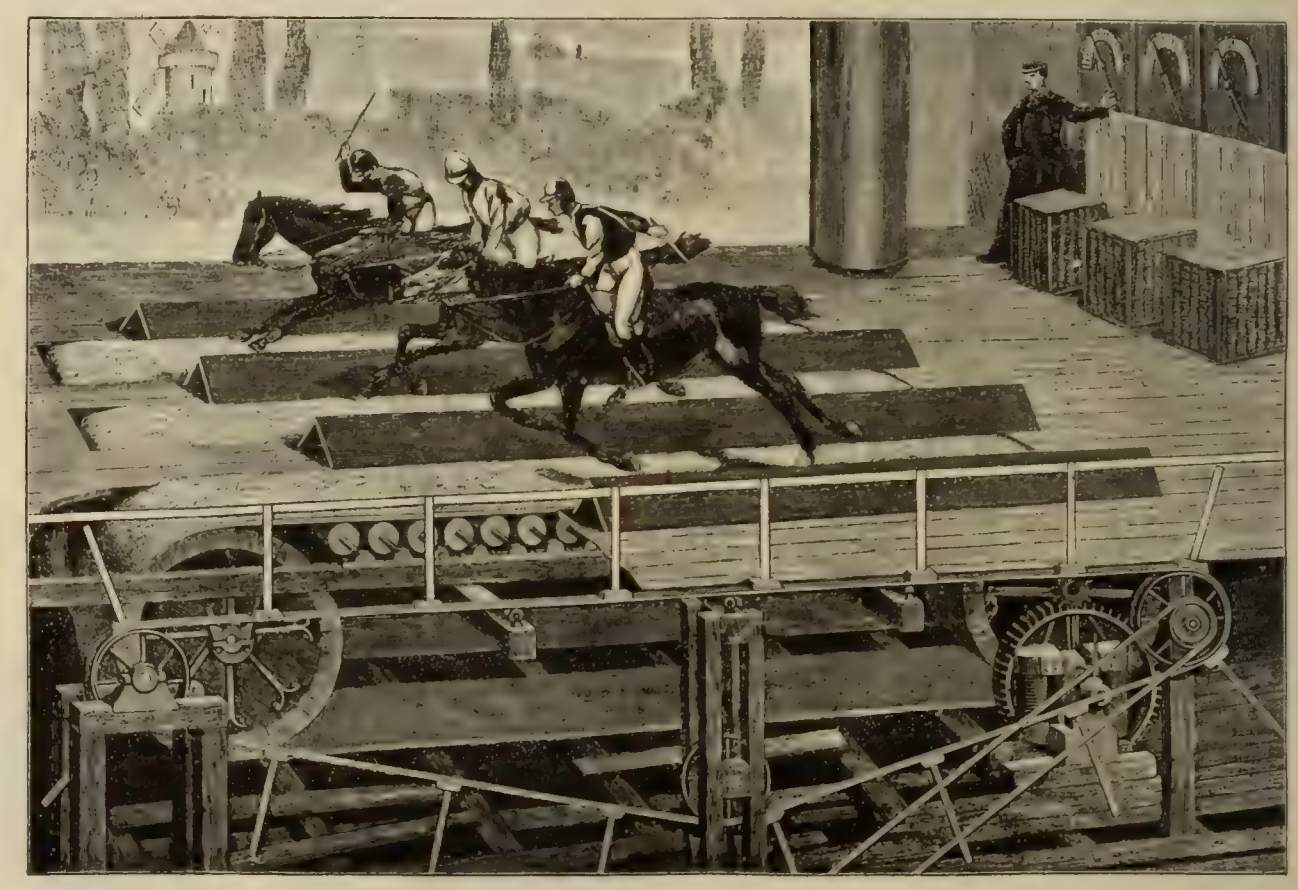
The maximum power of an electro-magnet is oportional to the least sectional area of the entire agnetic circuits.

With an electro-magnet mechanical actions are oduced at a distance under control, by the agency electric currents.

London *Electrical Review*.

ELECTRIC POWER ON THE THEATRICAL STAGE.

A novel application of electric power is shown in the accompanying illustration. In a piece played at one of the Paris theatres is a horse race, in which the horses, ridden by three jockeys, start off at full speed and continue galloping on the stage before the eyes of the audience. The horses really gallop but the motion is the reverse of what usually takes place at such events. While the horses are galloping at full speed they do not change their position with reference to the audience, but the ground disappears under their feet by moving in the direction opposite that of their running and the landscape, as well as the fences, also fly past the horses and the audience. The illusion is perfect and every one imagines that he is looking at a real horse race.



HORSE RACING ON THE STAGE.

The three horses run upon three tracks independent of each other but arranged side by side. The engraving represents in section one of these tracks, formed by an endless matting of cocoanut fibre of close texture. This belt, which is three feet in width, runs over two drums placed each side of the stage, and is made taut by a third cylinder on a level with the stage floor. It is supported by a series of wooden rollers, which are placed very close together and revolve on pivots. The drum shown at the left of the picture is set in rapid motion by an electric motor (shown also at the left) which receives current from a battery of accumulators in the vicinity. The starting and the velocity of the machines are controlled through switches, as shown at the left.

At the moment of the race each horse appears upon one of the tracks, the current is turned on and the motor begins its work; then the belt begins to move. The horses feeling the ground sliding and carrying them backward, first begin to move their feet in order to maintain their position, and then as the track moves with greater swiftness and the jockeys spur the horses, the latter begin to gallop and their speed is accelerated in proportion to that of the belt. The illusion is completed by the unwinding of a canvas in the rear of the stage representing a panorama of the country as seen from the stands of Longchamps, the famous French race course.

The endless belt moves at the velocity of 3,200 feet per minute, or at the rate of twelve to fifteen leagues per hour.

The apparatus used here is similar to that used in the play, "County Fair," that had a long run in this city, and which attracted so much attention through the horse race feature.

Our engraving and facts are taken from *L'Illustration*.

INDIA RUBBER.

The following particulars with regard to the cultivation of rubber in Assam, recently published in a letter to *Nature*, will be of interest to our readers:

After some preliminary experiments, the Government of Assam in 1873 determined to plant caoutchouc in the Charduar Forest at the foot of the Himalayas. This district is essentially damp, and the moist hot atmosphere in the summer months resembles that of a forcing house. The plan of concentrating rubber trees in artificial plantations was carried out as follows: At first attempts were made to propagate by cuttings, but it was soon discovered that rubber-seed germinated freely on well-drained beds covered with powdered charcoal or brick-dust, and that the seedlings, though at first small, became about two feet high in twelve months, and were much hardier against drought than plants produced from cuttings. In order to imitate nature as much as possible, some strong seedling rubber plants were placed in the forks of trees in 1874, but by 1885 only a few of them had reached the ground and were growing. Large nurseries were ultimately formed, in which the plants were retained until they were ten feet high and then planted out in belts of forty feet, separated by alternating strips of untouched forest sixty feet wide.

It was found that the rubber plants did not get sufficient light with lines less than forty feet broad, while the strips of forest keeps the soil and atmosphere moist, and afforded side shelter to the plants, forcing them to grow upwards. As this method involved considerable expense in clearing the lines, and wasted the wood, which was frequently unsalable, the Chief Commissioner of Assam, in 1874, directed that plantations of *Ficus elastica* should also be made in grass-land near Tezpur. The trees, however, when tapped yielded scarcely any rubber. An area of only eight acres was therefore planted out near Tezpur whilst the area of the Charduar plantation in 1889 was 1,106 acres, and contained 16,054 plants, besides large nurseries with 84,000 seedlings.

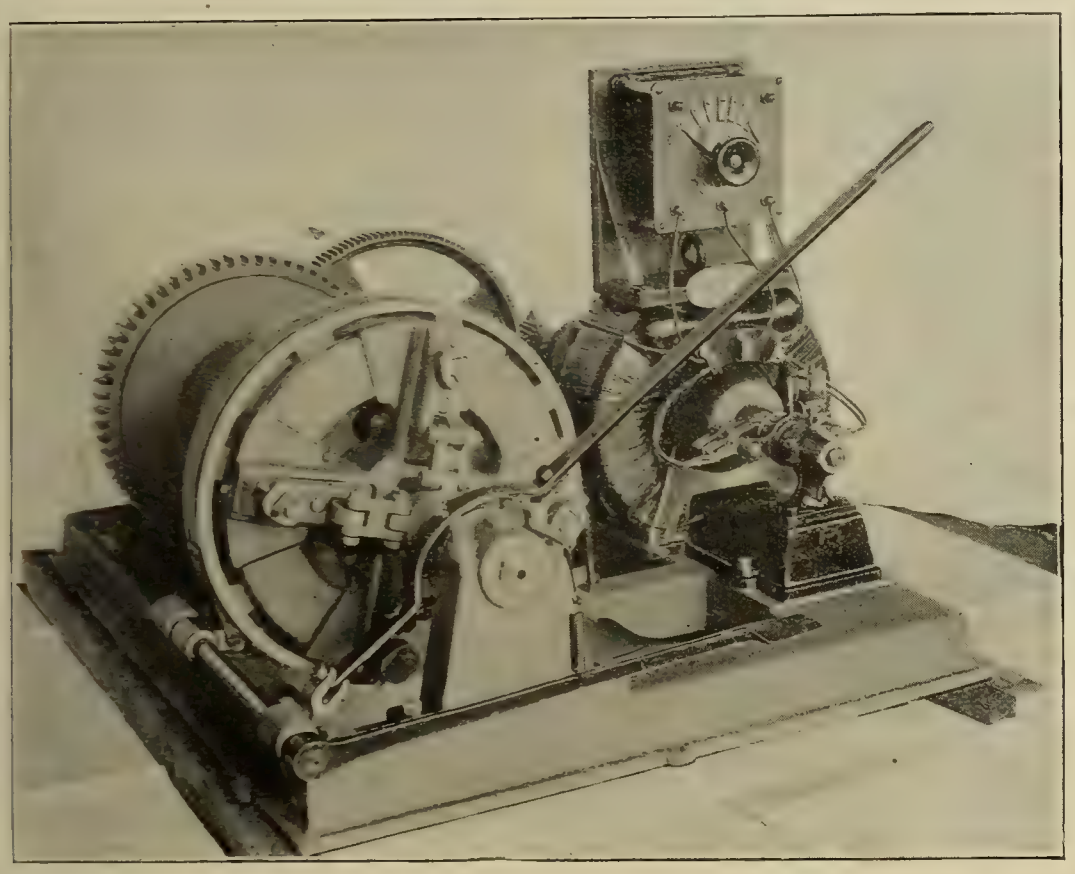
The present average annual growth in height and girth, taken from 350 plants, are respectively five feet, two inches, and eight inches. The upkeep of the plantation consists chiefly in clearing the lines round the plants, but four years after planting, the undergrowth is well kept down by the shade of the rubber trees. Experimental tappings were made in 1883 and 1884 on fifty

natural grown rubber trees in the Charduar Forest, the total yield being 438 lbs. in 1883 and 206 lbs. in 1884, giving an average yearly yield of 6½ lb. per tree.

NEW ELECTRIC HOIST.

One of the most useful applications of electrical power is for hoisting heavy goods or merchandise, and on account of the small space required for such apparatus, this class of machines is very rapidly growing into favor.

We illustrate herewith a new electric hoist, which possesses some valuable and practical features.



FRISBIE ELECTRIC HOIST.

The motor will be recognized at once as of the well known "C. & C." Electric Motor Company's make, and the Frisbie friction drum is used in connection therewith. The motor is situated at one end of the cast-iron base, and insulated therefrom by a thick plate of fibre, thus avoiding all magnetic leakage, which is, of course, a very important consideration in such an installation.

The pinion of the armature shaft is constructed of rawhide, which has the effect of reducing the noise to a minimum, and the machine is in consequence very quiet in its operation. This pinion, and the gear into which it runs, are machine cut, and the drum gear and pinion are machine molded. In this way smooth action and little friction are secured.

By the use of this friction clutch the load can be raised, dropped and caught with the friction without jar, or it can be held at any given point, by letting the friction slip just enough, which can be regulated according to the weight of the load. There is also a band brake for the purpose of holding the load when the friction is off altogether, as would be the case in hoisting coal or merchandise.

One of the most valuable features of these machines is the unlimited use to which they can be put, and they are much safer and more economical to operate than ordinary steam hoisting machines. They are always ready to start without the loss of time necessary to get up steam, and can be operated by an inexperienced person. The services of a licensed engineer are not necessary, therefore, these electric hoists effect a saving in operating expenses.

The machines are built in four sizes, viz : 5, 10, 15 and 20-horse power, and larger ones can be made to suit any work.

The D. Frisbie Company are the makers of these hoists, and any information concerning them can be obtained at the company's factory in New Haven, Conn., or their New York office, 112 Liberty street. The C. & C. Electric Motor Company, 402 Greenwich street, New York, can also supply any information.

TWIN CONDUCTOR.

The Interior Conduit and Insulation Company have issued a neat circular describing their Standard Twin Conductor, which we illustrate herewith. This conductor is absolutely free from the faults hitherto existing in twin conductors, particularly when employed in combination with this company's tubing. Beside its function as a safety conductor it possesses these important advantages: 1st, it costs less money than two separately insulated wires of like quality and capacity. 2d, it can be placed in smaller compass than any other double conductor or any two separately insulated wires. 3d, its extreme flexibility renders it easy to draw in and out of tubing of very close approximation to its own diameter. 4th, the combination of the two conductors in one tube and in one strand, materially lessens not only the cost of material but of the labor in any given installation. 5th, it affords an absolute guarantee that any fault that may develop at any time, will result in a short circuit and therefore blow the safety fuse and thus remove all danger. A full and careful study of the theory of the safety catch will, we venture to suggest, cause the company's ideas, as exemplified in this dual conductor, to be approved and accepted by all intelligent wiring men, notwithstanding the fact that the too ready short circuiting of their earliest make of twin wires has created some little prejudice against it by superficial thinkers. They have now removed these minor faults and realize in their new wire the full, practical application of their early theory, which they claim to be sound in principle.



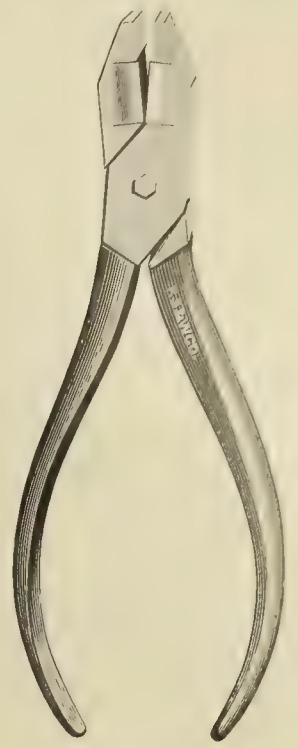
TWIN CONDUCTOR.

HIGH GRADE SIDE-CUTTING PLIERS

We illustrate herewith an instrument of great utility and value to electrical people, viz. side-cutting pliers.

Heretofore the best of these goods have been imported, and those made by Stubb have usually had the preference over other makes. The Peck, Stow & Wilcox Company, of 27 Chambers street, New York, have lately introduced side-cutting pliers which are said to be more durable than any ever used. They are made under the Andrus patents and are of solid cast steel, handles and all. The cutters are very strong and thick and not liable to break; they are inserted by the company's new process.

Linemen prefer them, and upon the most critical examination they seem to us to be an excellent grade of goods. They have every appearance of possessing all the qualities the makers claim for them. Their cost is reasonable, being less than that of the best quality of pliers of foreign manufacture. We have a sample on exhibition in our office.

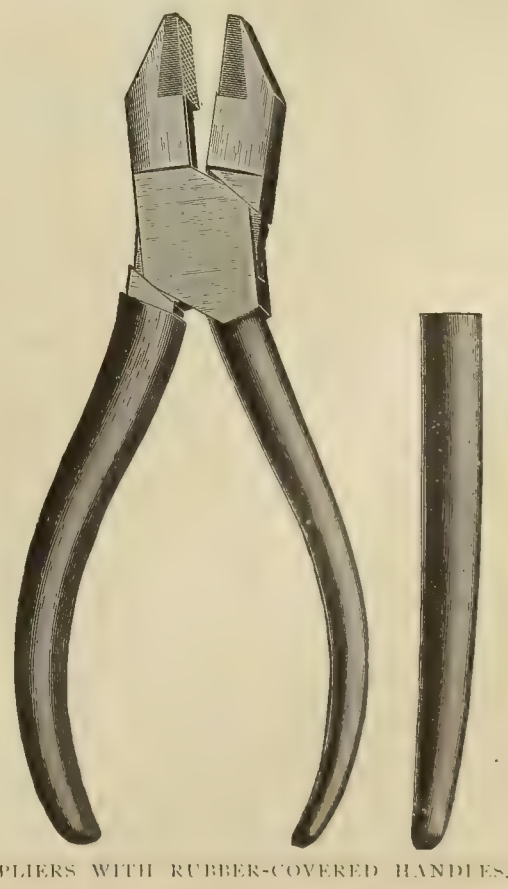


SIDE CUTTING PLIERS.

The Peck, Stow and Wilcox Company are manufacturers of a line of machinists' hammers and fine edged tools, and their factory is located in Southington, Conn.

RUBBER HANDLES FOR PLIERS.

The men who work around live conductors know that the handles on the pliers ought to be insulated and frequently resort to some crude method of supplying this protective covering. Thus they may slip a piece of soft rubber tubing over each handle or else they wrap tape around the same. Neither of these methods is satisfactory, but they both show how great a need there is for the rubber plier handles shown in the cut. These are moulded from good rubber stock, fit the handles snugly and give the hand an extra grip on the pliers. They are made to fit the various sizes of pliers used by electrical workers and are already in use in many stations. George Cutter, 333 The Rookery, Chicago, has the general Western agency for them.



PLIERS WITH RUBBER-COVERED HANDLES.

FOREIGN NOTES OF INTEREST.

There are at the present time 18,162 incandescent lamps in use in Milan, Italy. There are also 852 arc lamps in operation in the same city.

The St. Pancras Electrical exhibition closed on April 1st; between the date of its opening, March 14th, and the close, 14,000 people visited it.

Aberdeen, Scotland, wants the electric light, and the Town Council have advertised for a firm who will undertake the task of lighting the city.

Electric lighting is steadily increasing in China. At the present time there are some 1,700 incandescent lamps being installed in cotton mills near Shanghai.

The Berlin Tramways Company have decided to substitute electric cars for all of its horse cars. It is intended to adopt the Thomson-Houston overhead system.

The following towns in Spain have the electric light :—Valencia, 6,000 lamps ; Gijon, 1,000 ; Albacete, 800 ; Cuenca, 700 ; Pampeluna, 550 ; Talavera, 400 ; Guadalajara, 70.

Classes have been opened at the School of Military Engineering at Chatham, England, for instructing officers and men of the Royal Artillery in the manipulation of the electric light and of electrical machinery.

The Foreign Electrical Power Storage Co., has commenced suit against a number of continental firms, who, it is alleged, infringe their patents. The Tudor Co., which are the licensees of the Electrical Power Storage Co., are back of the suit.

The electric light plant of the Anglo-Roman Society for the Illumination of Rome, consists of four 600 horse-power dynamos and two 150 horse-power dynamos. The total number of lamps installed is equal to 33,000 8 c. p. lamps. There has been an increase equal to 12,000 8 c. p. lamps during the past year.

The English Institution of Electrical Engineers have started a fund to be called the "Benevolent Fund of the Institution of Electrical Engineers" for the assistance of necessitous members and their families, or families of deceased members. There is no necessity at the present time for such a fund, but it is argued that the time will inevitably arrive when such a fund in connection with the Institution will be found most desirable. The contributions will be wholly voluntary.

The deliveries of copper in England and France during March, although 1,500 tons less than in the corresponding month of 1890, exceeded the total supplies, the former being 9,962 tons, and the latter 9,284. In the past twelve months the deliveries have exceeded the supplies by 33,585 tons. The stocks are now reduced to 58,353 tons, as compared with 91,938 tons a year ago, that amount being slightly under that of three years ago. The present price of copper at £53 per ton compares with £48 15s. a year ago, and £39 15s. two years ago.

PERSONAL NOTES.

Mr. E. V. Baillard, electrician of the Accumulator Company, is now located at the factory of that concern in Newark, N. J.

Mr. E. S. Mendels has gone into his old business, that of stock brokerage. He will make his headquarters at 16 and 18 Broad street, this city.

W. R. Mason, general manager of the Electric Merchandise Company, Chicago, has been elected president of the Burton Electric Company, Richmond, Va.

Mr. D. A. Andrews, of the well known house of Pettingell-Andrews Company, Boston, Mass., was in this city last week.

ST. LOUIS NOTES.

A terrific electric storm prevailed in Hot Springs, Arkansas, on April 16, and did a great deal of damage to the telephone exchange. Sixty-five wires were rendered useless and the batteries and switchboard were badly damaged.

Owing to differences between the partners, the Western Electrical Supply Company was wound up by a receiver a short time ago. The former president, Mr. E. J. Wilson, has become proprietor of the concern, and will continue business on a larger scale than heretofore.

The directors of the Belleville and East St. Louis Electric Railway Company filed a bond for $20,000 April 20th agreeing to commence work within 90 days on the proposed electric railway between Belleville and East St. Louis. The road in a birect line will be 11¾ miles, and with extensions and turnouts about 18 miles, and will cost about $300,000. The company promise to haae it in operation next fall.

Captain W. A. Adams, a prominent capitalist and business man of St. Louis, died suddenly on the 10th inst. He was in his carriage on the way to his office, when he fell over, dead. Captain Adams was well-known as an amateur electrician and promoter of electrical enterprises. He was the principal stockholder in the Unicycle Electric Elevated Railway System, which exhibited a working model at the St. Louis Exposition last fall. He was also building a railroad in Illinois, on which he contemplated using electricity as a motive power.

ELECTRIC RAILWAY NOTES.

It is reported that Portland and Hillsboro, Ore., are to be connected by an electric road.

The Champaign and Urbana Electric Railway Company, Urbana, Ill., is now in practical operation.

Media and Chester, Pa., are to be connected by an electric road, which will run through Wallingford.

Advices from Tacoma, Wash., state that an electric line between Milton and Walla Walla will be built.

An electric railway is to be built from the Midland depot to the Cottonwood Hot Springs, Buena Vista, Col.

The Thomson-Houston Electric Company have purchased the property of the Atlanta Street Car Company, Atlanta, Ga.

A power house to cost $60,000 will be erected by the Los Angeles Consolidated Electric Railway Company, Los Angeles, Cal.

The Reading and Southwest Street Railway Company has been organized in Reading, Pa., to operate on the electric system.

The Birmingham Railway and Electric Company, Birmingham, Ala., intends to adopt electric power on thirty miles of its road.

The Capital Street Railway Company, of Little Rock, Ark., is to adopt electric power, and has bought land on which to erect a new power station.

Marion, Ind., is to have an electric street railway, for the operation of which a company has just been organized, with a capital of $150,000. The name of the company is the Queen City Electric Street Railway Company.

The two Edco storage battery cars installed upon the Eckington & Soldier's Home Railway Company's track, in Washington, D. C., March 13th, 1891, have, we are informed, given excellent satisfaction. On Sunday, April 19th, the two cars carried 1,293 registered passengers, besides nearly as many transfers, the cars running on the G and 5th street branch, connecting with the main line of the Eckington Road on New York avenue, where the trolley system is used. A fair calculation would therefore give 2,500 passengers as having been carried by the two Edco cars on that date. The greatest number registered on a single half trip being 75 passengers on the No. 1 car.

The State Board of Railroad Commissioners met in Brooklyn on April 22d to consider the application of the Atlantic Avenue Railroad Company, and the Coney Island and Brooklyn Railroad Company, for permission to substitute the electric trolley system for horse-power on their lines. Counsel for the opposition in advocating the cause of his clients used a very subtle argument. He quoted Mr. T. A. Edison as the authority for the statement that all the electric methods now in use were extremely crude, and that soon great improvements would be made. He argued that the companies should be compelled to wait for the improved methods. He also used other arguments which, it is safe to say, would not be borne out by the facts. One of these was the awful disaster that would result to the life and property of the Brooklynites should the desired permission be granted. On the other side the argument was more common sense and based on the experience in every place where the overhead electric system is in operation. The main point in the argument of the opposition was the one referring to Edison's statement, which, of course, when it was uttered by that gentleman, was in connection with something of an entirely different nature ; but it was seized upon nevertheless, to bolster up the opposition argument.

The advocates for the system met every objection. A further hearing is to be had.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
1001 OPERA HOUSE BLOCK,
CHICAGO, Ill., April 24, 1891.

The Standard Electrical Works of Cincinnati, Ohio, has given up manufacturing, and is now devoting itself to electrical supplies exclusively.

The Card Electric Motor and Dynamo Company, of Cincinnati, is getting out a large number of fine fan motors. The demand for these motors is greater than it has ever been before.

The Jones Bros. Electric Company, 28 East Court street, Cincinnati, Ohio, are increasing their power plant by the addition of a 300 horse-power Porter engine and two Stirling boilers.

The Central Thomson-Houston Company have moved from 215 West 4th street, to larger and more commodious quarters at 264 West 4th street, Cincinnati, Ohio. They now occupy several floors and report business good.

The Howard dynamo, which is manufactured by Hiram M. Howard & Company, Cincinnati, Ohio, is one that is composed of very few parts, which are made interchangeable. This firm has during the last year completed a large number of isolated plants in the states of Ohio, Kentucky and Indiana.

The Shaw Electric Crane Company, of Milwaukee, Wis., has been reorganized under Michigan laws and will remove their works to Muskegon, Mich., as soon as possible. The shops are expected to be ready for occupancy early in August, and will be fitted out as complete as anything of their kind in the country. Although having a very extensive and prosperous business, the firm is making preparation for double their present output.

An electric light plant is to be established in the city of Pulaski, Tenn.

MINNEAPOLIS NOTES.

The building of an electric line to the New Brighton Stock Yards has at last become an assured fact.

The Western Union Telegraph Company has agreed to place their wires underground, which the Council ordered them to do a year or so ago.

Work has been commenced upon the extension of the present Minneapolis electric lines, and there soon bids fair to be 200 or more miles of electric railway in this city.

Your correspondent after an extended business tour throughout the Northwest feels safe in making the assertion that the balance of the year will see greater activity in electrical affairs in that section than ever before. There is not only business, but money too.

The fire alarm superintendent complains of much trouble on the wires, on account of induction from the electric street railway lines. He has been obliged to change many of the fire alarm boxes wherever they were in proximity to the railway wires.

A complete revision has been made of the electric wiring rules of the building inspector's office, and a penalty has been attached for failure to comply with the regulations. Many new regulations have been added, especially in reference to central station companies.

J. M. Lennon of this city has been appointed sole American agent for the Sunbeam Lamp Company, Limited, of Gateshead-upon-Tyne, England. The celebrated Sunbeam Lamps have high candle power and took the prize in their class at both the Paris and Edinburgh expositions in 1888 and 1889.

A block of 18 flats is soon to be built in this city which will be equipped with an accumulator installation. The plans call for 300 lamps distributed over a space of 36,600 square feet, and all the wires are to be run in conduits. High grade Habirshaw wires are to be used throughout. This block promises to be fitted best, from an electrical standpoint, of any west of New York.

About 8.30 o'clock on the morning of April 20th occurred the worst, and really the first, setback the electric railway company of the Twin Cities has had. It seems that a leak occurred in the pipes leading from the gigantic oil reservoir at the St. Paul power house of the street railway company, and a steam fitter was ordered to repair it. He, with a recklessness born presumably of long familiarity with such work, prepared to enter the tank, which has a capacity of about 30,000 gallons of crude oil used for generating steam.

There is supposed to have been somewhere near 25,000 gallons of oil in the tank at the time the man entered it. He very foolishly entered the vat with a lighted candle, with disastrous resul s. In a few moments a stream of burning oil was forcibly ejected from the top of the enormous tank, which at once became a mass of roaring flames. The fire department were promptly on the ground, and at once turned their attention to saving the power house. After five hours' hard fight with the flames they were conquered and the power house was saved. As this is the only power house of the company in St. Paul, and as the new engine at the Minneapolis station is not yet running, all of the electric lines in St. Paul were disabled in consequence of the damage. This stoppage also affected the interurban line, as the power houses in Minneapolis and St. Paul each feeds the line for half the distance between the two cities. Even had the Minneapolis station been in full running order, it is doubtful whether it would have been possible to run even a portion of the St. Paul lines from that station, on account of the small size of the feeders. The steam railway companies are making all the capital they can out of the stoppage of the electrical lines, and the increase in the travel over their lines is enormous for the time being.

MEETINGS OF SOCIETIES, ETC.

FRANKLIN EXPERIMENTAL CLUB.

The regular semi-monthly meeting of the Franklin Experimental Club was held at the Club Laboratory, No. 6 Bloomfield Avenue, Newark, N. J., Tuesday evening, April 21st.

The principal speaker of the evening was Mr. Francis R. Upton, Manager of the Lamp Works of the Edison General Electric Company, who read a paper entitled, "The Possibilities of Electricity." The speaker began by describing his early experiences with Edison at Menlo Park. Then he spoke of the wonderful advance which had since been accomplished in this electrical age, the engineering problems confronting electricians to-day, and the possibilities which those problems held for future development.

A general discussion followed, being participated in by Messrs. Wm. J. Hammer, Geo. B. Webb, and Dr. T. W. Corwin.

In the course of his remarks, Mr. Upton stated that only about three per cent. of the electrical force generated was given out by an incandescent lamp as light, some 97 per cent. being dissipated in the form of heat. Two experiments were shown illustrative of this waste. Mr. Paul H. Jaehnig had hung a 16 candle power incandescent lamp in a globe of water, above the speaker's desk, and turned on the current, previous to the exercises. Before Mr. Upton finished reading his paper, the water quietly commenced to boil, being raised to the boiling point by the electric energy transformed to heat in the lamp.

Mr. F. W. Hillard had artistically arranged a little three candle power incandescent lamp, and an "electrical orchestra," consisting of a tamborine, a musical triangle, a gong, a large horn and a call bell. These were so arranged that either the lamp or the "orchestra" could be switched at will into connection with an Edison-Lalande battery of twelve cells.

M. Hillard switched the lamp into connection and the tiny lamp lighted up, giving out a miniature glow. He then threw the switch over, making connection with the "orchestra" with startling effect. The current which, passed through the lamp, had scarcely generated a glow sufficient to light a Brownie to bed, nearly raised the roof of the Laboratory when exerted on the "orchestra."

BROOKLYN INSTITUTE.

Mr. F. W. Jones, Electrician and Assistant General Manager of the Postal Telegraph Company, gave an interesting lecture on the "Quadruplex," before the Electrical Department of the Brooklyn Institute, Friday, April 17.

The lecturer carried the large audience with him in his description of telegraphic communication from its earliest conception to the multiplex systems used to-day, not only dealing with the history but also with the principles of the different apparatus.

Stereopticon views of the different inventors, inventions and numerous officials of present and past telegraphic companies, were thrown upon a screen. These views added largely to the interest of the subject.

Quadruplex instruments were set up in the hall giving those present the benefit of seeing the modern means of multiplex telegraphic communication in practical operation.

TAXPAYERS' ASSOCIATION.

Mr. Allen R. Foote read a paper before the Taxpayers' Association, Baltimore, Md., on Tuesday, April 28th, on the subject of "Municipal Control of Electric Lighting." He, of course, took the negative position in his arguments.

AMERICAN MECHANICAL ENGINEERS.

A social reunion will be held by the American Society of Mechanical Engineers at their house, No. 12 West 31st. street, April 30th, at which Mr. Park Benjamin will give a talk upon the early history of electricity. Members of the American Institute of Electrical Engineers will be welcome upon the same footing as the Mechanical Engineers, and may obtain cards of invitation by addressing R. W. Pope, Secretary.

YOUNG PEOPLES' ASSOCIATION.

Mr. James H. Mason, the well-known electrician, of Brooklyn, gave an illustrated lecture on "Electricity" before the Young People's Association, of the Brooklyn Tabernacle, on the evening of April 23d. Much interest was evinced by the audience in Mr. Mason's remarks, which consisted mainly of explanations of the various electrical apparatus now in general use. He performed many unique experiments, and explained the usefulness of the gas lighting apparatus, the thermostat, electric mats, burglar alarm apparatus, and the numerous uses to which small batteries can be put. The electrical display was considerable. Among the designs was a star fish studded with small different colored electric lights. Mr. Mason's own battery furnished the power to run sewing machines, to light the gas, and other work.

INSTITUTE OF ELECTRICAL ENGINEERS.

The following named gentlemen were elected as sociate members of the American Institute of Electrical Engineers at the Council meeting, April 21st last: Henry Alexander, Frederick Bedell, Turner D. Bottome, Frank Bourne, Charles B. Burleigh, George D. Burton, Louis Casper, Lewis M. Clement. A. R. Cogswell, Gano S. Dunn, Allen R. Foote, Thomas H. Foote, Francis R. Hart, John C. Henry, Herman S. Hering, Charles H. Herrick, Franklin S. Holmes, A. Langstaff Johnston, J. R. Lovejoy, Giacomo Schmidt, Robert J. Sheehy, George D. Shepardson, Hollon C. Spaulding, F. M. Tottingham, Alexander Thompson, Philip V. R. Van Wyck, Jr., and Edwin S. Webster.

NEW YORK ELECTRICAL SOCIETY.

The 137th meeting of the New York Electrical Society is announced for April 27th at 8 P.M., in the room of Professor Chandler, Columbia College, 49th street and 4th avenue. The lecture, which will be delivered by Charles Steinmetz, will be on "The Elementary Principles of Designing Alternating Current Apparatus."

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73.
BOSTON, MASS., April 24, 1891.

Mr. J. E. Wallace, of the Eastern Electrical Supply and Construction Company., is now on a trip through the South in the interests of the electric railway department of his company.

The Economic Electric Manufacturing Company of No. 1 Beacon street, is enjoying a large trade in the incandescent lamp line. The factory is running to its fullest capacity.

Electric motors are coming into general use in shoe factories. Manufacturers find the motors preferable in cleanliness, economy, and in every way to the old-fashioned way.

The case of Thomas Foy against the West End Street Railway Company, was on trial in the Fourth Session of the Superior Court this week. Mr. Foy wants $20,000 for injuries he received in consequence of a collision with an electric car, which it is alleged ran into Foy's team.

In the Legislature the Committee on Cities reported a bill requiring street railways to pay for their privileges, guaranteeing them thirty years' use in return. The most important feature is that a city or town may purchase outright the tracks of a company at the end of twenty years.

Superintendent of Streets Carter, has filed his answer in the suit brought against him by the New England Printing Telegraph Company to compel him to issue a permit to erect poles in certain

streets. In defence he relies upon the vote of the Board of Aldermen recently passed, revoking the authority granted to the company by the Board of Aldermen of 1890.

Mr. J. W. Larish, electrician for the Western Union Telegraph Company for New England, has been granted a patent on an electrical protector applicable to telegraph, telephone, electric light and power wires; in fact wherever electric current is used. The device is an absolute protector against high currents which might burn out instruments, etc. It is automatic.

The New England Fire and Heat Regulator Company, of 65 Federal street, has taken the New England Agency for the Standard Thermometer Company, of Peabody, Mass. The Standard Company makes a specialty of mechanical and electrical thermometers and water and steam gauges. Out of 18 thermometers exhibited by them at this place there was not a variation of one degree.

The Committee on Electric Wires gave a hearing on the petition of the Boston Electric Light Company for leave to erect 47 poles on Shawmut avenue. The New England Printing Telegraph Company through its counsel appeared in opposition. This is the location where the telegraph company were given right of way by a paper given them by the Mayor and Aldermen on Jan. 3. The matter is now under advisement.

In the Massachusetts Legislature, the Committee on Cities reported a bill providing for the sale of shares of street railway stock, and authorizing savings banks to purchase the same. The bill allows savings banks or institutions for savings to invest in such street railway stock provided it has a market value of at least 110 per cent. of the par value, and that the company has for the preceding three years paid 6 per cent. dividends.

The latest thing in the way of electric motors and one which promises to command widespread attention, is styled the "Simplex Motor." One of these machines is now on exhibition at the company's rooms, 113 Devonshire street, this city. It is of the multipolar type. The field is located on the inside and thus becomes more compact, and diminishes the weight to one-fourth of those now used. It also has the shortest possible magnetic circuit. The armature, which is in the form of a ring, encircles the field and can be extended to any diameter, thus an enormous initial power can be obtained. The coils are well ventilated, and there is no liability to burn out. The armature revolves from 100 to 300 times per minute. It is said that those who have studied the machine are unanimous in their opinion of its permanent value.

Judge Morton in the Supreme Court overruled the defendant's demurrer in the case of Delana, Shepley & Co. *vs.* the Edison Electric Illuminating Company, and the case will stand for a hearing. This is an interesting case involving several important questions of law. The plaintiffs own a manufactory on Kingston street, and alleged that the defendants being a public corporation incorporated for the purpose of supplying electricity to the public and having mains in the street refused to give them electricity. It was also alleged that an appeal had been made to the gas commissioners and that the latter had issued an order commanding the electric company to supply the plaintiffs, but that the company refused to do so. The plaintiffs brought a petition for a writ of mandamus and the defendants demurred on the ground that the mandamus was not the proper remedy. Judge Morton holds that the petition alleging that the defendant is incorporated for furnishing electricity, the writ of mandamus must issue unless some such state of facts is shown as to convince the court that this is not the case. A hearing on the merits will come at a later day.

Lowell, Mass.—Representatives of the stockholders of the Lowell Horse Railroad Company and the Dracut Street Railway Company, appeared before the railroad commissioners on a petition for consolidation under the act of the Legislature of 1890.

New Bedford, Mass.—W. H. Matthews, Treasurer and General Manager of the New Bedford Copper Company, has received an offer of a position with the Ansonia Brass and Copper Company, of Ansonia, Conn.

Hartford, Conn.—R. W. Rollins, recently district engineer of the New England department of the Westinghouse Electric Company, has accepted a position as assistant superintendent of the Hartford Electric Light Company.

Lynn, Mass.—There have been several changes among the foremen of factory "H" at the Thomson-Houston Works. Mr. Urquhart has been promoted to a place as an assistant to Mr. Barton, of the Supply and Production Department, and will have immediate charge of the purchase of raw material. Mr. Thompson has been placed in charge of the second floor of "H," and Mr. Day of the stock room.

The second annual banquet of the Thomson Scientific Club will occur May 13th, at the quarters of the club. It will be a notable affair.

Andover, Mass.—A party of seventy-five people from Boston and vicinity, visited the Craighead & Kintz Company's factory at Ballardvale, April 20th, by invitation of the officials of the Russell Electric Company, which has just begun manufactur ng the Russell Arc Lamp there. A number of the lamps were shown burning. The Russell Lamp, although a comparatively new invention, is already in use in several states. The party consisted of some of the brightest men interested in electricity, and they spent a very enjoyable day, returning to Boston in their special car, after refreshments were served.

Worcester, Mass —The power station of the Worcester, Leicester and Spencer Electric Street Railway is to be built by Cutting Bishop of this city. The building will be one story, 140x50 feet. The road itself is to be constructed by Shaw & Ferguson of Newburyport, Mass., who will begin operations at once.

Mr. Philip H. Moen, president of the Washburn & Moen Manufacturing Company of this city, died yesterday after a short illness, precipitated by a stroke of paralysis. Mr. Moen was one of the pioneer wire manufacturers in the country, and forty-five years ago was a hardware clerk. The company make some of the best wire in the world. All Worcester is in mourning to-day. The thousands of men employed in the works, to whom Mr. Moen had endeared himself by a uniformly courteous manner and consideration of their well-being, went home from their work with sober faces It is the universal feeling that the city has suffered the loss of a man whose place it will be difficult to fill.

F. E. B.

Consolidation.—The general offices in Philadelphia of the Accumulator Company and the Electro-Dynamic Company, have been consolidated, and new quarters have been secured on Chestnut street, Nos. 224 and 226. Offices for the accommodation of the executive officers, superintendents and other employees have been fitted up, and the factory facilities have also been increased by the addition of the rooms formerly occupied by the electro-Dynamic Company's offices. Mr. D. H. Bates, vice-president and general manager of the two companies, has resigned these positions and will take a general selling agency for the street car equipments on the Edco system. Mr. Bates will have his headquarters in New York in the offices lately occupied by the above named companies.

The magneto-motive force equals the product of the number of spirals and the number of amperes of current multiplied by 1.257.

A comparatively small dynamo may be arranged to light a greater number of lamps by the use of an accumulator than can be obtained from the machine direct.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOMS 7—12, "WORLD" BUILDING.
New York, April 25, 1891.

Messrs. Truex & Vail, 44 Broadway, will on May 1st move into the new Electrical Exchange, where they have secured rooms 619 and 620.

The Hunt Engineering Company, No. 238 Washington street, Brooklyn, have just closed a contract for 1,000 incandescent and 75 arc lamps for the Waterford, N. Y., Electric Light Company.

W. S. Chesley, electrical engineer and broker in electrical securities, No. 171 Broadway, will move into the new Electrical Exchange Building, Liberty and Washington streets, as soon as it is completed.

The New York branch office of Professor H. Aron, of Berlin, has been discontinued and all of the business pertaining to the celebrated Aron electricity counter will be transacted at the home office, 6 Lutzow street, Berlin, Germany.

Professor George Baillard, father of Mr. E. V. Baillard, electrician of the Accumulator Company, died on April 18th, after a short illness. He was 61 years of age. The friends of Mr. Baillard sympathize with him in his bereavement.

Mr. C. L. Eidlitz has been appointed sole agent of New York State, for the Economic Lamp made in Brockton, Mass. Before arranging for the agency, Mr. Eidlitz made a thorough canvas of this section and found that every user of this lamp preferred it to all others.

The National Electric Construction Company, and the New York office of the National Electric Manufacturing Company, both of which concerns have their present offices at 44 Broadway, will move to the new Electrical Exchange, corner of Washington and Liberty streets, on May 1st.

The Interior Conduit and Insulating Company having acquired the entire property, patents and good will of the Bergmann Manufacturing Company, will henceforth prosecute as a branch of its regular business all that class of work heretofore done by the Bergmann Manufacturing Company.

Messrs. Taylor & Son, 39 Dey street, this city, manufacturers of the well-known Taylor Primary Battery, have just issued a circular giving information concerning their cells, also containing reprints from the Electrical Age and other electrical journals, and testimonials from individuals regarding the battery.

The Equitable Electrical Manufacturing Company, with offices at 44 Broadway, this city, is about to introduce a printing telegraph system which is said to be the most complete of any ever brought out. It is a most important system for railroads. Mr. Cornelius Fellowes is president and Mr. D. H. Bates is vice-president.

Carpenters and painters are busy at work re-arranging and renovating the headquarters of the Crocker-Wheeler Electric Motor Company, 430 and 432 West 14th street. When completed the company will have very handsome and convenient surroundings. They have nearly doubled the former floor space occupied by them.

The callers at our office during the past week were Peter Claus of the Easton Electric Company of this city; E. V. Cavell, editor of the *Street Railway Gazette*, Chicago; Dr. Scott of the Scott Electrical Works, City; A. E. Rich, Secretary and General Manager of the Hunt Engineering Company, Brooklyn; E. S. Mendels, 16 Broad street, this city; F. N. Ferren, Boston office of the Standard Electric Company, of Vermont; George H. Kimber, of the Westinghouse Electric Company, Pittsburg, Pa.

W. H. Gordon & Co., 115 Broadway, are making a large number of estimates for Simplex wire and cables, and are placing some large orders. They have taken new offices in the same building in which their present offices are located, and will

carry a large stock of simplex wire in standard sizes for immediate delivery, Electrix switches, cut-outs, sockets, etc. The firm report good sales of these goods. In their new quarters they will have space devoted exclusively to the reception of their customers.

The Electric Construction and Supply Company, 18 Cortlandt street, report the following sales of Ward Arc Lamps: H. B. Claflin & Co., 185 10' ampere lamps, and 38 for the New York station of the New Jersey Central Railroad. The company reports that the business for April was by far the largest of any month this year, and that their lamps are giving excellent satisfaction. Thousands of them are in use throughout the country.

The Wainwright Manufacturing Company, of 8 Oliver street, Boston, Mass., report increased sales of their well-known corrugated copper tube feed water heaters and purifiers. This company, besides manufacturing these water heaters and purifiers, make heaters for compound condensing engines, surface condensers, corrugated copper tube expansion joints, and the Harvard pump governor. The machinery turned out is of first-class material and construction, and gives general satisfaction. The New York offices are at 121 Liberty street.

The Venezuela Government has placed an order with E. T. Copeland & Co., 106 Liberty street, this city, for four revenue cutters or gun boats. Two of the same are to be 75 feet long and 12 feet beam, and two are to be 65 feet long and 11 feet beam. They are to be equipped with triple expansion engines, and Worthington Water Tube Boilers. The vessels are to be schooner rigged and will be handsome and fast. These boats will be built at Piermont-on-the-Hudson, by the Tappan Zee Company, of which Messrs. Copeland & Styles are the principals.

J. H. Bunnell & Co., 76 Cortlandt street, have a very attractive display in one of their front windows, of Edison-Lalande batteries. Every type of these celebrated cells is represented, from the smallest to the largest, including an eight-cell cautery battery. On the big plate glass window are in large white letters the words, "Edison-Lalande Batteries, Edison Appliances." In the window a Bush revolving store fixture is kept in motion by two Edison-Lalande cells of the G type, and these keep the revolving table in motion for 100 consecutive hours. J. H. Bunnell & Co., who are selling agents for these batteries, report a very good demand for them.

Mr. John Dick, of Dick & Church, was in town last week. This firm are the manufacturers of the well-known Phœnix Engines, which are made of any horse-power, and with the latest automatic improvements. The engines are especially adapted to all electric light and power stations where economy is desired. This company also make Manning upright tubular boilers, and are placing some in several electric railway plants, for which they have lately received orders to install their engines. The factory of the company is at Meadville, Pa., and the headquarters are at 15 Cortlandt street, this city, where the well-known White Bros. look after the interests of the concern.

Incandescent lamp bulbs of vari-colors are in great demand for decorative purposes, and heretofore stained glass has been used for this purpose. In order to produce a cheaper bulb, and at the same time preserve the brilliancy of color of stained glass, the firm of Alexander, Barney and Chapin, 20 Cortlandt street, have been conducting some experiments. They have been successful in their efforts and can apply all colors in any shade, from the most delicate to the deepest, to the white glass bulb. The color is applied in the form of a wash, which when dried on the surface is perfectly transparent to the light rays. Some beautiful effects are capable of being produced by these colored bulbs.

The long life of the Packard High Grade Incandescent Lamps is attracting a great deal of attention. They are made by the New York and Ohio Company, of Warren, Ohio, and 200 or more of these lamps are now in use at No. 1 Broadway. They have been running 1,300 hours. The Richmond, Staten Island, Heat Light and Power Company, are using these lamps exclusively. They are giving much satisfaction, and those used in the station have been running as high as 1,600 hours. The Pullman Palace Car Company are using these lamps to the exclusion of all others. The Pennsylvania Railway Limited trains are equipped with them and they are giving very satisfactory service. It needs an extraordinary lamp to withstand such rough usage as is experienced in railroading, and the Packard lamp is giving the best of satisfaction.

The Interior Conduit & Insulation Company have taken possession of their new suite of offices in the Edison Building, 42 and 44 Broad street. The offices are situated on the fifth floor fronting on Broad street, on both sides of a private hall separated from the main passageway by an artistic gate. The several rooms are large, well ventilated, and have an abundance of light from all sides throughout the day. The two large rooms in front are occupied respectively by Mr. E. H. Johnson, President, and Mr. E. W. Little, General Manager, and are finished simply but substantially in hard wood. Mr. E. T. Greenfield, the Company's electrician, has his office, draughting, and show rooms directly back of Mr. Johnson's office, and Mr. F. A. Mason is with the financial department adjoining. All the conveniences usually found in a suite of well appointed offices go to make fitting headquarters for such a progressive company.

The following named electrical concerns and representatives of electrical houses will be found in the new Electrical Exchange Building, corner of Liberty and Washington streets, after May 1st:

Unico H. W. Schenck, agent for the Healy System of Ventilating Fans, manufactured by the Healy Fan Company, of Bridgeport, Conn.

Thompson, Murray & Co., electric railway builders.

The McCreary Electrical Specialty Company, dealers in patented reflectors and electrical specialties, room 306, second floor.

The Niles Tool Works have fitted up the main floor with traveling cranes so that tools and machines can be carried from end to end of the salesroom.

Truex & Vail, general agents for the Accumulator Company, the Electro-Dynamic Company, and the Walker Electric Company, and dealers in electrical accumulators, Edco dynamos, motors, switches, Walker recording ammeters and voltmeters, direct reading ammeters and voltmeters, etc., rooms, 619 and 620.

The following named electrical concerns will be found in the Central Building, Liberty, Washington and West streets, after May 1st:

The Field Engineering Company, constructors and builders of electric railway plants.

The Bridgeport Machine and Tool Works, Bridgeport, Conn., E. P. Bullard, proprietor.

The Engineering Equipment Company, contractors for steam and electrical materials, Underwood Cotton Leather Belting, etc.

Indurated Fibre Company, manufacturers of patented Indurated Fibre Pipe for electric subways, represented by the Engineering Equipment Company, sole agents. W. T. H.

NEW CATALOGUE.

The new catalogue of the Electrical Supply and Construction Company, No. 947 Liberty street, Pittsburg, Pa., is complete. This Company are dealers in electric light and wire supplies, wire cables, central station and street railway supplies, chandeliers, electroliers and portables. The quality of their goods is first class.

The position of the brushes of a dynamo which gives the least sparking, is not always coincident with the position for greatest electro-motive force.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

Name of Companies.	Capital.	Par.	Price.
Aluminum Co.	350,000	100 00	$100 00
American Electric Motor Co. (N.Y.)	1,000,000	25 00	5 00
American Private T'phone (N. Y.)	50,000	100 00	92 00
American Telegraph and Cable	14,000,000	100 00	82 50
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln.	2,000,000	100 00	115 00
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	205 50
Boston Electric Light	1,500,000	100 00	105 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5s	6,000,000		par
Brush Illuminating (N. Y.)	1 000,000	100 00	55 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	5 00
City Electric Street Ry. Co., 6's	200,000		par
Commercial Cable Co.	7,716,000	100 00	106 00
Complete Elec. Con. Co, N. Y.	50,000	100 00	175 00
Consolidated Electric Light	1,929,400	100 00	50 00
Consoli'd Elec. Storage Co. (N.Y.)	3,000,000	25 00	7 00
Consol Gas & E.L.Co. of West Co.6's	250,000		par
Consol Gas & E. Co. Batavia, 6's	80,000		par
Consolidated Gas Co. Batavia	100,000		
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	85 00
Easton Elect. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. 5s	2,000,000		*99
Edison Illuminating (N. Y.)	4,500,000	100 00	98 25
Edison General	14,000,000	100 00	99 25
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co. (N. Y.)	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Erie Telephone			49 00
Essick Printing Tel.	5,000,000	100 00	60 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	13 50
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Laclede Gas Co.	7,500,000	100 00	18 75
Laclede Gas, pref.	2,500,000	100 00	52 00
Laclede Gas 5s			*79
Law Telephone	400,000	100 00	
Long Branch Electric Light	50,000	100 00	78 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		
Manhattan Elec. Light Co. Lmtd. 5's	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	2,000,000	100 00	
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light (N.Y.)	500,000	100 00	90 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	87 00
Nat'l Cordage, pref.	5,000,000	100 00	103 50
Nat'l Lead Trust		100 00	19 00
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
New England Butt Co.	100,000	1,000 00	1,000 00
N. E. Telegraph and Telephone			51 50
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	97 50
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
North New York, Lighting.	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	102 00
Plainfield, Electric Light	100,000	100 00	75 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	65 00
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s			*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100,000	1 00	3 00
Swan Incandescent	800,000	100 00	2 50
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
Thomson-Houston Electric Co.	6,000,000	25 00	47 00
Thomson-Houston Pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100,000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	2 50
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Welsbach Inc. Gas	10,000,000	100 00	6 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	15 00
Western Union	86,188,852	100 00	82 50
Westinghouse Electric Co.	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			24 25
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

In constructing dynamo armatures they should be made as light as possible consistent with its other features.

FINANCIAL.

The State Railroad Commissioners held a session on the 22d inst. in Brooklyn to listen to all interested in the proposed adoption of electric motors on the surface roads. Arguments on both sides were presented, but, as it seems too often the case, affidavits, briefs, and the material statutory requirements were sadly lacking. The chairman of the commission never appears surprised although always expectant, but treats evidently the noted and learned (?) legal talent coming before him just as one from the city would expect to see him in the most quiet, sequestered railroad village in the State. Only one worthy point was raised, and that was how public park land should be valued in comparison with private property. Many noted but financially interested gentlemen were present and listened attentively to the teacher. The meeting adjourned without definite result to May 6, at the Common Council Chamber in the City Hall at Brooklyn, at 10 A. M., when those of our readers who desire to learn a great deal about electric railway motors, chiefly for the trolley system for city business, can in a few hours hear intelligent, terse, legal and practical discussion *pro* and *con*, with a chance for accurate knowledge which will not often present itself. The court is open and free to all readers of the ELECTRICAL AGE.

The following are the bids by the Gas Companies for lighting New York from May 1, to Dec. 1, 1891, per lamp:

Equitable Gas Company - -	$ 8.00
Standard " " - - -	8.69⅔
Consolidated " - - - -	11.66⅔
N. Y. Mutual " - - -	11.67
N. Y. & N. J. Globe " - - -	14.75
Central Gas Company - - -	18.00
Northern " " - - -	18.64
Yonkers " " - - -	18.66⅔

The bids are for territory served by their mains. The competition with incandescent electric light grows apace, and will reach a fighting point before the end of the century. A 32 candle-power incandescent can be furnished at a fair profit for $20, inclusive, per year, with aerial conductors. The difference of rental by underground circuit is easily computed.

A declaration was filed on the 22d of April, in the United States Court at Trenton, N. J., in a three million dollar suit for damages for breach of contract brought by Mr. Jewett against Robert Garrett, Henry Frick and Mr. Latrobe. The suit is the outcome of a transaction in London, and will be watched with considerable interest, as, no doubt, a number of disputed points will be settled on which other like suits rely for a final verdict.

PHILADELPHIA NOTES.

Camden, N. J., was in total darkness a few nights ago, on account of a break in the machinery at the electric lighting station.

W. S. Parker, of this city, has many new contracts to fill and reports the business outlook for the coming season as very bright.

The power of the Bristol Electric Light Company, will be increased by the erection of a 750 light dynamo in the near future.

W. R. Griffith & Co., of this city, have contracted to light the new building of A. H. Moore, at Colmar, Pa., with incandescent lights.

Councils have passed a bill granting to the Philadelphia Traction Company the right to erect on certain streets in West Philadelphia, electric trolley lines.

The valuable copper wire used on outside electrical work in this city, is a great temptation to thieves, and accounts of arrests for stealing of this kind appear in our papers almost every day.

The electric appliances for the new Chamberlin Hotel, at Old Point Comfort, will include a 600 number Partrick & Carter Annunciator with fire alarm and guest calls. The contract for this work has just been given to John R. Galloway, of Washington, D. C.

Vallee Bros. & Co., have finished remodelling the building in which this firm are located, by the addition of private offices. Mr. Roberts claims that with the addition of their handsome typewriter, business must certainly increase rapidly and this firm are deserving all the business that comes their way.

The Hale & Kilburn Manufacturing Company, are still filled with orders. Their immense factories are crowded with work, and are strained to their utmost capacity to turn out orders. So great has been the demand for their patented seats and other specialties, that they have been obliged to greatly enlarge their works in this city. They have recently purchased two properties adjoining their buildings on Sixth street, and another adjoining their Filbert street factories, upon which they propose to erect two handsome, large buildings. The work has already commenced upon the Filbert street building, which will be a hundred feet deep, extending from Filbert street back to the line of their present buildings on Sixth street and including an L-shaped addition, 28x35 feet. This Filbert street building will be six stories high, exclusive of the basement, making practically seven floors in all. The company has just received a number of orders for their patented seating for electric and other cars, and have fine prospects ahead for further business.

H. G. G.

BUSINESS NOTES.

Mr. A. B. Lawrence, 225 Pearl street, New York, manager of the Shultz Belting Company, reports that his company has the belting contract for the St. Louis and Suburban Railroad for two "Electric Dynamo" belts, each 72 inches wide and 154 feet long; ten "Electric-Dynamo" belts each 16 inches wide, and aggregating 700 feet; also "Electric Dynamo" belting orders for the Columbia Building, the Central Railroad Company's Building, the Inman Line S. S. City of Chicago, the New Haven Steamboat Company, all of this city, and the Staten Island Light, Heat and Power Company. The 72-inch belt for the St. Louis and Suburban Railroad is the largest used in any electric railway power house in the country.

Mr. A. L. Bogart, the well-known electrician and gas engineer, patentee and manufacturer of every variety of improved electrical gas lighting apparatus, No. 22 Union Square, this city, has just published a pamphlet containing very explicit instructions for installation and mode of operating multiple electric gas lighting apparatus. This pamphlet will interest the most experienced adept and an amateur can successfully install a multiple electric gas lighting plant by strictly following directions contained therein. It is fully illustrated and written in a clear style, and no doubt it will find a ready sale.

A third edition has just been issued of Practical Electrics. A universal handy-book on every day electrical matters, including connections, alarms, batteries, bells, carbons, induction intensity and resistance-coils, dynamo-electric machines, measuring microphones, motors, storage and telephones. It contains 135 pages, with 126 illustrations, and will be sent postpaid for 75 cents, by E. & F. N. Spon, 12 Cortlandt street, New York. This firm deals in all technical literature, and their catalogue of the valuable works handled by the firm is complete and interesting.

W. R. Fleming & Co., engineers and dealers in steam plants and power transmission machinery, 174 Fulton street, this city, are doing a brisk business. During the past two weeks, orders for some fifteen "Ide" and "Ideal" Engines, together with other contract work, have been taken. Among these are the following: One 500 H.P. Ide Cross Compound Engine, New England Engineering Co., Waterbury, Conn.; one 75 H.P. Ideal Engine, Pratt & Whitney Co., Hartford, Conn.; two 150 H. P. Ide Tandem Compound Engines, Somerville Electric Light Company, Somerville, N. J.; one 150 H.P. Ide Tandem Compound, Hackensack, N. J.; one 25 H.P. Ideal Engine, Tarrytown, N. Y.; two 100 H.P. Steel Boilers with Weitmeyer Patent Furnaces, Long Island City Electric Railroad Company and four contracts for shafting and friction pulleys manufactured by William Sellers & Co., and Moore & White Co,, Philadelphia, Pa., for whom W. R. Fleming & Co. are agents. All of the above plants are equipped with the celebrated Jewell Belting, which company they also represent. Several engines of well-known makes have been taken out in the above plants, and some bargains may be had by parties looking for second hand machines.

Mr. Thomas Pray. Jr., the Consulting Engineer, has recently located at room 193, *Times* Building, this city, and his services are now available for the measurements of steam or electrical power, in any part of the country, as may be required. Mr. Pray has an experience of many years in his line, has been engaged in the construction and operation of electric dynamos, incandescent and series lamps, plants and power stations, and now devotes himself to the indicating engines, for economy, or power as desired. He also makes all the tests of any electrical plant, both in the steam and electrical departments, and reports on the condition and results. He was employed by the Cramps on the second official trial of the U. S. Cruiser "Baltimore," and in the readjustment of her steam machinery, on the horse-power trial, made a handsome bonus of $120,000 for his clients. He was also employed by the Quintard Iron Works of this city, on the second trial of the U. S. gunboat "Concord," in January last, and is now engaged on some large ships on the steam power. Mr. Pray is busy with steam tests and changes in steam machinery of ships and on shore, to increase their efficiency. He has also had an experience in the making of high potential incandescent lamps up to 180 volts, and is the inventor of a peculiar filament for series lamps which has attained a very high efficiency and a maximum life, of which some figures are given below. He will give his assistance in this department if desired. Tests have been made of some of his lamps on series circuits, and some remarkable results have been attained.

They gave 240 candle-power on a current of 67 volts and 7¼ amperes.

The following table gives further results of these tests:

E. M. F.	Amperes.	C. P.	C. P. Per E. H. P. 746 watts.	Remarks.
35	6.80	100	313	Constant Current. Lamps in series. Life varied from 400 to 1000 hrs.
33.2	6.89	100	326	
35	7.25	125	367	
21	3.67	40	388	Lamps in series. Constant current machines.
19.5	3.52	32	348	

The filaments used in these lamps are the invention of Mr. Pray, and when taken out for the purpose of noting the effect upon them of the intense and prolonged current, were found to be as dense as steel needles. Mr. pray has produced lamps ranging from 13 volts, giving eight candle-power, to 180 volts at 16 candle-power, some of which are now in successful operation, having run over 10,000 hours.

Mr. Pray is the author of the well-known work, "Twenty Years with the Indicator," which has had a very extensive sale among steam users, and he now has two more works on steam in press.

A touch with an oily rag is sufficient to lubricate the commutation of a dynamo or motor.

Magnetic reluctance equals the length of core divided by the product of its cross-section and permeability.

The Mason Battery and Electric Company has been organized. Mr. J. H. Mason, the well-known electrician, is the general manager and electrician of the new company. The New York office will be situated at 257 Broadway, and the factory at 120 Park avenue, Brooklyn, N. Y. The company will make a specialty of the Mason Battery, in addition to which they will conduct a general electrical supply and constructing business.

The Scott Electrical Manufacturing Company, No. 26 Liberty street, this city, are sending out circulars describing the Electro-Calcium Light illustrated in our last issue.

The Moore Electrical Manufacturing Company, whose removal to larger quarters at 652 & 654 Hudson street, this city, we noted recently, are doing an extraordinary large business. At their new establishment they have every facility to fill promptly orders of any magnitude for electrical goods of all descriptions. All the machinery used is of the most approved pattern, and everything connected with the business is gotten up with a view to the manufacture of first-class goods. This company is the successor of the well-known firm of Moore Bros., who formerly occupied quarters at 108 Liberty street. The business of the company is constantly increasing, and their factory is a model of its kind.

Max. Wocher & Son, of Cincinnati, O., have just made a large shipment of Fleming faradic and galvanic batteries and surgical instruments to a well known Shanghai, China, establishment.

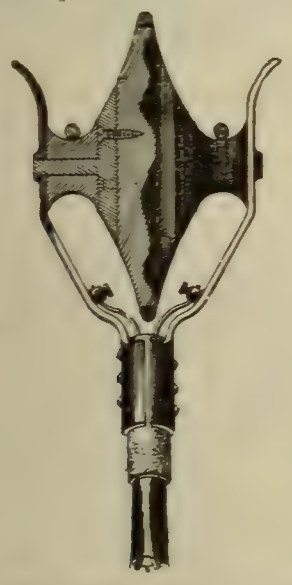
THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

ELECTRICAL PATENTS.

ISSUED TUESDAY, APRIL 21, 1891.

450,552. Armature. La Motte C. Atwood, St. Louis Mo., assignor to the Atwood Electric Company, same place. Filed Oct. 18, 1890.

The combination with a shaft of independent hubs fitted thereon and having arms or spokes, a wrapped ring encircling the shaft between the spokes of the hubs and having projections, a removable cylinder fitted snugly over the wrapped ring revoluble with the shaft, screws securing the cylinder to the projections and the screws passing through the cylinder into the spokes.



450,683—TROLLEY FOR ELECTRIC RAILWAYS.

450,558. Electric Call Bell and Indicator. William Cox, Toronto, Canada. Filed April 11, 1890.

450,577. Regulator for Electro-Therapeutic Apparatus. John H. Davis, Findlay, Ohio, assignor of one-third to Yeatman Bickham, same place. Filed May 12, 1890.

The combination. with a battery, of cylindrical tubular handles, perforated for about half their lengths from their open ends and covered for the remainder of their lengths with insulating material and pieces of sponge fitting in the perforated portions of the cylinders.

450,581. Electric Wire Connection. Edward J. Gatley, Rome, N. Y., assignor to Edward H. Walworth, same place. Filed Feb. 7, 1891.

450,586. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor by mesne assignments to the Thomson-Houston Electric Company, Boston, Mass. Original application filed June 4, 1889. Divided and this application filed Sept. 4, 1890.

In a branching electric railway, a main line conductor and a branch line conductor extending along the main line and branch tracks, respectively, in combination with two generators, one connected to the main line conductor and the other connected to the branch line conductor.

450,587. Electric Wire Supporter. Charles A. Lieb, New York, and Erwin Lavens, Brooklyn, N. Y.; said Lavens assignor to said Lieb. Filed Dec. 8, 1890.

An insulated supporter for electric wires, consisting of a hollow, open-sided metallic casing containing a threaded nut having insulating material surrounding it.

450,589. Holder for Electric Cables. Joseph W. Marsh, Pittsburg, Pa., assignor to the Standard Underground Cable Company, same place. Filed Sept. 12, 1890.

A socket fitting over the ends of the cable, and clips for attaching the ends of the cable to a spool.

450,605. Socket for Incandescent Lamps. George H. Alton, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Oct. 22, 1890.

A lamp socket comprising an insulating base, a U-shaped terminal attached thereto and adapted to be screwed into the collar of the lamp, thereby making connection with one lamp terminal and a spring terminal permanently fixed to the base at one end and having a free end which is pressed into engagement with the second lamp terminal upon screwing the lamp to the socket.

450,613. Electric Railway. Frank S. Culver, Eau Claire, Wis. Filed Sept. 25, 1890.

An electric railway trolley consisting of a slotted bar, a wheel at one end of the bar and another wheel having its axle movable along the bar, and a spring within the slot and connected to the bar at one end and at the other end to the movable wheel.

450,615. Means for Communicating Information. Patrick B. Delany, New York, N. Y. Filed Nov. 26, 1888.

450,628. Wall Socket for Incandescent Electric Lamps. Philip Lange, Pittsburg, Pa., assignor by mesne assignments, to the Westinghouse Electric and Manufacturing Company, same place. Filed June 11, 1890.

A wall socket for incandescent electric lamps, consisting of a cylindrical base of insulating material having a flange, binding plates carried upon the face of the flange, and exposed fusible strips between the binding plates.

450,630. Printing-Telegraph. Samuel R. Linville and Louis F. Hettmansperger, Philadelphia, Pa., assignors to the Keystone Battery and Electric Supply Company, Camden, N. J. Filed June 23, 1890.

A printing telegraph system comprising a source of electric energy, electrical and mechanical devices, a single line circuit, alternating devices at a station for alternating the direction of currents of the line, transmitting and receiving instruments looped therein and provided with two type-wheels, means for arresting the alternating devices and responding to different conditions of currents in the line, resistance keys and keys for breaking the line, arresting devices adapted to permit of the type-wheels of the instruments being simultaneously arrested at a character indicated through the depression of a key, and mechanical and electrical devices to cause a character on the type-wheels to be impressed therefrom simultaneously on all instruments in the line.

450,631. Printing-Telegraph. Samuel R. Linville, Philadelphia, Pa., assignor to the Keystone Battery and Electric Supply Company, Camden, N. J. Filed Aug. 12, 1890.

A printing telegraph system comprising sources of electric energy, electrical and mechanical devices located at a station for alternating the direction of the current in parallel circuits, arresting devices responding to pulsatory currents in a series circuit, transmitting and receiving instruments, keys therein, and electrical and mechanical devices responding to the keys to close the series circuit, arrest the alternator, and vary the intensity of the current in the parallel circuits.

450,639. Electric Motor or Generator. John F. Seiberling, Akron, O. Filed Nov. 17, 1890.

In an electric motor, the pole pieces of the field magnets, constructed each in two parts, one of which is made adjustable laterally relatively to the other.

450,641. Self-Exciting Alternate Current Electric Generator. William Stanley, Jr., Great Barrington, Mass., assignor to the Westinghouse Electric Manufacturing Company, Pittsburg, Pa. Filed Oct. 19, 1888.

The combination of two sources of alternating electric currents, the phases of which currents are 90 degrees apart, an electric converter wound with two coils respectively connected in series with the sources, of two circuits supplied with currents from the sources, respectively, the currents traversing one of the circuits serving to vary the electromotive force of the currents from the sources, and circuit connections from one of the circuits, including the exciting coils of the sources.

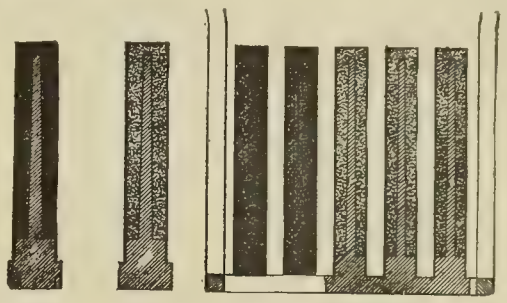
450,645, Railroad Signaling Apparatus. John D. Taylor, Piketon, O. Filed July 18, 1890.

450,646. Electric Railway Block Signal. John D. Taylor, Piketon, O. Filed Sept. 9, 1890.

In an electric railway block signal, the combination of a semaphore, a semaphore operating motor, break wheels operated by the motor, a polarized relay, a common relay, track instrument and electrical connections.

450,652. Electric Locomotor. George Westinghouse, Jr., Pittsburg, Pa. Filed Aug. 1, 1890.

Friction wheels for communicating motion from the driving wheels to other wheels of the truck, the friction wheels supporting a portion of the weight of the electric motor.



450,834—METHOD OF MAKING PLATES OF SECONDARY BATTERY.

450,683. Trolley or Traveler for Electric Railways. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed April 9, 1890.

A trolley or traveler comprising contacts in the form of rollers insulated from each other, and a device arranged between the contact rollers and projecting beyond the edges of the same for entering between the supply conductors.

450,687. Railway Gate Crossing for Overhead Lines. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 5, 1890.

An electric line conductor crossing the path of the gate and provided with a removable bridging section, actuated by an electro-magnet and circuit connections for operating the electro-magnet.

450,690. Clamp-Electrode for Electrical Dental Apparatus. Thomas S. Wilson, Chicago, Ill. Filed Oct. 22, 1890.

In a clamp electrode to be used in connection with an electric dental apparatus, a clamp in combination with an electrode, the same provided with stirrups connected with movable arms.

450,706. Electric Bell Pull. Lemuel B. Tinkham, Boston, Mass. Filed Oct. 11, 1890.

450,708. Insulator. Theodore Creighton, Tiffin, O. Filed June 19, 1890.

450,731. Steam Engine Indicator. Frederick Sargent, New York, N. Y. Filed Feb. 17, 1890.

The combination of two or more indicators the recording surfaces of which are moved by the engine or apparatus to which the indicators are attached, with electro-magnets for controlling the contact between the recording surface and stylus and a single circuit embracing all of the magnets.

450,734. Electric Cable. William I. Bunker, La Grange, Ill. Filed Oct. 7, 1890.

Electric cable composed of a series of conducting particles adapted to contact with each other to transmit a current.

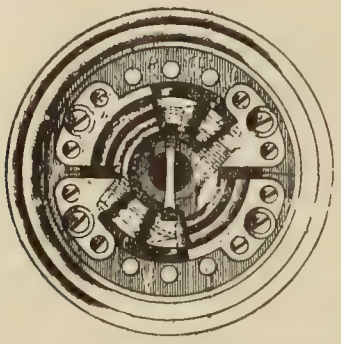
ELECTRICAL PATENTS—Continued.

450,742. Electrical Propulsion of Vehicles. Edward H. Johnson, New York, N. Y. Filed Aug. 8, 1890.

A method of operating an electrically propelled vehicle, consisting in successively closing circuit to two or more electric motors mechanically connected with the wheels of the vehicle in starting.

450,744. Power Transmitting Device for Electric Railways. Edward H. Johnson, New York, N. Y. Filed Oct. 11, 1890.

A compound nut for the transmission of power by friction, consisting of several concentric sleeves having engaging screw threads, each sleeve having several independent threads of long pitch.



450,973—ELECTRIC SWITCH.

450,834. Method of Making Plates of Secondary Batteries. Stanley C. C. Currie, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed Nov. 18, 1890.

The method of making a battery plate or element, which consists in fusing the salt or salts of a metal, casting the fused metallic mass between two supports, forming a matrix in the mass by withdrawing one of the supports, and attaching the mass to a conducting support by filling the matrix with fused metal and reducing the salt or salts to the metallic state.

450,839. Method of and Apparatus for Covering Electric Wires. Jabez E. Walcott, Providence, R. I. Filed Sept. 30, 1884.

450,840. Galvanic Battery. Charles Willms, Baltimore, Md. Filed Dec. 16, 1890.

The combination of a sealed battery cell and an inclosing case of wood, rubber, or other similar material having a cell space larger than the cell and affording space for the battery material when released from the cell.

450,846. Insulated Electric Car. John Stephenson, New York, N. Y. Filed July 5, 1890.

An electric car having a bridge mounted upon its upper surface and an electric trolley supported on the bridge, and having electric insulators interposed between the bridge and the upper surface of the car body.

450,853. Trolley Wheel Support for Electric Cars. Harold A. Webber, Passaic, N. J. Filed Aug. 13, 1890.

A trolley wheel support, consisting of a lower plate connected with the upper end of the arm and an upper plate free to rotate, having an extended bearing upon the lower plate and provided with bearings for the trolley wheel, and means for securing the plates together.

450,872. Electric Valve Controller. Charles B. Reardon, Franklin, Pa., assignor of one-half to John E. Gill, same place. Filed June 4, 1888. Renewed March 20, 1891.

The combination, with a hydraulic valve, of a tilting lever connected thereto, having a solid and a hollow weight at its ends, catches, electro-magnets, and a valve discharging into the hollow weight when raised, and a valve emptying the hollow weight when lowered.

450,875. Electrically Propelled and Steered Torpedo. Winfield S. Sims, Newark, N. J. Filed Dec. 22, 1890.

The combination, with a torpedo, of a steering magnet, an electrical generator, a relay for directing current through the steering-magnet, a resistance in a shunt around the relay contacts, and means for opening the shunt after the relay contacts are separated.

450,923. Electro-Magnetic Apparatus. Leonidas G. Woolley, Grand Rapids, Mich. Filed Aug. 16, 1890.

The combination, with an induction coil, of two circuits for the primary coil, a manual circuit closer in one circuit and a switch lever controlled by gravity in the other circuit, both including a vibrating rheotome, whereby the device is adapted for use either as an ordinary electro-magnet or for the production of secondary currents.

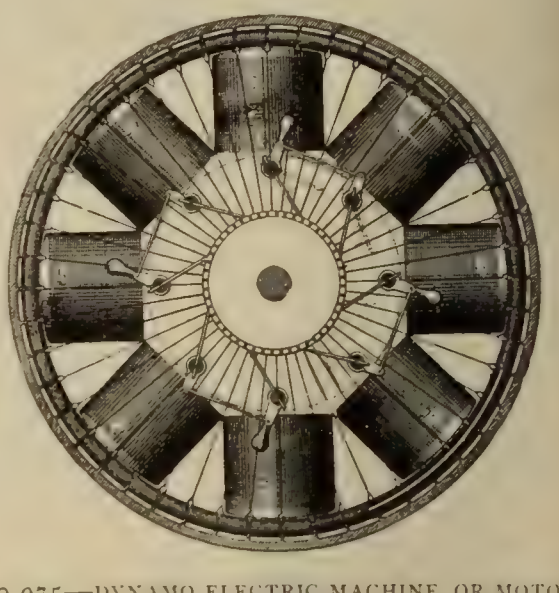
450,927. Automatic Electric Valve Controller. Ferdinand E. Chatard, Baltimore, Md. Filed Jan. 15, 1891.

An armature and solenoid to move the valve in one direction, with a weight to move the same in the opposite direction, a latch to hold the valve, and a magnet to actuate the latch.

450,966. Electro-Magnetic Apparatus for Operating Stop Watches. Frank A. Matthews, Providence, R. I. Filed Feb. 7, 1891.

450,970. Electric Motor Mechanism. Samuel E. Mower, New Haven, Conn., assignor to Henry G. Thompson & Sons, same place. Filed Nov. 4, 1890.

450,973. Electric Switch. John A. Norton, Bridgeport. Conn. Filed Sept. 26, 1890.



450,975—DYNAMO ELECTRIC MACHINE OR MOTOR.

450,985. Electric Current Regulator. Joseph A. Williams, Cleveland, O. Filed Nov. 15, 1890.

In an electric current regulator, the combination, with the movable brushholder of a dynamo, of two thermostatic bars oppositely arranged with respect to each other and connected with the brushholder, and mechanism for shifting the current from one bar to the other.

450,991. Ceiling Rosette for Incandescent Lamps. David J. Cartwright, Boston, assignor to John S. Potter, Newton, Mass. Filed Nov. 10, 1890.

A block of insulating material having an annular ring or lip on its upper side, combined with a pair of radial metal arms secured to it and projecting through cut away portions in the annular lip, the arms having their inner and outer ends provided with binder screws for securing them to the respective lamp and circuit wires.

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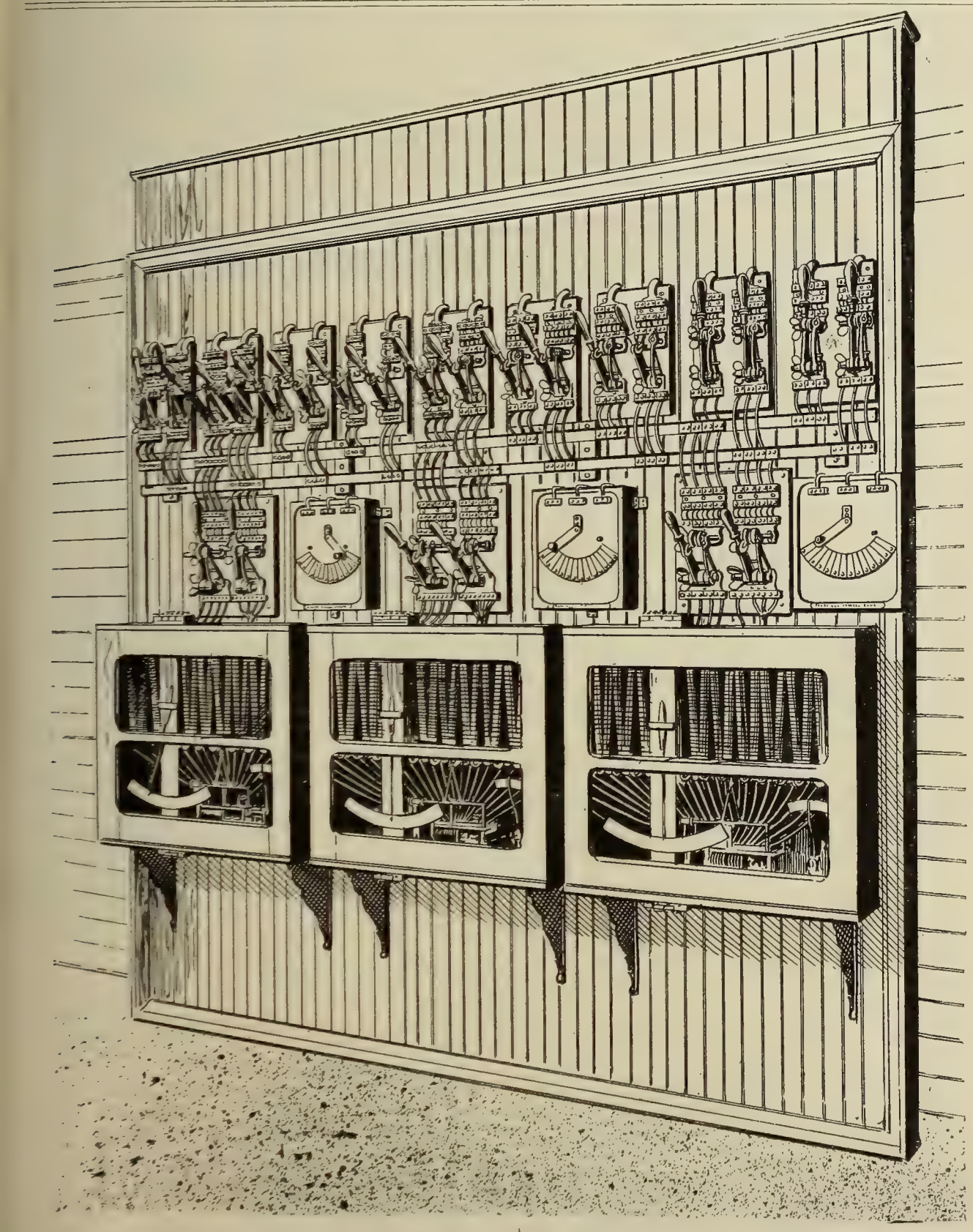
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WEEKLY.

Vol. IX. NEW YORK, MAY 9, 1891. No. 19.



THE ELECTRIC PLANT IN THE OFFERMAN BUILDING, BROOKLYN.

The Offerman Building on Fulton street, between Bridge and Duffield, Brooklyn, contains one of the most substantially built and efficient isolated electric light plants to be found anywhere in this vicinity. This magnificent building, of which Fig. 1 is an exterior view, is entirely occupied by the well-known dry goods firm of S. Wechsler & Bro., who have spared no expense in furnishing their establishment in the most thorough manner. The electric plant has received unusual care in its installation. A large section of the basement is occupied by the dynamos and steam plant, and there is plenty of room for additional machines should it ever become necessary to enlarge the plant.

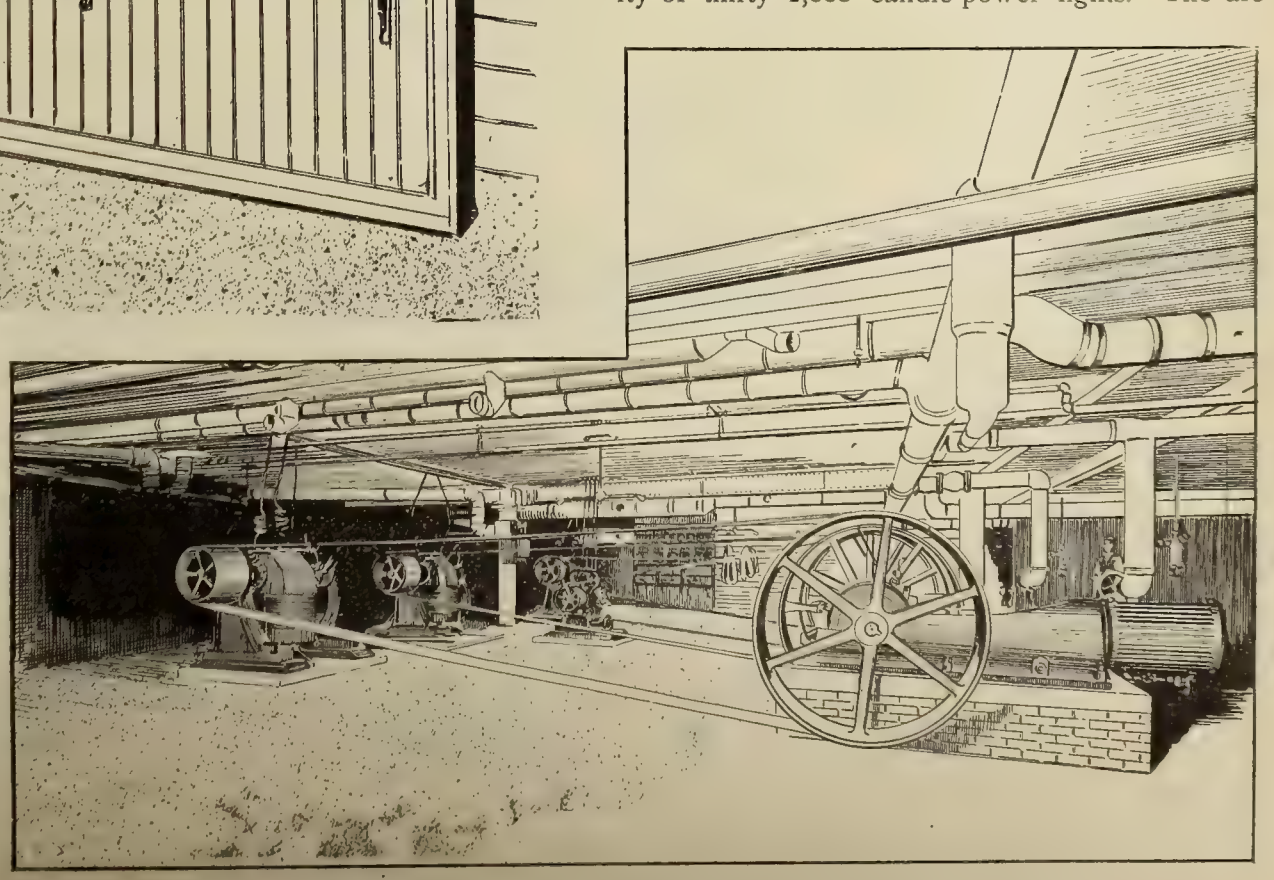
The electric system used is that of the Excelsior Electric Company, 115 Broadway, and the work of



OFFERMAN BUILDING, BROOKLYN.

installation was under the general supervision of Mr. Wm. H. Randall, the company's superintendent.

The electric plant consists of three 600 light, shunt wound Excelsior Dynamos of 110 volts each, and one arc machine of the new type, with a capacity of thirty 2,000 candle-power lights. The arc



SWITCHBOARD AND DYNAMO PLANT, OFFERMAN BUILDING, BROOKLYN.

dynamo is self-regulating, the brushes adjusting themselves according to the demand for current. There are distributed throughout the building between 1,800 and 2,000 sixteen candle-power incandescent lamps of the Sawyer-Man pattern.

The power plant consists of three Ball engines of 65 horse-power each, running at a speed of 300 revolutions a minute. There are four steam boilers of 110 horse-power each at 100 lbs. pressure. These were made by Messrs. Vought & Co., Williamsburgh, N. Y.

The distribution system in this building has many valuable features. The circuits on each floor are controlled from the engine room. There are also switches in wall-pockets on each floor, so that the circuits can be controlled independent of the engine room in case of necessity.

The switchboard contains nine circuit switches representing as many floors, and three main switches for controlling the dynamos on the bus wires. In the manufacture of this switchboard the utmost care was taken, and it is a most durably constructed piece of apparatus. The switches can be locked when open or closed, thus avoiding accidental closing or opening of the circuits. The locking is done by hand.

The switches are of the carbon type, so constructed that arcing between the metal parts is impossible. The switchboard contains a voltmeter and ammeter of the Excelsior Company's own make, and every provision is made to secure uniformity and perfect regulation in the current. The dynamos are connected in multiple, and can be all run together according to the demand for light.

The machines run with no sparking at the commutator, and with remarkable smoothness. They are set on solid foundations and the plant entire has every appearance of permanency and care in its installation.

The well-known perforated belting of Charles A. Schieren & Co. is used, and the electroliers used throughout the building were furnished by Cassidy & Son, Sixth avenue and 23d street, New York.

The best Grimshaw White Core Wire was used in wiring the building for lighting, and the wires are run in the tubing of the Interior Conduit and Insulation Company. The entire wiring was done by the New York Isolated Lighting Department of the Thomson-Houston Electric Company.

The entire plant in every detail has been most carefully looked after, and it is thought to be a model of serviceability and efficiency.

One of the features of this plant is the distribution of electric lights on each floor around the circular opening of the light well. This is 50 or more feet in diameter, and around the edge on each floor are distributed 48 lamps, which, when lighted have a very beautiful effect. Looking up from the ground floor seven of these circles of lamps can be seen, and when all are lighted the view is an exceedingly attractive one.

The transactions of the Twenty-second meeting of the Kansas Academy of Science contains a paper by Professor Lucien I. Blake and H. Radcliffe, of Lawrence, entitled "The Insulation and Resistance of Some Electric Light Wires." The transactions of the twenty-third meeting of the same society contains an abstract from a paper by Prof. Blake, entitled "An Electrical Hygrometer."

THE UNDERGROUND SYSTEM OF THE INTERIOR CONDUIT AND INSULATION CO.

One of the greatest electrical problems of the day is the underground question. It is easy enough to lay electrical conductors underground, but to keep them in perfect working order is quite a difficult matter. Insulation will deteriorate, and leakage ensues. Besides this, the usual method of underground conduit construction is an expensive operation, and not altogether satisfactory. It is customary to draw into the conduits cables containing usually many wires and if any fault develops on any one of them, the entire cable must necessarily be withdrawn to effect repairs. Such handling of cables is detrimental to insulation, and it is evident therefore that any system providing a duct for each individual wire, and at the same time be cheap in construction and efficient in service would measure well up to the standard of a model underground system. Such a standard is claimed for the underground system of the Interior Conduit and Insulation Company of this city, about which we give herewith some interesting facts.

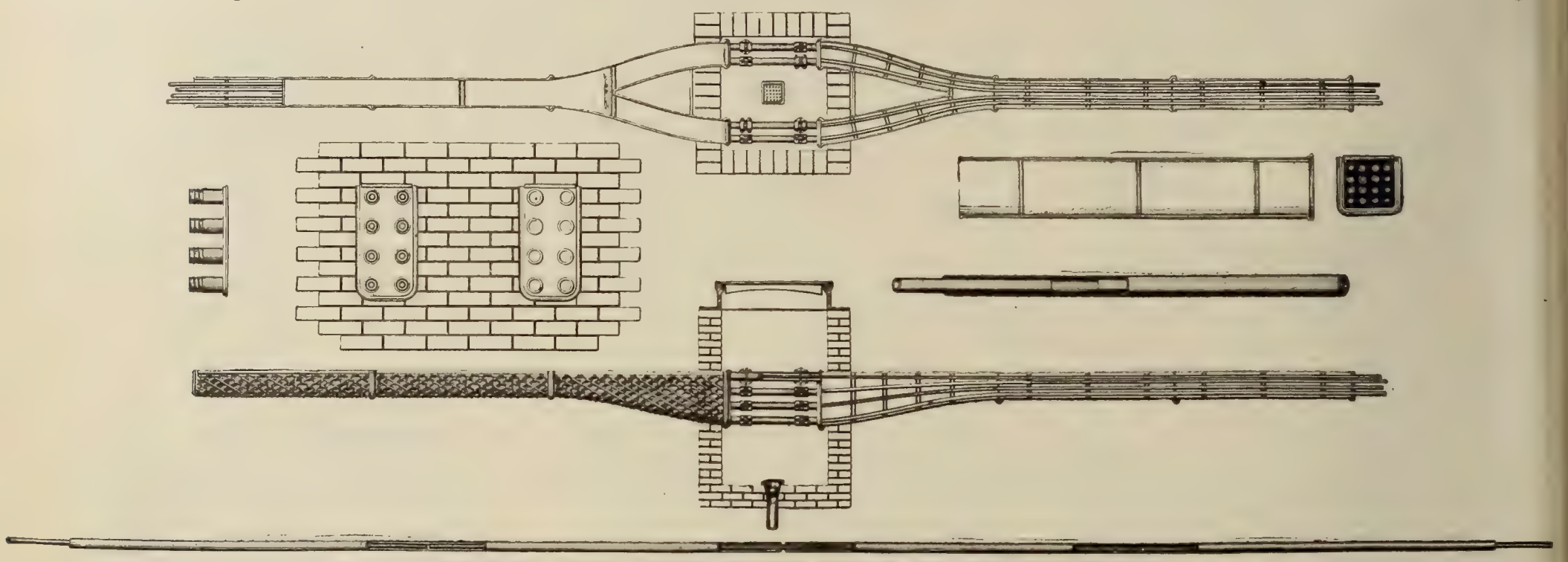


FIG. 1—UNDERGROUND SYSTEM OF THE INTERIOR CONDUIT AND INSULATION COMPANY.

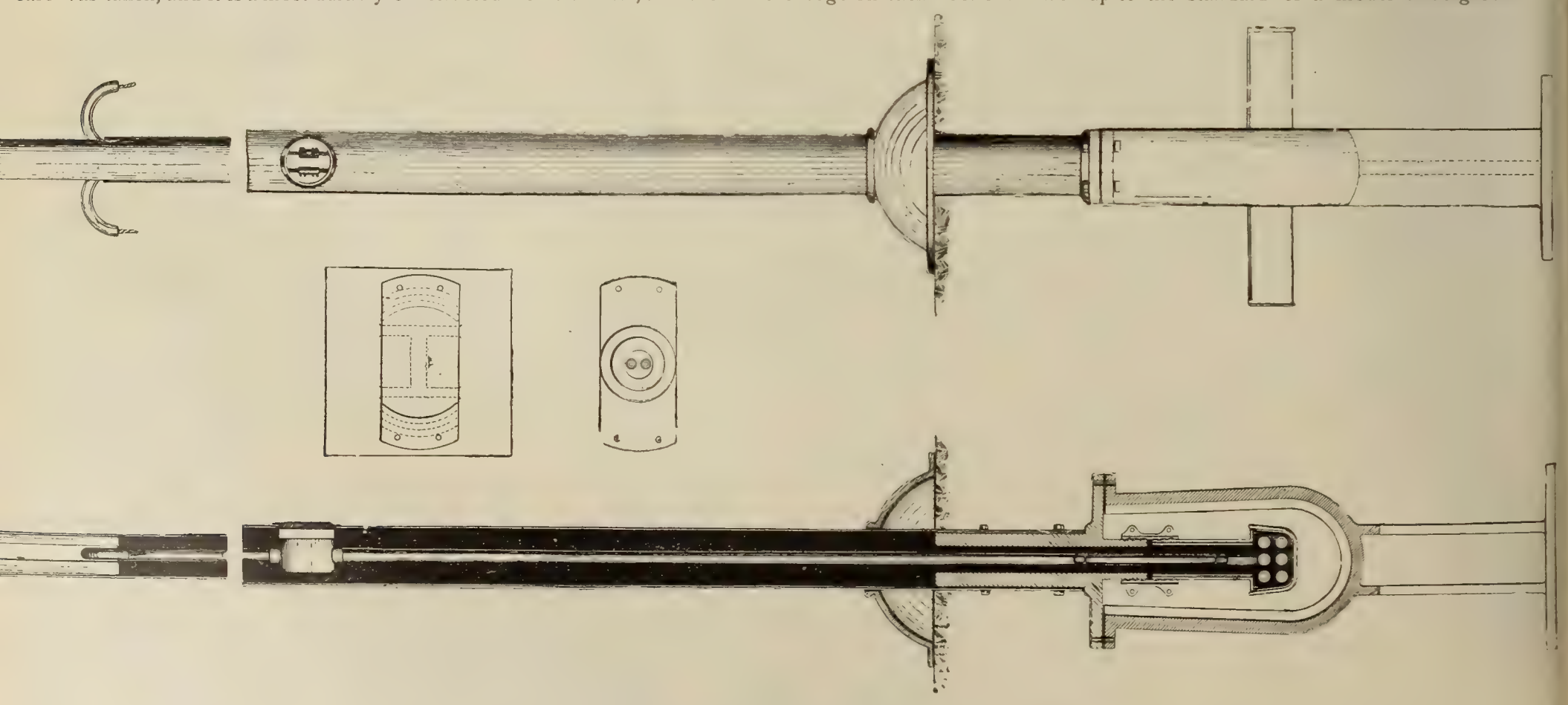


FIG. 2—METHOD OF RUNNING WIRES THROUGH LAMP POSTS AND FEEDER POSTS.

The underground or multiple duct system is more or less the outgrowth of the well-known interior conduit system of this company, and is the result of a series of costly and elaborate experiments to determine the practical requirements of underground electric conductors.

The system, like the interior system, consists of a series of highly insulating, water-proof tubes,

which form individual channels for the reception of electrical conductors, and provides for the drawing in or withdrawal of the conductors at any time. By reason of the insulating and moisture proof qualities of the conduits the bare copper conductors can be placed therein, the conduits themselves becoming the insulation.

No expert labor or special tools are required to lay this conduit, and an extension of the system or an increase of capacity simply means the withdrawal of the wires from the conduit and the substitution of larger conductors therefor.

One of the most important features of the system is that the conductors themselves need not be insulated: the conduits providing ample insulation. This means a great saving in cost for insulated conductors, and it is claimed that the cost of insulated cables and handling the same will ordinarily amount to more than sufficient to pay the entire cost of this conduit system.

The conduit may consist of any desired number of individual tubes or ducts continuous from one manhole to another, no joints or couplings being employed, thus a fruitful cause of leakage and consequent deterioration is absolutely eliminated. The method employed to convert the tube sections into continuous unbroken and unjointed ducts constitutes one of the important elements of the system.

The telescopically formed ducts constitute an important feature of the system. They consist of two tubes, one fitting within the other, the internal diameter of the smallest being just that called for by the requirements of the use to which they are put. These tubes are supplied in 10-foot lengths, and at the moment of laying the inner tube is coated with an insulating compound or cement and then telescoped into the exterior tube to just one-half of its length; thus each and every duct so formed of two complete tubes, cemented with a superior insulating compound, becomes, to all intents and purposes, a continuous unbroken tube, without sleeves or joints and possessed of very high insulating properties. This problem of absolutely reliable insulating continuity is, it is claimed, now solved for the first time by these telescopically continuous insulated ducts.

The manhole is a simple construction of brick, preferably cemented to protect it, to a reasonable extent, from the exudations of the soil, for the sake of cleanliness. The section of the general containing box or conduit entering the manhole is expanded in a forked form and also in a vertical line, as shown in the accompanying drawings, for the purpose of separating and therefore providing greater space around the duct ends for more convenient manipulation.

The end of each section entering the manhole is provided with a cast-iron head, on the face of which are short pipe projections, which are carried across the manhole to the opposite face plate by sectional iron pipes enclosing a section of the insulating tube. Those sectional pipes are adapted for easy and quick removal in order to render the conductors readily accessible. Thus the continuity of each duct is preserved even across the manhole itself, permitting the same to be left open with impunity in all kinds of weather.

Lamp posts, feeder posts, elbows and other branch connections are provided and are so constructed as to be nothing more or less than minor extensions of the system in its every feature. They are iron boxing or piping filled with our insulating compound and joined to the conduit proper by suitably constructed elbow extensions, thus providing for the drawing in of the conductors from the nearest manhole to the top or extreme terminal of the post or other branch.

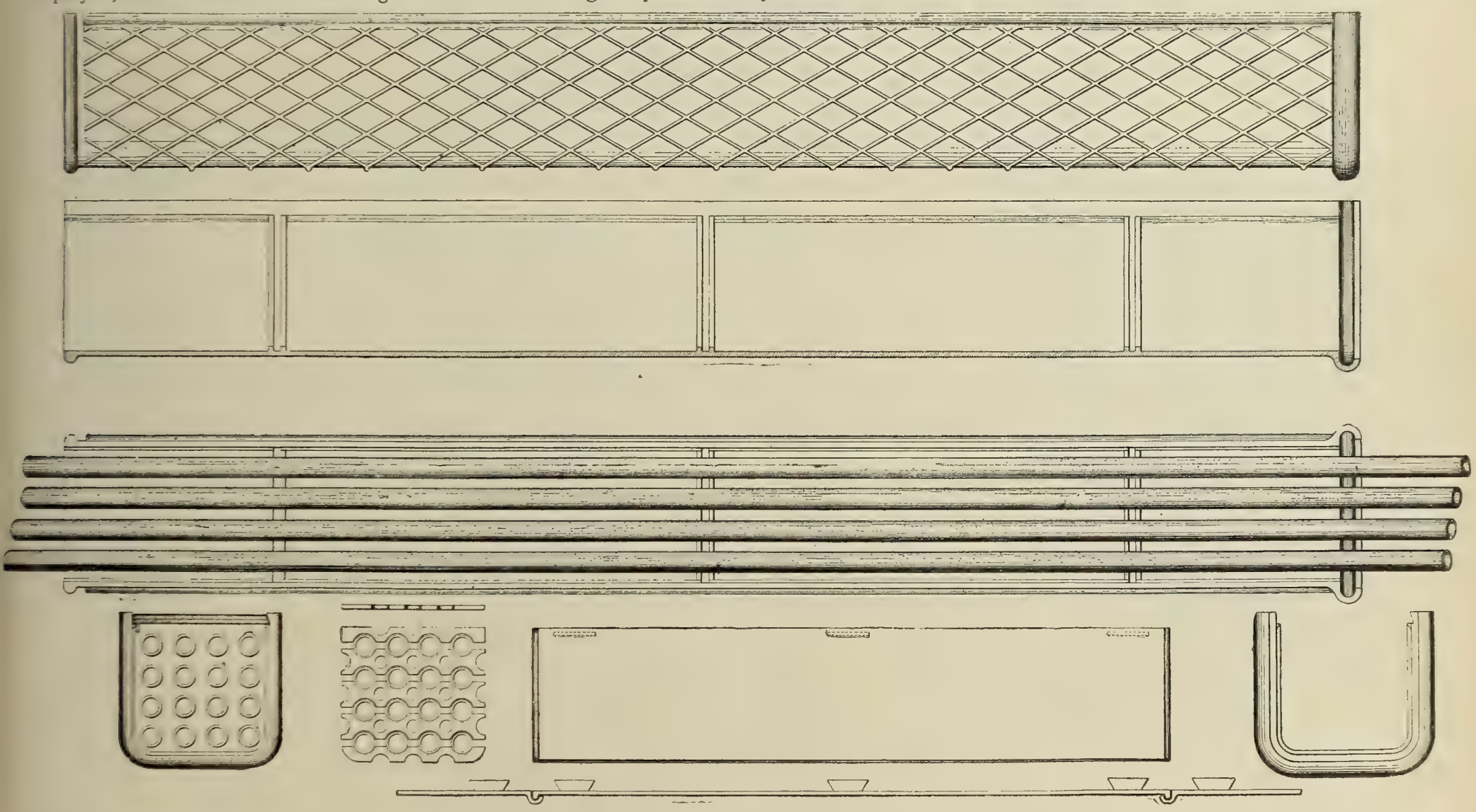


FIG. 3—DETAILS OF UNDERGROUND CONDUIT SYSTEM.

THE NATIONAL INVENTORS' ASSOCIATION.

The constitution and by-laws of the National Inventors' Association, recently organized in Washington, with particulars as to eligibility to membership, will be ready for distribution in a very short time. The annual dues for active membership will probably be fixed at $5, and life membership $100. Provision is also made for associate and honorary members. There will be an annual meeting of all the members at such place as may be determined upon. It is believed that the results secured by the formation of this National Association for the mutual benefit and protection of inventors and manufacturers, and the perfecting of the American Patent System will be far-reaching. Every inventor and manufacturer of this country ought to be a member of the association.

ILLUMINATION OF DRUG STORE SIGNS.—A recent application of the incandescent electric light is for the illumination, at night, of the large fancy shaped bottles containing liquids of various bright hues, which form a necessary part of the equipment of every drug store. These are, as a rule placed in the window, where, in the day time their bright colors show to the best advantage and at night when darkness prevails, their brilliant colors are made to shine forth by placing lights behind the bottles. In adopting the electric light to this particular use the colored liquids have been dispensed with and the electric lamp is placed within the bottle which is made of colored glass. It is a question, however, whether the new method is as good as the old. The old style light could be seen at long distances at night because the spherical shape of the bottles and liquids form a sort of lens which had the effect of concentrating the rays of light. In the new style, however, the filament of the electric light is plainly discernable through the colored glass, and the light does not seem to be so brilliant when viewed from a distance. There is some discussion going on in drug circles as to the merits of the new method of lighting these drug store signs, and there seems to be some division of opinion respecting the same. We should think that all of the effectiveness of the old style could be retained by still using the liquids and having the electric light placed therein. It would be a comparatively easy matter to accomplish this, and it would settle the question that threatens to split the body of drug store keepers into two factions.

BOOKS, CATALOGUES, ETC.

We have received a copy of the *Journal of the Electrical Society of Tokio, Japan, for January, 1891.* It contains, among many other valuable articles, Part 2 of "Electric Lighting for Beginners," which ran in the ELECTRICAL AGE through last year. Judging from the appearance of the journal and its list of contents, which is printed in English, it is evident that the society is a progressive one.

The financial condition of the society is very satisfactory, the report at the beginning of 1891 showing a balance of nearly $1,500. The society on that date had 1,152 members.

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NEW YORK, MAY 9, 1891.

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NOTES.

THE DISSATISFACTION that has existed among the London subscribers of the National Telephone Company resulted in a large mass meeting in that city on April 8th, to devise ways and means of remedying the cause of their complaints.

The general tone of the meeting indicated that subscribers suffered from inefficient service at exorbitant rates. Efforts were to be made to both lower the rates and obtaining a double wire system, by which means alone could the voice be heard clearly in London.

Comparisons were made between the London rates and those of other parts of the United Kingdom, and it was shown that charges imposed upon London subscribers were much higher than those prevailing in country towns.

One of the results of the meeting was the formation of an association for the protection of the subscribers to the National Telephone Company in England. It was stated that if the company failed to remedy the trouble complained of, efforts would be made to have the Post Office department establish a telephone service in London, and the practicability of this was shown by the following letter from the Postmaster General to the chairman, and read at the meeting: "As to any action which the Post Office itself may be prepared to take, I am to say that the Postmaster General could not be indifferent to a clearly expressed demand for the establishment of a telephonic service in London, but he regards it as premature at present to state what the charge for such service might be."

The Spring meetings of the American Institute of Electrical Engineers, which will be held in this city May 19th, 20th and 21st, promise to be most interesting as regards the subjects of the papers to be read. The paper which will most interest New Yorkers, will be that of Mr. Frank J. Sprague. He will suggest a proposed electrical equipment for the coming rapid transit system of New York City. Owing to Mr. Sprague's familiarity with this subject, the paper will likely be a most important and timely one. Some additional light will, during the meetings, be thrown on the much talked-of metal, aluminum, by Dr. W. H. Wahl, who will consider the subject retrospectively and prospectively. Aluminum has been exalted in the scale of metals until many persons now seem to regard it as possessing wonderful properties. The reaction, however, has set in and all speculation is giving way to desire for truth regarding this remarkable metal. Taking the programme altogether, there is every promise that the meetings will surpass in interest all those ever held.

An interesting question arises in connection with the unfortunate accident which resulted in the violent death of a lineman in this city a few days ago. He was at work on a pole and, it is claimed, received a shock through the crossing of one of the wires among which he was at work with an electric light wire, and fell to the ground. He expired very soon afterwards. At once the daily papers commenced their tirade against the "deadly wires," before any evidence was obtained that the man was killed by an electric shock. They assumed that he was, and at once opened the floodgates of censure on the wires and everything and everybody in any way connected with them. At the coroner's inquest it was shown that the man received fatal injuries in his fall, and the doctors were unable to determine whether the unfortunate lineman lost his life through the injuries received in his fall or by electric shock. There is no direct evidence that the man received a dangerous shock, hence it would require a very bitter enemy to electricity to maintain a claim that the man was killed in this way, and when a scientific investigation into the case fails to settle the question the daily press should go slow on their censure. But they become unreasonable when electricity can in any way be connected with an accident.

Those of our readers who like to solve problems and answer conundrums may be interested in a question which was propounded in a daily paper a few days ago. A man stands on an elevation in sight of a cannon, say two miles away, with telephone connection with the point of firing. He has the receiver to his ear and when the cannon is fired he sees the flash, and almost simultaneously he hears the report through the telephone. Then some seconds (eight or nine) later he hears the report without the telephone. There has been but one report. He has heard how many? One or two? And which one is the actual report?

Every business building that is erected these days is not considered complete without its electric light plant, and an architect to be abreast of the times must be something of an electrician as well. In planning the construction of a large building the disposition of the electric wires becomes an important factor in the calculations, and in the magnificent buildings, so many of which are being erected, electric wiring is one of the most important considerations in connection with the building operations. There is no longer apprehension in the minds of the electricians or landlords as to the safety of the electric light. Safety appliances have reached such a state of development as to settle all doubts, and the fact that almost every new building that is erected these times has its electric plant is abundant evidence that confidence in the light is universal, well-founded and permanent. Without that confidence landlords would not incur the heavy outlay for electric plants, and the electric light business would not be so prosperous as it is. Confidence is essential to success and prosperity, and the electric light is enjoying a full measure of both. We describe and illustrate in this issue a model plant in a model building just completed in Brooklyn. This electric installation represents the highest development in the art of lighting by electricity, and possesses many features of interest. Less than ten years ago if any person had the temerity to predict that immense buildings would be lighted throughout by electricity, by hundreds and thousands of incandescent lights he would have been looked upon as a subject for a lunatic asylum. But what changes ten short years have wrought in the development of electric light!

It is said that an apparatus is employed in connection with the famous Lick telescope in California for the purpose of automatically detecting comets, through the instrumentality of selenium. Certain rays of the light from a comet are made to fall upon a selenium cell which connects with a battery and an alarm. It is not necessary, therefore, for the observer to give personal attention to the work of comet searching. The telescope with the selenium can be made to sweep the heavens automatically and if a comet chances to come within the field of the telescope the alarm rings. This is one of the extremely few practical applications of selenium, which possesses the peculiar property of changing its electrical resistance according to the intensity of the light falling upon it.

In large cities certain sections are devoted almost exclusively to the transaction of the business pertaining to certain lines of industry, or professions. Thus we find on Wall and Broad streets and the immediate vicinity most all of the important financial concerns of the city; in and about Beekman street we find the paper district; the leather district, or the "Swamp" as it is popularly called, is in the vicinity of William, Pearl and Beekman streets, and the dry goods district is found on Broadway, with White, Thomas and Worth streets as the general centre. It is a notable fact, too, that those industries which thus become centralized are the leading ones, and the reason for these aggregations are natural. It is convenient to have the principal houses in one line of trade as near together as possible, both for the dealer and buyer, and the tendency is to still more centralize. Hence we find many of the modern large office buildings collecting together under one roof the representatives of concerns engaged in one line of trade. Electrical industries, too, owing to their vast importance, are subject to the same law, and within the past two weeks a fine large office building has been opened in this city for the use of the electrical and kindred trades. Some of the most important concerns in these lines are located there, and there seems to be a feeling of general satisfaction among electrical people over the fact that there is in New York one spot that they can call a real general electrical headquarters.

It is well known that the rays from an electric search light can be seen a far greater distance in a fog when projected vertically, than horizontally. This fact was known in the British Navy 12 years ago, and for the purpose of communication between ships a vertical beam represented a dot, and one projected at an angle of about 40 degrees represented a dash.

POLICE SIGNAL TELEGRAPHS.

The combination of the telephone and telegraph as an auxiliary to police service was first introduced in Chicago in 1880. Its value and efficiency were demonstrated largely through the efforts of Prof. J. P. Barrett, at that time superintendent of the fire alarm telegraph in that city, and now chief of the electrical department of the World's Fair, which is to be held in Chicago in 1893. At the outset the system was placed in the most turbulent district of the city and it so speedily increased the efficiency of the police force, by enabling them to concentrate promptly at any needed point, that within a very short time that particular district was as easily cared for and protected as the average district of the city. Patrolmen soon learned that in cases of necessity they could immediately summon assistance from the nearest police station, and could reckon with certainty on a response. On the other hand, the criminal and riotous classes discovered that there was little chance for them where electricity was so successfully utilized in aid of the law and its agents.

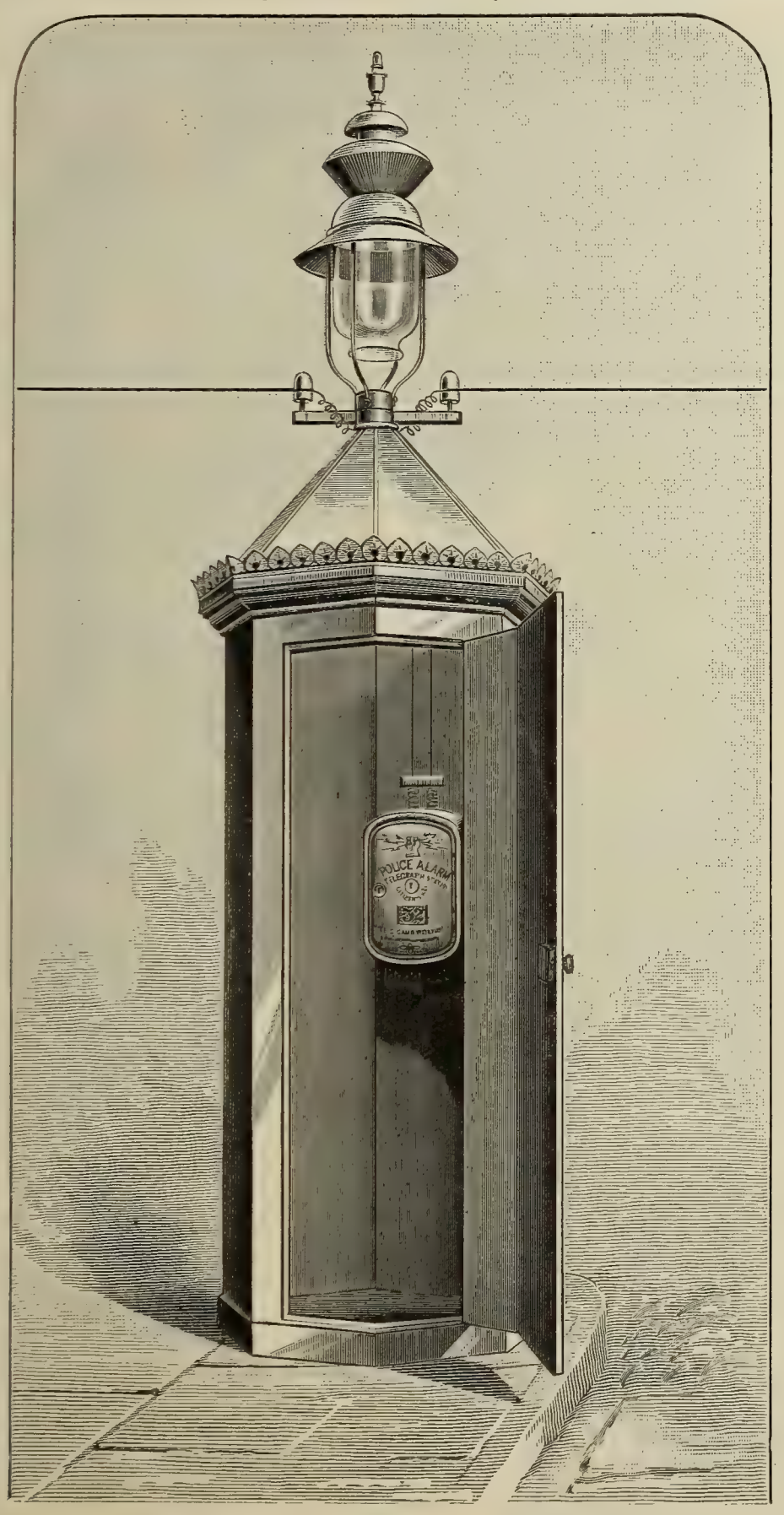


FIG. 1—POLICE SIGNALING STREET STATION.

This experiment was so successful that the system was extended, until now Chicago has over 500 street stations and many hundred private boxes, from which instant communication can be had at all hours of the day or night with all stations of the precinct.

Since its first introduction, the system has been very greatly improved, the Gamewell Fire Alarm Telegraph Company, of 1½ Barclay street, New York, and the Police Telephone and Signal Company, 118 LaSalle street, Chicago, co-operating for that purpose.

The following description and illustrations refer to one of the latest and most improved signal boxes furnished by the above companies, and their operation in connection with the Central Office apparatus, which has also been greatly improved since the original plant was constructed.

At the police stations of the city are placed the necessary instruments and batteries for receiving and recording telegraphic signals. This apparatus is entirely automatic, and requires no trained operator or electrician for its proper care and operation. The men usually in charge of police stations are competent for its supervision. At every such station one or more patrolmen are kept in reserve at all times of the day and night, in large cities a horse and wagon is always ready to respond to a call at a moment's notice.

The registers upon which the signals are received are self-starting, and whenever a signal is sent from the street station, the record is made whether the person at the station be in attendance or not, and the time of its reception is automatically stamped upon the upper side of the paper tape.

All signals requiring immediate attention are made to operate a continuous ringing bell, while other signals, such as those used to indicate the presence of the patrolman at a box, reports, or "on duty" signals, will be recorded silently.

Telephones are also placed in the central stations for use in addition to the automatic signals of the telegraph; and can be used even where a broken line has interrupted the transmission of the automatic signals.

Radiating from each police station are telegraph lines or circuits connecting with street stations or boxes of various sizes and shapes.

The street station shown in figure 1 is very extensively used. It is octagonal in shape, with pointed top, two feet four inches in diameter, and about eight feet in height. The top being made of glass and iron, it takes the place of a lamp post, and the gas or other lamp is placed upon the top, serving not only as a street light, but to light the interior of the station at night.

Wherever sufficient room can be found for them, these stations are, for many reasons, preferable to wall or lamp post boxes.

The street station also guarantees to the officers, while within it, perfect immunity from disturbance while communicating with his superior through the telephone, and insures for his communications a secrecy which is sometimes important.

Inside of each booth is placed a small iron case



FIG. 2—EXTERIOR OF WALL BOX.

with a door and lock, the case containing an automatic signal instrument, by means of which signals are transmitted to the police stations.

From the inner box patrolmen may transmit a number of different calls, such as "report," "telephone," "fire," etc. These boxes are generally furnished with telephones and transmitters by which patrolmen may communicate *ad libitum* with their headquarters.

Wall boxes are designed to be placed in depots, warehouses, factories, etc., and on poles or walls of buildings where it is unnecessary or impracticable to place the sentry street station, or as a matter of economy, and may be interspersed between the more expensive and elaborately equipped street stations. Figure 2 gives an exterior view of one of these boxes.

Figure 3 shows the box open, with the apparatus ready for the transmission of signals. By turning the pointer to the particular signal to be transmitted and then turning the handle, shown in the centre of the cut, the signal is transmitted and properly recorded on the tape at the police station. The telephone receiver and transmitter are also shown.

A certain number of calls in every signal box can be, if desired, reserved for the use of individual patrolmen, to indicate their personal presence at the box; but the safest, and probably the only method of identifying a patrolman at the box, is by the sound of his voice while using the telephone.

All boxes are provided with key and bell for code signaling, and they are so arranged and electrically connected that, although out of circuit when the boxes are not in use, they are instantly made operative as soon as the box door is opened or the citizen's key is used.

When a patrolman is wanted at his station, the fact is immediately made known to him as soon as he signals his presence at a box.

The advantage of automatic signals over those given vocally cannot be overestimated. In cases of excitement, experience has abundantly proven that wrong impressions are often unwittingly conveyed by the speaker or received by the listener, while with an automatic printed message there can be no variation or mistake. The mechanical result is invariably the same.

Suppose trouble of any kind occurs, demanding the presence of a police force in any part of the district covered by this system. The signal is instantly communicated to the district headquarters, and the reserve immediately hurries to the place whence the signal has come. Where horses are used, but a very short space of time elapses after the call before the aid required is at hand, ready for any service.

Patrolmen, as they go their rounds, may be required to report at the several stations on their beats as frequently as it may be deemed advisable. This will go a long way toward securing faithfulness of the force.

The bells of the fire alarm telegraph may be utilized, where this system is in use by the police department, to summon, in cases of emergency, the entire force to rally at the nearest street station, and then directions may be given them by telephone; so that when desired, the facts in detail may be made known to every policeman in the city.

Figure 4 shows the internal mechanism of the wall box, connections, etc.

Three hundred and eighty cities in the United States, of 10,000 inhabitants and over, are now using the fire alarm system of the Gamewell Fire Alarm Telegraph Company, and fifty-three are using their police signal telegraphs.

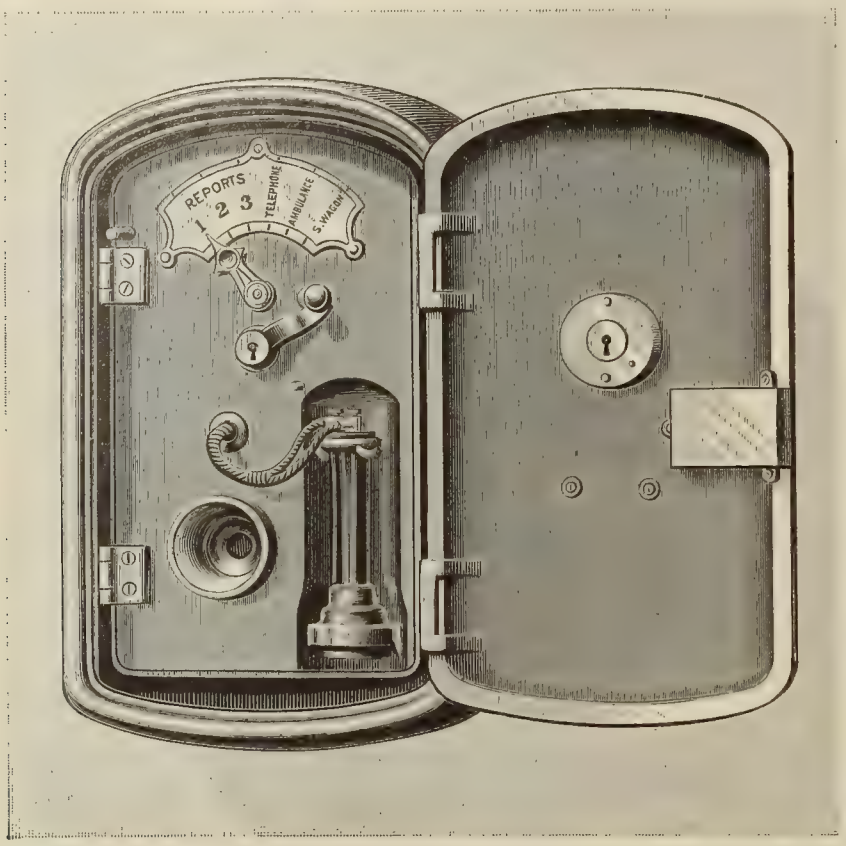


FIG. 3—INTERIOR OF WALL BOX.

THE RELATION OF THE AREAS OF WIRES TO THEIR CARRYING CAPACITY.

Considerable confusion exists in the minds of many people as to the practical effect of doubling the diameter of a circle and doubling its area, and it is difficult for them to understand why doubling the diameter more than doubles the area.

Fig. 1 shows 4 circles—1, 2, 3 and 4. Circle 1 has a diameter of one inch; circle 2, two inches; 3, three inches, and 4, four inches. Circle 2 has four times greater area than that of circle 1; 3 has nine times the area of 1, and 4 has sixteen times.

The area of a circle is equal to the square of its diameter multiplied by .7854; the areas of two circles are to each other as the squares of their diameters.

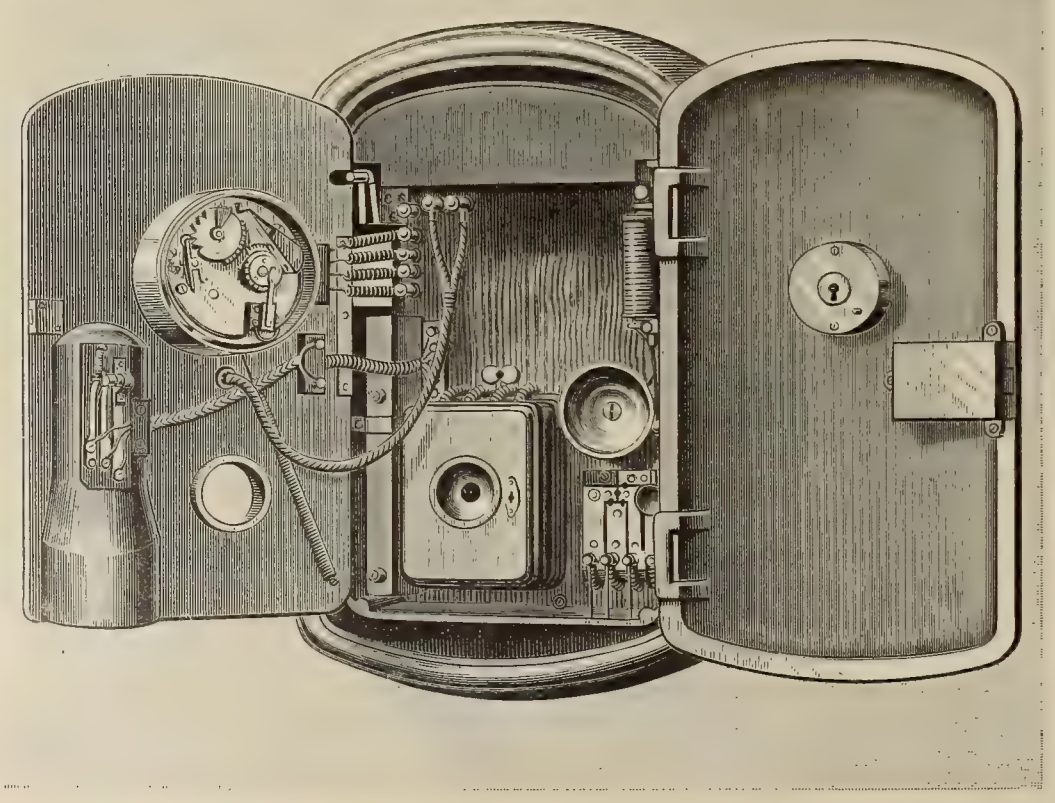


FIG. 4—INTERNAL MECHANISM OF WALL BOX.

Under this rule the area of circle 1 is .7854; that of circle 2, which is two inches in diameter, is [.7854 × (2×2)]=3.1416; the area of circle 3 is [.7854 × (3×3)]=7.0686; that of circle 4 is [.7854 × (4×4)]=12.5664.

Now, referring to Fig. 2, we get entirely different results. This figure shows four circles also, but in this case the AREAS of the circles and not the DIAMETERS are doubled. The difference in the size of these circles as compared with those in Fig. 1 is very marked. In the case of Fig. 1 the DIAMETER of the smallest circle is doubled, trebled and quadrupled, while in Fig. 2 the AREA is increasing in like manner.

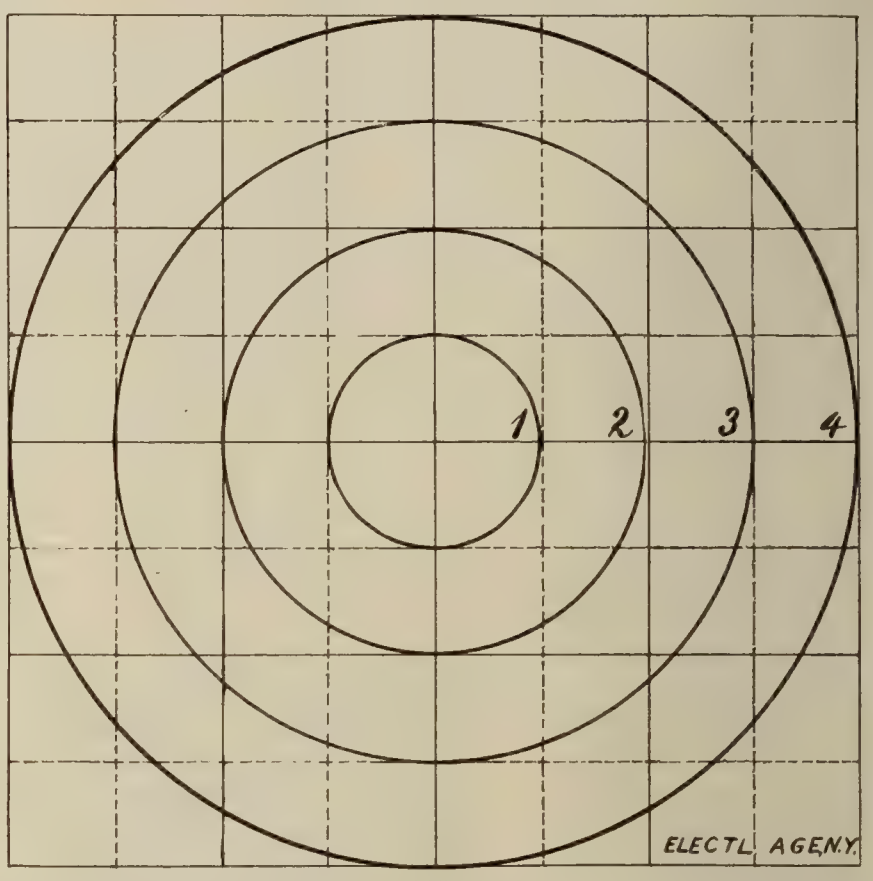


FIG. 1.

The area of circle 4 in Fig. 2 is the same as that of circle 2 in Fig. 1.

In Fig. 2 the area of circle 2 is twice that of circle 1; that of circle 3 is three times that of circle 1, and that of circle 4 four times.

In Fig. 1, as has already been stated, circle 2 has four times the area of circle 1; circle 3 nine times the area of 1, and circle 4 sixteen times the area of 1.

In Fig. 2 the area of the space bounded by the circumference of circles 1 and 2 is exactly equal to the area within circle 1, and the area of the space between circles 2 and 3 and 3 and 4 are also the same as that of circle 1.

Of course, it is understood that these calculations

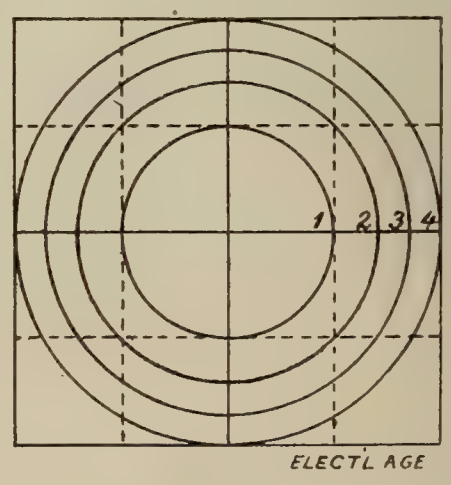


FIG. 2.

are applicable to any number of circles, and as they are of importance in computing the size of wires, we have shown the two cases diagrammatically, in order to aid to a better understanding on the subject.

The area of wires is now generally measured in circular mils, instead of fractions of an inch. In using circular mils the area of the wire is found by multiplying the diameter (expressed in circular mils) by itself, the result being area in circular mils. It is a much easier way of calculating the area of wires than with the inch unit of measurement. The above diagrams, however, are mainly intended to show the result of doubling the diam-

eter and doubling the area, which terms, as we said at the beginning, give rise to some misconception as to the real difference between them.

It will be understood. therefore, from what has been said, doubling the area of the wire increases its carrying capacity four times, making it three times larger gives it nine times its original capacity, and four times larger sixteen times its original capacity.

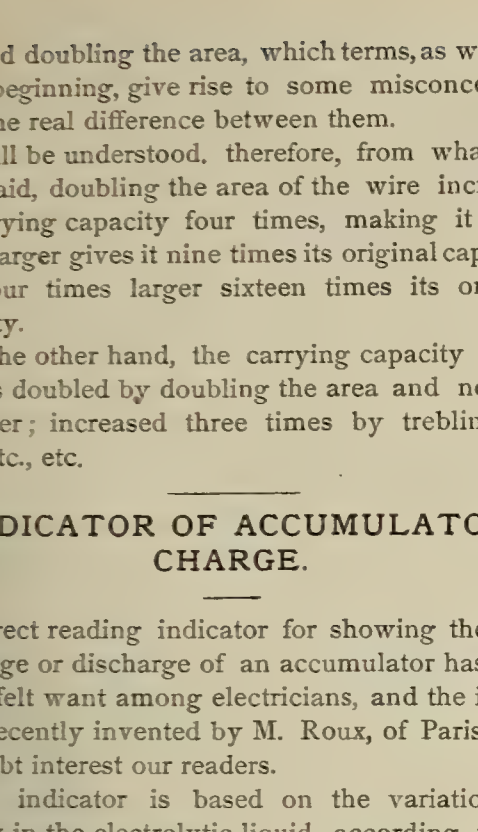
On the other hand, the carrying capacity of the wire is doubled by doubling the area and not the diameter; increased three times by trebling the area, etc., etc.

INDICATOR OF ACCUMULATOR CHARGE.

A direct reading indicator for showing the state of charge or discharge of an accumulator has been a long felt want among electricians, and the instrument recently invented by M. Roux, of Paris, will no doubt interest our readers.

This indicator is based on the variations of density in the electrolytic liquid, according to the different conditions of charge or discharge of the element.

Some experiments conducted by M. Roux showed that for certain densities and temperatures the mean density of the electrolytic liquid of an accumulator



CHARGE INDICATOR.

is in proportion to the quantity of electrical energy stored up, and to indicate the state of charge by this mean density the indicator illustrated herewith was designed.

The meter consists of a semi-circular tube, the length of which is equal to the height of the liquid, and which is suspended from a platinum wire .1 millimetre in diameter, thus constituting a constant volume areometer. The measurement of the mean density of the liquid amounts merely to the determination of the push received by the tube. The glass tube is heavier than the push it receives from the liquid and remains suspended from the extremity of a small lever oscillating round a horizontal axis. This lever arm is horizontal when the push is greatest and the accumulator charged to saturation point. When the accumulator is completely discharged, the angle of the lever is 45 degrees.

Two weights fixed on two rods on which a screw thread is cut, one of which is the prolongation of the lever arm to which the glass tube is attached, and the other making an angle of 45 degrees with this lever arm, enable the apparatus to be adjusted once for all in its two extreme positions, which are indicated by a long balanced needle passing behind a horizontal scale divided into 100 equal divisions. The displacements of the needle along the scale are in proportion to the variations in the density of the liquid, and consequently to the charge or the discharge of the accumulator.

The instrument is adjusted to zero when the accumulator is discharged, and at 100 when completely charged; the position of the needle shows, by a direct reading in parts of 100, the charge remaining in the accumulator.

Electric contacts can be used with the apparatus to automatically record the charge or discharge; one of the contacts being arranged to close an electric bell circuit at any point desired near full charge, and the other contact doing the same work at the discharged point.

A single indicator is sufficient for a battery of similar elements charged or discharged at the same time, but, practically, it is preferable in large installations to employ two indicators for two elements chosen at random in the series, these two being placed where the apparatus can most conveniently be examined.

It is said M. Roux's apparatus is perfectly practical, easily installed, requires no maintenance, and that it will be an important addition to all electrical installations using accumulators.

NORWAY IRON FRAME BELLS.

Within the last few years great improvement has been made in the manufacture of electrical goods, especially so in electric bells.

Soft Norway iron is the best material for bells, as it does not retain magnetism. As cast iron is hard, it becomes magnetized to a certain extent after being in use a short time, causing the movement of the armature to become sluggish, the bells become weak from no apparent cause, and additional battery does not remedy the defect.

The lasting qualities of a bell, as well as their first cost, should be taken into account in their selection.

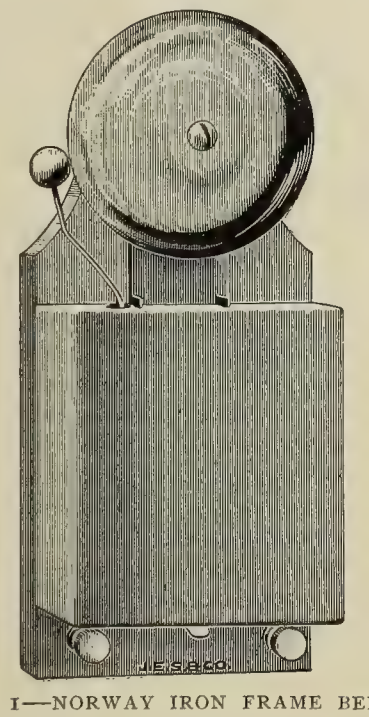


FIG. 1—NORWAY IRON FRAME BELL.

The bells made by J. Elliott Shaw & Co., of 632 Arch street, Philadelphia, have been constructed of Norway iron, so that while the current is passing through the magnets the armature receives its full power, and when the contact is broken and the current ceases to flow no trace of magnetism remains.

The entire frame, magnet cores and armature are made of the best and softest Norway iron that can be obtained. As seen in Fig. 1, which shows the Norway Iron Frame Bell complete, it is an ornament to any house.

Fig. 2 shows the cover removed, displaying the mechanism.

The magnet spools are wound with the best insulated copper wire to a resistance of 3¼ ohms, and possess unusual attracting force.

The gongs, binding-posts, striker and armature are nickel-plated, which adds greatly to their appearance and prevents rust or corrosion.

Pure platinum wire is driven into the adjusting screw, and sheet platinum is riveted to the German silver armature spring, making a contact which will not corrode or drop off.

The bell may be readily adjusted for any amount of battery strength by slightly bending the leg carrying the armature with a pair of pliers.

The bell cases are made of seasoned polished walnut and ash, the cap covering the movement being held in its place by an improved clasp.

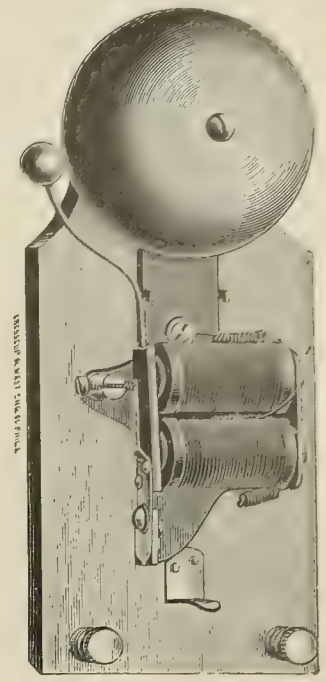


FIG. 2—BELL COVER REMOVED.

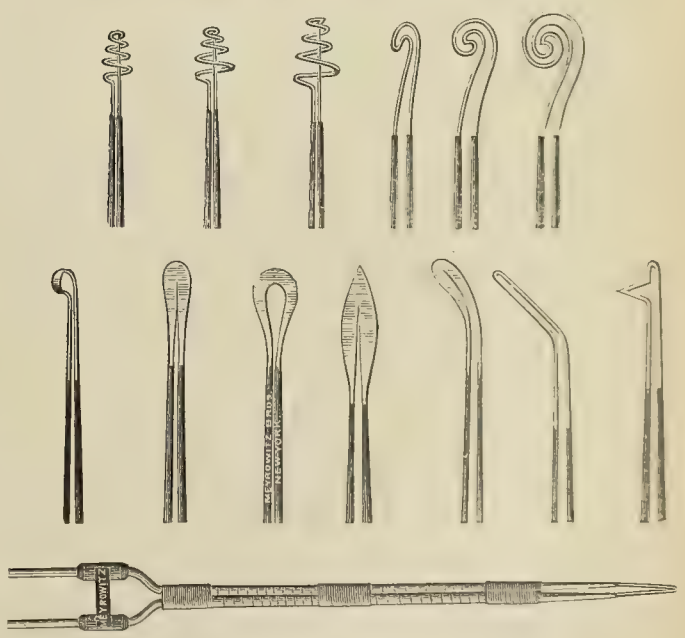
The gong, being securely attached to the frame carrying the movement, keeps the parts in correct position.

NASAL AND LARYNGEAL ELECTRODES.

It is surprising to what an extent electricity is being utilized for surgical purposes; and yet, when the beneficial effects of the electric current properly applied is taken into consideration, we can scarcely wonder that nearly every physican is supplying himself with electro-medical apparatus and batteries for heating cautery knives and electrodes used in eye, ear, nose, throat and dental surgery.

Anything to cure the ills and pains to which humanity is heir to is eagerly sought for by those making this subject a specialty, and improvements are constantly being made in the manner of applying the current.

The electrodes vary in shape according to the



NASAL AND LARYNGEAL ELECTRODES.

particular use for which they are designed, and as will be seen from the accompanying cuts, which show a few of the nasal and laryngeal electrodes made by Meyrowitz Brothers, 295 and 297 Fourth avenue, New York, they include everything from a point to a bulb. These electrodes have either straight, angular or curved shanks, and can be furnished with ivory shields.

This firm is constantly making improvements in their surgical apparatus, and their "MB" storage batteries and motors are giving satisfaction wherever used.

More satisfactory results are obtained by having a separate engine for each dynamo; the question of expense, however, in most cases renders this impracticable.

NOTES ON THE DESIGN OF MULTIPOLAR DYNAMOS.*

5.—RELATION OF AIR-GAP TO DIAMETER OF ARMATURE AND NUMBER OF POLES IN DIRECT-CURRENT MACHINES.

Continued from page 267.

Having established the proportionality of the volume and diameter, it is easy to find the relation which must exist between the diameter and length of air-gap for any particular angle of embrace in order that sparking may not occur. I need not take up time ringing changes on the

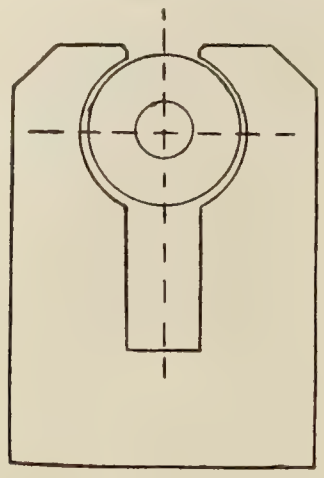


FIG. 3.

several equations, as to obtain the relation now referred to, all that has to be done is to substitute for v in (1) its value in terms of the diameter accordingly, as the winding is of the cylinder or drum type, and find the connection betweed l and d. Preserving the same safety factor throughout, it will be found that two-pole dynamos with a mean gap induction of 5,000 C. G. S. units per square centimetre, and pole-pieces embracing an angle of 130 deg., must have—the volume being related to the diameter as described—a gap of not less than .036 d if cylinder-wound, or .054 d if drum-wound. As will have been observed, the air-gap may diminish as the induction is increased, or as the volume is reduced.

But, as is also seen from the equation, the gap required for any particular volume is proportional to the angle of embrace, and if we substitute for two poles a greater number of correspondingly less angular width, working with an increased diameter and volume without a proportionally increased gap is made possible. This is where the advantage of the four, six, or even eight-pole machine comes in. Keeping to two poles, increasing the diameter requires either a proportional increase in the gap, whether the

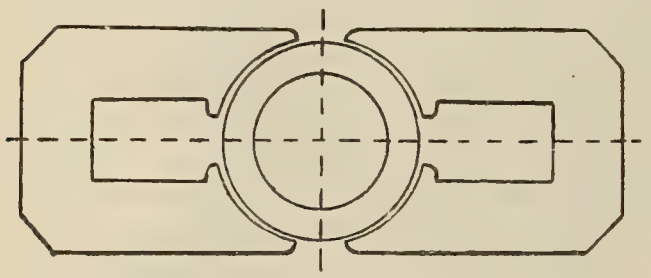


FIG. 4.

space is required for the conductors and clearance or not, or an increased induction, or a diminished polar angle, or a combination of these. In either case, the magnetizing force spent in the gap is increased ; and, other things remaining the same, obviously it would be of some advantage to adopt a construction which, while producing no greater tendency to sparking, would admit of the air-gap being reduced until its length was just sufficient to accommodate the conductors and allow of the necessary clearance. The work done by an armature of given external dimensions we have seen to be quite independent of the number of poles, and the choice of this number can only be a question, therefore, of structural and working economy.

*Paper read by W. B. Esson before the Institute of Electrical Engineers, London, April 9, 1891.

6.—DIMENSONS OF THE ARMATURE.

It has been observed that the output of an armature is proportional to d^2 L ; and the induction being the same, the weight of the core for a given number of poles must be proportional to the output, the radial depth increasing directly as the diameter, so that a proportionally increased field may be carried. The number of poles being fixed, the weight of the core for a given output may be taken, therefore, as approximately constant, whatever the ratio of L to d.

As the number of poles is increased, the induction remaining the same, the radial depth of the core is diminished in proportion, and, within the limits of practice, we may make the further assumption that the weight is inversely as the number of poles. The money value of a reduction in the weight of material due to increasing the poles can easily be arrived at.

The power wasted in hysteresis is proportional to the weight of iron magnetized, and to the number of reversals per second. The weight being inversely, and the reversals directly, as the number of poles, the power wasted is for a given out-put the same ; furthermore, as the output is proportional to the speed, we may say that for a given induction the loss in hysteresis is about proportional to the output only, without reference to speed of rotation, weight of core, or number of poles. If it be more important to reduce the loss by hysteresis than to reduce the weight of material, it can, of course, be done. It is a point for the designer to consider.

So much for the core ; let us now consider the copper part. Taking Gramme-wound armatures having an interior opening equal to .66, or two-thirds of the core-diameter, it is found—the output, speed, and temperature being predetermined—that the ratio from L to d may vary through a considerable range without making any great difference in the weight of copper or efficiency. For instance, the most efficient relation being $L=\frac{d}{3}$, it may be varied on the one hand till $L=d$, or on the other till $L=\frac{d}{6}$, without increasing the copper by more than about 10 per cent. Of course the watts wasted in the armature are correspondingly increased, but within the limits of the large variation mentioned the reduction in the electrical efficiency of the machine is under one-half per cent. In two-pole machines L varies from .5 to 1.5 d, the normal relation being about $L=d$. As has been seen, the gap has to be increased in proportion to the diameter, unless a greater number of poles be employed ; and the disadvantage of an increased maznetizing force would, in machines with only two poles, counterbalance the slight advantage of getting the armature dimensions nearer the best proportion. When the poles are increased, however, the gap may remain fixed, and if the radial depth of the core be correspondingly diminished, the proportions for least copper and highest efficiency are altered : thus, in a four-pole Gramme we can work from $L=\frac{d}{3}$ up to $L=\frac{d}{12}$ without a greater variation than 10 per cent. in the weight of copper. Observe, this is a question differing altogether from the one which was considered in my former paper. In that case the length and radial depth of the armature over the winding were fixed, the problem then being to find the best relation of copper to iron. Here both radial depth and length of core alter, also the peripheral velocity, though the revolutions per minute remain the same. Why the velocity is allowed to alter will be immediately apparent ; I only show at the moment that the dimensions of the armature may have their relations altered considerably without making any considerable difference to the weight of copper or efficiency.

To drum-wound armatures precisely the same reasoning applies. Here, speed and temperature being fixed as before, the best proportion for two-pole machines is about $L=3.3\ d$; but because of the distance between the bearings which such a relation would necessitate being inconveniently great, we rarely find $L=2\ d$ exceeded. The latter requires about 5 per cent. more copper than the former ; while for the usual proportion, $L=1.5\ d$, 12½ per cent. more is required than for $L=3.3\ d$. The variation which can be made without overstepping the limits of economy has a smaller range in drum than in cylinder machines, owing to the greater relative importance of the end wires, because of their greater length. If the length of the core is reduced below $L=1.5\ d$, the copper in machines with two poles increases rapidly ; but if the number of poles be increased, the length of the end wires being shortened nearly in proportion, the core length may be reduced to a fraction of the diameter without sacrifice of copper or efficiency. In a four-pole machine, for instance, the same copper is used with $L=.5\ d$, as in a two-pole one with $L=2d$; while for six poles, without increasing the copper, the relation may be as small as $L=.25\ d$. The effect of adding poles when the diameter is relatively great is not so noticeable in Gramme-wound machines, as the end wires are less important.

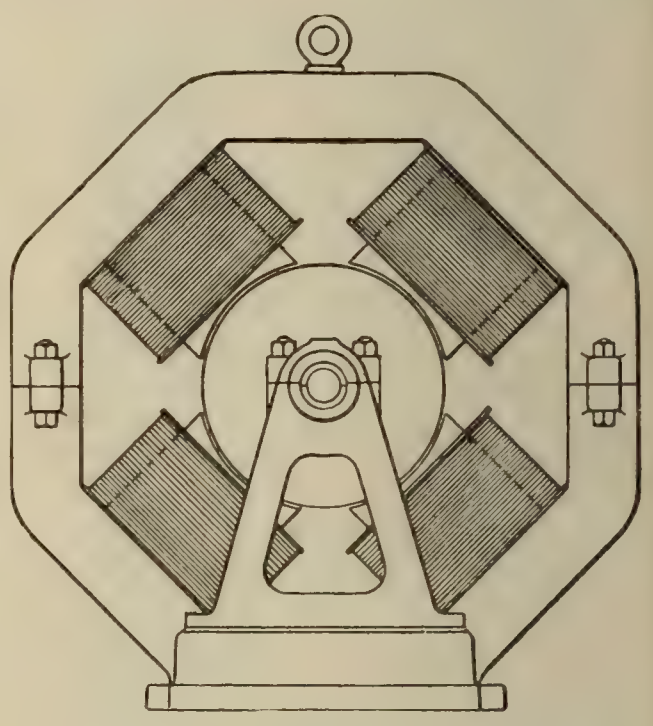


FIG. 5.

All the above facts go to prove that if there is anything to be gained, as regards the production of the field, by increasing the diameter of the armature and the number of poles, there is nothing, considering the armature by itself, to be lost by it. It may, in fact, be rather an advantage, because the weight of the iron core is reduced. It is true the peripheral velocity is increased ; but this does not matter in the least, provided a certain limit is not exceeded. Opinions differ as to what the limit should be, some machines working at 50 feet per second, others at 100, and a few as high as 125. But there is no reason whatever why any properly constructed armature should not run at a periphery speed of 100 feet per second ; and provided this velocity is not exceeded, any advantage which may be obtained by a relatively large armature and increased number of poles should be secured.

7.—DIMENSIONS OF THE FIELD MAGNETS.

It will be apparent, from the foregoing considerations, that the employment of two, or more than two, poles for direct-current machines of moderate dimensions resolves itself mainly into a deliberation regarding the most economical shape to give to the field magnets. As regards the armature, considered by itself, we may say that the choice of dimensions is mostly a matter of convenience, seeing that the amount of copper required and efficiency are for a given output practically unaltered by variations in this respect, while the reduction in the weight of the core due to an increased

number of poles is to some extent compensated by the extra expense of larger plates and increased weight of the armature supports. Again, the cost of the labor is increased by the larger diameter; but, everything being taken into account, considerations respecting the armature do not influence the design to a very great extent. One thing in favor of increasing the poles, as far as the armature is concerned, must, however, be remembered, and that is the reduction, consequent on a smaller conductor being used, of the losses arising from parasitic currents. We now turn our attention to the magnets.

I have said that for the prevention of sparking it is necessary that, the induction per square centimetre remaining the same, the air gap increases proportionally to the diameter, whether the space is necessary for conductors and clearance or not, but that the coefficient by which the diameter has to be multiplied to give the length of the gap necessary to prevent sparking, diminishes directly as the pole angle. In comparing the magnetic system of a four or six-pole machine with that of a two-pole one, it is necessary to adopt dimensions for the armature in accordance with the considerations already mentioned; hence, if the two-pole armature had a length of core equal to one and a half times its diameter, in a four-pole one the length should be about half the diameter. The diagrams (Figs. 3 and 4) show the cross sections of two such machines. The diameter of the four-pole armature is 1.4, and its length .5 times that of the two-pole

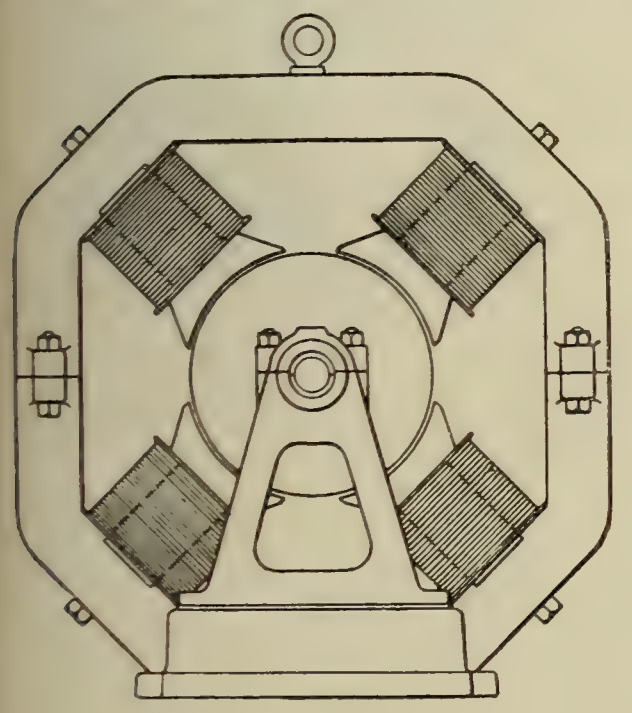


FIG. 6.

one, consequently both machines give the same output. The weight of the two horse-shoe magnets in the four-pole machine come to 56 per cent. of the weight of the single horse-shoe magnet, which indicates in this particular case a considerable saving in wrought iron. In taking the copper weight it is necessary to bear in mind that this does not vary simply as the length of the wire if the machines are of the same efficiency, but as the square of the length; so in this particular comparison the copper on the two horse-shoes would be, roughly, 30 per cent. more than on the single horse-shoe, assuming the length of the air-gaps to be the same. Now, if it were possible to reduce the gaps by 12 per cent. or so, the copper weight would be similar in both machines, and we should have credit for a certain amount of iron saved in the construction of the four-pole one, which could be balanced against the increased expenditure for labor. If the gap can be reduced by more than 12 per cent.—always retaining the depth of the winding the same—there is a saving of copper as well as iron, and it is simply the comparison between the value of the copper and other materials used and the cost of the labor in the two cases which determines, at least in machines of moderate size, whether two or more poles should be adopted.

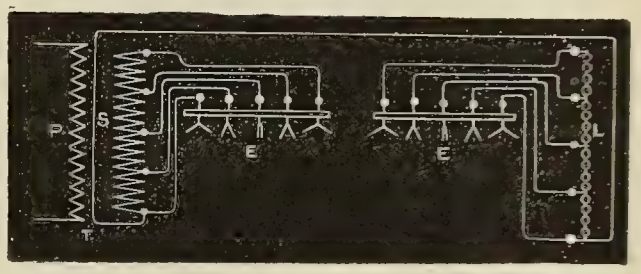
In getting out the best relation of L to d in the different types of armatures, it is assumed, of course, that, the volume being proportional to the diameter, the depth of the winding remains unaltered, as that is the condition which gives uniform rise in temperature. Accordingly, for a given output, the layer of copper on the armature will be of the same depth whether the machine has two poles and an armature having a length of one and a half times its diameter, or four poles and an armature having a length of only half the diameter. But whether it is possible to reduce the gap to an extent, which, with an increased number of poles, will lead to a less costly construction, is a question which for machines of moderate dimensions must receive careful consideration in each individual case. The answer depends upon how much larger the gap has to be to prevent sparking in the case of two poles only, than is requisite to accommodate the conductors and allow the necessary clearance. If the difference is considerable, it may pay better to add poles, and reduce the gaps that way, than to do the same thing by diminishing the pole angle or increasing the induction, or both. The question, it appears, is answered in different ways by different people. It is somewhat interesting to note, for instance, that one engineer, distinguished for the past six years as an ardent advocate of multipolar machines, has, after reducing from six poles to four, lately arrived at two, while another has jumped straight away from two to six without a halt at the intermediate number.

But when we come to machines of a certain size there is undoubtedly a gain in employing more than two poles, while very large machines become impossible of construction with two poles only. Consider the case of a two pole armature of 60 centimetres diameter. Assuming the induction in the gap to be 5,000 C.G.S. lines per square centimetre, and the pole angle 130 degrees, our calculations show that the length of air-gap would require to be 3.24 centimetres. This is some 40 per cent. in excess of the requirements of conductors and clearance; so, if the gap is reduced until it just allows of the requisite clearance, the induction must be increased from 5,000 to 7,000. Keeping the output of the machine the same, however, we can reduce the diameter of the armature to 54 centimetres, and work with an induction in the gap of 6,500. Observe, the magnetizing force spent in the gap has now been reduced by about 7 per cent., but the total field through the armature has been increased by 15 per cent., and the induction in the armature per square centimetre by more than 25 per cent. If we retain the same section of iron in the fields, it may be assumed then that about the same total magnetizing force is required, whether the machine has an armature 60 centimetres diameter, with a gap induction of 5,000 C.G.S. units, or one 54 centimetres diameter, with a gap induction of 6,500. The latter might turn out to be impossible owing to the greater heating of the armature core; anyway, what I am attempting to show now is, that by pressing up the induction with a view of reducing the gap, little, if any, advantage is obtained. But by increasing the number of poles, and reducing the gap in that way, we effect, without increasing the gap induction, a marked economy. As it is unnecessary to go into a mass of figures to prove what each can readily prove for himself from the data already before you, I will just give here the results. If we substitute for the two-pole armature of 60 or 54 centimetres diameter and 90 centimetres long a four-pole one of 84 centimetres diameter and 45 centimetres long, with a gap induction of 5,000, we require for the magnetizing coils while working at the same sparking limit, and with the same efficiency, rather under 70 per cent. of the copper on the two-pole field. When to the saving in copper there is added the saving in iron, there will be, after the extra labor is debited against the four-pole machine, a considerable balance in its favor. But to go beyond four poles in this case would be a mistake. Increasing the poles always results in actual increase of copper, unless at the same time the power spent in the gap is reduced, and this latter must be effected without reducing the thickness of the armature winding. The economy shown above is simply due to the fact that, in a two-pole machine of the dimensions specified, the gap necessary for the prevention of sparking must be much larger than the conductors require unless pressed up to a high induction. If with four poles the gap is still larger than necessary, we go to six poles, and so on. But when we arrive at a point where increasing the number admits of no reduction in the gap, we go no farther. It may be mentioned, however, that even in sizes where a four-pole construction showed no actual economy in first cost, it might still be preferable to the two-pole on account of its symmetrical field and the absence of the magnetic pull.

(*To be continued*).

EXPERIMENTS WITH HIGH TENSION ALTERNATING CURRENTS.*

Messrs. Siemens and Halske, of Berlin, recently invited the members of the Elektrotechnische Verein of that town to their works to witness the demonstration of a series of experiments on alternating currents under a pressure of 20,000 volts. Dr. Koepsel and Dr. Zickermann, engineers to the firm, explained that they had been experimenting with high pressure currents for about two years with the special object of testing cables, and had put together some of their apparatus in order to give the society an opportunity to see the same phenomena, which had been shown to a select party at Oerlikon some weeks previously, and had commanded so much interest among the general public. The company was assembled in a large room in which two transformers, constructed without the aid of liquid insulators each of 10,000 volt-amperes output, were placed on an elevated stage for the purpose of transforming up and down 15 horse-power of electric



T, Transformer; P, Primary Winding; S, Secondary; L, Lamps; E, Electroscopes.

energy generated in the alternator, which had been stationed in another building about 200 yards distant.

In order to show that the desired pressure was really *en evidence*, the high tension current was conducted through a pair of wires of only 0.2 mm. diameter to a battery of 200 100-volt glow lamps, all connected up in series. An ordinary Siemens electric light cable was inserted, and broke down at a pressure of some 15,000 volts.

Then a high pressure cable, insulated with a layer half an inch thick, of a special compound, was tested, and easily withstood a pressure of 20,000 volts. A loop of about a thousand yards aerial wire, supported on oil insulators, was next inserted, and perfectly withstood the pressure applied, notwithstanding the heavy rain which was falling while the experiments were going on. Next a most striking experiment was shown demonstrating that the potential in the middle of the secondary winding of the transforming up converter is zero, while it is 20,000 at each end of the winding. While feeding a battery of lamps in series, also in the middle of the battery a point is found, where the potential is zero, and from which, towards both ends of the battery, the potential rises to 20,000.†

Two plates of metal were each connected to one terminal of the high pressure winding and placed on each side of the sheet of insulation. A volley of thin blue sparks passed through the dielectric with-

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† The terminals of a battery of 200 glow lamps, all in series, were connected to the terminals of the secondary winding of the 20,000 volt transformer. At the same time a sufficient number of simple electroscopes were connected to various points of the whole system, showing the potential at all points. The accompanying sketch shows the result,

out destroying it, and at the same time a crackling noise was heard accompanied by a strong smell of ozone.

At the end of the meeting a few experiments on the formation of the arc under this enormous pressure were shown.

The sparking distance varied considerably according to the shape of the electrodes. At 20,000 volts a spark jumped from a ball to a ball about 10 millimetres, while between two points a sparking distance of 30 millimetres, and sometimes even more, was reached.

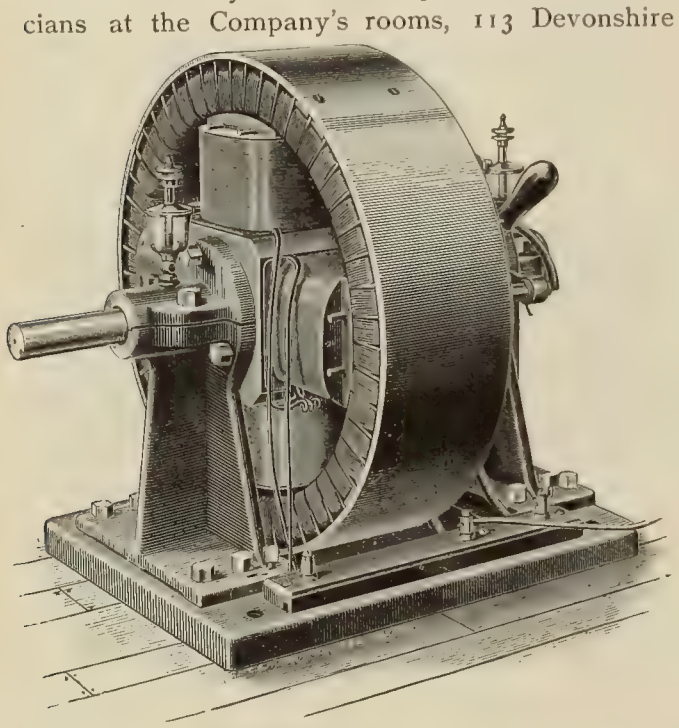
The arc which followed the jumping over of a spark made a loud humming and clapping noise, and flapped about, being easily carried away by the slightest draught.

The arc could be drawn out horizontally to something like 100 millimetres distance between the electrodes, and even to a distance of 150 millimetres, when carbon pencils were used as electrodes, but it always remained standing up in a point.

Messrs. Siemens & Halske are directing their special attention towards the investigation of the losses by condenser action in conductors for high pressure alternating currents.

THE SIMPLEX MULTIPOLAR MOTOR.

The latest development in the way of motors, one which will demand wide-spread attention, is of the multipolar type, is called the Simplex motor, and was recently shown to representative electri cians at the Company's rooms, 113 Devonshire



SIMPLEX MOTOR.

street, Boston. It is an invention which seems to reverse the order of things, for, instead of applying the power or current to the centre, as in the old types of machinery, the energy is concentrated on the outside or periphery. In the matter of construction lies the fundamental rupture between the Simplex and the prevailing type of motors. The location of the field is on the inside, and thus it becomes tenfold more compact, and diminishes the weight to one-fourth that of those now used. It also has the shortest possible magnetic circuit, consequently can be energized with less wire, and naturally less current. The armature being in the form of a ring, which encirles the field, can be extended to any diameter, thus an enormous initial can be obtained, and the speed of such an armature may be very slow. The ventilation of the coils is successfully accomplished, hence, there is no liability of "burn outs," for the armature is always comparatively cool.

This armature revolving as it does, only from 100 to 700 revolutions per minute instead of from 2000 to 3000, proportionately reduces the friction on bearings, and requires less attention to lubrication and replacing worn parts, and further, obviates the noise consequent upon the more rapid machines,—again in one direction at least, which the public will readily understand and appreciate.

The application of the Simplex motor to vehicles, it is claimed, may be obtained in several ways.

1. Directly, by making the motor a wheel of the vehicle. In this case, all of the benefit of weight is obtained for traction purposes, while but a small part of this weight is carried by the vehicle itself; that is, the motor rests on the rail or ground, according to the use to which it is put.

2. It may be suspended to the vehicle and directly connected to the axle of the same.

3. It may be mounted in the cab of a locomotive and connected to the axis by means of side bars, as in the steam locomotive, or by belting, the advantages of this method being that the motor is high from the ground, and is thus protected from moisture and dust accumulations, while at the same time, every part is open to view and as accessible as if it were stationary or located in the shop.

The first two of these methods involves no loss whatever in the transmission of power, the last named method involving only a very slight loss. It will thus be seen that there is no limit to the working capacity of this machine, the mechanical construction being capable of enlargement to an unlimited extent without materially increasing its weight, whereas the old types must necessarily be kept within a certain fixed weight.

LEGAL.

We are informed that the notice recently distributed claiming that Judge Lacombe, of the Circuit Court of the United States in and for the southern district of New York, has formally adjudged and entered a decree in favor of complainant in the cut-off case of Rousseau *vs.* Bogart is a voluntary misrepresentation. The fact is the decree was entered by and with the consent of Mr. Bogart in favor of complainant, in consideration of his being released and discharged, as well as of the release and discharge of his customers, from all accounting and claims for damages and profits incurred on account of the manufacture, sale or use of said Magneto Electric Clock-work Cut-off, signed by the complainant on the 20th of April, 1891, and more particularly on account of the fact that a suit is still pending in the same court of precisely the same character, instituted by the same complainant *vs.* The Electric Gas Lighting Co., which will be legally and perseveringly defended to the end.

GLASS INSULATION FOR ELECTRIC WIRES.

Next to dry air the best insulating substance is glass, but on account of the brittleness of this material and other characteristics, it is wholly impracticable to use it for the insulation of electric wires. No doubt if wires could be insulated with glass, which is impervious to moisture and a resistant of all chemical actions, it would render the electric service in general far more efficient than it is at the present time. The fact that glass is not used is wholly due to mechanical difficulties in the way of its utilization. Every electrical engineer recognizes the value such insulation would be in practical service. It would mean greatly reduced cost in operating expenses, and less danger to life and property.

The nearest approach to the practical utilization of glass for the insulation of wires has been attained by Mr. T. S. Reed, 562 Second street, Jersey City. He uses spun glass, which is wound around the wire, and other insulating material is wound on top of the glass, answering as well for the protection of the glass insulation as an additional insulation in itself. The glass is spun in extremely fine threads, far finer than silk fibre. It is collected in skeins and is wound around the wire spirally, making a thick and strong insulation. It is claimed that this method of applying the glass is equal to the solid substance, as to its insulating qualities, while it has the additional advantage of being flexible.

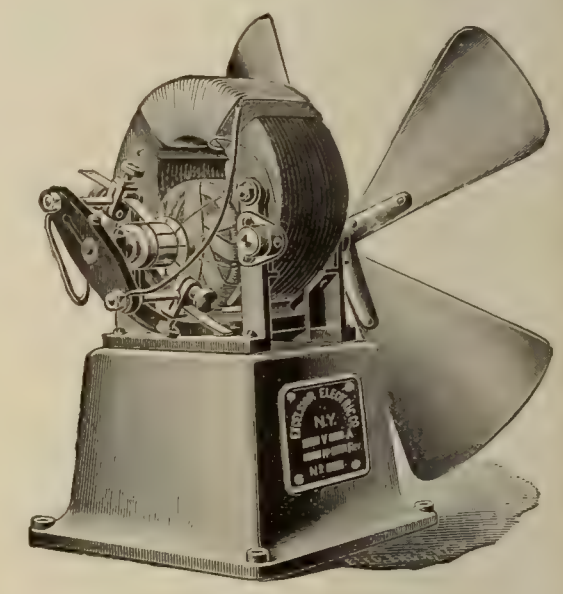
Mr. Reed has shown us samples of wire insulated in this way, and from all appearances it would seem that the advantages he claims for his method of insulation might be fully realized in practice.

ALTERNATING CURRENT MOTOR.

A large demand for small electric motors for domestic purposes, such as driving fans during the heated term, and for the operation of sewing machines, etc., has resulted in the production of some excellent machines of this class.

We illustrate herewith an alternating current motor, manufactured by the Excelsior Electric Company, 115 Broadway, New York, which possesses some features of extraordinary merit. The machine shown in the illustration is wound to run on 52 or 104 volt circuits, and can, with a slight change in the winding be made to run on a 110 volt direct current circuit.

The value of carbon for use on brushes is now fully recognized by electricians, and the Excelsior Electric Company use this material on the brushes of their motors, thus reducing wear on the commutator, besides securing the many valuable and well-known advantages attained by the use of carbon brushes.



ALTERNATING CURRENT MOTOR.

The bearings of these motors are all self-oiling, and when the oil reservoirs are fully charged with the lubricant the machine practically requires no care for a long period.

These motors are built in every respect in a first class manner, the best materials entering into their construction, and as much care is given to the assembling of the parts and finishing as to the larger machines.

They are self-starting, which is an important feature in alternating current motors. The motor is light in weight, and will drive a 12-inch fan at 1,000 revolutions per minute, with a current of about one ampere; the core and field magnets are finely laminated, and there is very little heating of the iron when the motor is in operation.

This motor is one of the simplest forms of alternating current motors yet devised and is a commercial success. It was designed by Mr. William Hochhausen, the Electrician of the Excelsior Electric Company.

ST. LOUIS NOTES.

A franchise has been granted for an electric street railway in Brooklyn, Ill.

Most of the stock has been subscribed for a new electric street railway from Clayton, a suburb of St. Louis, to a connection with the Lindell electric line, near Forest Park.

At Venice, across the river in Illinois, G. A. Niemann has completed his plans and let the contract for his electric light building last week. The building will be of brick, 35x70 feet, and will cost about $2,500. He has contracted for the Excelsior arc electric light system, with a 30-arc dynamo, for illuminating the town; also a 75 horse-power engine. He will have a separate dynamo for incandescent lights, having received contracts from a number of private citizens. He expects to be ready to light the town in sixty days.

MEETINGS OF CLUBS AND SOCIETIES.

THE MAGNETIC CLUB.

The spring meeting of the Magnetic Club was held at Zangheri & Gazzo's restaurant, No. 878 Sixth avenue, New York, on the evening of April 29. There were about 75 persons present, representing the telegraph, telephone and other electrical industries. An elegant dinner was served, after which speech-making and instrumental and vocal music were indulged in. A good time was had, and everybody seemed to be well pleased with the evening's entertainment.

FRANKLIN INSTITUTE.

The stated meeting of the Electrical Section of the Franklin Institute, Philadelphia, was held on Tuesday, May 6th. The following communications were presented: "Underground Electrical Conduits for the City of Philadelphia," Mr. David Brooks; "Ewing's Theory of Induced Magnetism," Professor Henry Crew; "A Rough-and-Ready Dynamometer," Mr. John Hoskin.

BROOKLYN INSTITUTE.

Two papers are announced to be read before the Department of Electricity of the Brooklyn Institute, on May 8th. One of the papers will be by Dr. E. A. Bartley on "The Interrupted Current in Electricity," and another by Dr. L. Criado on "Galvanism in Medicine." The meeting will be held in the lecture room of the Y.M. C.A. Building. The members of this department will, on invitation, attend the meeting of the New York Electrical Society on May 22d.

NEW YORK ELECTRICAL SOCIETY.

The one hundred and thirty-seventh meeting of this society was held in Prof. Chandler's room, Columbia College, Forty-ninth street and Fourth avenue, Thursday evening, April 30th. The lecturer of the evening was Mr. Charles Steinmetz and his subject was "The Elementary Principles of Designing Alternating Current Apparatus." Mr. Steinmetz has made this subject a specialty for several years, and the lecture was illustrated by experiments and diagrams, the methods of designing converters, the proportioning of winding, and the general principles of alternating generators and motors. He also used various pieces of apparatus and an alternating current to illustrate his remarks, and the experiments and the demonstrations on the blackboard of the laws and principles of alternating currents were frequently interrupted by applause. The lecture throughout was an interesting one and highly appreciated by the good-sized audience present.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The spring meetings of the Institute will be held on May 19th, 20th and 21st, at its headquarters, No. 12 West Thirty-first street, New York City. The preliminary programme, as arranged by the Committee on Papers and Meetings and the local Committee of Arrangements, is as follows: The regular monthly meeting of Council will be held in the secretary's office at 5 P. M., May 19th. The annual meeting for the presentation of reports, election of officers and other business will follow at 8 P.M., on the same date. The morning session, May 20th, will assemble at 10 o'clock, when the following papers will be read: "The Development of the Dynamo," by Prof. Harris J. Ryan; "Evolution of the Stationary Electric Motor," by Dr. S. S. Wheeler; "Some Data Concerning the Photometry of the Arc Lamp," by Prof. E. L. Nichols. Afternoon session, May 20th: "A New Graphical Method of Calculating Leads for Wiring," by Mr. Carl Hering; "Street Car Motor Design," by H. F. Parshall: "Some Recent Improvements in Printing Telegraphs," by Henry Van Hoevenbergh; "A Proposed Electrical Equipment for the Coming Rapid Transit System of New York City," by Frank J. Sprague. Evening session at Columbia College: "Experiments with Alternating Currents of High Frequency," by Mr. Nikola Tesla. Thursday morning, May 21st, the members will meet at the Crocker-Wheeler Motor Company's factory, 430 West Fourteenth street. After an inspection of this establishment, the meeting will reassemble at 12 West Thirty-first street, when the following papers will be read: "A New Device for the Measurement of Alternating Current Potential," by Prof. Gei. S. Moler; "A Study of the Fluctuationsof E. M. F. in the Open Coil Armature of a Constant Current Machine," by Mr. M. E. Thompson; "Some Results in the Practical Utilization of Electric Welding," by Dr. F. A. C. Perrine. Afternoon session, May 21st: "Electric Meters," by G. W. Walker; an address by Dr. W. H. Wahl on "The Aluminum Problem, Retrospective and Prospective," also a paper entitled "Shall Aluminum be Alium," by Mr. Oberlin Smith. In connection with this subject there will be an exhibit of Aluminum products. Thursday evening a reception will be tendered to the Institute by the Electric Club. Visits to different electrical establishments and objects of interest will also be arranged for Friday, May 22d, an anouncement of which will be published in the official programme.

BOOK REVIEWS.

TWENTY YEARS WITH THE INDICATOR. By Thomas Pray, Jr., New York. Tenth thousand; p.p. 285. Numerous illustrations. Price, $2.50.

This valuable work for the engineer or student has just gone through another edition, this being its tenth thousand. In the new edition the work has been newly arranged, the former two volumes being combined into one handy volume. Electrical engineers and others having the care of steam engines will find this a useful work to have at their side, as it is a practical text book without the complex formulæ so usual in books of this kind. The illustrations are numerous, and the rules for getting the most economical results from any steam engine are very simple. The lessons in the book are drawn from actual practice; with very few exceptions the diagrams being taken by the author's own hands. Since the first edition of the book indicator practice has been largely revolutionized; brought about to a large extent by the light thrown upon the subject by the author.

THE ELECTRO-PLATER'S HANDBOOK.—A practical manual for amateurs and young students in Electro-Metallurgy. G. E. Bonney; pp. 208. 61 illustrations. D.Van Nostrand Company, New York. Price, $1.20.

We do not know of a subject that could be more interesting at the present time than that covered by this little book. Works on electro-metallurgy are usually voluminous and expensive, covering large numbers of points not needed in actual practice by the largest electro-plating establishment. Mr. Bonney in his work has covered the entire ground, so that it is not only a text-book for an amateur, but the practical electro-plater will find new ideas to help him. The book carries the reader from the definition of the word "metallurgy" to the finished electro-plated article, describing every method and appliance used in the art, in language that any one can understand.

ALUMINIUM: ITS HISTORY, OCCURRENCE, PROPERTIES, METALLURGY AND APPLICATIONS, INCLUDING ITS ALLOYS. —Joseph W. Richards, M.A., A.C. Henry Carey Baird & Co., Philadelphia; pp. 511; 30 illustrations. Price, $5 00.

This valuable work on the subject of aluminium is now in its second edition, having run through its first edition in a remarkably short space of time. The book, as its title indicates, covers all that is known about the metal that interests engineers so much at the present time, and is probably the only work on the subject published in the English language. There are attributes claimed for this metal that it does not possess, and between the many doubts arising as to its position in metallurgical economy, engineers are inclined to run to extremes, either placing it at the head of the list of metals, or giving no credit whatever to it. This valuable work by Mr. Richards will set them right, as it deals with all known methods of extraction, and exhaustively explains the physical and chemical properties of the metal. A copy of the book should be possessed by every one having anything to do with metals.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 75,
BOSTON, MASS., May 1, 1891.

The Eastern Electric Cable Company are having a new office built at their factory on Hampshire street.

A fire in the Codman Building, on Hanover street, damaged the Redding Electrical Company to a great extent.

J. E. Wilson & Co., agents for the Rollin's Automatic Cut-Off Engine, are now occupying their new and elegant offices at 8 Oliver street.

The Card Electric Motor and Dynamo Company have sold—through their Eastern agents—a fifteen horse power dynamo, to a large manufacturing concern in this city.

The Standard Electric Company, of Vermont, have closed their Boston office, and hereafter the business will be conducted from the factory at St. Johnsbury, Vt.

The American Circular Loom Company are receiving large orders for their celebrated "Canvas Jacket" wire. This concern are doing an extensive business in re-covering old wire.

The care of fire alarm wires in the city of Boston, which have been under the charge of a supervisor of wires for less than a year past, has again been given to the fire commissioners.

C. E. Bibber, general manager of the Consolidated Electric Manufacturing Company, has returned from a three weeks' business trip through Canada and the West. He reports a brisk trade.

The Bell Rock Electrical Conductor Company contemplate giving a public exhibition of the workings of their new wire-covering machine, at an early date. The electrical people generally will be invited.

The directors and managers of the West End Railway Company held a meeting at Young's Hotel last Tuesday morning, to consider the electrical appliances of the road. The meeting was strictly private, and about 25 gentlemen were present.

The Mayor of St. Ignace, Mich., recommends that the City Council consider the feasibility of lighting the place by electricity. There is every indication that the town is ripe for it, and everything seems to be favorable for the introduction of electric light.

J. E. Wallace, manager of the railway department of the Eastern Electrical Supply and Construction Company, is now on an extensive trip through the South and West. By reason of the large increase in business with this concern they have been compelled to lease the entire building at 65 Oliver street. For the present they will occupy only the first three floors.

At the State House this week the Railroad Committee reported a bill to incorporate John Q. Adams, H. L. Higginson, Chas. H. Porter, W. G. A. Pattee, P. L. Saltenstall, G. E. Armstrong and J. R. Graham as the Quincy Electric Freight Railway Company. The location is to be 50 feet wide and the gauge is of standard width. The capital is to be $300,000, and $150,000 in bonds may be issued.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOMS 7-12, WORLD BUILDING,
NEW YORK, May 2, 1891.

U. H. W. Schenck will shortly be settled in his new offices at 136 Liberty street.

The United Electric Traction Company, are located in rooms 609-610, Electrical Exchange Building, 136 Liberty street.

The Hill Clutch Works of Cleveland, Ohio, J. E. Irwin, New York agent, moved their office to 15 Cortlandt street, on May 1.

The offices of *Electric Power* have been removed from 132 Nassau street, to rooms 527, 528, and 530, Electrical Exchange Building, 136 Liberty street.

The Standard Electric Light Company are to be found in room 201, of the Electrical Exchange Building, also the Pulsion Telephone Company, in room 222.

Mr. D. Elwell is the energetic secretary of the Eastern headquarters of the World Columbian Exposition. His offices are in the Stewart Building, this city.

Mr. C. A. Hussey will be found in room 614, the Electrical Exchange Building. This gentleman is noted for his inventions of closed and open circuit batteries.

F. Latshaw, the New York representative for the National Electric Manufacturing Company, Eau Claire, Wis., has settled in room 622, Electrical Exchange Building.

Truex & Vail were found are hard at work getting their house to rights in rooms 619-620, Electrical Exchange Building. They looked very dry when your representative called and offered them—to get some.

Mr. C. G. Ferguson, well-known in New York and elsewhere, through his connection with *Electric Power*, has accepted a position with *Railway Appliances*, with headquarters in the *World* Building, New York.

The new fibrous dry battery of Alexander, Barney & Chapin, is meeting with a big demand, and Mr. Louis Walsh, who has charge of this department, says that he has more orders now than he can fill for some time to come.

Alexander, Barney & Chapin, 20 Cortlandt street, have just brought out some Fibrone push buttons of handsome design. This material is made in 12 different colors, and can be made in any form.

Mr. W. Putnam Freeman, a well-known electrician of New York, has gone into the real estate business, and is now connected with the Real Estate, Law, Loan and Collection Company, 21 Park Row, New York.

Among the callers at the ELECTRICAL AGE office during the past week were : Charles Dutton, Auditor, Southern Bell Telephone Company ; A. S. Brown, Superintendent U. S. Aluminum Metal Company, Boonton, N. J.

The Fitchburg Steam Engine Company, whose engines have received high encomiums from steam users in connection with electric light and power plants, are located in room 626, Electrical Exchange Building, 136 Liberty street.

The National Electric Light Association have taken room 505, Electrical Exchange Building, 136 Liberty street. Mr. Beane, the secretary of the association is hard at work getting his house in order, having lately returned from an extended trip North.

The Eddy Electric Company, W. C. McIntire, agent, are nicely settled in their rooms, Nos. 209-210, in the Electrical Exchange Building, 136 Liberty street. The motors made by this company are having an excellent sale for general power use.

C. S. Van Nuis with his switches and cut-outs, has switched into room 305, Electrical Exchange Building. He will be pleased to cut in his popular goods for any electric railway or lighting plant, on any of his high voltage and high tension switches and cut-outs.

Mr. G. C. Baillard, of the electrical supply house of Alexander, Barney & Chapin, closed an order this week for 1,000 lamps of the "A. B. C." pattern. They are for use in a large hotel in New York. Mr. Baillard expects shortly to close for 3,000 more lamps. These lamps are attracting general attention in the trade.

Herman Aich, importer of enameled steel ware, 43 Murray street, sole agent for the Thale Iron Works, Ltd., Germany, is taking orders for enameled steel ware, and has many samples of shades, etc. for arc and incandescent systems. The goods handled by this gentleman are of the very finest description.

The Gamewell Fire Alarm Company, 1½ Barclay street, this city, paid a regular quarterly dividend, May 1st, of one dollar per share on $100 shares. The capitalization of the company is $750,000. This company lately completed a contract for fifty call boxes with their Police Telegraph System, for Atlanta, Ga., and have received the pay for the same.

The McCreary Electrical Specialty Company will be found nicely settled in their light and airy rooms at Nos. 205-207 Electrical Exchange Building, 136 Liberty street, this city. They are fitting up a handsome room for the display of their specialties, reflector shades and portables, incandescent half shades in ground glass, plain white and in colors, also fusible cut-outs.

Titsink & Eising, manufacturers of artistic gas and electric fixtures, at 157 to 163 West 29th street, this city, have been established over four years. They were formerly located on 6th avenue, whence they lately moved to their present address, and are prepared to take orders for the above line of goods. They have on exhibition a choice line of samples of their goods, which they make to order, keeping no standard stock.

The callers at the Electric Exchange of Alexander, Barney & Chapin, 20 Cortlandt street, during the past two weeks were as follows: F. G. Robinson, J. D. McIntyre, A. A. Knudson, H. B. Cram, A. M. Lamb, F. S. Leeby, A. J. Martin, H. H. Hubbell, H. M. Morrison, A. T. Rich, A. H. Bauer, E. F. Phillips, John Bayard, Benjamin Rhodes, H. Bottomly, Ward Lewis, F. C. Phelps, C. B. Rookine, E. A. Buck. T. J. Fay, F. A. Wyman, W. A. Bynner, and J. M. Auford.

Mr. R. A. Keasbey, manager of the Magnesia Sectional Covering Company, 58 Warren street, is receiving compliments all around for the excellent appearance of his covering on the steam pipes in the new Offerman Building, Brooklyn, which is described in another column in this paper. Over one thousand feet of steam pipes are covered. The work was done by Baker, Smith & Co. and reflects credit on the merits of these goods.

Mr. W. S. Chesley, electrical engineer and dealer in electrical apparatus, is now making his headquarters at 136 Liberty street, this city. Mr. Chesley makes a specialty of handling second-hand plants and apparatus. He reports selling recently two 750 light Westinghouse alternators and converters for 1,000 lights; a 10-light Weston arc machine with lamps; a 3-light American arc machine; a 50-light American ; one 1,200-light U. S. incandescent machine; a 1 horse power motor, and 2 1-3 horse power motors.

Mr. F. H. Sparling, formerly vice-president of the Northwest Electrical Supply and Construction Company, has become associated with W. H. Gordon & Co., electric light and power supplies, 115 Broadway, this city. The latter company have moved into their new quarters and have a fine exhibit of their goods. They are the general agents for the specialties of Fletcher & Fletcher, Cleveland, Ohio. The trade is awakening to the fact that it pays to use the best goods, such as are handled by this firm and their business is, in consequence, prosperous.

The Eureka Electric Company, 18 Broadway, this city, are installing a marine electric plant of 35 lights on Mr. S. Wilcox's steam yacht "Reverie." The plant will include 28 cells of accumulators to run 25 incandescent lamps for the period of six hours. The accumulators will be charged by a Loomis dynamo. The company have also closed an order for a 150-light plant, including one Loomis dynamo, for Cuba. They are also installing two 500-light Loomis dynamos in the Gerlach apartment house in this city, where two standard Westinghouse engines will be installed to drive the dynamos.

The Riker Electric Motor Company, of 45 York street, Brooklyn, N. Y., makers of slow speed dynamos and motors, are building several of their motors and dynamos for steam yacht lighting, and it is understood have secured several of E. T. Copeland & Co.'s Case Engines to supply the power for the dynamos. This concern is bringing out several styles of generators and motors, among which are the well-known multipolar generators and motors of the slow speed type. Mr. Riker has also built and has in successful operation an alternating current dynamo and motor. This company build to order any style of dynamos or motors required, from plans and specifications, and do all kinds of electrical work.

Messrs. E. T. Copeland & Company, 106 Liberty street, New York, has secured the agency for the Ball Engine Company in New York. From Mr. Copeland's long experience in the sale of engines, the Ball Company can rest assured that their interests could not be in better hands. Oiwng to the large increase in the business of the Ball Engine Company they have been compelled to seek larger quarters, and a large addition to their present works is now in progress. The enlarged factory will be equipped with the latest and best tools for ensuring perfect construction of these celebrated engines, which the company will endeavor to make so as to give even better satisfaction, if possible, than heretofore. Every engine is fully tested under steam and load before leaving the shop, and every part of the work is thoroughly inspected.

Thomas Murray Company, are located in their handsome quarters, rooms 103, 105 and 107 in the new Electrical Exchange Building, overlooking Liberty street, from which point they will be able to see possible customers. This company has lately closed a contract for five miles of electric railway for Lawrence, Mass., to be fully equipped with the most modern apparatus. They have also closed a contract for fifteen miles of railway for Fall River, Mass. They are drawing up plans for these two roads, which are to be equipped in the shortest time possible. The Grand View Beach Electric Railway, running from Rochester to Charlotte, which was built by this company, will be completed on May 20th, according to contract. Eight miles of road-bed is nearly finished. Fourteen cars, with double motor trucks, are now ready for running; seven of the cars are open. The Rae system is adopted here.

Mr. E. H. Cutler, General Manager of the Elektron Manufacturing Company, of Brooklyn, manufacturers of the popular Perret dynamos and motors, made an attempt to resume his active duties a few days ago but found himself too weak to give proper attention to business, after his serious attack of "La Grippe." He had his valet gather together his traps, and has departed for some favorite nook in the country, where he will recuperate. The Elektron Manufacturing Company have bought two of E. T. Copeland & Co.'s Case engines, of five and ten horse-power, one of which is to be bolted to a side wall, to be used for running a generator for lighting a factory. One will be used couple direct on the same base for Mr. Pulitzer's yacht. This craft is now being fitted out with the complete Perret system of electric lighting, and is to be on the ocean in ten days. The company have a number of other small yacht plants under way.

When the Edison General Electric Company was organized in August last, and purchased the Edison Electric Light Company, giving stock of the new company in payment, four stockholders of a total of 500, objected and began proceedings in the name of one of them, Martin A. Frank, an owner of $3,300 of the stock, to enjoin the transfer of the stock of the old company to the new company. They also asked for a receiver for the old company, which was said to have a large amount of securities which should be sold and applied to the payment of dividends. The motion for an injunction and a receiver was argued before Judge O'Brien of the Supreme Court, recently, the opposition arguing that the injunction should not be granted when nearly all the stockholders were in favor of the change. It was claimed that the new company was paying a dividend of twenty-two per cent., whereas the old company had not paid any. Decision was reserved.

L. J. Wing & Co., manufacturers of Wing's Disc Fans, high speed engines, dynamos, motors, etc., have their main office at 136 Liberty street, this city, also offices at Chicago, Cincinnati and Boston. They make a specialty of cleaning, drying, removing steam, dust, smoke, etc., furnishing dynamos, motors, and combination high-speed engines and dynamos, for isolated lighting or power. They also furnish a combined electric motor and exhaust fan. Among a few of the houses they have supplied with their disc fans and outfits are the following: Crowley & Johnson, Cincinnati, O.; National Cordage Company, New York, three motors and exhaust fan outfits; W. H. Tolhurst & Son, Troy, N. Y.; New York Screw Top Works, Brooklyn, N. Y.; Wm. Wicke, New York; Faber & Sons, New York; W. T. Henry & Co., Philadelphia; Tannette Manufacturing Company, New York, exhaust fans increase; Mutual Gas Light Company, New York; Franklin Motor Company, Peabody, Mass.; Arlington Manufacturing Company, Arlington, N. J.; McCreary Electrical Specialty Company, New York, ¼ horse-power motor and fan outfit.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Aluminium Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
American Electric Motor Co. (N.Y.)	1,000,000	25 00	4 00
American Private Tphone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 50
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Angle-Am. Elec. Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	115 00
Avenell Insulating Condnt.	3,000,000	100 00	6 00
Bay Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	206 50
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5s	6,000,000		par
Brush Illuminating (N. Y.)	1,000,000	100 00	60 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	5 00
City Electric Street Ry. Co., 6's	200,000		par
Commercial Cable Co.	7,716,000	100 00	106 00
Complete Elec. Con. Co, N. Y.	50,000	100 00	175 00
Consolidated Electric Light	1,929,400	100 00	50 00
Consoli'd Elec. Storage Co. (N.Y.)	3,000,000	25 00	7 00
Consol Gas & E.L.Co. of West Co. 6's	250,000		par
Consol Gas & E. Co. Batavia, 6's	80,000		par
Consolidated Gas Co. Batavia	100,000		
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	85 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	2,000 000		*99
Edison Illuminating (N. Y.)	4,500,000	100 00	98 25
Edison General	14,000,000	100 00	100 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Erie Telephone			49 00
Essick Printing Tel.	5,000,000	100 00	50 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	13 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*95
Laclede Gas Co.	7,500,000	100 00	19 50
Laclede Gas, pref.	2,500,000	100 00	48 00
Laclede Gas 5s	10,000,000		*79
Law Telephone	400,000	100 00	96 00
Long Branch Electric Light.	50,000	100 00	78 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		
Manhattan Elec. Light Co. Lmtd. 5's	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	2,000,000	100 00	100 00
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light (N.Y.)	500,000	100 00	90 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	98 50
Nat'l Cordage, pref.	5,000,000	100 00	109 00
Nat'l Lead Trust		100 00	19 50
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
New England Butt Co.	100,000	1,000 00	1,000 00
N. E. Tel. and Tel.			51 50
N. Y. & N. E. Telephone	10,394,600	100 00	
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	97 50
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
North New York, Lighting	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	60 00
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s			*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100 000	1 00	3 00
Swan Incandescent	800,000	100 00	4 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
Thomson-Houston Electric Co.	6,000,000	25 00	47 00
Thomson-Houston Pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers 6's.	100 000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power.	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	2 50
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000 000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Welsbach Inc. Gas	10,000,000	100 00	5 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	10 00
Western Union	86,188,852	100 00	82 50
Westinghouse Electric Co.	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			23 37
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

The era of great speculative activity which has set in with the spring upon the Stock Exchange, and what is generally termed "The Street," is extending to all classes of investors and traders in industrial enterprises, of which it may be truthfully said electrical inventions stand at the head. Early in the '80's men of brain and capital found or were coerced into thinking the art had reached a point where their money could be successfully used, and the commercial life of electrical business began. After a very few years the vast amount of mechanical appliances—some improvements, others the opposite—began to creep in on the partially established methods, with the usual result of exhausting the profits as fast or faster than they accumulated, which in due course led to decreasing the market price for shares and at the same time increasing the capital of those corporations who in the struggle had reached a stage where it was evident increased business required it. Then came a long period of comparative financial stagnation, so far as returns on the investment was concerned, but in the meantime plants were established all over the country. The people, educated by seeing the prime collateral which was represented by the shares or bonds offered them, watched the growth of the newcomer as it stretched out over the land winning its way to permanancy and recouping the introducers. Soon small dividends were declared in all directions, growing annually as the machinery in its various departments wore down and worked smoothly, until this spring those conservatives who preferred to pay a higher price for an established, proven undertaking are coming in from all sides for their portion of the grand banquet. The enhanced value is willingly paid as the entertainment, from soup to cheese, from dynamo to dividends, is one triumphal advance, guided by an army educated and disciplined, whose accoutrements have passed inspection after drill and parade. No financial writer can keep track of the dividends earned and paid in the United States to-day by electric corporations. The capital of local companies is increased by stock dividends and continual amalgamations of conflicting or adjacent interests under new corporate designations so rapidly that no human commutator will ever be able to catch up with accurate statistics; at least, not until Uncle Sam takes the whole public business in hand, at which time all accounts will centre for a moment in a single bureau, when the gross sum will surprise all who live to read it. The financial condition of individual companies is easily arrived at, but special inquiry is necessary. There is no safer or better paying investment than a few shares in almost any of the electrical corporations. With the bonds, of course, there is no speculation; the same holds with the preferred shares. I refer more particularly to the common stock. It is not seeking a market to-day as much as purchasers are seeking it, and for a safe permanent investment, after your home, there is none superior to your local electric security.

The National Automatic Fire Alarm Co. was incorporated under the old laws of the State of New York, with a capital of $150,000, to operate on the whole length of Long Island. The subscribers are James L. Jensen, John C. Reilly and Alexander Cameron, all of Brooklyn.

On the 1st of May, twenty-five general corporation laws and hundreds of amendments were superseded by five new laws of this State, governing for the immediate future the formation and conduct of new corporations. The few lawyers and others who seem to have noted the passage of the act made quite a rush to get in where they felt somewhat sure of their footing. All who come with the new regime may have to prove their cases, which must of necessity be by new rules.

We regret to hear of the appointment of a receiver for the business so long and extensively conducted under the name of the Cary & Moen Wire Springs Co. This course was deemed best when the failure of the public to absorb the new stock became apparent. The concern will no doubt be voluntarily wound up. The liabilities are estimated at $180,000 and the assets $194,000, consisting of machinery $117,000; stock in various stages: manufacture, $42,000; supplies, $2,000; book accounts, $15,000; other assets, $18,000. Phillip L. Moen holds a mortgage on the machinery for $45,000. There are seven stockholders in the company, Edward A. Moen, 661 shares; Philip L. Moen, 444 shares; Robert W. Barratt, 57 shares; Silas Nourse 35 shares; J. P. Hale Company, 27 shares; Charles H. Stone, 16 shares; L. F. Requa, 10 shares. Can it be possible that if during the successful period of a business the general public are invited to come in and share the profits they

would not in times of depression willingly assist and tide over all troubles. I hold that the investor is as much entitled to share in the net profits of all public or joint stock companies, as the laborer who manufactures the goods. United they stand, divided they must, do, and will continue to fall. So-called close corporations doing business under a limited liability law when viewed, even through smoked glass, have a selfish, isolated private, "I want it all" appearance and if some stormy morning they wake up to find themselves in trouble, they, before noon, find they are indeed alone and without friends.

The birth of a preponderating majority of our industrial securities dates properly from the application of the inventor for the patent. He it is, who, as a rule, in solitary wretchedness completes the conception only to see others reap the benefit. Much of this unjust punishment might at the beginning of this, the second century of our Patent system, be alleviated by adjusting the demands of the service to the requisite expenses. With a surplus of nearly four million dollars belonging to the Patent Office, and a net profit for the year 1890 of nearly $250,000, it is almost disreputable that over 3,500 inventors failed to pay the final fee, and it is human to ascribe the reason to sheer inability to sustain existence, many futile but often costly tests, and, before possible remuneration, to raise and pay in money $15. Occasionally a patent solicitor adds some trifle to this for a retaining fee, and the labor of years assumes partial animation, battles with interferences, technical similarities, and all the other legion of infantile difficulties inseparable from this stage, which having been successfully met, another $20 and the inevitable lawyer's fee in cash must be found before the patent can issue as a real "sure enough." This state of things is not demanded by the financial condition of the government, and it is reasonable to request a reduction in the final fee. It costs two dollars to get one out of the ground, or a patent, but the one dollar is worth more than two, and a constant producer after it has been got out. It is un-American to permit an inventor to lose his property after having paid $15 to be protected in it because he is unable to make the final $20 payment. Five dollars could have been spared from each payment last year, and the office would have been self-sustaining. The country would have been enjoying the results of the inventions, some of which would, no doubt, have reached a front rank in financial circles.

When the electric light companies having contracts for street lighting in the city of New York, will resume dividends is a conundrum, the solution of which is becoming somewhat difficult. The cost of a 2,000 candle-power arc light may fairly be placed at thirty cents per night under the best of conditions, with overhead wires and the aid and protection of the party of the first part; what it is when poles and wires are being removed by strangers in all directions, regardless of connections with actively employed circuits, and long distance connections called for on a moment's notice, with bills from commercial customers in constant dispute, imperative demands by the subway companies for rental, whether occupied or not, which must be met, or the conduit or conductor is liable to be occupied by competitors, is a question which causes many shareholders to wish their capital was invested in something more active than electricity. A compromise may be arrived at any moment which will determine the current mystery, and give the millions invested a mercantile chance, but at present the gap is wide.

All over the land, local companies after paying the interest on their bonds find a nice dividend for their shares, besides adding from income to their plant, and laying aside something for a rainy day. They value their investments at more than 5 per cent. too. If the bill becomes a law making 5 per cent. the legal interest for money in New York, the export of gold and silver will become active and extend in all directions, until in less than five years not enough would be left to ransom the city in case it is ably demanded. The cash capital in this city is owned by men, who, like deep water sailors, are always ready and eager for charter to the best paying market. No patriotic or local sentiment would deter its migration. The evolution which has permitted the passage of imports in bond without breaking bulk only shows how easy it will be to find strong boxes yawning to receive and utilize money at another centre, in which case it will soon be learned that the world never goes backward.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
417 CHAMBER OF COMMERCE,
CHICAGO, Ill., May 1, 1891.

The Central Electric Company report large sales of the Packard Incandescent lamp. They find that the lamp is very well received by users and is considered by everybody one of the very best incandescent lamps ever made.

The Okonite Base Ball Club, which consists of employees of the Central Electric Company, are whitening up their belts and getting in trim for the summer campaign. They have already secured a diamond in Jackson Park, near the World's Fair grounds, for Saturday afternoons in July and August and will then be ready to meet all comers. This club covered itself with glory in the memorable contest with the Kerite Club last season and we expect to see some very brilliant work from them the coming summer.

The Great Western Electric Supply Company, Chicago, have recently put upon the market a new arc lamp, for both arc and incandescent circuits. It sells upon its merits, and has already replaced the lamps of several other makes. This company has the exclusive right to manufacture this lamp, and can therefore give very advantageous terms to dealers. The lamp sales of the Great Western Electric Supply Company, for the past month were of a very gratifying order. These lamps are A No. 1, and are giving the most excellent satisfaction throughout the country. They are not only durable and artistic in appearance, but also cheap in price. "K. K." wire is still to the front, and the Great Western Electric Supply Company, Chicago, report very large sales for the same. They have recently closed several large contracts involving large quantities of bare and insulated wire, nearly all of the latter being "K. K." This company are headquarters for the celebrated brand of line wire, as well as for this well-known Underwriters' wire, of the same company, which has no superior.

H. C. W.

PHILADELPHIA NOTES.

Messrs. O. D. Pierce & Company were awarded the contract for wiring the residence of Mr. A. J. Drexel at Lansdown, Pa., for 150 lights of the Perkins incandescent pattern.

The American Reflector Company, of this city, are turning out an incandescent lamp shade which is being universally adopted by all who appreciate a steady mellow light. It is certainly something that should be seen over every office desk, when incandescent lights are in use.

The Atlantic City Amusement Company and pleasure grounds, under the management of President James B. Lafferty, have contracted with the Thompson-Houston Electric Light Company, for 25 arc and three hundred incandescent lamps to illuminate the grounds. The boats in shape of whales, etc., will be run by electricity.

Mr. A. H. Chadbourne now represents the Railway department of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., at Philadelphia. His office is in the Provident Life Building where he is prepared to give complete estimates for railway apparatus and cost of equipping roads with the improved Westinghouse direct gear and gearless motor.

Vallee Brothers have received a number of congratulatory communications from Naval officers, upon their installation of blowers and motors on the new cruisers Bennington and Concord. These motors are used to exhaust the air from the dynamo room, and are said to be the best that have ever been placed on Naval vessels for this purpose. They are the Connecticut motors, made at Plantsville, Conn.

The de Kosenko & Hetherington Manufacturing Company, of this city, are creating a reputation for themselves through the artistic forms and fine workmanship of the chandeliers and bracket fixtures for electric lighting, which are unsurpassed. The taste displayed in the designs, and the thoroughly mechanical construction of the goods have given the firm a national reputation, so that its products have come to be known throughout the country as standard work of the highest grade. In addition to the gas and electric fixtures the de Kosenko & Hetherington Company are large makers of memorial tablets and art work in all the metals. Under the present able management and with their well equipped plant, the company is prepared to execute orders in a most satisfactory manner. Their quarters are in *The Times* Annex Building, at Eighth and Sansom streets.

H. G. G.

COMPARATIVE COST OF OPERATING ELECTRIC ROADS.

Superintendent Porter, of the Census Bureau, on April 24th made public a bulletin upon the subject of the relative economy of cable, electric and animal motive power for street railways. While it is stated that it is too early to form a final judgment regarding the value of electric motive power for this purpose, yet the statistics presented being a record of actual experience, are believed to throw considerable light upon the subject.

The bulletin covers statistics of 50 lines of street railway—10 operated by cable, 10 by electricity and 30 by animal power. The operating expenses of the cable lines per car mile were 14.12 cents, and per passenger carried 3.22 cents; of the electric roads, 13.21 cents per car mile and 3.82 cents per passenger; of the animal power roads, 18.16 per car mile and 3.67 per passenger.

The expenses per car mile on cable roads varies from 9.39 cents to 21.91 cents; on electric roads from 8.34 cents to 36.04 cents; on animal roads from 9.10 cents to 27.02 cents. Of the electric roads under consideration, nine are operated by the trolley system and one by the storage battery system.

BUSINESS NOTES.

The perforated belts of Chas. A. Schieren & Co., 45 to 51 Ferry street, corner Cliff street, N. Y., are giving good satisfaction wherever used, and the company report largely increased sales. A letter received recently by them from the Home Electric Company, of Seattle, Wash., one of the most prominent electric companies in the Northwest, speaks highly of these belts. The letter reads as follows: "We have two of your perforated electric belts running. One of them has been in use about thirty days, and the other has

been running two weeks; they run beautifully and are very satisfactory. You may refer other parties to us if you choose, and rely on their receiving a very favorable impression of the value of your perforated belts. Yours truly, HOME ELECTRIC CO., BY E. C. KILBOURNE."

The Central Electric Company, of Chicago, has received a letter from the Waterloo Electric Company, Waterloo, Iowa, of which the following is a copy: "We are just in receipt of your new catalogue of electrical supplies. Please accept our thanks for same. It is without doubt the finest and fullest catalogue sent out by any firm in the United States, if not in the whole world. Hoping to be able to get even with you for kindness in the past, we are, Very truly yours, WATERLOO ELECTRIC CO."

The National Electrical Manufacturing Company, 14 and 16 Vesey street, New York, have notified the trade that Mr. John L. Moore no longer represents that company.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued Tuesday, May 5th, 1891.

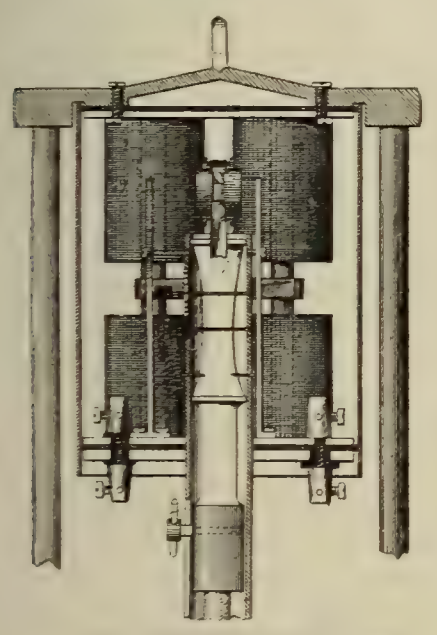
451,101. Electric Arc Lamp. Charles G. Young, New York, N. Y. Filed Jan. 3, 1889.

In an electric arc lamp, the combination of a weight sustaining the upper carbon of the lamp, a pulley mounted on a lever, a take-up drum mounted on the frame of the lamp independently of the pulley, a cord or band attached at one end to the weight, and passing over the pulley, and attached at its opposite end to the take-up drums mounted below the pulley, a detent wheel geared to the drum, and a detent therefor engaged by an arm or projection from the lever.

451,121. Electro-Mechanical Gong Striking Machine. Thomas F. Gaynor, Louisville, Ky., assignor to the Gaynor Electric Company, same place. Filed July 25, 1889.

The combination of magnets, two frame plates having supports for the magnets, pillars by which the frame plates are secured together, an armature adjusting screw fitted in one of the pillars, and a magnet adjusting screw in another one of the pillars.

451,125. Electric Meter. Frank K. Irving, New York, N. Y. Filed Oct. 22, 1890.



451,101—ELECTRIC ARC LAMP.

A recording dial, having an indicator lever, its free end provided with a recording pen or pencil and mounted on a common pivot with an arm carrying an adjusting weight and an arm provided with a segmentally curved core surrounded by a correspondingly curved solenoid located in the circuit to be measured.

451,142. Electric Battery. Jean T. Van Gestel, New York, N. Y., assignor to the Crosby Electric Company, same place. Filed Aug. 29, 1890.

The combination, with the positive or carbon electrode of a layer or coating of binoxide of manganese or its equivalent applied to the surface.

451,143. Telephone Call Box. Frank Villiers-Stead and Elward R. Hedgman, London, England, assignors to Knight Brothers, trustees, New York, N. Y. Filed July 28, 1890.

The combination, with a normally open telephone circuit, of a catch or detent and a flexible toe on the telephone switch, the same constituting a catch tripping or discharging mechanism brought into automatic operation by the act of preparing the instrument for another message.

451,149. Hanger for Electric Lamps. Peter S. Bates, York, Pa., assignor to W. F. Bay Stewart, same place. Filed Jan. 6, 1891.

A hanger for an electric lamp, comprising a rotatable spring actuated drum, a flexible cord carrying the lamp wound upon the drum, electric connections between the lamp and a supply system, a detent for locking the drum against the tension of its spring in any position of adjustment, and means controlled by the cord for releasing the detent.

451,154. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Original application filed March 18, 1886. Divided and this application filed Sept. 21, 1887.

Conductors electrically connecting the main supply conductor at intervals along its length with the working conductor of the main line railway.

451,155. Electrically Propelled Car. Rudolph M. Hunter, Philadelphia, Pa. Filed Jan. 3, 1891.

Motors journaled upon the car axles by means of journal bearings rigidly secured to the field magnets of the motors, and a supporting frame hung from the axles through the bearings of the motors.

451,157. Electric Signal for Railways. Uriah S. Jackson, Ossipee, N. H., assignor of one-half to Harry F. Cady, Lowell, Mass. Filed June 26, 1890.

451,177. Brush Holder for Dynamos. William Le R. Emmet, East Rockaway, N. Y. Filed Sept. 18, 1890.

The combination of a pressure device for thrusting the carbon brush normally against the commutator, guides for the carbon brush, devices for loosely attaching the pressure devices to the brush, and a catch to hold back the pressure devices and brush from the commutator.

451,190. Electric Switch. Le Roy S. White, Waterbury, Conn., assignor to the Electrical Appliance Manufacturing Company, same place. Filed Oct. 11, 1890.

451,202. Suspending Device for Electric Lamps. David P. Thompson, Lynn, Mass. Filed Aug. 1, 1890.

An adjustable incandescent lamp support consisting of a clamp secured to and supported by the flexible conductors by which the lamp is hung, and a stiff rod secured to the lamp and passing through the clamp, by which it is guided and held at any desired position.

451,208. Portable Magnetic Riffle. William C. Edwards, Holyoke, Mass., assignor, by direct and mesne assignments, of one-half to Roswell M. Fairfield, same place, and Oscar S. Greenleaf, Springfield, Mass. Filed Dec. 11, 1890.

A portable magnetic riffle consisting of a series of magnets inclosed in non-magnetic covering and fixed on a base holding the magnet poles elevated.

451,211. Trolley. Roderick Macrae, Baltimore, Md., assignor to the Donaldson-Macrae Electric Company, same place. Filed July 24, 1890.

A trolley consisting of a frame and pulleys supported thereon on vertical pivoted pintles and arranged to bear upon the side of the wire.

451,212. Starting Device for Electric Motors. Edward P. Sharp, Boston, Mass. Filed Dec. 5, 1890.

A rotary arm having its right angular brush and periphery contact with resistance blocks, in combination with an oscillating double ended hook and cam stop armature and line magnet.

451,226. Electric Indicator. John L. Ricketts, Philadelphia, Pa. Filed Nov. 28, 1890.

451,239. System for Electrically Supplying Hot Water for Consumption and Heating Purposes. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed April 5, 1890.

Subjecting water to a heating effect produced by an electric current in a part of an electric circuit, circulating the water in a pipe leading to one or more localities and provided with outlets for releasing or drawing the water from the pipe and controlling the current to maintain the water at a constant temperature.

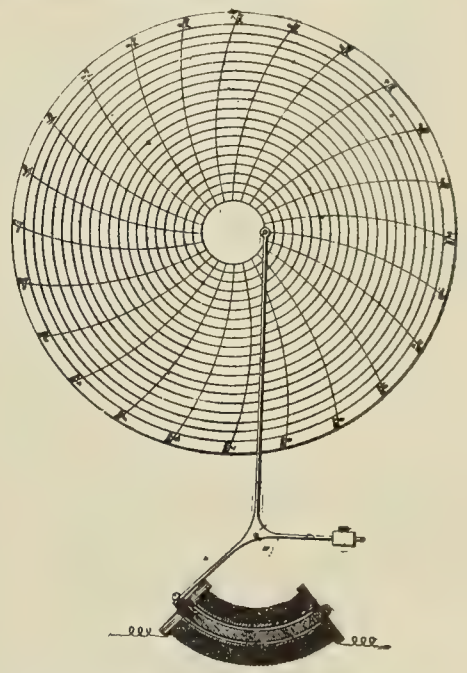
451,240. Method of and Apparatus for Electrically Supplying Hot Water for Consumption and Heating Purposes. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Original application filed April 5, 1890. Divided and this application filed Jan. 12, 1891.

The method of supplying hot water for consumption or heating purposes, consisting in subjecting water contained in a pipe to a heating effect produced by an electric current in a portion of an electric circuit composed of pipe and circulating the water in the pipe leading to and through one or more localities, whereat the water may be released from the pipe or utilized for heating purposes.

451,242. Armature for Electric Motors and Generators. Perrin Grant, Baltimore, Md. Filed Nov. 28, 1890.

A compound armature core formed of a number of sections fitting around the shaft and having air spaces between their adjacent edges.

451,250. Electric Arc Lamp. Addison G. Waterhouse, Hartford, Conn. Filed July 3, 1890.



451,125—ELECTRIC METER.

The combination, with the carbon rod, of a feeding mechanism which will regulate the arc, a retarding mechanism provided with a clutch to engage the carbon rod and to travel downward with the rod, and a tripping mechanism carried by the retarding mechanism for controlling the position of the clutch.

451,267. Electric Switch. Horace T. Clark, Bridgeport, Conn. Filed Feb. 5, 1891.

The combination, with the circuit closing bar, of a reciprocating handle, two pairs of toggle levers interposed between the bar and handle, and a spring interposed between the two pairs of toggle levers and adapted to exert a constant pressure thereon.

451,268. Electric Switch. Horace T. Clark, Bridgeport, Conn. Filed Feb. 25, 1891.

451,308. Solenoid and Spool Magnet. Harvey S. Park, Chicago, Ill. Original application filed March 20, 1890. Divided and this application filed July 29, 1890.

451,309. Electric Arc Lamp. Rupert Schefbauer, Paterson, N. J., assignor to the Universal Arc Lamp Company, of New York. Filed Oct. 3, 1890.

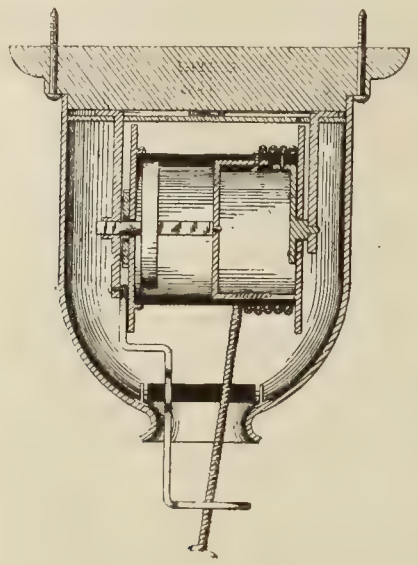
The combination of an oscillating electro-magnet located in a shunt circuit, a tension spring acting on the electro-magnet, stationary pole pieces applied to the supporting frame of the lamp, a pinion on the axle of the electro-magnet, fixed arms on the axle of the oscillating electro-magnet, a train of gear wheels and an escapement supported by the arm, an upper carbon holder provided with a rack meshing with the pinion, and a stop device for the escapement.

ELECTRICAL PATENTS—Continued.

451,312. Regulator for Dynamo Electric Machines. Friedrich Tischendoerfer, Brooklyn, N. Y. Filed Dec. 8, 1890.

A dynamo electric machine having auxiliary field magnets provided with independent sections, in combination with an automatic electro magnetic regulator adapted to vary the magnetic effect of the machine by varying the number of sections in circuit.

451,320. Electric Motor. Rudolf Eickemeyer, Yonkers, N. Y. Filed Aug. 28, 1890.



451,149—HANGER FOR ELECTRIC LAMPS.

A reciprocating electric motor having an electro-magnet embodying a central core and an inclosing magnetic shell, affording an annular magnetic field space, and a longitudinally reciprocating armature helix or solenoid provided with guide bearings.

451,326. Tension and Cut-Out Device for Electric Railways. Byron Jennings, San José, assignor of one-half to James Brusie, Oakland, Cal. Filed Sept. 19, 1890.

Plates supported upon insulators and having a pulley journaled between them. A conductor passes around the pulley, thence around an insulated hanger and a weighted lever connected with the hanger. Wires secured or clamped to the plates are run to a switch box, wherein they are connected or disconnected.

451,345. Method of Electric Welding. Elihu Thomson, Swampscott, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed June 14, 1890.

The process of welding or shaping metals by the agency of electricity and pressure applied through the rolls, hammers, or other devices, consisting in first heating the part of the metal to be operated upon to the proper working temperature by passing an electric current through the part, then breaking the electric circuit, and after the removal of the current subjecting the part to the action of rolls, hammers, dies, or other devices.

451,364. Electric Connection. Horatio J. Brewer, New York, N. Y. Filed Sept. 5, 1890.

A conductor terminal consisting of a metallic wire having a sheathing of tin wrapped or folded over the bare portion of the wire and constituting a connector for the conductor.

451,369. Magnetic Ore Separator. John P. Conkling, New York, assignor to Gurdon Conkling, Glens Falls, N. Y. Filed Aug. 7, 1889.

451,370. Magnetic Ore Separator. John P. Conkling, Glens Falls, N. Y., assignor to Gurdon Conkling, same place. Filed Sept. 13, 1890.

A magnetic separator consisting of a conveyer, a feed hopper, a transverse rotary shaft with a non-magnetic cylinder secured to it, a cover supported above the conveyer and extending from the point where the ore is deposited on the conveyer to a point in proximity to the periphery of the cylinder, several sets of electro-magnets attached to and rotating with the shaft, each pole of every magnet having an independent segmental pole piece forming the arc of a circle and in superficial contact with the internal surface of the cylinder, and means for directing a current of electricity through each of the electro-magnets in a set when the latter is presented opposite the conveyer.

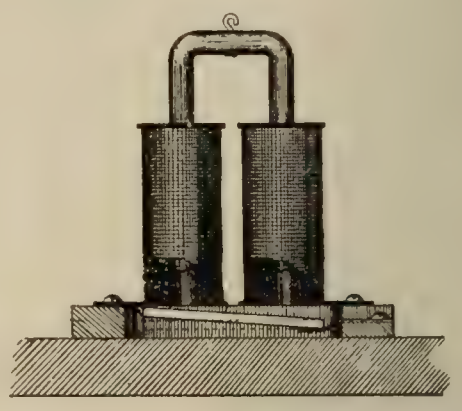
451,377. Safety Connection for Electric Conductors. Robert H. Gould, Berlin, Germany. Filed Sept. 11, 1890.

451,379. Insulator. Robert D. Haines, Corning, N. Y, assignor of two-thirds to Alanson B. Houghton and Arthur A. Houghton, both of same place. Filed Dec. 12, 1890.

The process of forming a body or core of clay, drying it until it is firm and rigid, then dipping or submerging it in molten glass or otherwise covering it with glass in a plastic state, and finally annealing the glass-plated conduit in a suitable kiln.

451,397. Electric Switch. Henry A. Chase, Stoneham, assignor of one-half to George W. Gregory, Boston, Mass. Filed Nov. 2, 1886.

The combination of a number of circuits radiating from the main office with a switchboard having a movable switching device and a pole changer and operating electro-magnets and local circuit therefor. The contact points of the pole changer are connected with the movable switching device, whereby the pole changer may be placed in control of any desired one of the circuits. The movable switching device is provided with a key controlling the local circuit of the pole changer.



451,308—SOLENOID AND SPOOL MAGNET.

451,402. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 2, 1890.

451,407. Method of Making Electrodes for Secondary Batteries. Henry H. Lloyd, Camden, assignor to the Electric Storage Battery Company, Gloucester City, N. J. Filed Oct. 27, 1890.

An improvement in the art of making and providing a battery plate or element with a grid, frame or supporting rim, consisting in preparing material or materials to constitute the plate or element and forming the mass in a suitable appliance, and then applying thereto a molten material or materials under a heavy pressure by means of compressed gas or gasses to cause the grid, frame, or rim to be instantaneously and firmly attached to the plate or element.

451,414. Polarized Bell. Albert Storer, Boston, Mass., assignor to George W. Gregory, same place. Filed Aug. 7, 1890.

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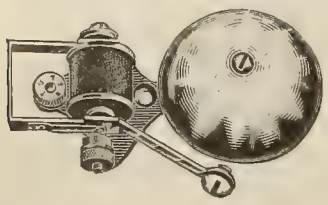
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WEEKLY.

Vol. IX NEW YORK, MAY 16, 1891. No. 20.

EXHIBITION OF RAILWAY SIGNALS.

A most interesting exhibition of railway signals may be seen at the offices of the Hall Signal Company, No. 50 Broadway, this city. A large room is entirely devoted to the purpose of exhibiting the various apparatus of the company in actual working order on a small scale, that is, as far as the distance between the separate parts of the system are concerned. The instruments used are the same as those used in actual practice. Here the action of the various parts of the system as applied to railroad operations may be witnessed under different circumstances.

The accompanying illustration is that of the exhibition room. Among the apparatus shown in actual working order are the permissive block signal, train order signal, the street crossing bell, the absolute block signal, and the application of the block system to single track roads, junctions, crossings, etc. Switch signals are shown which turn semaphores; the latter give the usual visual signal to intercept trains when the switch is turned. Track instruments are also shown; these devices are operated by the wheels of the passing trains.

This system of signaling is now in use on seventeen different railroads in various parts of the country, and it is also being applied on several other lines in addition to the above. The Hall Signal Company claim to possess the only reliable automatic signal system, and a close examination of their system and its working certainly tends to prove their assertion. Railroad officers are always cordially welcomed to inspect the signals.

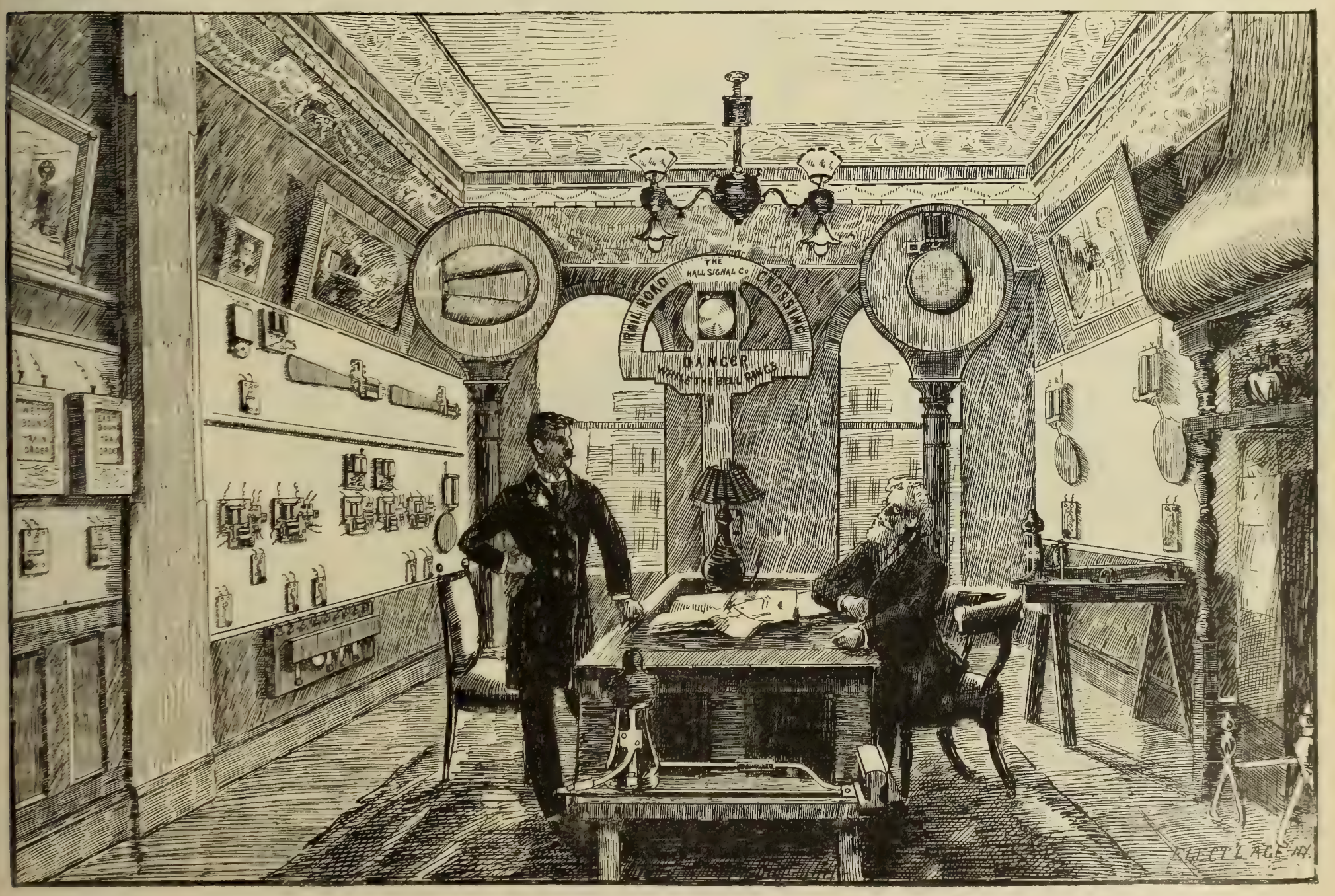
Referring to our illustration, on the extreme left will be seen the indicator boxes of the train order signal system. This system is used in connection with the electric block system in those sections which include a telegraph station.

Station operators and agents have so many duties to perform, selling tickets, checking baggage and receiving train orders for trains that stop but a minute that much annoyance and many serious accidents have been occasioned by their forgetting to deliver train orders, and the object of this system is to prevent the giving of a "clear" signal before the delivery of the orders intended for a train.

In the centre of the exhibition room is seen the danger signal for street crossings. This bell is rung by electricity, and the current is turned on by the wheels of the train passing over the track instrument, which is located several hundred feet from the crossing. The bell vibrates continuously until the train has passed the crossing, and if there are two tracks and two trains approaching the crossing, the bell will continue to ring until both trains have passed.

On each side of the crossing signal is seen the well-known Hall disc and semaphore signals. These are familiar to most travelers.

One of the track instruments is seen in the foreground of our picture. The wheels of the passing train operate the mechanism which closes the circuit, and this in turn causes the crossing bell to ring as already mentioned.



EXHIBITION OF THE HALL SIGNAL COMPANY'S SYSTEM.

THE ELECTRIC PLANT AT THE MANHATTAN ATHLETIC CLUB HOUSE.

The electric light plant in the magnificent building of the Manhattan Athletic Club, on the corner of Forty-fifth street and Madison avenue, New York, may be said to be, without doubt, one of the most complete, conveniently arranged, and artistic installations found anywhere in the country. On entering the dynamo room the effect is most pleasing and inviting. The engines are painted in a very artistic manner, and the dynamos themselves are decorated correspondingly. The floor of the room is tiled, the tiles being of squares of two or three inches. In the centre of the floor, wrought in red tiles, is the well-known monogram of the club.

The foundation of the engines and dynamos above the level of the floor is also tiled, and all machinery in the room is kept up at a high state of polish. Brass and copper trimmings abound everywhere, and the plant entire is a thing of beauty as well as of great practical utility.

There are two United States dynamos, each of 110 volts and a capacity of 750 lights—1500 lights in all. The machines are shunt wound and fitted with every improvement.

There are 1500 Sawyer-Man lamps distributed throughout the building, of which 500 are of 32 candle-power. The greatest number of lights are in the theatre (312), and on the first floor (296).

The building, which is seven stories high, is wired throughout with Grimshaw white core wire, and tubed with the well-known conduit of the Interior Conduit and Insulation Company. The wiring was done by the United States Company. Eighteen feeders rise from the switchboard, each being 00 in size.

The power necessary for the operation of the dynamos is supplied by two Straight Line engines of 90 horse-power each. They make 235 revolutions per minute, and run with remarkable smoothness and regularity.

The boiler plant consists of two horizontal tubular boilers manufactured by the Bigelow Iron Works, New Haven, Conn. Each has a capacity of 90 horse-power, and, it is said by the chief engineer, that these two boilers make more steam than any other two in New York City.

Besides the machinery already mentioned, the steam plant includes eleven pumps and two New York Safety engines, one for laundry purposes and the other to drive fans, etc. In the engine room there are no less than 276 valves. These include all service pipes and the object of having them located at one place is that they may be cared for and controlled by the engineer, instead of having them scattered in different parts of the building, as is usually done.

The switchboard is a complete piece of apparatus. There are two magnetic circuit breakers, two ammeters and one voltmeter, all of the Westinghouse Company's make. Double pole switches are used and the connections are made by the sliding bar method.

In speaking of the magnetic circuit breakers, the engineer states that they give excellent service. They are capable of fine adjustment and are very sensitive. They never fail to act at the proper moment, and immediately there is a short circuit anywhere, these circuit breakers perform their work in a most admirable manner.

Schieren's Perforated Belts are used, and the attendants speak very highly of their performance.

The club is just about to add to the comfort of the engine room by putting in some ventilating fans to withdraw the hot air and replace it with cool air from out of doors.

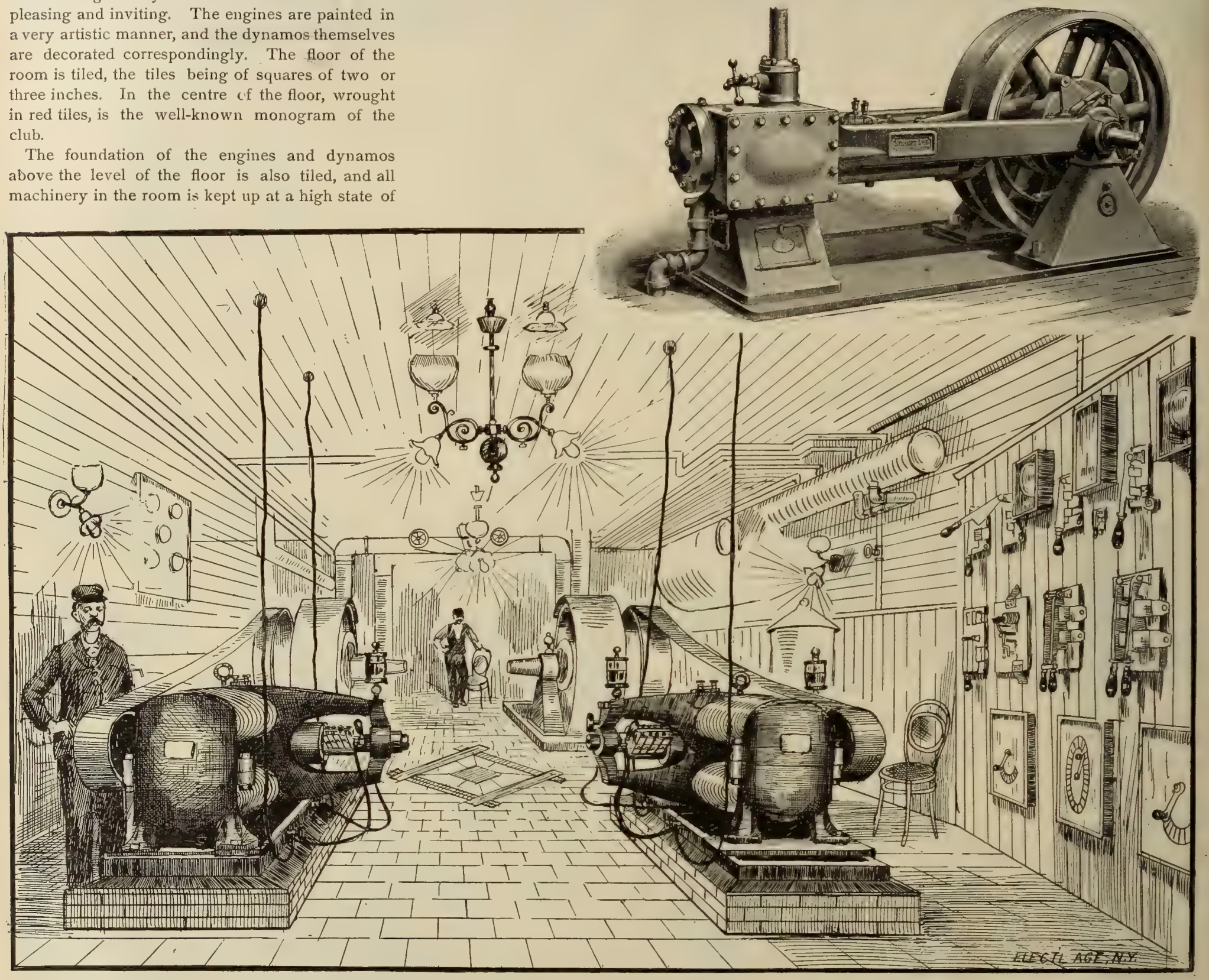
This plant was started on October 1st last, and the dynamos, engines and boilers have been doing their work in a highly satisfactory manner ever since. One engine is started about one or two o'clock in the afternoon, according to the necessity of the business of the house, and the second engine is started up at about six, or as soon as darkness requires the full number of lights. The average running of the engines per day is 19½ hours for 1200 lights.

The foundations of the engines and dynamos are most excellently constructed. They are made of concrete and brick, and so solid and firm are they that a person standing right alongside of an engine in motion, with his back turned toward it, could not tell that it was running except for the usual air vibration, which, of course, cannot be avoided. There is not the slightest jar or vibration to the foundation, floor or any part of the room, and it is a remarkable feature of this plant that the solidity of the foundation has been attained to such a high degree.

Another important feature is that the attendants may stand in any part of the room and be able to see all of the gauges and the switchboard, and can tell, wherever he may be, whether everything is working properly or not. While the engineer is attending to other duties he cannot fail to see at any time when anything goes wrong in the mechanical apparatus in any part of the building.

The plant was installed under the supervision of

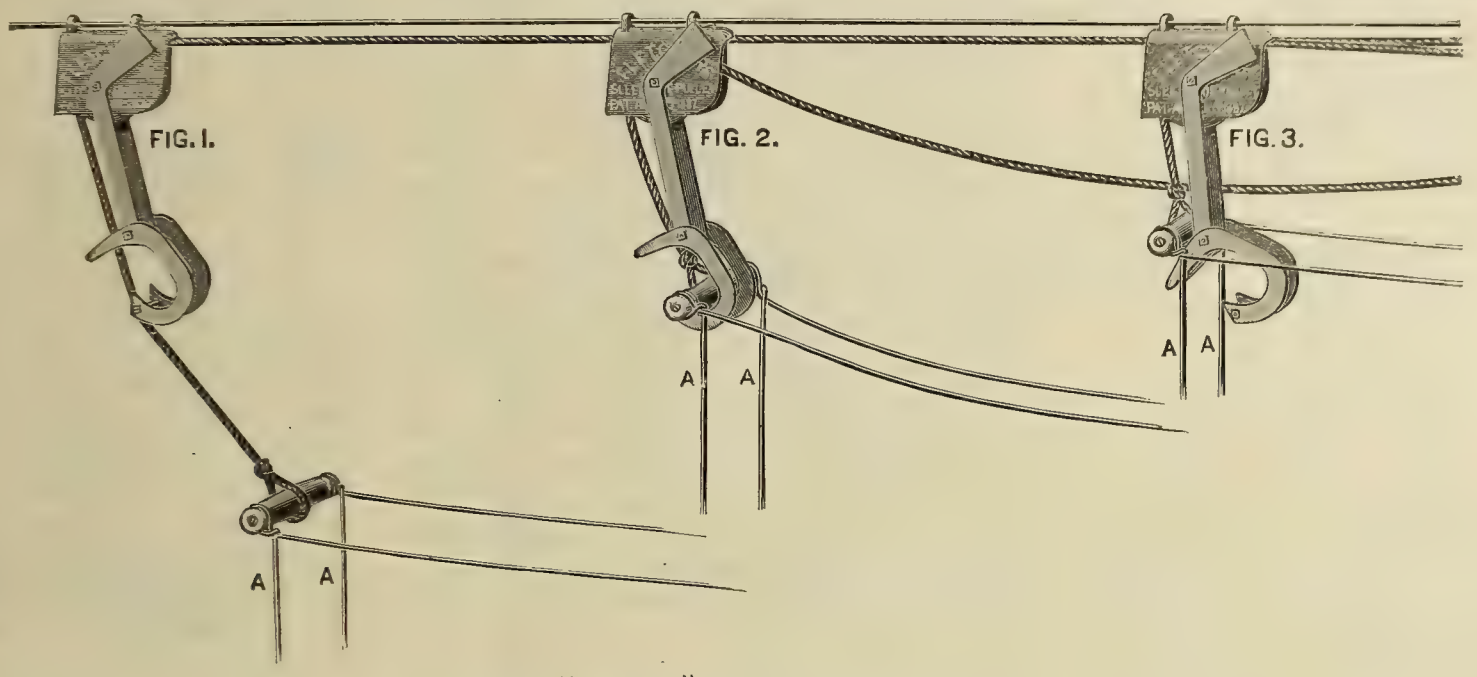
Continued on page 297.



VIEW OF THE MANHATTAN ATHLETIC CLUB ELECTRIC LIGHT PLANT—THE STRAIGHT LINE ENGINE.

ARC LAMP SUPPORT.

The accompanying illustrations show a simple and handy device in the way of arc lamp supports, which, no doubt, will be appreciated by electric lighting companies.



THE "DANALS" ARC LAMP SUPPORT.

Figs. 1, 2 and 3, show the operation of "The Danals" Arc Lamp support, which is one of the modern safety devices in electric arc lighting. Its operation is so simple and the security of the lamp whilst in suspension so perfect, that its virtues cannot be too highly set forth.

Security to those passing underneath arc light lamps has been one of the chief desires of all light companies who operate street corner suspension lamps, and this support seems to meet such wants exactly.

This device has been brought out by the Electrical Manufacturing Company, Dayton, Ohio, who are sole proprietors and manufacturers.

A NEW ELECTRIC BELL.

We illustrate herewith a new iron box electric bell, just brought out by W. R. Ostrander & Co., manufacturers of speaking tubes and electric goods, 195 and 197 Fulton street, New York, which possesses some new and meritorious features.

The armature has bottom and side adjustments, and is pivoted in such a manner that although it works very freely, it is impossible for the points

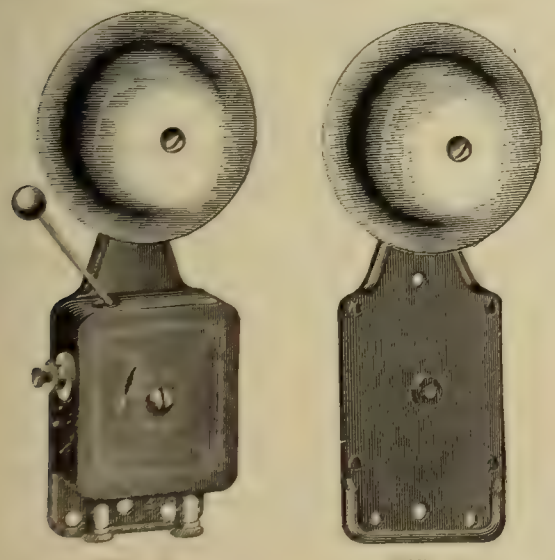


FIG. 1. FIG. 2.

to get out of contact. It can be adjusted to ring on one cell of battery. The contact points are made of platinum wire riveted in, and the armature spring is of phosphor-bronze, the valuable qualities of which metal are well known. The hammer rod is twisted into the armature, which renders it impossible to work loose. In some makes of bells this is a very annoying feature, and once these hammer rods get loose there is no end of trouble, unless the bell is at once put into the hands of a repairer.

The mechanism of this new instrument is all in the box, which is held to the back plate by a centre screw. Usually electric bells are made with the magnet and their mechanical parts fixed to the back plate of the bell, but in this case the mechanism is all contained in the box itself, and when the box is removed the magnets all go with it. The bell or gong is fixed to the back plate. When once the back plate is attached to the wall, it need never be taken down in order to get at the works, as they are contained in the box, as already stated.

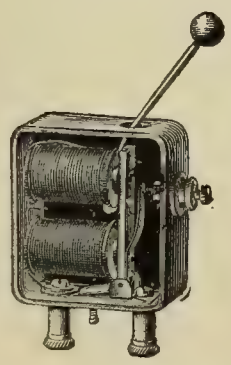


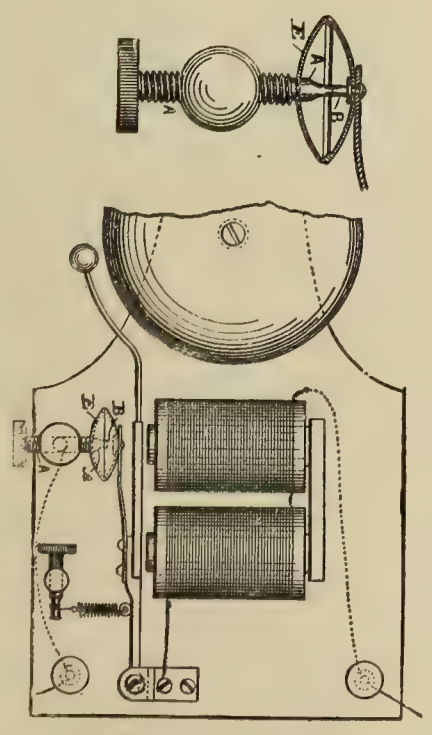
FIG. 3.

In the manufacture of this bell the very best material is used, and the makers consider the instrument to be perfect in every respect.

The facility of adjustment and accessibility to the mechanism are features of this bell which commend it to all users of electric bells. Fig. 1, shows the bell complete ; Fig. 2, the back plate with box removed, and Fig. 3, the box.

VARLEY'S ELECTRIC CONTACT PROTECTOR.

Much difficulty is frequently experienced in the electrical operation of call bells, in consequence of particles of dust or other foreign substances getting



CONTACT PROTECTOR.

in between the contact points, and the risk of the alarm becoming inoperative is augmented by the fact that considerable periods of time often elapse during which the call is not in use.

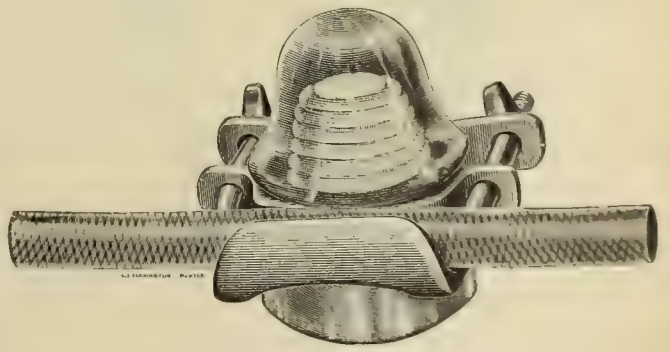
To obviate this, Mr. Richard Varley, Jr., of Englewood, N. J., electrician at the works of the Okonite Company, has invented the device shown in the accompanying illustration. As will be seen, the contact A is in the form of a screw with a platinum plug, and the other contact, B, is held by the spring attached to the armature.

The protector, E, is made of thin sheet rubber that extends from one contact to the other, forming a dust-proof inclosure. This protector is made of two discs with a central opening in each, one fitting around the button head of the contact B, and the other around the end of the screw A. The discs are united at their edges and vulcanized, thus excluding all dust. Hence it is not necessary to enclose the bell or magnet in a case, as is sometimes done, to aid in keeping the bell in working order.

The protector can be similarly made for the contacts of a telegraph key, the contact studs having heads with annular channels or necks for the edges of the elastic discs.

THE P. A. FEEDER-WIRE HOLDER.

We illustrate herewith another of the many good things brought out by Pettingell-Andrews Co., of 192-196 Summer St., Boston. This firm have designed a good many original electric light and electric railway appliances, but this—their latest invention—is of that class most appreciated in construction work.



FEEDER-WIRE HOLDER.

Our illustration shows so plainly the P.A. Feeder Wire Holder for railway use that an extended description is unnecessary. It shows clearly the nature of the holder and the manner of clamping the wire. It will fit any insulator, and as there is no danger of cutting the wire, short circuits from that cause are impossible. This holder will be a saving both in time and money. It holds the wire or cable firmly and securely.

A street railway company has been incorporated at Riverside, O., under the name of The Riverside Electric Street Railway Company. The capital stock is $50,000.

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NEW YORK, MAY 16, 1891.

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NOTES.

Every mining engineer fully recognizes the fact that the mining of the future will involve the question of electrical transmission and the conversion of energy at great distances, and the paper read before the Association of Mining Engineers of the Province of Quebec by Mr. H. Ward Leonard, of the Edison General Electric Company, at Montreal, on April 29th last, is both timely and valuable. It is, besides, of extreme interest and no doubt will be carefully read and studied by those concerned in such matters. There is a great field for the application of electricity to mining operations. Mines are usually located in mountainous regions, frequently far away from water power. Under such circumstances electricity is the only power available that can be put down and used where wanted, and the mining engineer will in the immediate future develop this water power, convert its energy into electrical energy and in this form transmit it to the distant mine, there to be reconverted into the various forms of energy which may be required. Among the applications of electrical energy delivered at the mine may be mentioned the following: the lighting of mines, buildings and grounds by arc and incandescent lamps; the operation of machinery at the mills; operation of the drills, hoists and pumps; electric tramways at the mine; ventilating fans; heating the buildings; refining copper; recovery of gold and silver and the concentration of magnetic ores. One of the difficult problems electrical engineers have had to solve was that of drilling by electric power. This has at last been successfully accomplished, and Mr. Leonard fully describes the Edison percussion drill which represents the successful result of much experimentation. This drill, it will be remembered, was fully described and illustrated in the Electrical Age of April 11, last. Mr. Leonard also described the electric diamond drill, recently put on the market by the Edison General Electric Company, which is said to be meeting with great success. The paper from beginning to end is most interesting, and is a masterly exposition of an interesting and important subject.

During the discussion which followed the reading of the paper of Mr. A. S. Brown, at the meeting of the American Institute of Electrical Engineers, April 21st last, on the subject of the production of aluminium by electricity, Professor F. B. Crocker, in a few remarks, humorously referred to the exaggerated notions prevalent concerning aluminium. He compared the sensational claims made for that metal with many of those made for storage batteries, and, he said, "a combination of the two is simply irresistible" to would-be inventors. He little thought when he uttered that casual remark that some one would appear on the scene with the very thing he referred to in a jocular way. A despatch from Pittsburg reports the designing there of a pleasure boat to be made of aluminium, to be propelled by electricity developed from a storage battery, the plates of which are also made of aluminium, instead of lead. The designer claims to have found a way by which the plates for boat building can be united and made water-tight, and he asserts that his boat, which will carry four or six persons, will not weigh more than from sixty to seventy pounds. We regret that we cannot give our readers more than a taste of this good thing; our information up to this time is very meagre. If the boat works well on paper it may not work so well in the water, and as to the aluminium storage battery—well, we, with the rest of our readers, await with interest later developments.

A Pittsburg paper is authority for the statement that the affairs of the Westinghouse Electric and Manufacturing Company have been settled definitely, and in a satisfactory manner. It is stated that negotiations for the placing of the preferred stock have been completed, and that Boston, Pittsburg and New York parties will take large blocks of it. It is said that Pittsburg parties will take $600,000; Boston, $1,400,000, and New York $1,000,000. The statement is also made that the Thomson-Houston Electric Company, and the Edison General Electric Company came to the aid of the embarrassed concern.

There has been an unusual amount of moving among electrical concerns this year, and the first of May spirit of unrest has had as great a sway in the electrical ranks as had *La Grippe*. Unrest is perhaps not the proper word to use in this connection, because nervousness can hardly be said to be characteristic of the electrical fraternity. The power that has moved so many electrical concerns this year is necessity—necessity for larger and more convenient quarters We do not know of a single instance of the many where an electrical house has made a change of base for any other reason than that larger quarters were needed. This indicates general prosperity, and we are glad to make note of it. We furthermore trust that the general electrical business will continue on the ascending scale, and that next year it will be necessary to move again for the same reason.

It is extremely unfortunate that the electrical exhibit at the World's Fair to be held in Chicago, will have to be scattered. The electrical people of Chicago made a good and earnest fight against it, but fate had decreed otherwise. The blunder is directly chargeable, as far as we can learn, to the committee on grounds and buildings, who did not listen to the wishes of the electrical people at the proper time, before settling upon building plans. The result is the building will be erected on the original plan which, it was decided, could not be altered. While the electrical fraternity will be greatly disappointed in not having the entire exhibit under one roof, they will do the best they can under the circumstances. If the building committee refuse to alter the plans, all that remains to be done is to make the best of a bad job. It is a great disappointment, and we think a great mistake has been made by the building committee.

One of the possibilities of the future is a reliable underground conduit system for electric railway conductors. When this is produced the electric railway and rapid transit problems in large cities will practically be solved. Many persons look to the storage battery for the solution of the problem, while others look upon the underground conduit system with confidence. As every one knows, the main difficulty met with in the conduit system is dampness and consequent leakage of the current. Therefore, in planning an underground system the thing of most importance is to overcome dampness. Dampness means leakage of current, and loss of current means waste of energy Every underground system is claimed to be moisture-proof, but many of them, when put into practice fall far short of the mark. The cost of laying such a system is, of course, another important factor in the calculations pertaining to construction and maintenance, but even this might in many instances be considered of secondary importance were there a practical and reliable system. We describe and illustrate elsewhere in this issue an underground conduit system which seems to have some meritorious features. It is quite impossible for surface water to enter the conduit containing the electrical conductor, and the condensation of moisture which usually takes place on the side walls of such conduits is said to be avoided in this system by the use of tarred canvas or some similar material with which the conduit is lined. It has some excellent features, but as to its cost we know nothing.

On the night of the 13th of April a fire occurred at the lamp factory of Siemens & Halske, in St. Petersburg, Russia, which caused a damage to the amount of 250,000 roubles.

It is reported that the Street Railway Company of Toronto, Ont., will be compelled to adopt electricity as a motive power, and if the present management does not accede to the demand, the city will buy out the company and install an electric plant to displace the present system.

Some years ago a toy steam engine was brought out whose power was rated at so many "flea" power. A small electric motor is now on the market rated by "mouse" power. It would be interesting to know just what power a well-developed and healthy flea possesses. We know it has great penetrating power, but what is its mechanical power and exactly what power can a mouse exert?

Mr. C. L. Hammond, the chief engineer of the club. All the machinery and piping throughout the building were put in under his immediate supervision, and the fact that everything is so conveniently arranged speaks well for this gentleman's ability as a mechanical engineer. In addition to the chief engineer, the crew consists of two assistant engineers, two oilers, three firemen and one steam fitter.

NOTES ON THE DESIGN OF MULTIPOLAR DYNAMOS.*

(*Concluded from page 285*).

Having discussed the design of multipolar machines as influenced by both theory and practice, it remains to conclude this communication by calling attention to some of the ordinary forms of multipolar fields. The double wrought iron horseshoe (Fig. 4) is not very frequently used,

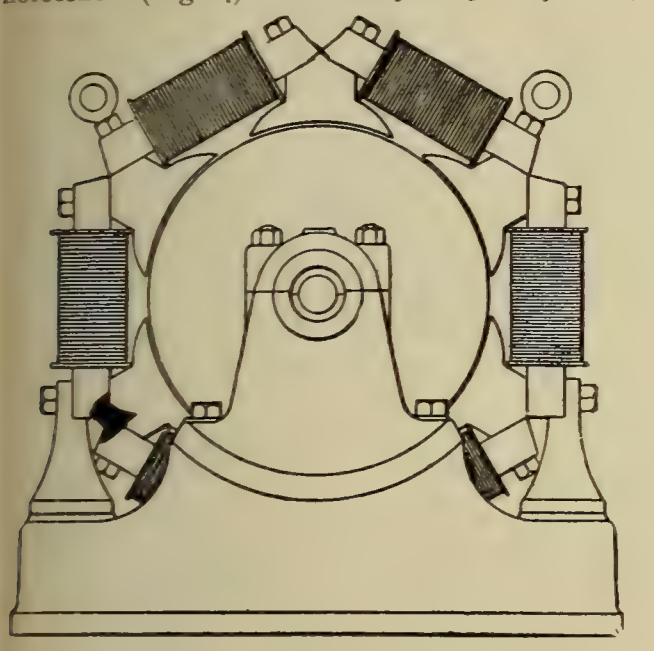


FIG. 7.

being rather costly; but a similar machine, with magnets of cast iron, lately made by my firm for the National Line s. s. America. The armature core in this case was formed by winding square annealed iron wires on a gun-metal flanged cylinder. The winding was of the Gramme type, and the machine was coupled direct to an inverted engine. This design, introduced by Gramme in 1869, generally gives place to the arrangement shown in

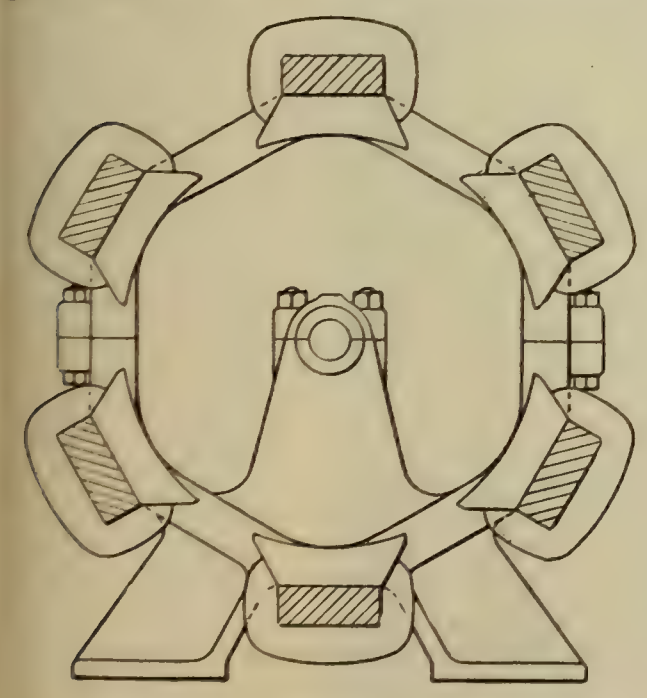


FIG. 8.

Fig. 5, a form designed by the same inventor in 1885, and since adopted for cylinder-wound armatures by many makers, including Mr. Jasper, in Belgium, Mr. Brown, of the Œrlikon Works, in Switzerland, and Messrs. Paterson and Cooper, in England. Lately Mr. Kapp has used the same form for six and eight-pole machines with drum armatures. The magnets and octagonal yoke in Fig. 5 are of cast iron in two pieces, the lower limbs, the bottom half of the yoke ring and bed plate being one casting, and the top limbs and upper part of the yoke being another. Fig. 6 represents a similar field in which the magnet cores are of the wrought iron, fitted with cast iron pole pieces, as used by Mr. Kapp in the machines above mentioned. The decision as to whether cast iron or wrought iron should be used is arrived at in a very simple manner—by comparing the excess of copper required on one hand with the extra machining required on the other.

It will be observed that in the designs Figs. 5 and 6 the yokes are considerably longer than those shown in Fig. 4, and the weight of the former, if made of the same material, would be, roughly, twice that of the latter, though even then the complete magnet system would be but 75 per cent. of the weight of Fig. 3. The yokes being of cast iron, however, the system really comes about 20 per cent. heavier than Fig. 3; the less expensive character of the material compensating, of course, for the increased weight.

All these are examples of single magnetic circuits, where the lines of force from each pole remain undivided in their paths through the magnetizing coils; but in Figs. 7 and 8 are shown examples of double magnetic circuits, in which the lines from each pole take two paths through separate coils. Fig. 7 is a type of magnet used by Sautter-Lemmonier, of Paris, for Gramme-wound armatures, and by Cuenod-Sautter, of Geneva, for armatures having a Siemens winding as modified by Thury. The magnetizing coils are wound upon the parts of the system constituting in Fig. 6 the yokes, and a greater amount of copper is in consequence required. It looks at first sight as if the weight of copper was not very different in the two types, but in this respect appearances are deceptive, for, as a matter of fact, the field of a four-pole machine made according to Fig. 7 would require about 125 per cent. more copper than if made according to Fig. 6. It will be observed, however, that the magnet cores and pole pieces, which are made throughout of the softest wrought iron, are very light. In Fig. 8 the magnets are a series of wrought iron bars lying parallel to the armature, each fitted with a cast pole piece in the middle of its length, and having two magnetizing coils, one on each side of this piece. It is a structure which may be frequently met with, though not precisely in the form shown, and the observations regarding the copper made with reference to Fig. 7 apply equally here.

The cost of a four-pole machine is approximately represented by the cost of a couple of two-pole machines of the same efficiency, which give each half the output at twice the speed; the cost of a six-pole by that of three two-pole machines which give one-third of the output at three times the speed, and so on. For comparison, the fields must be in both the multipolar machines and two-pole machines of the same character—that is, with single or double magnetic circuits.

The fields of alternators may be similarly divided into those having single and those having double magnetic circuits; the former requiring, as in the fields of direct current machines, much less copper than the latter. Among those having single-magnetic circuits are the machines of Siemens, Ferranti, Mordey, Westinghouse, Elwell-Parker and Paterson and Cooper. Mr. Kapp possesses the distinction of having the only alternator with double magnetic circuits. The "Phœnix" alternator, shown in Figs. 9 and 10, possesses some features which may be of interest, as illustrating the way in which the commercial aspect of designing has to be considered. The yoke-ring is of cast iron, but the magnets are of tooled wrought iron, shaped as shown. If the magnets had a breadth equal all the way up to the length of the armature core, they might as well have been of cast iron, for the little advantage consequent on the reduction of copper obtained by narrowing them would not have paid for the extra work in tooling wrought iron. But when we reduce the breadth where the magnetizing coils are, as shown, we at once diminish the copper on the fields by 60 per cent., greatly reduce the leakage area, and get

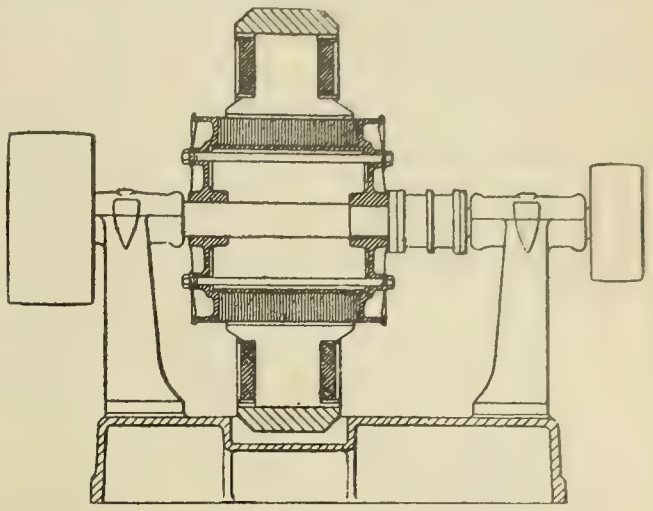


FIG. 9.

a good balance after paying for extra tooling. The machine, as will be seen, has 12 radial magnets, and there are on the armature six flat coils, each equal to three times the width of the magnet cores, and laid on the periphery with a space equal to the core between them.

The length of the paper prohibits me from dealing with many special types of machines, to which, however, all the reasoning here used may be applied without difficulty.

* Paper read by W. B. Esson before the Institute of Electrical Engineers, London, April 9, 1891.

ON THE POTENTIAL DIFFERENCE NEEDED TO PRODUCE A SPARK.*

BY F. PASCHEN.

The author has experimented with spheres of different diameters placed at various distances apart. The gases selected for testing were air, hydrogen, and carbonic acid, and the influence of the pressure under which those gases were examined was also investigated.

With spheres of one centimetre radius the potentials in electro-static units (300 volts) required for sparking distances of 1, 2, 3, up to 7 millimetres, are found to be 16.1, 27.7, 38.8, 49.4, 60.0. 69.4 and 78.9 respectively, and the sparking potential is slightly less in summer than in winter. The

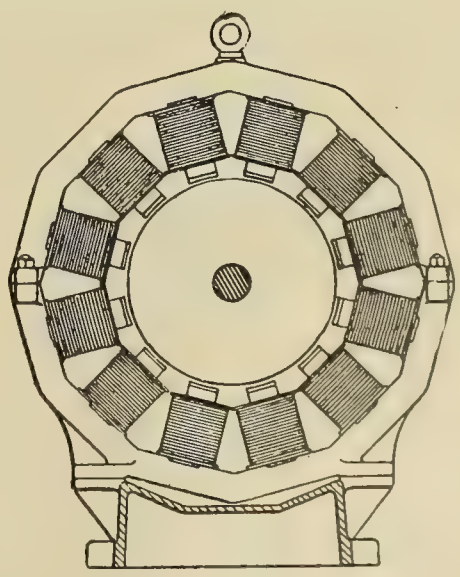


FIG. 10.

potential required is less the smaller the radius of the balls, except at very short-sparking distances, when a greater voltage is needed. Thus, for a sparking distance of one-tenth of a millimetre the potentials required for balls of 1cm. and 0.25cm. radius, are respectively 3.35 and 3.67; for a distance of 3mm. the corresponding numbers are 38.8 and 38.7, and for 8mm. they are 87.8 and 66.8. The diameter of the wires leading to the sparking knobs also exercises an appreciable influence, more especially at long-sparking distances. Thus, with a distance of one centimetre separating balls of one-quarter centimetre radius, the sparking potential was 68.9 for leading wires of 0.07cm. diameter, and 73.9 for wires of 0.57 diameter.

* Abstracted from *Wied. Ann.*, Vol. XXXVII., pp. 69–90.

The principal result of the experiments is to evidence the following law : For a given gas at a given temperature the voltage required to produce a spark depends only on the product PD, if the pressure P of the gas, and the sparking distance D are varied; that is to say, the voltage is constant if the product PD is so.

A great number of experiments were made on the three gases for pressures varying from P=100mm. of mercury to 750mm.; the corresponding values of D varying from 0.75cm to 0.10 cm, so that the product PD was in all cases equal to 75. The mean values of the sparking potentials needed under these circumstances for air, hydrogen and carbonic acid were found to be respectively 16.65, 9.68 and 17.37. The average divergence of each observation from the mean value was about two per cent. for the first two gases, and 3 per cent. for the third

A further set of experiments were made on the gases under various pressures with sparking distances, so arranged that the product PD was 200. Under these circumstances the mean potentials required were 34.64 for air, 19.45 for hydrogen, and 33.37 for carbonic acid. The average divergences of the different observations from each other were about the same as before.

As the density of the gas is proportional to its pressure, we may state the law given above in the following form :—

The difference of potential necessary to produce a spark is a function merely of the product of the density and the sparking distance; or, in other words, this difference of potential depends only on the number of molecules encountered in the path of discharge, and not on the average distance of these molecules from each other.

As M. Cardani has shown that the sparking distance is constant in an atmosphere consisting of a quantity of air kept at constant volume, while its temperature is raised to 300°C., it may also be concluded that the sparking potential does not depend on the relative velocity of the gaseous molecules

A MOISTURE-PROOF CONDUIT.

We illustrate herewith a mechanical arrangement for overcoming the principal difficulty experienced in the operation of underground electrical conduits—the accumulation of water and moisture—that will interest all those who look to the underground system for the solution of the

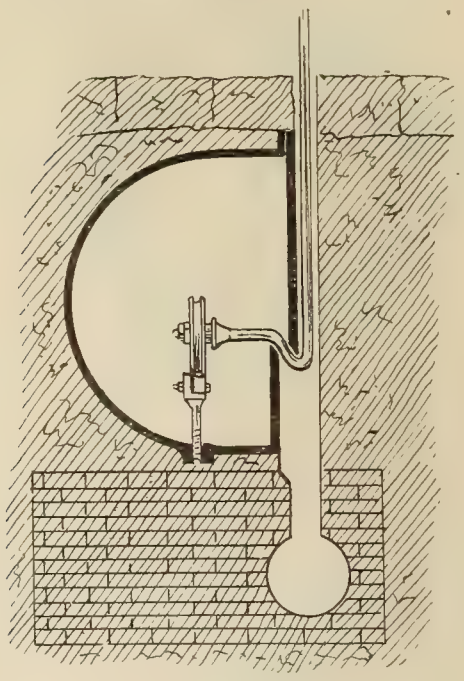


FIG. 1.
SECTIONAL VIEW OF MOISTURE-PROOF CONDUIT.

electric railway problem. It is extremely annoying to have the wires in a conduit grounded, crossed or otherwise rendered useless by the accumulation of water every time it rains, and experts have been endeavoring to successfully overcome this difficulty.

Capt. William Bradley, of Fort Wayne, Ind., has invented a conduit with this object in view, which will be understood by the following description and illustration. As is readily seen in Fig. 1, which shows a cross-section of the conduit, the opening is at the side instead of at the top, as is usual, and an easily removable side-plate covering the opening overlaps the upward curved portion of the conduit, preventing water from entering. Below the conduit and directly under the opening for the entrance of the trolley arm is a chamber for carrying off any water that enters the trolley arm passage. This is done without any possibility of leakage into the interior of the conduit.

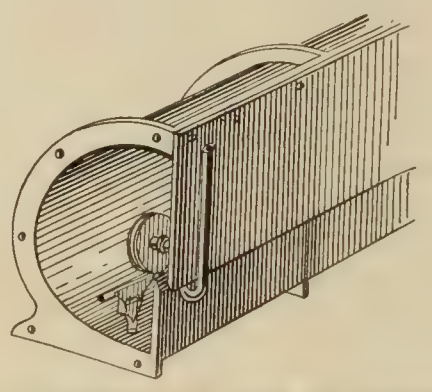
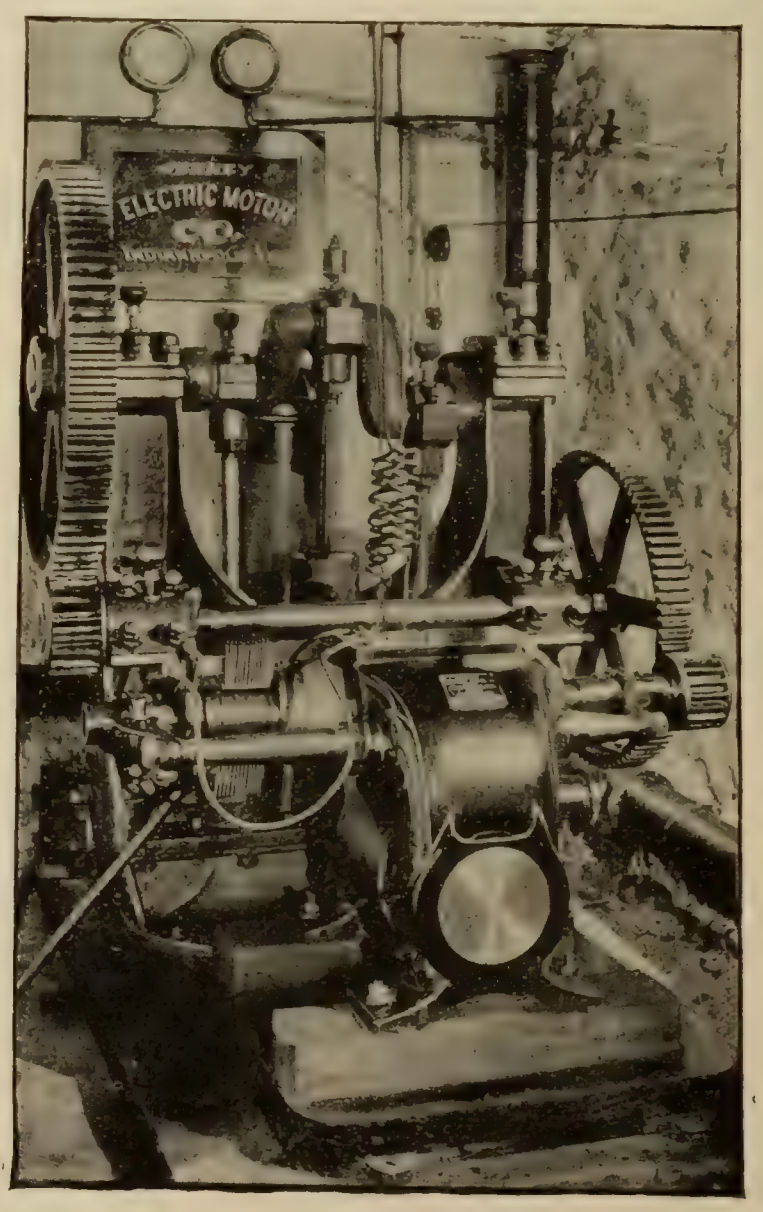


FIG. 2—PERSPECTIVE VIEW OF CONDUIT.

The trolley arm curves under the side plate, the trolley wheel running along the wire as shown in Figs. 1 and 2. The trolley wire is supported on insulators of compressed paper. The interior of the conduit is lined with tarred canvas to prevent condensation of moisture on the surface of the iron.

JENNEY MOTOR APPLIED TO A HYDRAULIC PUMP.

An important application of the electric motor is that of pumping water, especially for operating hydraulic elevators. A notable instance of this kind is illustrated by the accompanying cut. A 7½ horse-power Jenney motor is shown geared to a Gould Triplex pump at the Board of Trade Building, Indianapolis, Ind. City water had been used to operate the passenger elevator, but it was found that quite a saving in expense could be effected by sinking a well, putting in motor and pump in the basement, and a tank on the roof.



JENNEY MOTOR OPERATING PUMP.

The combination has been working successfully for several months, furnishing ample water for the passenger elevator as well as for use throughout the building.

The motor requires very little attention, and is much more desirable than a steam plant for the same work, as there is no heat, dust, noise, or danger of explosion. It is started and stopped automatically by means of a special switch which is operated by a float in the tank The small pinions are of rawhide and the bearings on the motor are self-oiling.

These combinations apply equally well to roof or to pressure tanks, for elevator work, and are very effective for such work as draining of mines.

The operation of this plant has been satisfactory from the start, and is worthy of special notice on account of the very considerable saving in expense.

TEST OF A NEW STORAGE BATTERY AND ELECTRIC MOTOR.—The New York *Times* on May 5th, published an account of some tests of a new street car motor in Philadelphia, made in the presence of several electrical engineers. The new system includes a storage battery and a motor designed especially for street car use, the inventors of which are J. B. Entz, W. A. Phillips and Montgomery Waddell of New York. The feature of the system is that in running down hill the motor is run as a dynamo, and charges the storage battery, which is placed under the seats in the car. It is claimed that the storage battery is entirely different from anything ever before used, both in the materials and chemical action. The positive pole is of copper, and the negative of iron, and the liquid used is a solution containing zinc and potassium. The motor is of the slow speed type with Gramme ring armature. The tests are reported to have been very satisfactory.

PREPARING FOR THE CONVENTION.—Mr. J. W. Beane, Secretary of the National Electric Light Association, paid Montreal a visit recently for the purpose of looking over the ground in connection with the Montreal meeting of the Association next August. He was well received by many representative men, and reports that everything is favorable, as far as present appearances are concerned, for a successful and enthusiastic meeting.

LOCKING SHADE HOLDER.

The accompanying illustrations show a recent innovation in shade holders that will find considerable favor among users of incandescent lamps.

Fig. 1 shows the parts separately. The ring slides over the socket frame and in order to fasten the holder thereto the ring is pushed up, thus permitting the shade holder to be clamped to the socket. The ring is then forced down over the shoulder of the shade holder and in this way securely clamps it to its place.



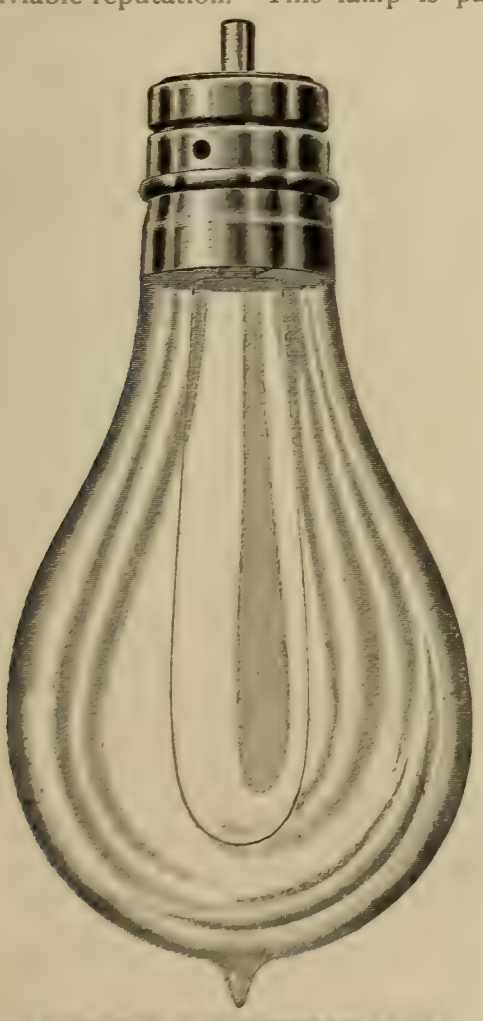
FIG. 1—PARTS OF SHADE HOLDER.

There are no screws used to fasten the shade holder. The method of fastening it is so simple that any one can apply it with greater speed and ease than any other style of shade holder. The annoying screw driver and the handling of small screws are done away with.

The "Remhof" Ring Locking Shade Holder is made to fit standard and special sizes, by A. Remhof, of 375-381 Kent Avenue, Brooklyn, N. Y.

IMPROVED INCANDESCENT LAMP.

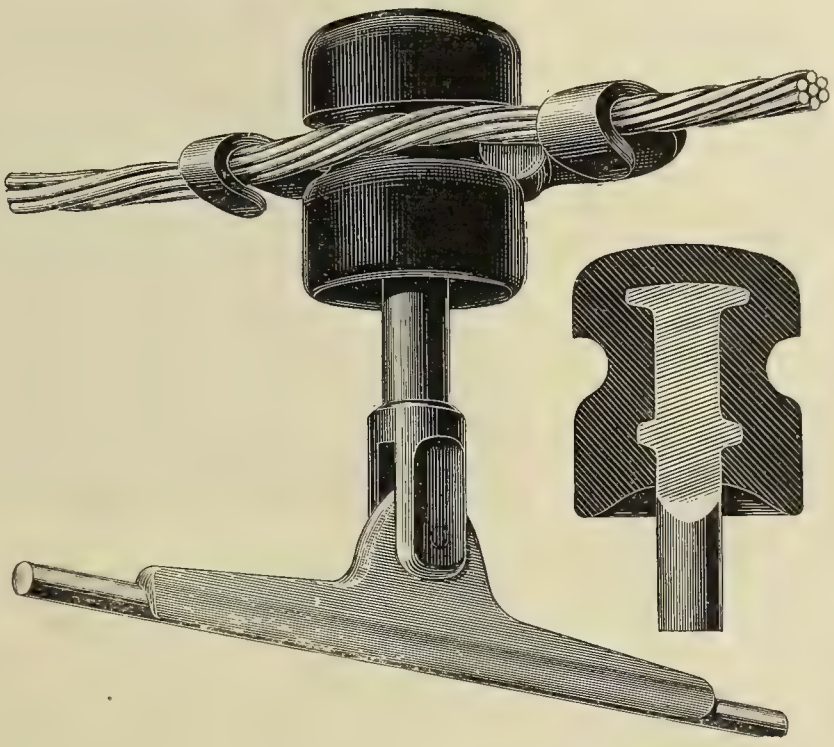
The Economic Incandescent Lamp, which we illustrate this week, has been on the market less than a year, but in that time has gained for itself a very enviable reputation. This lamp is particularly noted for its brilliancy of illumination, burning without discoloration and has long life. It also has the additional advantage of a very moderate price. The factory of the company located at Brockton, Mass., is thoroughly equipped with the latest improved mechanical apparatus and employs only the best skilled labor. The headquarters for these lamps are the Economic Electrical Mfg. Co., 1 Beacon St., Boston, Mass. The trade west of and including Ohio is supplied by the Northwestern Electrical Specialty Co., 1017 Chamber of Commerce, Chicago.



ECONOMIC INCANDESCENT LAMP.

THE CINCH INSULATOR.

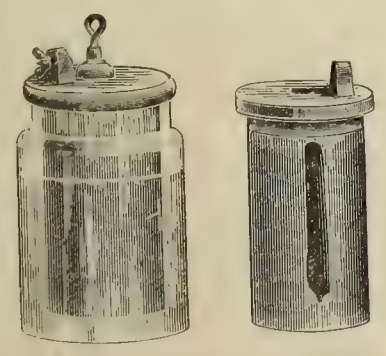
This trolley wire insulator has many distinct advantages, which has won for it the unqualified approval of every practical man who has seen it. The insulating material is comb stock rubber, the stem and yoke are of malleable iron, and the pin is of brass. The strains on the insulating material are solely those of compression. There are no screw threads or other parts subject to deterioration from exposure. It is claimed that the wire pin is more perfect in its details than any similar pins that have heretofore been introduced. The objects aimed at in the design of this insulator, are great strength, high insulation, small size, convenience, durability and cheapness. This insulator is manufactured by Messrs. Emmet Bros. & Griswold, 150 Broadway, New York, who will send a sample free to any one wishing to examine the insulator.



CINCH INSULATOR.

CRANDELL BATTERY.

The Crandell Manufacturing Company, of 49 South Fourth street, Philadelphia, have earned a well deserved success with their carbon battery, an excellent cut of which we give herewith. These cells are direct acting, strong and practically everlasting new sal ammoniac only being needed when the battery is exhausted or run down.



CRANDELL CARBON BATTERY.

This firm also manufactures to order all kinds of punched or turned work, besides electrical goods of all kinds.

The *Review and Record* is now conducting an exhibition of building material at 276 to 282 Washington street, opposite the new post office, Brooklyn, that is interesting to architects, builders and the public generally. Every kind of material used in the construction, finish, equipment and decoration of buildings is displayed. There is included a special exhibition of architects' drawings contributed by the leading architects of Brooklyn and New York, including many men of national reputation. The combined exhibition is free.

A NEW TRAILER CONNECTION.

On most of the electric railways in this country the current is used to light both the motor cars and the tow cars or trailers. For this purpose two pieces of flexible cord hanging from the end of each car are joined by a connection, which should possess a number of good points. Thus, its two parts must be interchangeable, since the cars are apt to be turned end for end. Then it must have large contact surfaces, and spring catches must allow it to pull apart when a train separates, instead of breaking the cord. This point is the more important as the men who handle the cars will sometimes forget to disconnect the lighting cords.



TRAILER CONNECTION.

Several connectors now in use combine the above points, but as their projecting ends are always in circuit, any one handling them is apt to get a five hundred volt shock. To avoid this unpleasant feature, Mr. Chas. G. Armstrong has designed a new connection, shown in the accompanying cut, in which the projecting metal parts are dead when disconnected. Each part has a brass spring catch as terminal for the cord, this catch being insulated from the projecting metal tip by a bushing of hard rubber. On putting the two halves together, each tip completes the circuit between the two metal parts of the other half. The contact surfaces are large, and the stiff springs insure a quick make-and-break. The end of each conducting cord is soldered into a brass tube as shown in the cut, and a knot in the cord takes the strain off this joint. The whole is put up in a tightly-fitting hard rubber shell, and is not much larger than the illustration. It is well made, and would seem to be just the thing for the purpose. It is being put out by Geo. Cutter, of Chicago.

DISCHARGING ACCUMULATORS.

When the plates of an accumulator are nearly discharged, that is, far below the minimum permitted, nearly all the paste on the positives is in the form of $Pb\,SO_4$. This soon decomposes into the higher sulphates which ruins the plates, and apart from other consequences, cause them to buckle when discharging is proceeding. It is, therefore, evidently essential to keep a residual charge sufficient to give an E. M. F. of two volts per cell. In fact, after being fully charged, the cells may be steadily emptied

to the permitted limit, giving practically two volts per cell the whole time. Then comes a rapid fall of pressure, soon reaching zero point.

Too quick a discharge buckles the plates, and a very sudden large discharge drives the paste out of them, although the current may be well within the maximum. Therefore when motors are started it should be done through a variable resistance, apart from the requirements of the motors themselves. For the same reason, large batches of lamps should not be simultaneously turned on. Quantities of gas driven from the plates at the moment of sudden, heavy discharges, causes the injury. A large sudden discharge may be regarded roughly as one of 30 per cent. of the maximum.

THE ELECTRICAL TRANSMISSION AND CONVERSION OF ENERGY FOR MINING OPERATIONS.*

BY H. WARD LEONARD.

The transmission and conversion of energy is above all others the question of importance in every kind of engineering work and in mining engineering this is most conspicuously true.

Until quite recently all practical methods of transmitting and converting energy involved the actual transfer of sensible matter over the distance in question and this matter necessarily possessed such qualities as weight, magnitude, temperature, inertia and other qualities common to all matter.

It is, therefore, not surprising that all engineers, and particularly mining engineers, are watching with the keenest interest the development of methods for transmitting and converting energy by means of electricity, for, in electrical problems, the many considerations and restrictions due to the inflexible characteristics of matter may be entirely disregarded and the possibilities of mining engineering are correspondingly increased.

The transmission and conversion of energy by water, steam, cables, compressed air, and so forth, we are all familiar with, and we know to our sorrow the limited distance, the low efficiency or the tremendous first cost which has hampered our engineering work at every turn.

With the utilization of electricity for the transmission and conversion of energy we absolutely reverse these conditions and are enabled to operate at practically unlimited distances, with extremly high efficiency and very low first cost.

The invention of the incandescent lamp marks the commencement of an era upon whose threshold we now stand and in which the possibilities of engineering will be extended to a degree we can, at present, have no adequate conception of. Until the Edison lamp was invented and introduced all distribution of electrical energy was by what is known as the series system, which did not lend itself readily to the development and use of electric motors. With the Edison lamps came the system of distribution on the multiple arc plan, and the commercial possibility and development of electric motors dates from that time.

The stationary electric motor, supplied from the lighting circuit, was naturally the first on account of the number and simplicity of its applications; then the motor was applied to propelling street cars and the modern electric street railway system was rapidly evolved. The electrical engineer in his search for "new worlds to conquer" next turned his attention to the mining field.

The great variety of the applications in this field, the distance from the mines to the principal cities where electrical developments have been most rapid, and the lack of knowledge as to the exact requirements have until recently made even the simplest applications of electricity to mining rather rare.

Perhaps the greatest stumbling block has been the percussion drill. Until recently, when a mine owner asked if we could transmit his power, light his mine and operate his pumps, hoists, tramways, and mills, we could confidently reply, "Yes!" But when he asked if we could replace or operate his air drills we were obliged to say, "Not yet."

Since the drill is the most universal of all mining appliances operated by power other than hand power it was not possible to make rapid progress until this deficiency was corrected.

The Edison General Electric Company has put upon the market in commercial form, during the past thirty days, three types of electric drills which will enable the mining engineer to accomplish all that he has been able to accomplish heretofore by other drills, and not only this but to accomplish far more than was heretofore possible and under conditions heretofore prohibitory.

First in importance comes the electric percussion drill, the invention of H. N. Marvin, of Syracuse.

Following is a brief description of the principal features of the drill:

Fastened upon a suitable tripod or column is a piece of boiler tube seven inches in diameter and about two and a half feet long. In the forward half of this casing are placed two cylindrical coils of wire in the form of solenoids, each about eight and a half inches long, having an outside diameter of about six and three-quarter inches, so as to make a loose fit with the casing, and an inside diameter of about two and one-eighth inches. These two solenoids are placed so as to be against each other end to end in the casing. The bit plunger plays freely through the centre of these solenoids and is supported by two bearings placed just beyond the outside ends of the two solenoids, respectively. The back portion of the casing contains a spiral spring of the form frequently used for car springs. The plunger is composed of a central portion made of wrought iron about fourteen inches long, and both the forward and back portion of the plunger, which are made of aluminum bronze, are rigidly fastened to this iron portion. The forward portion is about thirteen inches long and carries the bit socket. The back portion is spirally milled for a length of about nine inches so that the cross section of this portion is hexagonal. At the extreme back end is a steel buffer which strikes against the cushioning spring. The spirally milled portion of the plunger is similar to that used in other percussion drills, and causes the drill to revolve upon its axis one-sixth of a complete turn with each stroke. The ends of the coils of wire are brought to contact pieces at the top of the adjacent ends of the two solenoids, where there is a socket for receiving the terminals of the cable and thus making electrical connection with the drill. There are three conductors leading from the generator to the drill, one of which is connected to one terminal of each of the solenoids and the other two conductors are connected to the two remaining terminals of the solenoids respectively.

The generator is of the simplest kind, the coils on the armature having their terminals connected to two insulated collars on the shaft.

One collar is a continuous metallic ring and upon this one rests a brush which is connected with the conductor, which is common to both solenoids. The other collar is metallic for half of the circle and the remaining half is insulated from the armature wires. Upon this half ring rests two brushes diametrically opposite each other and each brush is connected to one of the two remaining conductors leading to the solenoids in the drill.

If we now revolve the armature of our generator in a separately excited magnetic field an electric current will flow, let us say, from the armature to the half ring then through one of the two brushes which happens at the instant to be in contact with the half ring along the corresponding conductor to one terminal of one solenoid, let us suppose the rear one, then through the rear solenoid itself and back along the mutual wire to the continuous ring and then to the armature again.

This current in passing through the rear solenoid makes a powerful magnet of it and this tends to pull the plunger back into a position such that the centre of its iron portion shall be in the centre of the rear solenoid.

When the armature moves forward a half revolution the polarity of its wires is reversed and the other brush with its conductor is now in contact with the half circle. Consequently the current in the mutual wire will be in the reverse direction from that of the former wave, the rear solenoid and its conductor, formerly active, are now out of circuit and the circuit is made through the other conductor and its corresponding solenoid, that is the forward solenoid.

The magnetic action of this solenoid now tends to make the plunger move forward so that the centre of the iron portion shall be in the centre of the forward solenoid.

Thus we get a reciprocating action of the plunger and every revolution of the armature of the generator will cause a complete stroke of the drill. By varying the speed of revolution of the generator we can make the drill strike any number of blows per minute we choose. In usual practice 600 blows per minute is found to give excellent results. The spiral spring, it will be observed, stores up the energy of the back stroke and returns it to the forward stroke, assisting the magnetic impulses and greatly increasing the strength of the blow.

In order that we may form an unbiased judgment of this drill I will quote the opinion of Andre, perhaps the best authority on power drills, and who many years ago stated the requirements of a first-class power drill to be as follows:

1. Simple in construction, strong in every part.
2. Few parts, especially moving parts.
3. As light in weight as can be made strong.
4. Take up little space.
5. Striking part of relatively great weight and strike directly.
6. Piston alone exposed to shocks.
7. Piston capable of variable length of stroke.
8. Sudden removal of resistance should not injure any part.
9. The rotary motion should be automatic.
10. The feed of machine, if automatic, should be regulated by the advance of the piston as the cutting advances.
11. Should be capable of working with moderate pressure.
12. Should be readily taken to pieces.

It may be sufficient to say that the Marvin Drill possesses every one of the good qualities Andre specifies and in a most marked degree, but, in describing the good qualities of this drill, we can if necessary, add considerably more than Andre specifies. For example:

1. It is simple in construction and strong in every part.
2. It has a minimum of moving parts, that is one.
3. It is very light in weight for its strength, this being possible because of the perfect cushioning at both ends of the stroke.
4. It takes up very little space.
5. The striking part is of relatively great weight and it strikes directly.
6. The length of the stroke is variable at will.
7. The drill cannot damage itself by its own blow.
8. The rotary motion is automatic.
9. It has very few parts.
10. It can be entirely taken apart and put together again inside of ten minutes.
11. There are no joints to be fitted or packed.
12. It is not affected by heat or cold.
13. It can be operated at great distances from the source of power.
14. It has a much higher efficiency than other drills.
15. It is independent of the action of any valve.
16. The rate of striking is independent of the kind of material it strikes.
17. It will operate in the open air without striking anything, and hence can be made to strike an extremely light blow at its full rate which is very important in starting holes, and so forth.
18. It can be rapidly moved from one position to another at a great distance, since the energy is transmitted through flexible cables.
19. No loss is suffered due to elbows, bends, valves, and so forth, in the conductors.
20. The conductors can be carried on very light supports both because of their light weight and because the transmission of energy through them does not tend to distort their position.

The importance of the above characteristics will be apparent to anyone who is familiar with the operation of the steam and air drills.

It is interesting to note that in driving the Hoosac Tunnel the average life of the power drills, before sending them to the shop, was 50 hours. Even to-day, after a development of twenty-five years, we find that it is common practice to have in the shop one-half the total number of drills employed.

In pushing engineering work it is frequently of paramount importance that the work be done quickly. Therefore, any means of greatly increasing the rate of drilling is extremely valuable. To increase the rate of drilling we must either increase the strength of each blow or else we must increase the number of blows per minute. A limit to the rate of striking is soon reached when a valve of considerable weight must be moved from rest by the concussion of the previous blow and when a material substance, such as air or steam, must then fill the space back of the piston and raise the pressure to the working pressure. Also the strains and shocks caused by the valve and the air or steam soon become troublesome as we increase the rate of striking. With the elec-

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tric drill the speed of rotation of a perfectly balanced cylindrical armature of small diameter has no such limitations and there is apparently no limit to the rate of striking, except the magnetizing and de-magnetizing of iron which is already done in daily commercial practice at the rate of 10,000 times per minute with the highest efficiency.

With 800 blows per minute we have already drilled at the rate of four inches per minute a hole 1½ inches in diameter in the hardest Quincy granite, and that with an expenditure of energy not exceeding 3 horse power.

I firmly believe that in a comparatively short time we will be furnishing percussion drills whose rate of striking will be several times as much as that we now employ, and that with no more and no heavier drills than are now used the rate of driving a heading will be increased many times. The importance of rapid driving of work is practically illustrated by the fact that in driving the Sutro Tunnel Mr. Sutro offered the men at work, in addition to their regular wages, the following bonus:

For every foot per month over 300 and under 400, $5.

For every foot per month over 400 and under 500, $10.

For every foot per month over 500, $20.

A bulletin from the Census Department, under date of March of this year, shows that in granite quarrying the cost of labor is 84 per cent. of the total cost of production, and in Massachusetts, where the out-put is much greater than in any other State, and where the longest experience and most approved methods are met with, the labor is 82½ per cent. of the total cost. It will be evident that any labor-saving device in such a field will be extremely valuable.

Another drill of great value to the mining engineer is the diamond drill. The Edison General Electric Company have, during the past thirty days, put upon the market an electric diamond drill which they have been developing for the past two years. The drill is the invention of I. E. Storey of Denver. It presents a great many advantages over the diamond drills heretofore used, as will be evident from the following description of it.

The drill weighs complete 239 pounds. The average power consumed is about 1¾ h.p. and with this expenditure of power the drill will bore a hole of 1¼ inches diameter in hard rock at the rate of two inches per minute, taking out a core of ¼ of an inch. The drill-rod is rotated at the rate of 400 revolutions per minute without any load, and when drilling at full load the speed is practically the same.

The drill-rod is geared by a single set of gears to an electric motor which revolves at 1,600 revolutions under conditions of full load. The motor has four poles and the keeper joining the poles is in the shape of a surrounding cylindrical shell, which thoroughly protects all the parts of the motor and other parts of the machine.

Upon the drill-rod is placed a rotary pump which supplies the drill with the necessary water.

In using the diamond drill the following points are of great importance:

1. The speed should be uniform and automatically controlled very closely, so that removing the load quickly will not permit the drill to run away.

2. The drill should be extremely steady, as any material vibration transmitted by the drill-rod to the diamond points is disastrous to them.

3. The drill should run at as high a rate of speed as is consistent with smooth drilling and a proper supply of water.

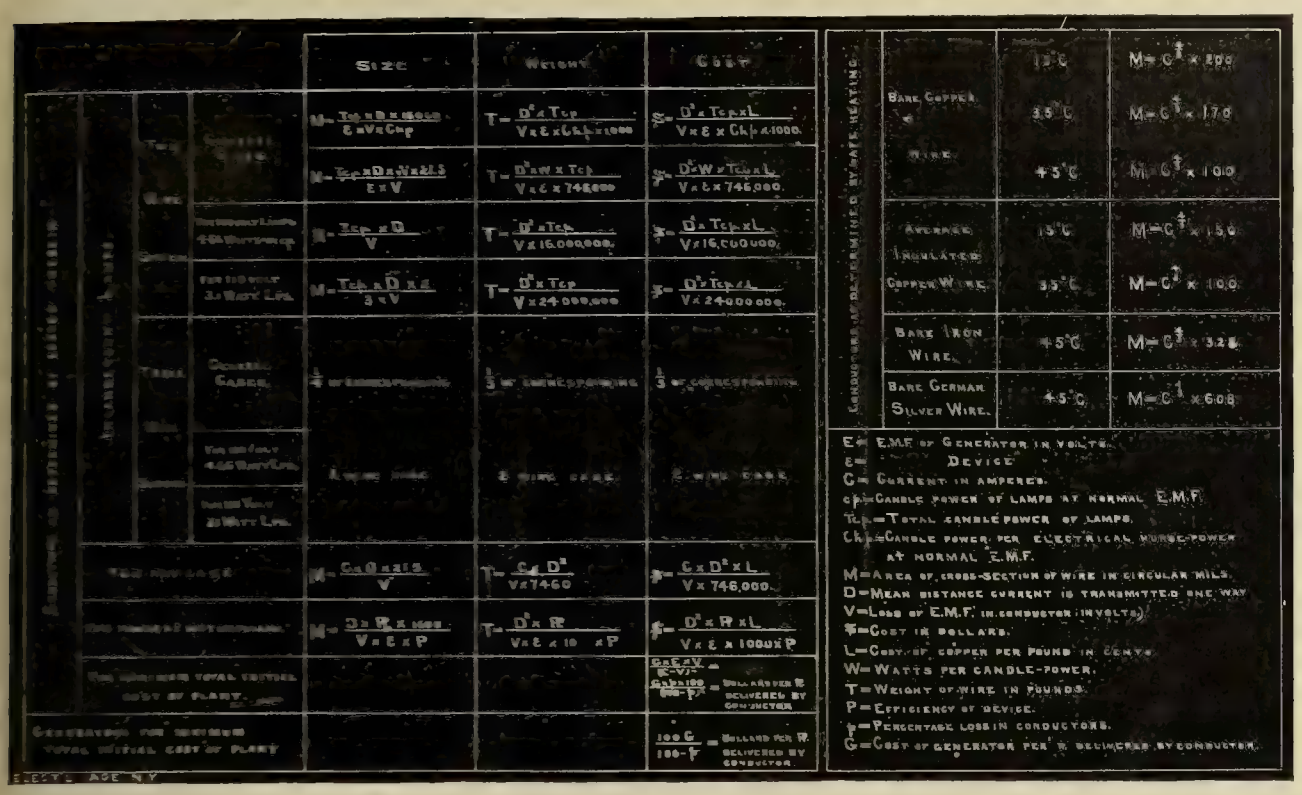


FIG. 1—ELECTRICAL TRANSMISSION FOR MINING OPERATIONS—TABLE OF FORMULÆ.

4. The drill should be as light and compact as is consistent with the requisite strength.

5. The drill should be capable of being readily and rapidly moved considerable distances and put into operation again with the least loss of time.

Up to the present time diamond drills are operated by reciprocating engines, and the engine is fastened upon the same frame as the drill-rod, to which it is geared by suitable gearing. The engine usually has two cylinders of the oscillating type, to reduce the vibration as much as possible and eliminate the dead points. With these small engines it is practically impossible to automatically get the close regulation of speed which is desirable, and hence the speed is governed entirely by hand throttling, and the engines cannot be run at a very high speed because of the vibration they would produce and because of the rapid depreciation of such engines at high speed. It, therefore, becomes necessary to gear to the drill-rod by gearing which is often times objectionably large, and would become even more so if a higher speed upon the drill-rod were attempted as is desirable. The space occupied by the drilling machine is quite large as the engine, gears, etc., occupy much space. This is a great objection in cases of operation in tunnels, shafts, and so forth.

With the electric drill the motion is free from any jar, as there are no reciprocating parts, and the speed can be made absolutely constant under any condition of load up to the full load. The speed of the drill-rod can be made anything desired—up to several thousand revolutions per minute if required—and under any conditions of speed above 1,600 per minute there would be no gears whatever. The weight of the electric diamond drill is, for the same power, much less than that of the steam diamond drill and the space occupied is in a direct line with the hole, and is extremely small in amount.

The drill can be operated from any existing electric light circuit, and the current for it can be supplied at two miles distance from the source of power by wires of size No. 10 B. W. G., having a diameter of about ⅛ of an inch. The drill can be carried whenever a man can carry 35 pounds, which is the weight of the heaviest single piece, and hence can be set up and operated in the most inaccessible places.

It will be evident that for prospecting work, when a certain territory is to be explored, this drill is particularly adapted.

Starting from a convenient and economical source of power, we can, if desirable, lay our wires along the surface of the ground, and in a very few hours can be operating our drill miles off. We can then reel up our wire and lay it again in an exactly opposite direction, and again be in operation at perhaps five or ten miles away in the course of a few hours more. In laying the wire, a couple of horses yoked abreast and carrying a reel is all that is necessary. For operating at a distance of one mile in any direction the diameter of the wire necessary is but $\frac{1}{10}$ of an inch and the total weight of the wire only 340 lbs.

The facility with which prospecting and also drilling in permanent works, such as mines, can be done with this drill will no doubt lead to its rapid and general use.

There is every reason to expect that with the electric diamond drill the speed of the rotation of the drill can be very greatly increased with consequent increase in the rate of drilling, which is of the greatest importance.

The Edison General Electric Company have a third kind of drill which is a rotary high speed drill, having a solid steel bit, and this drill is used for drilling coal and similar comparatively soft materials, and also for drilling metals, where it will have an extensive use in the construction of steel ships and bridges and similar works where

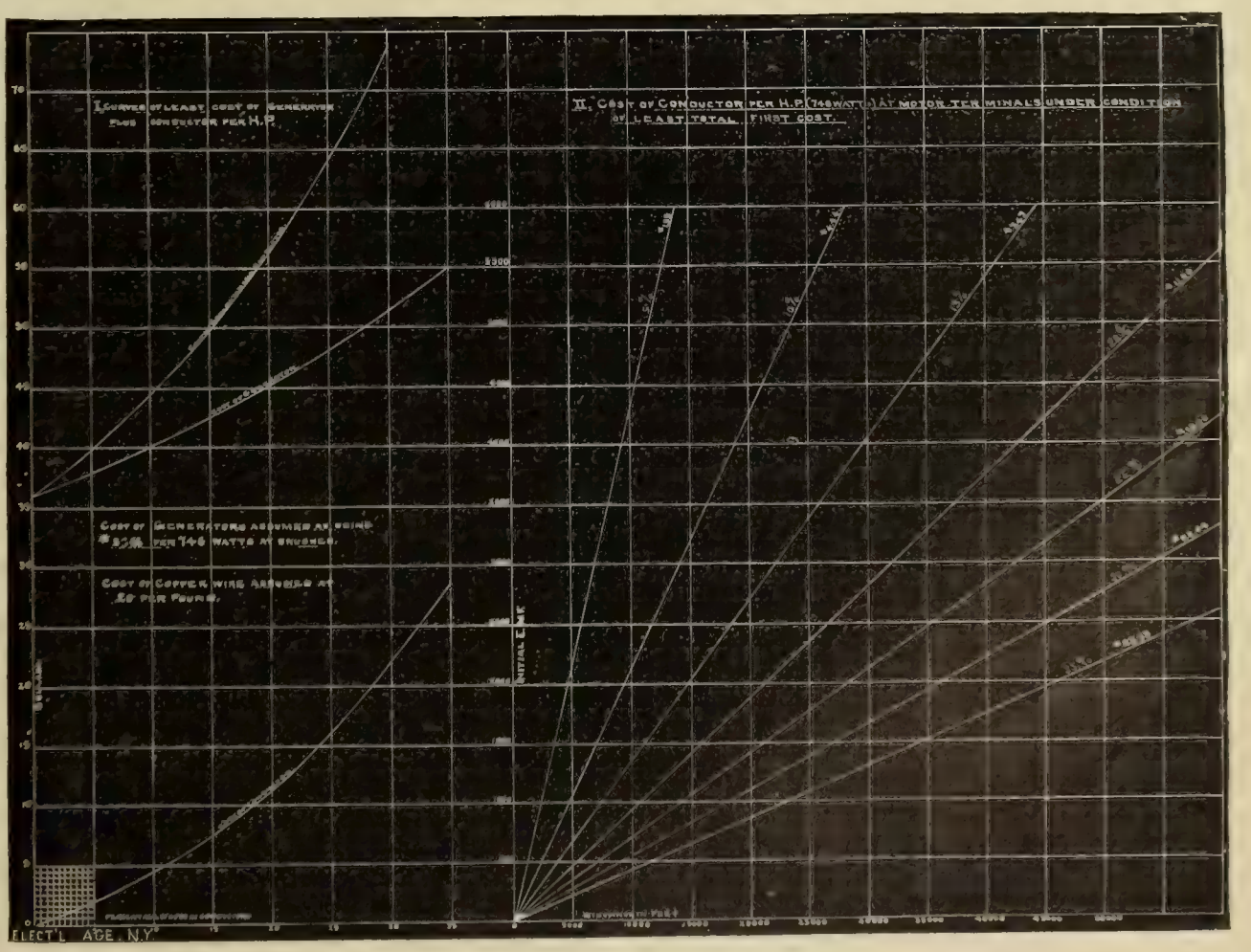


FIG. 2—CHART SHOWING LAWS GOVERNING CONDITIONS OF MINIMUM COST.

the drill has to be taken to the work rather than the reverse.

With the three drills which I have described, the Edison Company is now able to do any class of drilling desired, and these drills are likely to play an important part in the future of mining engineering.

The electric mine locomotive, and the hoists, pumps, ventilating fans, crushers, stamps, and so forth, operated by electricity are instances of the application of electricity to mining which have already proved themselves entirely successful. The under-cutting of coal by electricity is an important field in which the Edison Company has made great strides, the machines being of two entirely distinct types, which becomes necessary in order to properly comply with the conditions met with in practice in different mines.

The electric refining of metals, especially of copper, is an extremely interesting subject to the mining engineer. The Edison Company have established the majority of the plants of this nature in the United States; and I need only say that the results are highly economical and most satisfactory in every way.

The electrical transmission and conversion of energy at great distances is destined to come up in nearly every mining problem in the future. Mines are usually in a mountainous country, and it is seldom that a water power cannot be found within a few miles of a mine. The mining engineer in the immediate future will develop this water power, convert its energy into electric energy, in which shape he will transmit it to the distant mine, when it will be again converted into the various forms of energy which he may have occasion to require.

Among the applications will be the following:

1. The lighting of the mines and the buildings and grounds by arc and incandescent lamps.
2. The operation of any machinery in the mill, such as crushers, stamps, and so forth.
3. The operation of the drills.
4. The operation of the hoists.
5. The operation of the pumps.
6. The operation of an electric tramway in the mine.
7. The operation of ventilating fans.
8. The heating of the buildings when fuel is scarce.
9. The refining of copper and recovery of gold and silver in certain cases.
10. The concentration of magnetic ores in certain cases, such as iron, nickel, and so forth.

In order to give you a commercial idea of a plan such as is likely to be used in mining operations in the immediate future, I will suppose a case and give you an estimate of the first cost and operating expense of such a plant. Let us suppose that we have a mine where we have to operate the following devices:

360 incandescent lamps of 16 c.p. each.
10 arc lights.
1 hoist requiring 30 h.p.
1 pump requiring 20 h.p.
6 percussion drills for drilling 1½ inch holes at the rate of three inches per minute.
2 rotary diamond drills 1¼ hole ¾ core rate 2 inches per minute.
1 mine locomotive 10 h.p.
Milling machinery requiring 30 h.p.
Heating requiring 10 h.p.

The total power required for the above will be 180 h.p. delivered by the main motors. Suppose that at a distance of 3 miles there is a good water power which can be developed and equipped with water wheels to produce 300 h.p. by an expenditure of $15,000. In considering transmission of the power by electricity, we must first determine what loss we shall sustain in transmission, and then we must determine what electrical pressure we will operate with.

In designing such a plant there are certain fixed laws governing the conditions of highest economy and minimum first cost; and some years ago I investigated these questions and reduced formulæ expressing these laws.

These formulæ are given in tabular form in the accompanying Fig. 1. I have also expressed the laws governing the conditions of minimum initial cost graphically in Fig. 2.

It may be interesting to note here in passing, a fact which you will observe by examining the formulæ given, namely: If we pay proper attention to the laws governing the highest efficiency and the least first cost, the cost of the conductors for the plant will depend solely upon the initial E. M. F. and the distance. Thus under practical conditions to-day, if we are to operate with 2,000 volts, E. M.F. at a distance of five miles, the minimum first cost would be realized when we operate with a loss of 20¼ in conductors. The cost of copper (at 20 cents per lb.) for each horse-power delivered at the motor brushes under those conditions would be $7.47. This simple but invariable law which is embodied in the formulæ given herewith, you will find of great assistance to you in considering questions of electrical transmission.

You will also notice that the formulæ show that for any given percentage of loss, the electrical pressure to be employed will vary directly with the distance. Thus, for 20 per cent. loss the cost of copper being $11.20 per horse-power delivered at motor brushes, the E. M. F. necessary for transmission of 15,000 feet will be 1,500 volts at 32,000 feet we should use 3,000 volts and at 9,000 feet 750 volts.

In order to secure the 160 h.p. necessary at our various devices in and about the mine, we must deliver 200 h.p. to our main motor in the form of electric energy in the conductor at the brushes of the motor. With 25¢ loss in conductors this will mean 266 h.p. at the generator brushes, or 300 h.p delivered by the water wheels.

For the sake of reliability and economy we will use two generators instead of one, each being 133 h.p. At the mine there will be two main motors of 90 h.p. each, wound for 900 volts and 83 amperes, producing a total of 180 h.p. which will drive the drill generator of 17 h.p. and a generator of 250 volts and 300 amperes for operating the incandescent lamps, the arc lamps, the locomotive, the hoist, the pump, the diamond drills and the heating. The main motors will also supply the milling machinery with the necessary 30 h.p.

By formulæ on Fig. 1, we find that to transmit 180 h.p. three miles with 25 per cent. loss, and an initial pressure of 1,200 volts, there will be required a wire having a circular millage of 190,000 circular mils; this is having a diameter of 436 thousandths of an inch, or a little less than half an inch.

We find by other formulæ on sheet No. 1, that the copper will weigh 20,000 lbs., and will cost $4,000, which results check each other and prove the accuracy of the calculation.

We are now able to make an estimate for the total plant, as follows:

Estimate of cost of plant for transmitting 180 h.p. a distance of three miles with a loss of 25 per cent. in conductors, the plant to comprise the apparatus as specified:

Developing original water-power and installing water wheels of 300 h.p., -	$15,000
2 generators 100 KW each (1,200 v—83 amp. each) at $36 per K.W. -	7,200
2 motors 75 K.W. each (900 v—83 amp.) at $36 per K.W., - - - - -	5,400
Copper 32,000 feet No. 000 B.W.G. -	4,000
1 6-drill generator, - - - - - -	2,000
1 generator of 250 v 300 amp. 75 K.W. at $36, - - - - - - -	2,700
6 electric percussion drills, - - -	3,300
2 electric diamond drills, - - -	1,100
360 incandescent lamps and appliances, -	360
10 arc lamps, - - - - - -	220
1 30-K.W. hoist, - - - - - -	2,255
1 20-K.W. pump, - - - - -	1,595
1 10-K.W. locomotive - - - - -	1,815
Heaters 10-K.W., - - - - -	600
Conductors for all secondary transmissions, - - - - - - -	1,000
Labor of installation, - - - - -	3,000
Poles, - - - - - - - - -	455
Freight, cartage and sundry expenses,	1,000
Total, - - -	$53,000

The operating expenses of such a plan will be those mainly due to the wages of two men for each shift, one at the water-power and one at the mine.

A fair allowance for depreciation and repairs will be 5 per cent. per annum of the first cost.

The operating expenses will therefore be about as follows:

1 first operator, - - -	$ 900 per year.
1 second operator, - - -	600 " "
Depreciation and repairs 5 per cent. on $53,000, - - - -	2,650
Sundry incidental expenses, -	250
	$4,400

The production of the same power by steam, when coal is $2 per ton, and labor such that an engineer's wages are $2 per day, would be not less than double this amount; and in many instances where water and fuel suitable for the generation of steam are difficult to obtain, such a plant would represent a saving of its entire first cost every year.

ELECTRIC RAILWAY NOTES.

The Electric Street Railway Company, of Allentown, Pa., will soon commence work on their new road between Allentown and Bethlehem, Pa. Fifteen cars have been ordered from the Briggs Carriage Company, of Amesbury, Mass.

The Edison Company has secured the contract for the construction of the electric street railway lines at Charlotte, N. C. It is expected that the road will be completed about the middle of May.

The rolling stock of the Consolidated Street Railroad of Columbus, O., was increased during April by the addition of ten electric cars.

The Western Electric Construction Company, of Kansas City, are pushing the work on the Denver, (Colo.) and Suburban Street Railway. The company is at present having trouble with the City Cable Company over the possession of the Champa crossing.

The Rapid Transit Company, of Colorado Springs, Colo., have added a 40 horse-power Richard's electric track cleaner to their equipment. A 30 horse-power motor is used to drive the brushes.

The Rapid Transit Company, of Beatrice, Neb., have commenced construction work on their new electric line.

The stockholders of the Atlantic avenue Railroad Company, of Brooklyn, have voted to increase the capital stock from $1,000,000 to $2,000,000, the increase to be used in reconstructing and equipping the road with electrical power.

The Gilbert Car Manufacturing Company, of Troy, N. Y., are building twelve electric cars for the Buffalo Street Railway Company of Buffalo.

The large amount of traffic on the new Westinghouse electric road at Flushing, L. I., have set the company thinking about the extensions to their lines that will soon be needed.

The new street railway at Glens Falls, N, Y., is being equipped with Westinghouse motors.

The Seattle Electric Railway Company, of Seattle, Wash., will soon add twelve new cars to its equipment, to accommodate the summer traffic.

Efforts are being made to induce the Jersey City and Bergen Railway Company, of Jersey City, to extend its lines to Greenville, Bayonne and Bergen Point.

The Common Council, of Detroit, Mich., has been petitioned by the Detroit Suburban Street Railway Company for a franchise to run electric cars from the western city limits to some point near the City Hall.

At a meeting of the stockholders of the East St. Louis, (Ill.) Electric Street Railway, it was voted to issue $50,000 in six per cent. bonds to run fifteen years.

TheHelena, (Mont.) Electric Railway Company, have applied to the City Council for the privilege of restoring ten cent fares. They claim that the five cent rate does not pay.

East Liverpool, O., is to have an electric street railway.

Grand Rapids, Mich., is changing its cable system of car propulsion to the electric system.

The Westinghouse Company have been given the contract for furnishing the new street railway at Kankakee, Ill., with their motors.

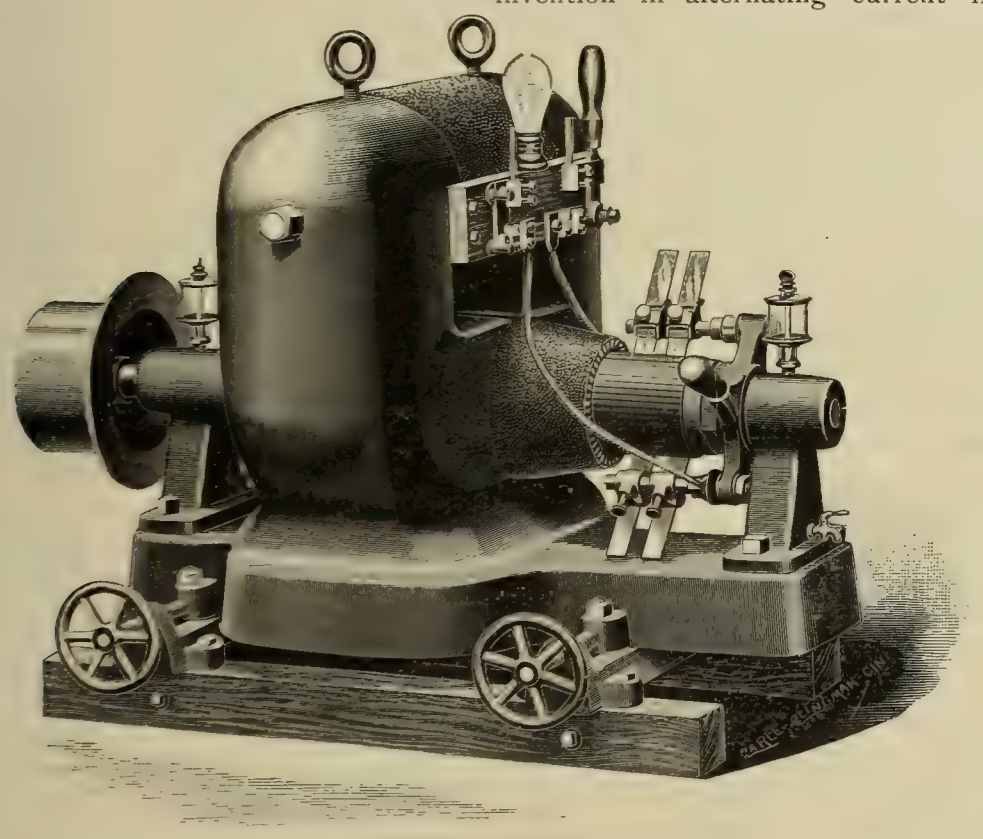
Six new motor cars have just been added to the equipment of the Muskegon, Mich., electric railway.

THE HOWARD DYNAMO.

The accompanying cut represents the Howard Dynamo, manufactured by Hiram M. Howard & Co., Cincinnati, Ohio.

It has been the aim of the manufacturers of this dynamo to produce a machine that will embody the highest attainable efficiency with the simplest form of construction and fewest number of parts, that the machine may at once be a strictly first class production and yet be made at a moderate cost and sold at a correspondingly low price.

The field magnet has a single magnetic circuit which, being rendered exceedingly low in magnetic resistance by the material used and the proportions of the various parts, needs only one coil to bring the magnetism up to a sufficiently high point to bring the electromotive force up to the desired point at a moderate speed. The core is built up of charcoal sheet iron and by means of special machinery is made round and very dense, with the striæ of the sheets lying in the direction of the lines of force. The pole-pieces are each a single casting of charcoal iron and are very massive, having a sufficient cross-section to give that part of the magnetic circuit the same magnetic conductivity as the core. The coil is compound, having a high resistance in the shunt with only a few turns in the series.



HOWARD DYNAMO.

The armature is of the drum type, having the usual laminated core. Its marked peculiarity is in the method of winding, which is done with a flat or ribbon-like conductor, wound in such a manner that a sufficient number of turns having a large area of cross section can be put on the armature core still maintaining a short distance between the core and the faces of the pole pieces.

In the 300 light machine the armature has eighty turns in the conductor, the resistance of which is 0.02076 ohms. The series coil of the field has a resistance of 0.00858 ohms, the shunt coil has 19 ohms.

These machines are at present built in twelve sizes, ranging from 10 to 500 light capacity, and are also wound for motors from ½ to 35 horse-power. The motors are wound for 110, 220 and 500 volt current.

There have been a number of these dynamos lately installed at various points throughout Ohio, Kentucky and Indiana and their operation speaks well for them. The motors also have justly won their manufacturers a reputation for a high class of work.

Incorporated.—The Akron Electrical Manufacturing Co., Akron, O., has been incorporated and will manufacture motors, dynamos and general electrical supplies.

MEETINGS OF CLUBS AND SOCIETIES.

THE BUFFALO ELECTRICAL SOCIETY.

Mr. Frank Kitton, chief operator of the Western Union Telegraph Company at Buffalo, read a paper before the Electrical Society of Buffalo, on May 4th, on the subject of the "Tangent Galvanometer." The lecture was very interesting and highly appreciated by those in attendance. Mr. Kitton explained in a very clear manner the various uses of this most valuable instrument.

FRANKLIN EXPERIMENTAL CLUB.

The Franklin Experimental Club, of Newark, held its thirty-first regular meeting at the Club Laboratory, Tuesday evening, May 5th. The President, Mr. Wm. J. Hammer, read a finished and scholarly paper entitled "The Arc Light."

As illustrating the rapid development of this industry, the speaker instanced the fact that there was exhibited at the Centennial Exposition, in Philadelphia, in 1876, but a single arc system —the Wallace—while now arc lights are burning everywhere and are numbered by the thousand and the hundreds of thousands. Mr. Hammer summed up the problems confronting the arc light men and called attention to the field for invention in alternating current lights. The paper was illustrated by diagrams prepared and mounted for the occasion.

Mr. F. M. Crane spoke on electric railroads. He compared the three systems which are striving for supremacy in this field—the trolley, the storage and the conduit.

At the next meeting, May 19th, Prof. Geo. C. Sonn will read a paper on the phenomena of earthquakes, and will illustrate it with lantern slides. Mr. Earl Atkinson will speak on electric motors.

At the first meeting in June it is expected that Mr. Nikola Tesla will address the Club.

Serves Him Right.—The National Street Railway Convention is to be held in Pittsburg next October, and steps were taken recently to secure suitable accommodations for the delegates at the Monongahela House, Pittsburg. The proprietor of that institution, however, does not believe in entertaining members of conventions, and has refused absolutely to grant any concessions. He has refused to allot rooms and name prices for accommodations, and has announced that he will pay no attention to early applicants, but will let his rooms to the highest bidder. The result of his cupidity will be that he will probably not get any of this trade, as already a large number of delegates have secured quarters at another hotel.

BOOKS AND CATALOGUES RECEIVED.

J. A. Berly's Universal Electrical Directory for 1891 (the tenth year of its publication) just out, is more complete than ever. It gives the adresses of all concerns and individuals connected with electrical industries on the Continent, America and Great Britain. It is very complete, and a valuable work for every one engaged in the electrical trade. It is published by William Dawson & Son, London, and is thoroughly revised.

With the beginning of the month of May most people expect to move, and it is no unusual sight to see storage vans carrying "grids" and "plates" from one installation to be planted elsewhere. To be in the current, the Consolidated Electric Storage Co., of 120 Broadway, New York, moved along with the van with a new catalogue of the Julien storage batteries. The main "elements" of the catalogue are its neatness and completeness, and we read over the large accumulation of details and formula without a "jar."

We have received from Mr. Allen R. Foote, of Washington, a copy of his paper read before the Tax Payers' Association of Baltimore, Md., Tuesday, April 28. The title of the paper is "Municipal Ownership of Quasi-Public Works."

ST. LOUIS NOTES.

A. A. Wicks, manager of the Telephone Exchange, at Alton, Ill., was probably fatally injured last week by the falling of a pole, at the top of which he was making some changes in the wires.

The anticipated strike of the Electric Wiremen and Linemen's Union did not materialize on May 1st. Many of their members express themselves as satisfied with present conditions, and their opposition to going out prevailed. Most of the other trades unions concerned appear to have won the fight, the employers conceding an eight hour day. It was rumored that the Western Union Telegraph Company notified some of their linemen, who were members of the Wiremen's Union, that they must withdraw from it or they would be dismissed. This has been denied and the denial is doubtless correct.

Mr. Chas. P. Higgins, manager of the Western Union Board of Trade Office, has been appointed superintendent of the Municipal Fire Alarm and Police Telegraph system.

Postmaster Harlow is agitating a scheme to utilize the Cable and Western street railway conduit—which is about to be vacated in consequence of the change of motive power by that line from cable to overhead electric—for pneumatic tubes in connection with the post office delivery system. The vacant conduit would afford a fine opportunity for experiment in this and several other directions.

Bills granting franchises to several new electric street railway lines are now before the municipal assembly.

The Laclede Gas Company will soon be in complete possession of the facilities for lighting the city, as it will this month secure the Municipal Electric Lighting and the Missouri Electric Light and Power Companies, by an outright purchase of the plants and franchises.

Consulting Electrician.—Mr. S. D. Greene of the Edison General Electric Co., has been elected and has accepted the position as consulting electrician of the Burton Electric Co., of Chicago. Mr. Greene has for a number of years taken a great interest in the heating of street cars by electricity, and the Company deems itself fortunate in having secured his services.

Conventions.—The Railroad Telegraph Superintendents' Convention takes place in Cincinnati, in June; that of the National Electric Light Association in Montreal, in August and the National Telephone Association meets in New Orleans, in September.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOMS 7-12, WORLD BUILDING,
NEW YORK, May 9, 1891.

Mr. W. H. Markland, electrician for the Pennsylvania Railroad Company, at Altoona, Pa., was in town last week.

Secretary J. W. Beane, of the National Electric Light Association, announces that the office of that association is now located at 136 Liberty street, this city.

Messrs. Tucker & Hall, electrical contractors, will move into the Electrical Exchange Building during the present week. They will occupy two elegant rooms, Nos. 232 and 234. They report great activity in their line of business.

Mr. Frank C. Mason, Superintendent of the police service in the City of Churches, proposes to have his system the very best in the world. It is already considered excellent, but constant improvements are making it even more so.

Mr. Frederick Pearce has been awarded contracts from the Police Department of Brooklyn, for furnishing patrol boxes and equipping the police central offices. Duplicate sets of instruments are to be at once placed in the offices.

Mr. B. Blum, of the Kemble Building, this city, has lately bought out the interest of his former partner, Mr. E. B. Hess, and is now carrying on the business of export agent on his own account. Mr. Blum has been appointed the agent for the New York Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, Md.

The business of C. C. Sibley & Company has been purchased by the Interior Conduit and Insulation Company, and Mr. C. C. Sibley has accepted the general managership of the Universal Arc Lamp Company, with offices at Nos. 42–44 Broad street, this city. Mr. Sibley is a well known and enterprising gentleman, and it is safe to predict a large increase in the business of the company with which he is now connected.

The Engineering Equipment Company, contractors for steam and electric equipment materials, and manufacturers' representatives, have taken possession of their new quarters in the Central Building, 143 Liberty street, this city. This company will continue to carry a stock of Underwood's belts and Habirshaw wires at their old place of business, 73 Cortlandt street and they represent among other concerns, the Underwood Manufacturing Company, Albert and J. M. Anderson and the Indurated Fibre Pipe Company.

The annual meeting of the New England Telephone and Telegraph Company took place at 18 Cortlandt street, May 4th. The following officers were elected for the ensuing year: President, Thomas Sherwin; Vice-President, Henry S. Hyde; Secretary, Samuel W. Leedom; Treasurer, William R. Driver; Executive Committee, J. E. Hudson, Moses G. Parker and Thomas Sherwin; General Manager, Jasper M. Keller; Auditor, Samuel W. Leedom. The following were elected Directors: Frederick Ayer, Leonard F. Beckwith, John H. Cahill, Joseph P. Davis, Benjamin C. Dean, William H. Forbes, Edward W. Bell, John E. Hudson, Henry S. Hyde, John Jameson, Joseph Kavanagh, E. P. Meany, Moses G. Parker, David B. Parker, Stephen Salisbury, W. D. Sargent and Thomas Sherwin. The directors' report shows the gross earnings for the year ending December 31, 1890, to be $1,383,767.58; the expenses, $1,045,039.53, and the net earnings, $338,630.05.

Jesse H. Lippincott, President of the North American Phonograph Company, No. 10 Wall street, and sole licensee of the American Graphophone Company, made an individual assignment on May 4th. It is said that the liabilities are about $500,000 and the assets probably $400,000, in stock of the two companies. It is also said that the assignment does not affect the companies. His own means were tied up in these stocks, and his personal obligations were so large that he found it impossible to meet them as they matured. The North American Phonograph Company was organized in July, 1888, under the laws of New Jersey, with a capital of $6,600,000, Mr. Lippincott owning about 80 per cent. of the capital stock. The company sold territorial rights to about forty companies. Mr. Lippincott was also licensee of the American Graphophone Company, of Washington, controlling the sale of its graphophones, and taking the output of the company's factory at Bridgeport, Conn., paying a royalty of $100,000 per year. The phonograph and graphophone contracts are capitalized in the North American Phonograph Company, which controlled the sale of both. Mr. J. Robinson, the treasurer of the North American Phonograph Company, is also reported to have assigned about the same time.

The Tucker Electrical Construction Company, 20 Whitehall street, this city, are installing three Mather dynamos, two of 800-light and one of 500-light capacity (16 c. p. lamps), in the big wholesale dry goods house of H. B. Claflin & Company, Worth, Thomas and Church streets, New York. They have one 500-light Mather dynamo in use now, and there will also be one 500-light dynamo installed in the new addition to their building, corner of Thomas and Church streets. The large order taken by the Electric Construction and Supply Company, of 18 Cortlandt street, for 185 "Ward" Arc Lamps, to be installed in H. B. Claflin & Company's handsome warerooms, will be run from these dynamos. The Tucker people are also installing 500 16-candle power Perkin's lamps in addition to the 500 of the same make now in use, and they are using the Bishop Gutta Percha Company's best insulated wire throughout in this installation. There will be thousands of feet used. The Perkins switches will also be used, and there will be separate circuits run from a handsome switchboard in the basement to each floor. The Tucker Company have just closed a large contract for a 500-light, 16-candle-power, plant (Mather dynamo), for the Pearce Building, Franklin and Hudson streets, New York, including one Phœnix engine built by Dick & Church, of Meadville, Pa. Messrs. White Brothers are the agents for these engines, at 15 Cortlandt street, and are meeting with much success in the sale of these machines. The Tucker Company will use in their installation the new automatic push button switches, made by the Interior Conduit and Insulation Company, of 42–44 Broad street, who lately absorbed the Bergmann Gas and Fixture Company. Mr. S. Bergmann is the inventor of the new automatic switches, and this is said to be the first installation in which they have been used. In one of their construction jobs on Fifth avenue, the Tucker Electrical Construction Company are running three different circuits to every outlet, so that each can be lighted from three different points. For instance, all the halls may be lighted from the second story front room, and the halls may be lighted on entering the front door of the house. Any number of lamps may be lighted in one room from three different points, giving a difference of illumination from one to three lights. The Perkins lamps are meeting with excellent success, through the sales of the Tucker Electrical Construction Company.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	4 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 50
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	115 00
Averell Insulating Conduit	3,000,000	100 00	6 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	207 00
Bell Telephone 7's			112 00
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5s	6,000,000		par
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Illuminating (N. Y.)	1 000,000	100 00	60 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	10 00
City Electric Street Ry. Co., 6's	200,600		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	106 00
Complete Elec. Con. Co, N. Y.	50,000	100 00	175 00
Consolidated Electric Light	2,500,000	100 00	50 00
Consoli'd Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Consol Gas & E.L.Co. of West Co.6's	250,000		par
Consol Gas & E. Co. Batavia, 6's	80 000		par
Consolidated Gas Co. Batavia	100.000		
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Detroit Electric L. & P. Co.	300,000		12 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600 000		par
East River Electric Light Co	1,000,000	100 00	85 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	2,000 000		*99
Edison Illuminating (N. Y.)	4,500,000	100 00	99 50
Edison General	14 000,000	100 00	100 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Erie Telephone			49 00
Essick Printing Tel.	5,000,000	100 00	50 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	13 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500.000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*95
Laclede Gas Co.	7,500,000	100 00	16 25
Laclede Gas, pref.	2,500,000	100 00	48 00
Laclede Gas 5s	10,000,000		*75
Law Telephone	400,000	100 00	96 00
Long Branch Electric Light	50,000	100 00	78 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		
Manhattan Elec. Light Co. Lmtd 5's	1,000.000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light (N.Y.)	500,000	100 00	90 00
Morristown L. H. & P. 5s (N. J.)	25 000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	100 00
Nat'l Cordage, pref.	5,000,000	100 00	110 50
Nat'l Lead Trust	9,000,000	100 00	18 75
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
New England Butt Co.	100,000	1,000 00	1,000 00
N. E. Tel. and Tel. Co.	10,394,600	100 00	53 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	97 50
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
North American Phonograph	6,000,000	100 00	20 00
North New York, Lighting	150,000	100 00	60 00
Newark E. L. & P. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	65 00
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s			*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Sawyer-Man Electric Light Co	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100.000	1 00	3 00
Swan Incandescent	800,000	100 00	4 00
Standard Ug'd Cable Co.	1,000,000	100 00	95 00
Staten Island L., H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
Thomson-Houston Electric Co.	6,000,000	25 00	47 00
Thomson-Houston Pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100.000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100.000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	2 50
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Welsbach Inc. Gas	10,000,000	100 00	5 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	10 00
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co.	7,000,000	50 00	15 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			22 75
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

An electric street railway company has been organized at Kalamazoo, Mich. The new company will be operated on the storage system.

FINANCIAL.

The annual exodus to Europe has fairly set in, and the ways and means calculator is in the field shouting that at least 100,000 courageous Americans will cross the "pond" this year, taking $1,000 per capita, or a grand total of $100,000,000, say a billion dollars every ten years; besides this, we are just now exporting a couple of million a month in gold; and yet, with all this evident prosperity, Italy seriously thought of inaugurating what must have been a long, if not very active war, which, no doubt, would have implicated other nations and made it fashionable to remain at home for a season. What a boom to the South and West, the influx of $100,000,000 cash over the counter would start; the pleasure and safety would be at least equal. The old wooden ship which blew over and worked her passage back gave more time for health and permitted one to sleep with more inward assurance of seeing home again than the ponderous machines in use to-day, urged on to their utmost by steam and illuminated, guided and practically commanded by electricity, controlled by engineers who, in any case have had but a short ten years' experience with the newly applied agent. Most of the vessels—a thing afloat with a couple of jigger-masts is not entitled to the grand name of ship—as has been lately shown are not perfect in their electrical installation or insulation. The metal hull of tne monster must be as dangerous as a little innocent-looking wire not so big as my thumb, which the Mayor of New York declares so deadly that it is ordered into permanent quarantine. Still worse, nearly, if not all European nations demand the actual discharge of every employee on arrival at their home port; very few of them, except the heads of departments, make more than one round voyage without change. Where so many precious lives, so much money, mails, insurance and other interests are at stake, surely a file of electrical papers should be kept on hand at the proper place for consultation. It is of equal service with the nautical almanac or medicine chest assistant. The ELECTRICAL AGE is the best for the purpose, but a carefully preserved file of some journal treating solely on the science should be at hand, by law, if necessary, wherever an electric generator is afloat on common carriers.

The disbursements for May in New York City this year in the shape of dividends and interest is about $300,000,000, and yet the orations on "The Bloated Bondholder," seem to have changed to other subjects. There is too much electricity in the air to hold an audience on the old war cry. The Argentine Republic is more attractive; gold down there demands over 250 premium, and you can become a bondholder for about the same price Italian titles sell for. There are few miscarriages in these investments as is shown by the late fire in Scranton, Pa., where the People's Street Railway Company lost twenty-nine electric cars and a few other *tenas ictas.* I still advise you to become an electric stock or bondholder and enjoy your share of the $300,000,000.

On the sixth inst. the State Railway Commission met the Brooklyn people to listen to the tales they had to tell regarding the Trolley. Both sides were well represented, and with the exception of some unparliamentary language, the arguments were well put. Thirty days' time was given to file all documents with the county clerk of Kings County. I think next year will see a system adopted and both the public and the stockholders happy. I note a $50,000 suit for libel against our contemporary, the New York *Times*, forms part of the history. Many readers of the ELECTRICAL AGE were present at the meeting, and all expressed themselves satisfied that the public discussion of the various systems of electric power aided the education of the people, which is practically a necessity before a profit can be hoped for on such an investment. A month hence Brooklyn will be a seaside resort, and if a meeting is held I hope all our readers interested in electric propulsion will not only be there, but make themselves heard. It will be nearly as good for the new motors and batteries as an advertisement in the ELECTRICAL AGE.

The Municipal Electric Light and Power Company of St. Louis, is one of the most extensive local plants in the United States. The Missouri Electric Light and Power Company of the same city, is said to earn over 10 per cent. net, and at a meeting of the Laclede Gas Company held in St. Louis lately, 63,294 shares were represented, the unanimous vote being in favor of taking over the two electric companies. This will no doubt be completed before Fall. Let us hope that when the negotiation is consummated, there will be but one company with a corporate name, the others being annihilated. "Three hearts with but a single thought," and that to light St. Louis at a good profit to the shareholder. Laclede gas is regularly dealt in on the New York Stock Exchange, and the latest market price will be found in my list, corrected weekly.

The Electric Stock market has been very active the past week or two and prices advanced rapidly. Continual dividends draw attention and hold it. Burrell Electric Signal Co. advanced $5 per share; Bell Telephone $2; Edison General $2; National Cordage $3; Rockaway Beach Electric Light $5, and Westinghouse $3. There are not many sales of local electric stocks but we seldom hear of a transfer without a profit beside a dividend.

If the local companies will notify me of the date and amount of their dividends I shall be pleased to note the fact, regardless of what part of the country they may serve, in the financial column of the ELECTRICAL AGE.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73,
BOSTON, MASS., May 8, 1891.

Mr. F. E. Pettingell, of the Pettingell-Andrews Co., 196 Summer St., Boston, is traveling in Europe for the benefit of his health.

Dr. Mason of the Simplex Electrical Co., 620 Atlantic Av., is now in search of health on the island of Jamaica, after a siege with pneumonia.

The Beacon Vacuum Pump & Electrical Co., with offices at 15 High St., will soon have something of interest to makers of incandescent lamps.

The Bernstein Electrical Co., 620 Atlantic ave., are busily engaged in filling orders for their specialties, lamps, etc. Mr. Henry Cram has just returned to Boston.

There is great talk in Boston about the new storage system of the Union Storage Battery Co., Post Office Square, Boston. Colonel Hewins is at the head of this company.

Mr. A. L. Mariner is preparing to engage in the manufacture of electrical specialties. He was formerly superintendent of the electrical manufacturing for the West End road, and has lately sold out those interests to engage in his new business.

Mr. R. T. White, dealer in patented material for street railway road beds, also cable, electric and elevated railways, 12 Pearl St., has on exhibition his new system for overhead traffic. The car on exhibition is celebrated for its name, which is "Kossheshebogannoggan."

When your correspondent called on Mr. J. E. Barney, of The Barney Ventilating Fan Co., 70 Pearl St., that gentleman was experimenting on cold storage work, and could not find time to talk as he was up to his neck in business. He had a large motor running an eight foot blower at the time.

Seth W. Fuller, the manufacturer and fitter of all kinds of electrical apparatus, located at 27 Arch St., Boston, reports a thriving business in bells and speaking tubes. This gentleman is an authorized contractor for the installation of the Edison electric light and has some fine isolated plants under way.

John Post, Jr. & Co., 70 Kilby street, Boston, Mass., New England agents for the Ide engines, are meeting with excellent success this spring. While passing the new building, corner of Milk and Pearl streets, Boston, your representative observed two of the Ide engines being put in for the new electric light installation. This will be one of the handsomest isolated plants in New England.

Mr. William Jacques, electrician of the American Bell Telephone Co., who is now traveling on the continent for pleasure, while driving with his daughter in Florence, Italy, on May 5th, was attacked by a mob. His daughter was severely injured. The cause of this unfortunate affair is a mystery to Mr. Jacques' friends. Mr. Jacques was formerly a professor at the Johns Hopkins University at Baltimore.

The building in which the Redding Electric Co. is located, No. 48 Hanover St., Boston, was partially destroyed by fire recently, and in consequence the company have secured new quarters. They are now moving their offices and salesroom to Franklin and Congress Sts. Some changes have been made recently among the officers of the company, and Mr. Jerome Redding will hereafter devote his time to the factory.

Mr. Wm. P. Mullen, Vice President and Eastern Agent for the Shultz Belting Co., 164 Summer St., is doing a thriving business in these well-known belts. He has recently sold 201 feet of 21-inch electric double fulled leather belts, also 100 feet of 18-inch belt, to go to Lowell, Mass., and one of 72 feet, 32-inch, for the same place. On May 6 Mr. Mullen shipped no less than 60 small belts. Three large link-belts sold a short time since for electric light work in Boston, are giving excellent and satisfactory service, and are spoken of by the operating companies in high terms.

W. S. Hill, of 133 Oliver St., the well-known maker of electric switches, has lately completed eight sizes of his new motors, ranging up to 5 h. p. He recently made a test of them for electric lighting, and in one instance ran forty-five 16 candle power lamps from one of his 3 h. p. motors. The machines are excellent in design, and will sell on sight. The motor is highly efficient, as has been proved in many tests, and it offers an extraordinary opportunity on which to build up a successful business. Capital will find a safe and remunerative investment in the manufacture of these machines.

The Tripp Manufacturing Co. are working on their new truck, which they expect to bring out shortly. The main feature of it will be that it can be transferable to open or closed cars. The truck is so constructed that it will readily turn sharp curves, and is made to meet a long felt want. The West End Road find it necessary to use such a truck. It will no doubt be adopted on a large number of other roads, as the present trucks on closed cars cannot be used on open cars. The cost of equipping the cars with double motors is too great to permit most street railroad companies to incur the expense of extra equipment. The new truck will have loose wheels and the bearings will be ten inches long.

The Electrical Gas Lighting Co., 195 Devonshire St., Boston, are doing a larger business this Spring than ever before. The business for April was 25 per cent. larger than that for the same month

last year. The Samson Battery is doing remarkably well. The sales at the present time are 4500 in excess of what they were this time last year. Colonel Burnham, who is now in the far West, is meeting with extraordinary success, and is sending in some heavy orders from California, and continues to do so as he wends his way homeward bound. On May 5, five good sized orders were received from him. The demand for household specialties is increasing, and the outlook is very promising. This company have taken the Eastern agency for the Porter motors, manufactured by M. D. Porter of New York. These motors are made in three sizes for small power, such as jewelers work, sewing machines, etc. W. T. H.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
417 CHAMBER OF COMMERCE,
CHICAGO, Ill., May 8, 1891.

The New York Insulated Wire Company's office and warehouse, Nos. 78-82 Franklin street, is one of the largest business places in the city. It has an area of 10,000 square feet.

Mr. Frank X. Cicott, of the Electric Merchandise Company, of Chicago, sailed for Europe from New York, on May 9. Mr. Cicott expects to be absent about two months, during which time he will push the interests of the concern he represents in the direction of electric railways.

The Short Electric Railway Company, Cleveland, O., has secured the services of Mr. R. C. Garhart, well and favorably known as a former representative of the Westinghouse Company. Mr. Garhart will represent the Short Company in different Eastern territories for the present.

The *Street Railway Gazette*, in order to accommodate their largely increasing business, has moved into quarters in the Mallers Building, a new structure opposite the Grand Pacific Hotel, on Lasalle street. This journal continues to successfully maintain its high standard, and it is with pleasure we note its prosperity.

As the Boards of Underwriters in some States have condemned the use of any lamp cord that is not fireproof, the Central Electric Company, of Chicago, are offering a cord with an absolutely fireproof covering. They have already had large sales of this cord, and predict that before long it will drive all inferior articles out of the market.

Mr. George Cutter, 333 "The Rookery," has just moved his stock into larger quarters, also in the Rookery building, thus doubling his facilities for prompt shipments. His large stock of Simplex wire and K. W. cutouts made this increase of space necessary. Lately he has sold several large batches of extra heavy Simplex wire for use in mines, where it meets the most severe conditions of practice.

The Central Electric Company have come to the front with a new portable photometer, which seems to be especially appropriate now, when so much is being said about the efficiency of incandescent lamps. This machine will enable any station superintendent to measure the candle-power of his lamps, and thus accurately determine exactly how much each lamp consumes. The instrument is being offered at a very moderate price and promises to become popular at once.

Mr. Paul W. Bossart, of The Short Electric Railway Company, is making an active and efficient canvas in street railway circles of the West. He reports the most favorable outlook for the new gearless motor. Everyone is interested in it and speaks of the highest terms of its simplicity, predicting a wonderful future for this new departure of the Short Company. Mr. Bossart is fortunate in representing so strong a company and one whose past reputation for reliability and excellence of work is of the very highest.

The New York and Ohio Company, Warren, Ohio, manufacturers of the popular Packard incandescent lamps are receiving a large number of orders from all over the States. This lamp is in use in a number of isolated and central station plants in this section, and is giving general satisfaction. Numbers of them have been burning from 12 to 1,500 hours and are still in use. As was remarked by one of the users: "If they continue to give as fine a diffusion of light as they have in the past 1,200 or 1,500 hours, there is no reason why they should not last forever."

H. C. W.

PERSONAL MENTION.

Mr. Thomas A. Edison and Samuel Insull left for Chicago, May 9, on a tour of inspection

A. H. Chadbourne, general agent in Philadelphia of the Westinghouse Company, is South on business.

J. G. White, of J. G. White & Company, 50 Broadway, New York, is in North Carolina.

W. A. Stadelman, chief engineer and general manager of the Equitable Engineering and Construction Company, of Philadelphia, is in Richmond, Va., on business.

PHILADELPHIA NOTES.

The American Reflector Co., of this city, report large sales of their new incandescent lamp shade. It must be seen to be appreciated.

Mr. H. T. Paiste pays a visit to Chicago this week and will no doubt return with some large orders for his renowned snap switches.

Walker & Kepler reports business brisk, their books showing some very large contracts. This firm have gained for themselves a reputation second to none in the electrical business.

Mr. T. L. Townsend, of the Partrick & Carter Co., is making himself heard throughout the West, judging from the large orders he has been sending in from that section of the country.

The De Kosenko & Hetherington Mfg. Co., are getting up some new designs which they will shortly place on the market. Their new quarters, although nearly twice the size of the old place, are taxed to their utmost capacity. H. G. G.

THE WESTINGHOUSE COMPANY'S FINANCIAL AFFAIRS.—It is stated that the affairs of the Westinghouse Electric and Manufacturing Company, have been satisfactorily settled, and that plans have been agreed upon for the reorganization of the company by a syndicate composed of New York capitalists. Printed circulars have been prepared and will be mailed to every stockholder. The present capital of the company—$10,000,000—is not to be increased. The common stockholders are to surrender 40 per cent. of their holdings, which with the treasury stock unsold, will make a total of $57,920,000 of unsold treasury stock. One million dollars of the surrendered stock is to be converted into preferred stock, and this, in addition to preferred stock not issued, will make a total of $5,000,000, which will be entitled to 7 per cent. dividend and a pro rata share of all dividends after 7 per cent. has been paid on their outstanding stocks. Three million dollars of the preferred stock are to be issued for money and in payment of the company's debts; $500,000 to be kept in the treasury for working capital. The circular states that provided the stockholders assent to the plan proposed the Syndicate and certain creditors stand ready to take at par $3,000,000 of the preferred stock. Mr. Westinghouse expressed himself as confident of the success of the proposed plan.

VALUABLE BOOKS.

THE ELEMENTS OF DYNAMIC ELECTRICITY AND MAGNETISM, by Philip Atkinson, A.M., Ph.D. This is a complete, comprehensive treatise on the principles of practical electricity. It is written in a clear, unmathematical style, and has 405 pages and 120 illustrations, and its contents by chapter are: 1. The Voltaic Battery—Definitions. 2. One-Fluid Cells. 3. Two-Fluid Cells—Battery Formation. 4. Magnetism. 5. Electromagnetism. 6. Electric Measurement. 7. The Dynamo and Motor. 8. Electrolysis. 9. Electric Storage. 10. The Relations of Electricity to Heat. 11. The Relations of Electricity to Light. 12. The Electric Telegraph. 13. The Telephone. The price of this book is $2.00.

EXPERIMENTAL ELECTRICITY, by Edward Trevert.
This is an elementary work, and is valuable to students who are passing through the experimental stage of their electrical studies. It has 164 pages and many scale illustrations; price $1.00.

THE ELECTRIC RAILWAY OF TO-DAY, by H. B. Prindle.
This little work explains in a clear and popular manner the operation of the electric railway. It is of extreme interest and should be read by all; price, 50 cents.

A DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES, by Edwin J. Houston, A.M.
This work, as its name implies, is an electrical dictionary, and is the most complete and valuable book of this character ever published. No electrician or student of electricity should be without it, as it is a wonderful aid in research and study. It has 656 pages and 397 illustrations; price $2.50.

BELL HANGER'S HAND BOOK, by F. Badt.
This little book gives valuable instructions for wiring buildings, for the operation of electric bells, annunciators, burglar alarms, etc. It contains many illustrations which greatly aid in a better understanding of the subjects discussed. It gives rules and much other valuable information; price $1.00.

ELECTRICAL ENGINEERING, for Electric Light Artisans and Students, by Slingo and Brooker.
This is a complete work on the subject of electrical engineering, and is valuable alike to the student and the practical electrical engineer; price $3.50.

All books on electrical subjects can be obtained of the ELECTRIC AGE Publishing Company, *World* Building, New York.

NEW FIRE ALARM.—The Lancaster Automatic Fire Alarm, a Lancaster, Pa., invention, is said to be a very superior system of giving an alarm of fire. The active principle of the device is a volatile liquid contained in two small cylinders, which act in accordance with the natural law of gravitation. A rise in the temperature to a point for which the liquid is arranged, causes it to flow from one cylinder to the other, reversing the position of the cylinders, thus, by means of a sliding contact, sending the alarm to the central station. This apparatus may be connected with an ordinary annunciator, and when the alarm sounds the fire is at once located. The new thermostats, as they are called, can be placed in any portion of the building, and it is said that their cost is inconsiderable, so that one can be placed in each room of a building. This alarm is well adapted for hotels, stores, warehouses, manufactories and private residences, and can be put into a building that is already wired. This new invention is manufactured and being placed on the market by the firm of Stoner, Myers & Co., of Lancaster, Pa. This concern is also introducing some other electrical alarm specialties that have several points of merit.

OUR LAW.

$$C = \frac{E}{R}.$$

E=Talent, Energy, Enterprise, Honesty, Integrity, Literary and Business Ability.

R=o. The ELECTRICAL AGE, having so many firm and solid contacts with the business community, and there being so many channels through which it is steadily flowing, the resistance is absolutely nothing. These different channels are the various branches of the electrical trade.

C=Circulation or current, which results from the high E. M. F. meeting with no resistance. The circulation or current, is necessarily very great, and as the conductivity is increased the current of ELECTRICAL AGES is increased proportionately. As our electromotive force increases, which it is doing all the time, our current becomes proportionately larger.

Advertisers should know and remember that the conductors of the ELECTRICAL AGE carry it to the furthermost corners of the earth, and as the insulation is high, there is no "grounds" or "short circuits," the current reaches directly the places where the energy is to be expended and utilized, and all of our E. M. F. is thus transformed into work for the benefit of our friends who advertise with us.

BUSINESS NOTES.

The Pittsburg Reduction Co., manufacturers of pure aluminum, have secured from the U. S. Circuit Court for the Northern District of Ohio, an order restraining the Cowles Electric Smelting and Aluminum Co. from increasing its present output of aluminum, and from selling its products at lower prices than those at which the complainant company is now selling pure aluminum. The price is fixed by the Pittsburg Reduction Company at $1.50 per pound for all grades and in any quantities. The former reduction to $1.00 a pound was caused by the cutting of rates by the Cowles Electric Smelting and Aluminum Co.

Now ready, a second edition, revised and enlarged, of "Practical Electrical Notes and Definitions", by W. P. MAYCOCK, containing the rules and regulations to be observed in electrical installation work as issued by the Phœnix Fire Office and The Institution of Electrical Engineers; 130 illustrations and diagrams. Pocket form, price $1.75. E. & F. N. Spon, 12 Cortlandt Street, New York.

Messrs. Henry Oakley and C. D. Seabright no longer represent Jas. H. Mason, or the Mason Battery and Electrical Co. of New York and Brooklyn.

The Ball Electric Light Company of Montreal, have secured the agency of the Wenstrom Consolidated Dynamo and Motor Company of Baltimore, Md.

Charles R. Vincent & Company, the well-known consulting and contracting engineers, No. 15 Cortlandt street, have terminated their contract with the Ball Engine Company for the sale of their automatic cut-off engines. The business of Charles R. Vincent & Company, with its firm name and good will, will be acquired by the Ball and Wood Company which, having purchased the Ball patents, is preparing to build improved Ball Automatic Cut-off engines, with Mr. Ball as vice-president and general manager. Mr. Wood assumes the presidency of the new company; Mr. Vincent will become its secretary and treasurer, and to Mr. Smith will be entrusted the interests of the company, with his principal office at Cincinnati, his old home. During this firm's three years' connection with the Ball engines, they have had confided to them many important contracts, and made many friends among those with whom they dealt. The offices of the Ball and Wood Company will embrace those heretofore occupied by Charles R. Vincent & Company, at No. 15 Cortlandt street, New York, where estimates and proposals for Ball Automatic Cut-off engines will be cheerfully furnished.

Frank H. Ball has terminated his connection with the Ball Engine Company of Erie, Pa., and has sold all his recent patents and inventions covering engine governing devices, to the Ball and Wood Company, No. 15 Cortlandt street, New York City, a corporation possessed of ample capital, which he has organized, with others, for the purpose of building improved Ball Automatic Cut-off engines. The new company has purchased of the Central R. R. Company, of New Jersey, a very desirable site of four and a half acres adjoining the latter company's tracks at Elizabethport, which is but twenty minutes from the New York office of the new concern. They are erecting machine shops on the approved gallery plan, and equipping them with new and modern tools, solely with a view of building their specialty, Improved Ball engines, with the greatest economy and excellence. Associated with Mr. Ball are gentlemen who have spent their lives in the engine business, and with the experience of twenty years himself, devoted exclusively to engine work, and covering the introduction and development of High Speed Automatic Cut-off engines, he confidently believes that the new Ball engines he is designing will not only maintain, but decidedly eclipse the excellent reputation acquired by those heretofore built in Erie, where the disadvantage of inferior facilities necessarily hampered them in attaining the perfection they sought.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

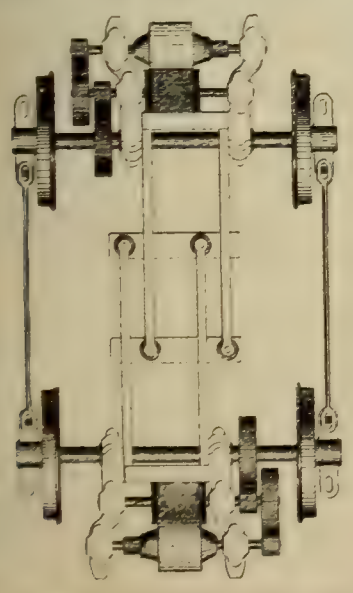
Issued Tuesday, May 5th, 1891.

451,445. Secondary Battery. Truman H. Aldrich, Cincinnati, Ohio. Filed Dec. 27, 1890.

A body of active material formed with an aperture adapted to receive a conducting-plate, taken loosely into it.

451,449. Telegraph Repeater. Albert C. Booth, Cedar Rapids, Iowa, assignor of one-half to William P. Ward, same place. Filed Aug. 24, 1890. Renewed March 21, 1891.

451,491. Electric-Railway Truck. Water H. Knight, Boston, Mass. Filed Feb. 15, 1890.



451,491—ELECTRIC RAILWAY TRUCK.

Two axles of an electric-railway truck, with a propelling-motor upon each axle and inward extensions flexibly united at their inner ends to permit freedom of radial adjustment of the axles.

451,514. Electric Brake. Joseph M. Payne, Cressona, Pa. Filed March 31, 1890.

Draw-bars provided with laterally-extending ears provided with perforations, with electrodes supported in the perforations.

451,520. Electric Meter. Edwin W. Rice, Jr., Lynn, Mass. Filed March 8, 1889.

In an electric meter, the combination, with two expansible rods, bars, or pieces separated so that neither shall be heated by conduction or radiation from the other, of two circuits or branches of circuits formed in the path of heating-currents for developing a heat to expand the same, and switch mechanism and connections for throwing the currents successively through the circuits.

451,521. Combined Switch and Lightning Arrester. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 5, 1890.

The combination, with a manual circuit-breaking switch in an electric circuit, of a blow out magnet having poles adjacent to the contact-point of the switch, and a supplementary lightning-arresting contact also adjacent to the poles and connected to the ground.

451,540. Secondary Battery. George A. Washburn, Cleveland, O., assignor to Ford & Washburn, same place. Filed July 23, 1890.

An insulating-casing for the cell, having a cup-lining of conducting material, an inner wall of conducting material apart from the lining, and active material between the wall and lining, in combination with a battery element centrally within the case.

451,541. Secondary Battery. George A. Washburn, Cleveland, O., assignor to Ford & Washburn, same place. Filed Oct. 24, 1890.

A porous pot containing active material and conductors in the pot constructed to form an open space in the pot for solution and to yield under lateral pressure or expansion.

451,548. Temperature-Alarm. Louis Zagelmeyer, West Bay City, Mich. Filed Dec. 8, 1890.

A thermostatic coil loosely sleeved upon a standard and having one of its ends secured thereto, and a radial arm formed on the other end, two index-hands frictionally secured on a pivot in the axis of a coil, and a thermometric scale for adjusting the index-hands and the arm of the coil.

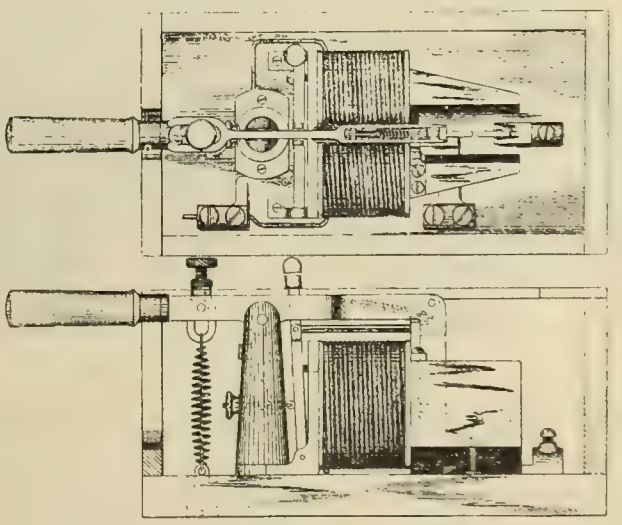
451,559. Electric Motor. Walter E. Hyer, Newburgh, N. Y. Filed Nov. 26, 1890.

The combination, with an armature, of a field-magnet having a single coil surrounding the armature and standing in a plane oblique to its shaft, the magnetic circuit being composed of two hollow castings bolted together on a plane including the armature-shaft, the castings containing each one-half of the journal boxes of the armature-shaft.

451,574. Dynamo-Electric Machine. Louis C. Rice, Denver, Col. Filed May 14, 1890.

Field-magnets with bobbins having grooves in their adjoining sides, and an armature made up of a series of sections longitudinally grooved upon their outer surface and suitably joined together, the upper portion of each section being cut away for the insertion of the coil, and the sections when joined together inclosing the coils at the points of contact.

451,586. Insulated Electric Conductor. James B. Williams, Oakland, Cal. Filed July 12, 1890.



451,521—COMBINED SWITCH AND LIGHTNING ARRESTER.

451,587. Insulated Electric Conductor. James B. Williams, Oakland, Cal. Filed Nov. 13, 1890.

451,603. Magnetic Attachment for Windows. Thomas N. Sterry, Norwich, Conn. Filed July 2, 1890.

A window and sash, one bearing a magnet and the other a keeper, the elements being combined.

451,605. Electric Conductor. Joseph D. F. Andrews, Westminster, England. Filed Oct. 31, 1890.

451,614. Underground Electric-Wire Conduit. Henry B. Cobb, Wilmington, Del. Filed April 29, 1890.

ELECTRICAL PATENTS—Continued.

451,634. Telephone-Receiver. William S. Corwin, Newark, N. J. Filed Nov. 30, 1888.

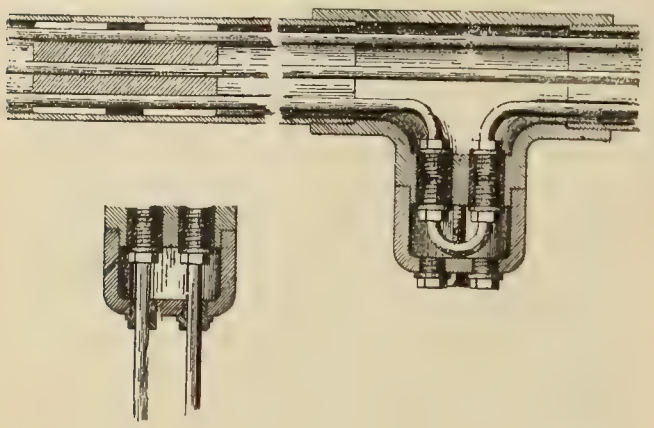
An improved telephone-receiver, combining therein a permanently-magnetized steel casing or tube, a soft iron core or centre rod insulated therefrom at its rear end, a diaphragm, a bobbin and connecting means.

451,637. Electric Railway System. Charles K. Harding, Atlantic, Iowa. Filed Oct. 27, 1890.

451,639. Alarm-Signal. Michael A. O'Donnell, Chicago, Ill. Filed March 17. 1890.

In an alarm signal, the combination of a club or baton, having a signal inserted in its handle, and a signal-operating shaft of a patrol-box operated by the mouth of the club signal.

451,649. Electric Stop-Motion. Charles A. Dayton, Preston, Conn. Filed April 21, 1890.



451,614—UNDERGROUND ELECTRIC WIRE CONDUIT.

An electro-magnet, whose armature serves as a latch to control a system of levers connected with a clutch-pulley on the driving shaft of an engine governor.

451,656. Socket for Incandescent Lamps. Samuel Deacon, Lynn, Mass., and Merle J. Whitman, Hartford, Conn., assignors to the Thomson-Houston Electric Company, of Connecticut. Filed March 15, 1890.

451,666. Watchman's Time-Recorder. Edwin C. Gee, Bayonne, N. J., assignor of one-half to Albert P. Fisher, New York, N. Y. Filed July 22, 1890.

The combination with impressing devices provided with a hammer and laterally-movable pin of shifting devices connected to the pin, and containing a motor controlled by the hammer.

451,692. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignment, to the Thomson-Houston Electric Company, Boston, Mass. Original application filed April 28, 1888. Divided and this application filed Feb. 25, 1889.

451,696. Switch for Overhead Electric Conductors. John Kuehnle, Detroit, Mich., assignor of one-fourth to Edward Martyn, same place. Filed Dec. 18, 1890.

451,700. Dynamo-Electric Machine. Lawrence N. P. Poland, Cincinnati, Ohio. Filed May 7, 1888.

451,730. Pole for Electric Lines, etc. John R. Fletcher, Dayton, Ohio, assignor to the Electrical Supply Company, Chicago, Ill. Filed Sept. 30, 1890.

A pole for supporting electric lines, consisting of comparatively wide upwardly-tapering side plates and narrow angle-bar edge plates, the whole bolted together so as tomake a hollow pole.

451,732. Electric Car-Lighting Apparatus. Budd J. Jones, Chicago, Ill. Filed Oct. 7, 1890.

451,754. Ship's Telegraphic Apparatus. William Chadburn, Liverpool, England. Filed Sept. 8, 1890.

A rotating transmitter having a movable pointer or indicator, and a receiver having a traveling pointer or indicator, with motion-reducing gearing connecting the pointer or indicator of the transmitter with the pointer or indicator of the receiver.

451,786. Method of Operating Reciprocating Electric Engines. Charles J. Van Depoele, Lynn, Mass. Filed Jan. 3, 1891.

A reciprocating electric engine having one set of coils adapted to be energized by an intermittent continuous current and another set energized by alternating currents having a defined rise and fall.

451,798. Current Regulator for Electric Lamps. Charles H. Balsley, Jr., and Edwin M. Porter, Connellsville, Pa. Filed Jan. 17, 1891.

451,815. Conduit System for Electric Railways. William H. Ford, St. Louis, Mo. Filed Oct. 8, 1890.

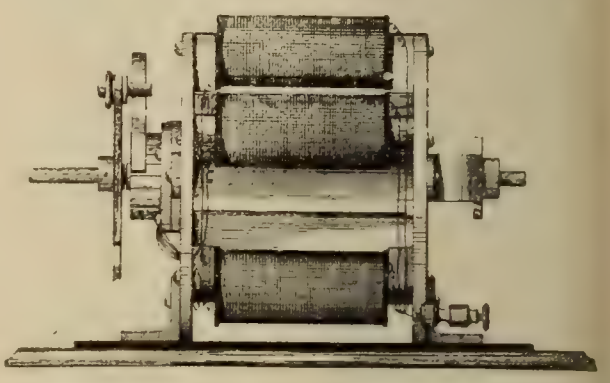
451,832. Electric-Railway Pole. Foster Milliken, New York, N. Y. Filed Feb. 19, 1891.

451,870. Electric Motor. Ernest M. G. Hewett, Boston, Mass., assignor to Albert L. Jewell, same place. Filed Nov. 14, 1890.

An electric motor comprising a series of electro-magnets, an armature composed of bars of soft iron, and a commutator consisting of a number of segments arranged in sets each set containing a number of segments corresponding to that of the electro-magnets, a series of plates placed the within the segments, and of a number corresponding to number of electro-magnets, and provided with projections each of which engages one of the segments of each set, a brush having a bearing-surface less than the width of each interval between segments, and suitable electrical connections whereby each electro-magnet is energized by the entire current only several times during each revolution of the armature.

451,872. Electric Motor. Frank M. La Boiteaux, Cincinnati, Ohio, assignor of one-half to Henry Varwig, same place. Filed June 4, 1890.

451,884. Electric Motor, or Dynamo-Electric Machine. Schuyler S. Wheeler, New York, N. Y., assignor to the Crocker-Wheeler Electric Motor Company, same place. Filed April 23, 1890.



451,870—ELECTRIC MOTOR.

The ring-armature core formed with the trapezoidal slots or openings in its periphery and coils or windings laid in the slots and passing through the inside of the ring, the windings on the inside of the ring forming trapezoidal-shaped coils or sections which fit against one another and fill the interior of the ring, and the slots being of the same shape and cross-section, so that the coils are symmetrical with respect to the outside and inside of the ring.

451,894. Electric Motor or Dynamo Electric Machine. William F. Collins, Chicago, Ill., assignor, by mesne assignments, to the Crocker-Wheeler Electric Motor Company, New York, N. Y. Original application filed April 17, 1888. Divided and this application filed March 2, 1891.

An armature-core for an electric motor or dynamo-electric machine formed with trapezoidal slots in its periphery of greater width at the bottom than at the top, the windings or conductors being contained in the slots.

451 902. Fire-Alarm-Telegraph Apparatus. Joseph W. Stover, Newtonville, Mass. Filed Jan. 23, 1888.

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SOLE MANUFACTURERS OF
HARD VULCANIZED FIBRE,
In Sheets, Tubes, Rods, Sticks and Special Shapes to order. Colors, Red, Black and Gray. Send for Catalogue and Prices.
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The Clark Arc Lamp for Incandescent Circuits, Single or in Series, 7½ and 15 Hours Continuous Burning.
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ELECTRIC MOTORS, FAN OUTFITS.
Brushes for Sprague Motors, Hoods for Arc Lamps. Write for Prices.

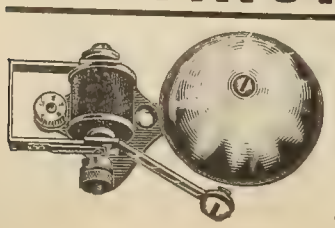
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IMPROVED ZINCS
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Our Zincs are composed of an alloy of **Zinc and Mercury only**, and can be furnished of any size or shape desired. They are guaranteed to be as represented. Their use affords an **increase** of Electro-motive Force and a **Decrease** of Internal Resistance **in any cell.** Hence **Increased Economy and Efficiency.**
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CROW FOOT ZINCS.
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Also HYDRAULIC and STEAM.
AND ELECTRIC DOCK HOISTS
In practical and successful operation.
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THE AMERICAN ELECTRIC ELEVATOR Co., 15 Cortlandt St., New York.

THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

WEEKLY.

Vol. IX NEW YORK, MAY 23, 1891. No. 21.

THE HOME AND WORKSHOP OF MR. EDISON.

In New Jersey, fifteen miles from New York, lies the beautiful suburban town of West Orange, which has become famous in late years on account of its being the home of the distinguished electrician and inventor, Mr. Thomas A. Edison. The famous Edison Laboratory is also located in West Orange, and is but a short distance from the great inventor's home, of which we give herewith an excellent view.

The town of West Orange lies on the eastern slope of the Orange mountains, and it is one of the most delightful places imaginable for the home of a great man. The air is pure and exhilarating, and no doubt is a material aid to the man who spends much of his time in the great laboratory, which lies in the Orange Valley at the foot of the mountains.



RESIDENCE OF THOMAS A. EDISON.

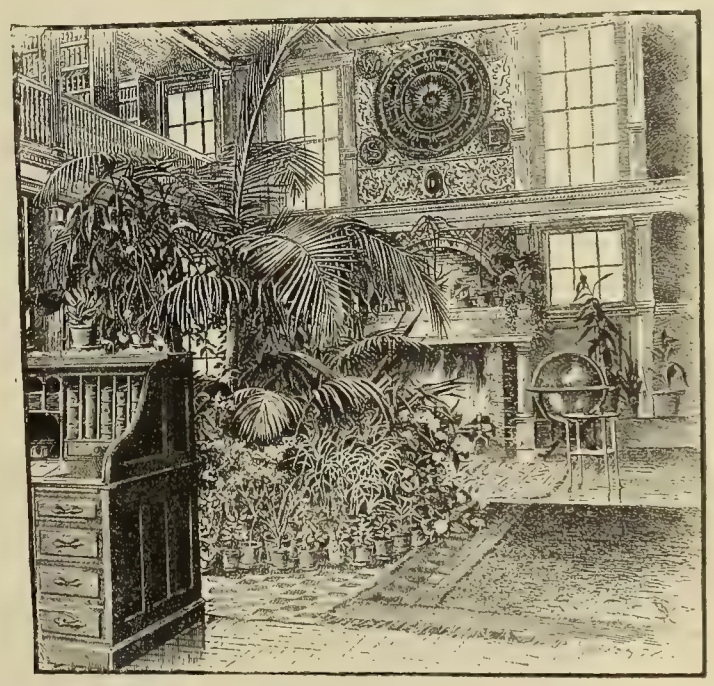
The surroundings of the laboratory are of the quietest nature, and there the unceasing work of experimentation and invention is carried on by Mr. Edison under the most favorable circumstances. The quiet of the surroundings is rarely disturbed in the natural course of events; it is only when some scientific body makes a pilgrimage to the famous building that there is anything like activity thereabouts. It is a delightful place to visit, as all who have had the good fortune to make the trip can testify.

Mr. Edison's home is situated in the beautiful Llewellyn Park, which lies along the slope of the mountain. It is of the prevailing style of architecture, and is handsome in appearance. The grounds around the house are about fifteen acres in extent, and are as beautiful and attractive as human skill can make them. There is an air of quiet refinement and elegance about the place that is delightful.

The house is lighted by 500 incandescent lamps, supplied with current from the laboratory, which is but a short distance away.

"Glenmont" is a centre of social attraction, and frequently Mrs. Edison entertains her friends in a most elegant manner. On such occasions the house and grounds are made beautiful by decorations of incandescent lamps and choice flowers and plants. The scene at night on these occasions is most charming.

Our other illustration gives a view of the library in the laboratory. Here Mr. Edison sometimes works, and at others find a relief from the monotony of close application to business. Here the receptions are held, and the place is made brilliant on these occasions. The room is a veritable corner in fairy land, and there is much to delight the visitor. Mr. Edison's great library is arranged along three sides of the room, and books without number on all scientific subjects, and in all languages, can be found there. The room is lighted by windows on three sides, and the floor is of hard wood in beautiful designs, with elegant rugs laid here and there.



EDISON'S LIBRARY.

On a mantel-piece, shown in our picture, is a model of the first Edison electric locomotive, about which so much was said and written at the time Mr. Edison was experimenting in this direction at Menlo Park, some years ago.

The celebrated statue, "The Genius of Light," which Mr. Edison purchased in Paris, stands in the centre of the room, as if welcoming visitors and lighting their way.

There is also, in one corner, an elegant organ, and in another a phonograph to entertain the visitor.

A visit to this delightful spot is a treat that cannot be compared, and there is an air of expectancy and mystery about the place, which is impressive and long to be remembered.

WINDING OF DYNAMOS.

Dynamos give different E. M. F's for different currents taken from them when running at one speed. These variations may be drawn, diagramatically represented by curves called "Characteristics," and every dynamo has its own peculiar curve. A perfect machine would give the same E.M.F. for all currents when running at one speed, and the curve would become a straight line. Good dynamos have curves approaching this form for all currents within their capacity. The shunt-wound dynamo is best suited for charging an accumulator. The series and compound wound dynamos are liable to have the polarities of their field magnets reversed, should the E.M.F. at the terminals approach very near to, or fall below that of the cells when great damage may be caused, before the cut-outs have had time to act.

In a series wound machine the E.M.F. rises with an increased current; in a shunt-wound dynamo, the reverse takes place, and the compound machine is wound partly series, partly shunt, so that the E. M. F. is practically constant at a particular speed for all currents. The shunt dynamo has a falling curve (*i. e.*, the E.M.F. falls as the current in the outside circuit is increased) due to three reasons; first, the armature absorbs more E.M.F. as the current is increased; second, as the outside resistance is lowered, the shunt current becomes less and the field weakens; third, the current in the armature reacts upon the field. As the outside resistance is increased the E.M.F. rises to the work. Many have supposed that a shunt machine will always respond to the work in a definite and suitable manner. This is not the case in good dynamos because, by reason of their construction, the curve is nearly straight for all currents within their capacity, and such modern dynamos are in general use, although those with falling curves have certain advantages in small installations, where waste is not of great consequence. If the

terminals of a shunt dynamo are short circuited, no current flows, because no current traverses the shunt circuit to create a field.

Dynamos give a different E.M.F. in proportion to the speed, but if a much higher E.M.F. be required than was originally intended, then two things must be considered. The first is to ascertain whether the armature is strong enough to withstand the increased speed, and secondly, whether it will not become necessary that the shunt resistance should be increased by inserting an outside resistance, to prevent too much current passing and the wire becoming too hot. In dynamos intended to run at two speeds, it is usual to place the shunt parallel for slow rates, and series for fast; in this way the use of an outside resistance is avoided. The E.M.F. and speed are not exactly proportional, for as the E.M.F. rises more current is sent round the field magnets, and the field becoming stronger, the E.M.F, has an increase due to this cause also, inasmuch as the iron of the magnets is not near saturation point in modern dynamos, except where they have been made for some special purpose. Yet, within small limits the speed and E.M.F. may be taken as varying together directly after the speed, for which the machine was intended to run, has been reached. The relations between the speed (limited by the strength of the armature), field and resistance of the armature, are the data which determine the E.M.F. and curve; and the diameter of the armature wire limits the current, which can be produced without injury to the machine.

ELECTRIC PERCUSSION DRILL.

In our last issue we printed in full the paper of Mr. H. Ward Leonard, read before the association of Mining Engineers of the province of Quebec, at Montreal, April 29, 1891. In that paper Mr. Leonard gave a description of the electric percussion drill made by the Edison General Electric Company. We are now enabled to present to our readers a diagram of connections illustrating the action of the drill, which will be of interest. In order that the illustration may be fully understood we give herewith an abstract of Mr. Leonard's descriptions of the apparatus as printed in last issue.

There are three conductors leading from the generator to the drill, one of which is connected to one terminal of each of the solenoids and the other two conductors are connected to the two remaining terminals of the solenoids respectively.

The generator is of the simplest kind, the coils on the armature having their terminals connected to two insulated collars on the shaft.

One collar is a continuous metallic ring and upon this one rests a brush which is connected with the conductor, which is common to both solenoids. The other collar is metallic for half of the circle, and the remaining half is insulated from the armature wires. Upon this half ring rests two brushes diametrically opposite each other and each brush is connected to one of the two remaining conductors leading to the solenoids in the drill.

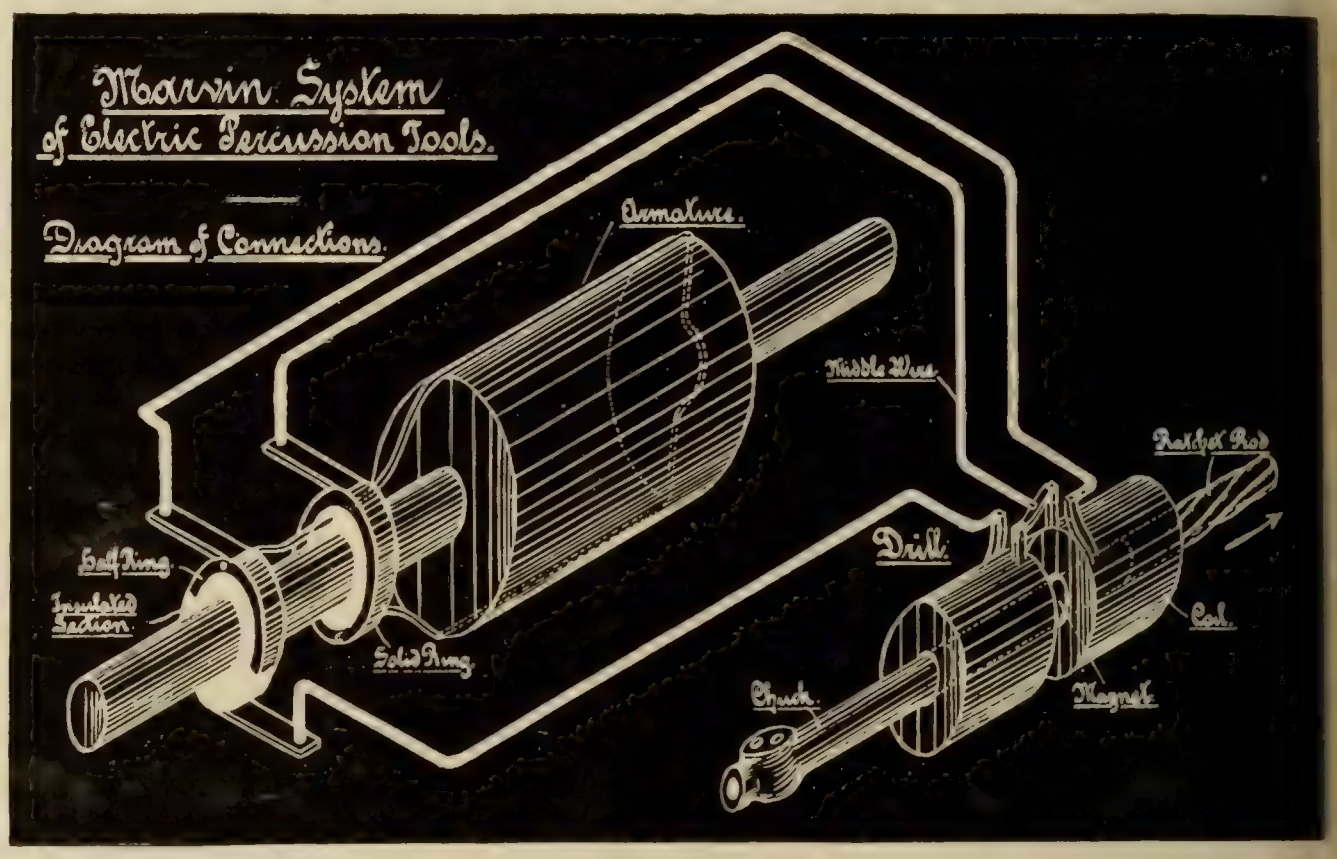
If the armature of the generator in a separately excited magnetic field an electric current will flow, let us say, from the armature to the half ring, then through one of the two brushes which happens at the instant to be in contact with the half ring along the corresponding conductor to one terminal of one solenoid, let us suppose the rear one, then through the rear solenoid itself, and back along the mutual wire to the continuous ring and then to the armature again.

This current in passing through the rear solenoid makes a powerful magnet of it and this tends to pull the plunger back into a position such that the centre of its iron portion shall be in the centre of the rear solenoid.

When the armature moves forward a half revolution the polarity of its wires is reversed, and the other brush with its conductor is now in contact with the half circle. Consequently the current in the mutual wire will be in the reverse direction from that of the former wave, the rear solenoid and its conductor, formerly active, are now out of circuit and the circuit is made through the other conductor and its corresponding solenoid, that is the forward solenoid.

The magnetic action of this solenoid now tends to make the plunger move forward so that the centre of the iron portion shall be in the centre of the forward solenoid.

Thus we get a reciprocating action of the plunger and every revolution of the armature of the generator will cause a complete stroke of the drill. By varying the speed of revolution of the generator we can make the drill strike any number of blows per minute we choose.



ELECTRIC PERCUSSION DRILL.

TRANSFORMER DISTRIBUTION CONDENSERS.*

Condensers frequently figure in electric light literature, but they are only put forward as possible means for transforming currents. Direct currents and interruptors are generally discussed. Condensers may, however, have another very large opening in connection with ordinary alternate current distribution. Take, for instance, the case of arc lamps. It is customary, whenever possible, to run arc lamps in long series with high pressures, generally with direct currents. In many cases such an arrangement is very convenient ; but wherever there are incandescent lamps to be fed at the same places as the arcs, it is of course, wasteful to run two sets of engines, dynamos, and leads. With direct currents this is sometimes necessary, for arc lamps in parallel do not burn well on 100-volt circuits, and must be used two at a time ; and at 50 volts resistance is needed in series, which is wasteful. With alternate currents nothing is easier than to run lamps with choking coils. If the supply is high pressure, each lamp can have its own transformer, and the transformer can be wound for nearly constant secondary current. Prof. E. Thomson has brought out several forms of constant current transformer, and so has Mr. Tesla. The "Hedgehog" form, however, lends itself especially well ; all that is necessary is winding the coils one at each end instead of one over the other. Whether the mains are high or low pressure, choking coils or constant current transformers will give rise to large currents whereas the same power, if the current did not lag, would be supplied by 2,000 volts and 33 amperes. This gives rise to several troubles. Suppose each machine has an armature wound to give 2,000 volts and 33 amperes, or 66,000 watts, it takes three instead of one to work the lamps. In addition to this, the lagging of the current weakens the field of the dynamos, so that they need more excitation to give 2,000 volts than they would need even on full load on a non-inductive resistance. Moreover, running three engines and dynamos at a third load instead of one at full load is not economical. A condenser takes a current which leads relatively to the pressure, so that it counteracts the effect of the lagging current. The 100 amperes may be regarded as compounded of 33 amperes in step with the pressure, and 95 amperes lagging a quarter of a period. A condenser of about 85 microfarads will supply the 95-ampere component, while one dynamo supplies the 33 amperes really needed by the lamps. This reasoning holds good without the curve of sines assumption.

The use of condensers to overcome troubles arising from exciting or magnetizing currents of closed or open circuit transformers has already been mentioned.

They may also be used to increase the output of dynamos. As already explained, even if a dynamo is worked on resistance, the cross induction causes the current to lag, and the back induction weakens the field. If a condenser is put in shunt to the terminals of the machine, its current strengthens the field again and increases the terminal pressure, and therefore the output. If the condenser is large enough, and if the armature actions are great enough, it might be possible to make a machine excite itself without any field winding at all. This action of a condenser on a dynamo may be equally easily explained on the self-induction theory. The difference between the two theories may be shown here, however.

*Abstract from paper read before the English Institution of Electrical Engineers by J. Swinburne.

According to the self-induction theory, if the condenser is large enough to produce resonance—that is to say, when $(2 \times n)^2 \text{ L K} = 1$—the output increases till the current is as great as if the no-load pressure of the machine were short circuited on the armature resistance. According to the armature reaction theory, the machine increases its field till the field magnets become more saturated. In fact, the machine is like a direct current shunt wound dynamo which has a low resistance shunt. I do not wish to go into this matter further here, for it might lead to a discussion of a rise in the Deptford mains—a subject which will be treated, I am informed, in a forthcoming paper, and will certainly receive full justice at the hands of the authors.

The commercial manufacture of high pressure condensers is not so easy as might be supposed. Knowing the difficulties there are in insulating leads and mains—in which thick insulation is permissible, and, in fact, advisable—it may be realized that to insulate many hundreds of square feet of metallic surface with the thinnest possible material is anything but an easy problem. In addition to being a good insulator, the dielectric must be free from "absorption." Some account of my work on condensers has lately been given.* Mr. W. F. Bourne, who has carried out all the experiments, has tried almost every conceivable kind of dielectric, and finds a kind of paper called "butter skin," soaked in paraffin oil, the best material. It is curious that this particular kind of paper is specially made so as to be grease-proof. Some kinds of bank post paper worked nearly as well, but is too expensive for commercial use. It seems as if the paper must be relied upon for insulation, not the paraffin. The condensers are simple cast-iron boxes containing numbers of sheets of paper and tinfoil. Lids are fitted on and made tight.

*Phil. Mag., Feb. 1891.

A NEW CAR TRUCK.

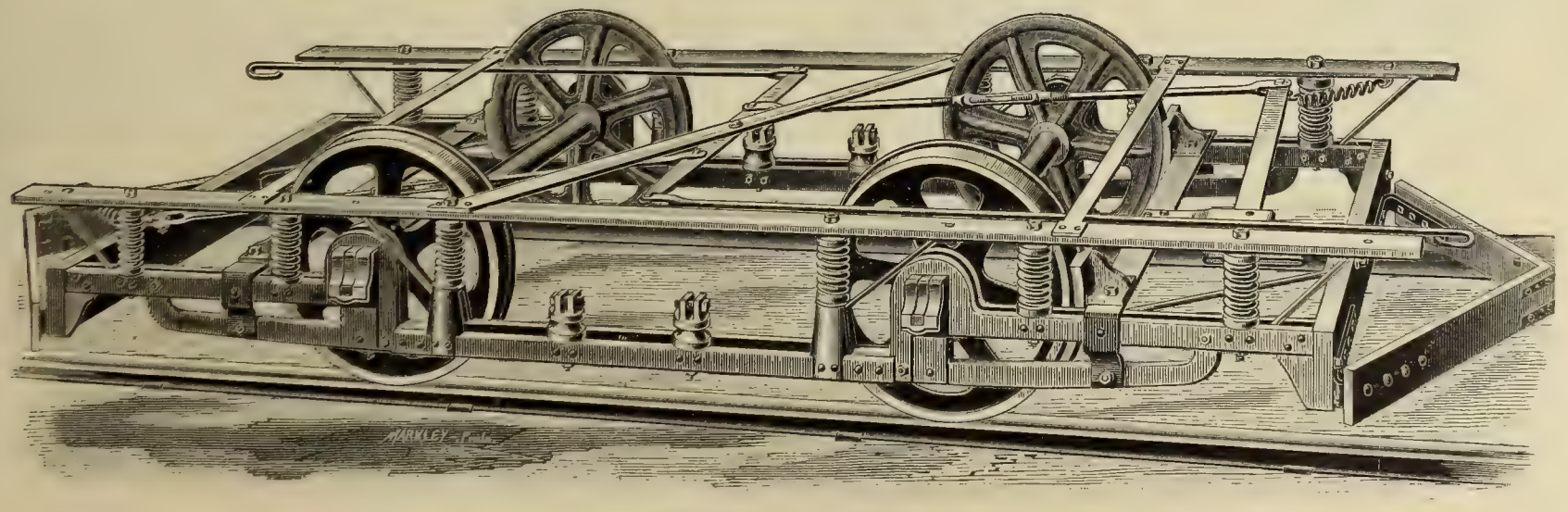
One of the difficult problems engineers have had to contend with in the designing of trucks for use on electric cars has been the reduction of oscillation of the car body to a minimum. This motion is, to say the least, decidedly unpleasant to the passengers, and while many improvements have been made in this direction, there is yet room for more. The designer of the truck which we illustrate herewith, Mr. C. M. Robinson, of Altoona, Pa., has adopted a new form, which is claimed to successfully reduce oscillating motion to a minimum. He has discarded the cast-iron yoke and pedestal method of constructing trucks. Constant observation and experience taught him that these yokes, riveted to the side frame, in order to support the extreme ends of the car body, must, necessarily, be so heavy that the truck was usually cumbersome, and the rivets which held the side bars to the yoke were located in the most vital part of the truck, which latter frequently pounded itself to pieces, the only alternative being the use of a truck so heavy that extra power was really required to run it.

In the truck shown herein, the car body is supported at the extreme ends by springs—no less than a dozen of these springs being used in all. The yokes, in which the journal boxes ride, are made of continuous steel bars, braced below the journal box with an equalizing bar, which distributes the weight equally, and the car wheels and axles may be removed and replaced without disturbing the car body or brake mechanism, by simply removing a bolt at each end of the bars.

The brake can be applied from either end, all up to the wheels being gripped simultaneously. The brake bars slide on the rigid side frames and grip the wheels at the same point, regardless of the weight of load; the brake mechanism lies close up against the car body and does not interfere with the motor.

The motor or armature can be easily removed without disturbing the car body or brake mechanism, thus making all the electric parts readily accessible.

The construction is such that the truck is admirably adapted for the new gearless motor, as well as for the old style motor.



ROBINSON CAR TRUCK.

A NEW FORM OF STANDARD CELL.*

BY CARL HERING.

The standard cells used at present may be said to be limited to the Clark cell and the Daniell cell. Each one of these has its specific advantages and disadvantages. The Clark cell is always ready for use, but is difficult to make, is affected by temperature, and has the important disadvantage that if by accident it is short-circuited it polarizes so rapidly and so much, that it is of no use at all until it has been allowed to rest and recuperate for some time. Such accidental short circuits are not unlikely to occur, and they may furthermore occur by the crossing of two wires, for instance, without the knowledge of the operator, thus making it possible that the measurements made with it are incorrect. The Daniell cell, on the other hand, does not polarize at all; it may be short-circuited and used almost immediately afterwards; furthermore, it is very easy for any one to construct a Daniell, and it is practically independent of temperature. But it has the important disadvantage that it must be freshly set up just before using and cannot be kept standing. In their good and bad qualities, therefore, the two cells are diametrically different.

The object of the present form of cell is to try to combine all these good points in one and the same cell. As the polarization of the Clark cell is an inherent fault and cannot be remedied, there remains only to endeavor to devise a form of Daniell which is always ready for use. The difficulty is due to the fact that there are two liquids which must be in contact with each other; these liquids will tend to mix, and if they mix to the slightest extent only, the cell can no longer be used as a standard. The difficulty therefore resolves itself to a means for enabling two liquids to be in contact without mixing. Numerous forms of Daniell cells have been devised with this object, but they accomplish it only in a degree, as for instance, by capillary tubes, porous diaphragms, etc., all of which, however, do not prevent mixing, but merely diminish the rapidity of the mixing.

In a number of these forms, in which two bottles or reservoirs are connected together by a tube, the mixing takes place quite rapidly unless the pressure of the liquid is exactly the same in both bottles, a condition not always easily complied with.

Some time ago the writer had occasion to use a cell of this form devised by Prof. Barker, which consisted of two bottles containing the two liquids with their respective electrodes, the bottles being connected at their bottom by a small tube with a stopcock. This cock was opened only during the moment when the cell was being used. But even during a few seconds no small amount of mixing took place, especially if the pressure was different in the two bottles. It is very difficult to avoid the latter, owing to the different specific gravities of the liquids and their different heights in the two bottles. The writer therefore modified this form by inserting two stopcocks in this tube and allowing the portion of the tube between the two cocks to communicate directly with the air, as shown in the adjoining cut. By this means the liquids, which mix at their contact, are allowed to drain off as rapidly as they mix. As there is an outward flow of the liquids through the cocks, the mixed liquids cannot pass back into the bottles. The liquids in contact with the electrodes will therefore always remain pure. To prevent too rapid a flow, which would needlessly waste the liquids, some filter paper, cotton or asbestos is packed into the tubes. The intermediate tube may be drained completely; there is always a film of liquid sufficient to answer for a contact if the cell is used on open circuit, which is the only way any standard cell should be used. It was even found that the film of liquid through the cocks when closed, was sufficient to give an electro-motive force which, however, falls as soon as the slightest current is allowed to flow.

The internal resistance of such a cell is naturally quite high, from 10,000 to 20,000 ohms, but this is no disadvantage for the usual class of open-circuit testing.

The E. M. F. of a Daniell cell, according to a report of Dr. Fleming, is as follows: when the specific gravity of the zinc solution is 1.2, and that of the copper is 1.2, when the zinc is amalgamated, and the copper is freshly electroplated with an untarnished, salmon-colored coating, having no brown spots, the E. M. F. is 1.105 true volts at about 16 degrees C. The temperature correction is negligable. The solutions and metals must be perfectly pure, and the solutions made with distilled

Continued on page 317.

* Read at the stated meeting of the Electrical Section, held Feb. 24, 1891.

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NOTES.

The extensive use in this country of electricity as the motive power on street railroads has led to many inquiries from tramway companies in foreign countries as to the practical working of our roads. Many orders for tramway materials have been received by American houses from foreign companies, and the interest in electric railways is constantly increasing in these lands, as is evidenced by the fact that questions are continually being asked. It is believed that many foreign tramway companies are ready for the adoption of electricity on their lines and if the advantages of the American system were properly and fully explained to them, a splendid foreign trade no doubt would be thrown open to American enterprise. These foreign companies need more light on the subject, and it is a good time to strike the iron now it is hot. One enterprising American house has anticipated the demand for American electric railway material and already sent a representative to Europe for the purpose of developing a foreign trade in this line. The success of electric railways in the United States is justly attracting a great deal of attention among foreign street railway owners, and no doubt before long electric railways operated on the American system will be quite familiar in foreign cities.

The determination of Foucault and hysteresis losses separately is a task that is not easy of accomplishment, but Mr. Gisbert Kapp, the well-known English electrical engineer, has developed a very simple method of doing this very thing, which is capable of further development so as to become applicable to alternators and converters. We print elsewhere in this issue a timely article by this gentlemen, on this subject, which no doubt will be of extreme interest to all practical electricians.

The success of the London-Paris telephone lines has given a great impetus to long distance telephony on the continent of Europe. We learn that a newspaper in Brussels has commenced a news service between that city and London, *via* Paris, and that the same paper is now arranging for similar service between Brussels and Berlin. Our Brussels contemporary possesses some of the enterprise and spirit that characterizes the American newspapers.

THE Board of Electrical Control, on May 15th, awarded to the Empire City Subway Company, limited, the privilege of building subways in New York for low tension currents. This company was recently organized to relieve the Consolidated Subway Company of the low tension conduits, and it was necessary to obtain an act of the legislature to legalize the division of the work. The creation of the Empire City Company was brought about by the alleged slowness on the part of the Consolidated Company in the construction of subways. It is hopeful that the work of subway building will hereafter progress with greater rapidity, as many of the New York streets are in a state of topsy-turvy, much to the discomfort of pedestrians and residents.

We learn from an English contemporary that steps have been taken to keep the entrance to the London Council subways locked, and that when a gas, water, electric lighting or other companies having pipes, wires or other apparatus therein desires to obtain access to the subways, 24 hours notice in writing must be given to the Council's Chief Engineer. Such a rule may work all right in London, but it would not and could not be observed very long in New York. No doubt it will work all right when it is desired to merely inspect the underground plant, but suppose a water pipe should burst, or a gas pipe leak, the subway for a considerable extent would likely be irreparably damaged.

The large and increasing consumption of india rubber has, in late years, given rise to considerable uneasiness on the part of those directly interested in this important product, as to how long it will be possible for the supply to meet the demand. It has been stated that the supply is being rapidly diminished, and that in the near future the consumption will far greatly exceed the production. The electrical industries are very large consumers of rubber, and, so far as known, there is no other substance that fulfills every requirement as an insulator as does rubber. In order to be prepared for the dearth in rubber, which is regarded by many as sure to come, and soon, many inventors and scientists have turned their attention to the production of a substitute. Some good results have been attained, but nothing so far as we know has been produced that fulfills every requirement. It will be of interest, therefore, to electrical people to learn that an "india rubber" tree is claimed to have been found in China, which, if all reports concerning it are true, will probably prove to be a valuable and extensive source of this quite indispensible substance.

In the development of electric lighting and the widening of the field of its application, the necessity has manifested itself for power in some form which would be cheap and require the least amount of attention. As we have pointed out on previous occasions, domestic electric lighting—that is the lighting of our homes by electricity as we do now with gas—is a tempting field for the inventor. It is not desirable nor convenient to have a steam plant on one's premises, for various and obvious reasons, but if water power could be supplied to run a small dynamo on the premises, the solution of the problem would seem to be solved. An efficient water motor would unquestionably go a great ways in making domestic electric lighting practical, and for this reason an article on a machine of this class, which we print elsewhere in this issue will, we think, be of interest, and no doubt full of suggestions.

For a long time a sort of a halo of glory has surrounded the metal aluminium. It has enjoyed a pseudo reputation as being capable of doing wonderful things and accomplishing remarkable results, and greatly exaggerated and sensationalistic ideas concerning the metal have taken possession of the minds of many people. But as the metal becomes better understood these baseless attributes vanish like a mist and leave it exposed to the light of truth, which reveals its true nature. There is an effort among scientists to correct these erroneous impressions concerning aluminium, and while they all acknowledge the value of the metal for some purposes, they are doing a good work in telling what it is not good for. Prof. F. B. Crocker made some interesting remarks on the subject at the last meeting of the Institute of Electrical Engineers, and threw a good deal of light on the nature and value of the metal. The popular idea of aluminium is that all the good properties of all its alloys are attributed to the aluminium itself, and one of the most common mistakes is the attribution to this metal of the tensile strength of aluminium bronze, the composition of which is nine parts of copper, to one of aluminium. Another common error is that aluminium is free from oxidation. This attribute has no foundation in fact. Indeed, it is eagerly attacked by acids, and is freely dissolved by alkalies, whereas most of the metals are not. It is not much affected by sulphur or sulphurated hydrogen, and this is one advantage. In alkaline solutions aluminium is dissolved, as most metals are in acids, with the evolution of hydrogen. Much has been said about the value of the metal for the manufacture of kitchen utensils, but, even this notion is exploded. The alkali in the soap would attack the metal, and salt would have a bad effect on it. So, after all, aluminium will not be put to so many valuable and important uses as people imagine. It has good qualities but its extensive use would be retarded by the absurd exaggerations of them, because when the people begin to use it they will be greatly disappointed. Prof. Crocker covered the ground very well and completely, and we commend his remarks, which are published elsewhere in this issue, to the thoughtful consideration of all our readers.

We have received from Mr. William J. Richardson, secretary of the American Street Railway Association, an excellent India proof of a steel plate engraving of Mr. Thomas Lowry, of Minneapolis, Minn., president of the association for the year 1889-90.

The electric light service in Berlin is to be extended, and new underground cables are to be laid for the purpose.

ELECTRICAL MEASURING INSTRUMENTS FOR SCHOOLS.

We illustrate herewith a number of Electrical testing and measuring instruments, just designed and put upon the market by Messrs. Queen & Company, of Philadelphia, expressly for the use of schools and beginning students in laboratory work. They are capable of doing very nice and accurate work, and are especially adapted to the use of beginners, as they are strongly made and have their delicate parts so arranged as to be easily and quickly replaced in case of injury. In these instruments all unnecessary and superfluous finish has been avoided ; at the same time, they are neat and well made and will not appear out of place in the best appointed laboratories.

The list, as published by Messrs. Queen & Company, is a most complete one, and includes all the instruments necessary for a thorough first year's course in laboratory electricity.

Fig. 1, shows a neat form of horizontal gavanometer for ordinary work ; this style is furnished with different windings, so as to measure currents ranging from 0.01 to 40 or 50 amperes.

Fig. 2, is the same thing with a heavy copper strip moving over a graduated arc, thus allowing the measurement of heavy currents and the demonstration of the laws of the cosine galvanometer.

Fig. 3, is a fibre suspended galvanometer, pivoted on a vertical axis, for use as a sine galvanometer.

Fig. 4, is a reflecting galvanometer of the Thomson type ; a small brass cylinder with glass face may be pushed backward and forward in the central axis of the coils, thus altering the size of the air chamber in which the mirror swings, and enabling the deflections to be made very dead beat.

Fig. 5, is another "dead beat" galvanometer, of the Edelmann type, the mirror being attached to a bell magnet moving in a mass of copper ; by removing this mass of copper the instrument is made ballistic, thus making it useful for measurements of condenser capacities, battery resistances, comparison of electro-motive forces, etc. The coils are readily removable, as seen by the illustration, and may be changed in a moment for others of a higher or lower resistance. Both these last two styles of galvanometers are furnished wound to high or low resistances, as ordered.

The well-known Depres-D'Arsonval Galvanometer, as it is commonly called, appears in Fig. 6. This galvanometer, one of the most sensitive types known, and very "dead beat," needs no explanation or comment.

Fig. 7, is a tangent and sine galvanometer. Fig. 8, is one of the four or five resistance boxes of this series and represents the type ; the particular box shown is a combination Wheatstone Bridge and Resistance Set, having twelve coils in the resistance portion aggregating 1,110 ohms, and bridge arms of 10,100 and 1,000 ohms on the side, thus giving a range of measurement from $\frac{1}{100}$ ohm to 111,000 ohms ; the coils in these sets are all guaranteed to $\frac{1}{5}$ of 1 per cent. A slide wire bridge is shown in Fig. 9.

There is also a reading telescope, Fig. 10, for use with the previously mentioned reflecting galvanometers. This telescope has adjustments for altitude, and both coarse and fine adjustments for azimuth. For those not partial to telescope methods, a neat lamp stand and scale is provided. Keys of all descriptions, some of which are illustrated, are included also. The list is completed by speed counters, standard cells, chloride of silver test batteries, small ammeters and voltmeters, copper voltmeters, etc.

A neat 16-page catalogue, 1-70, of all this apparatus is issued by Queen & Company, which will be sent free on application to intending purchasers.

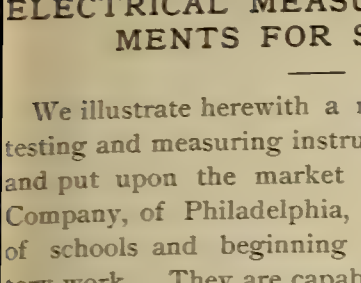


FIG. 1.

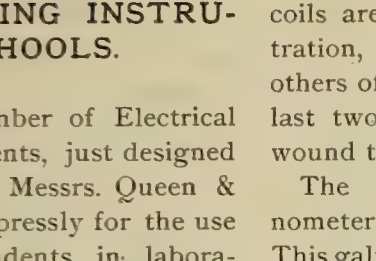


FIG. 2.

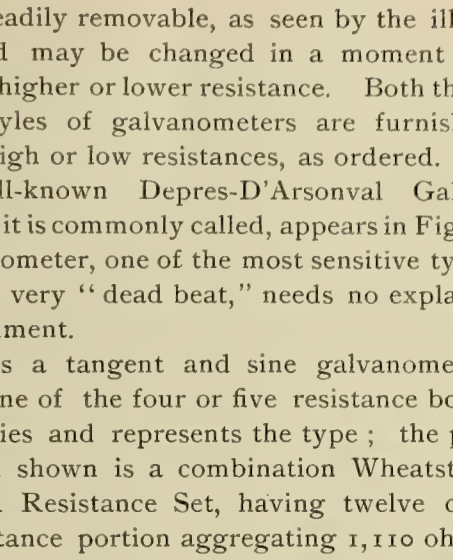


FIG. 3.

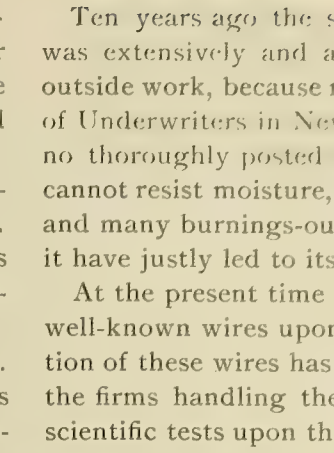


FIG. 4.

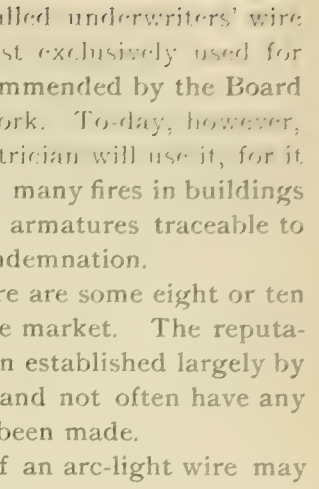


FIG. 5.

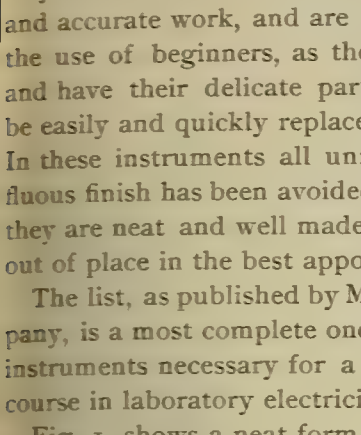


FIG. 6.

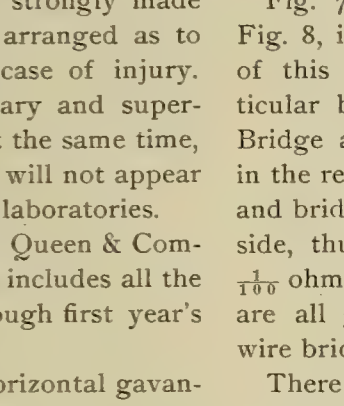


FIG. 7.

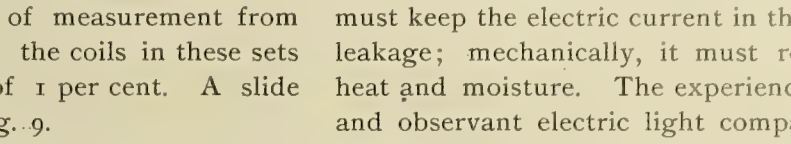


FIG. 9.

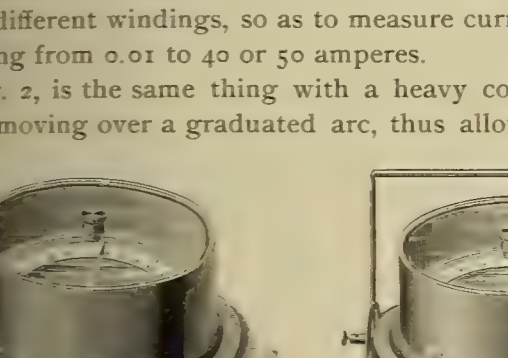
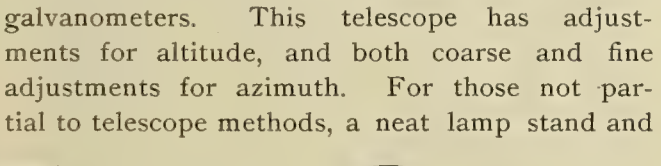


FIG. 8.



KEYS.

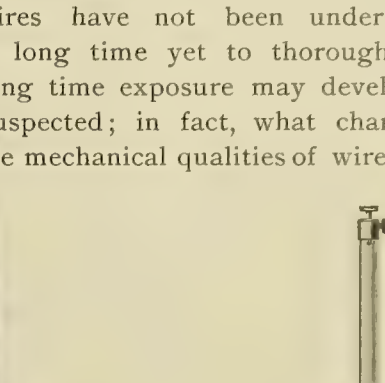


FIG. 10.

THE INSULATION RESISTANCE OF SOME ELECTRIC LIGHT WIRES.*

The insulation resistance of electric light wires is commercially of great importance. Leakage through defective or insufficient insulation represents not only expensive waste, but great danger to the generating machines by grounding them, and thus exposing their armatures to burning out. The element of risk to life and property also depends somewhat upon the character of the insulating sheath of the wires.

Ten years ago the so-called underwriters' wire was extensively and almost exclusively used for outside work, because recommended by the Board of Underwriters in New York. To-day, however, no thoroughly posted electrician will use it, for it cannot resist moisture, and many fires in buildings and many burnings-out of armatures traceable to it have justly led to its condemnation.

At the present time there are some eight or ten well-known wires upon the market. The reputation of these wires has been established largely by the firms handling them, and not often have any scientific tests upon them been made.

The insulation sheath of an arc-light wire may be considered to have two functions, one electrical and the other mechanical, though the former is largely dependent upon the latter. Electrically, it must keep the electric current in the wire without leakage; mechanically, it must resist abrasion, heat and moisture. The experience of any good and observant electric light company will determine a wire's claims to the mechanical part, though wires have not been under trial a sufficiently long time yet to thoroughly prove them, a long time exposure may develop faults not yet suspected; in fact, what changes may occur in the mechanical qualities of wires bearing for many years high-tension currents, we do not know. Particularly as regards alternating currents, it seems to us highly probable that after some years the wires will show unexpected changes in brittleness and tensile strength. We know scarcely anything yet about heavy alternating currents.

Certain facts, however, in regard to the electrical qualities of an insulating sheath may be determined by tests. With this object in view, experiments were made in the spring of 1890, in the physical laboratory of the State University, upon six of the principal arc-light wires in the market. All of them had been in outside use by the Lawrence (Kas.) Electric Light Company. These tests were made to determine the insulating power of the wires against leakage when exposed to moisture. The wires were No. 6 American wire gauge, guaranteed by the makers to be water-

* Paper of Professor Lucien Blake and H. Radcliffe, read at the Kansas Academy of Science.

proof. Lengths of about 25 feet were taken, wound into coils and immersed in large tubs filled with hydrant-water. The two ends of each coil projected about two feet out of the water. The coils were left in the water for nearly three months, measurements at first being made every day so long as considered necessary. The mode of testing was that known as the substitution method. One of the projecting ends of a coil of wire was connected to a delicate Wiedemann adjustable-coil dead-beat mirror galvanometer and to the positive pole of a single gravity cell. The negative pole was connected by a wire to a copper plate 20 inches square, which was placed in each tub of water in the centre of the coil. The other projecting end of each coil was left insulated in the air. Resistance boxes reading to 100,000 and 33,000 ohms, respectively, were so connected that they could be substituted in the circuit of the galvanometer and battery in place of any particular coil. For convenience, a special mercury switch was so constructed that the observer could throw in succession the different coils or the resistance boxes into the galvanometer circuit, and by equal deflections the resistance of the insulation sheaths could be determined. It is evident by the arrangements of the experiment, that only through the insulating layer of the wire could the current escape to complete the galvanometer circuit; and from the reputation of the wires, only a small leakage was to be expected. The insulation resistance should be several million ohms per mile. After three months' immersion' final tests were made, which gave the following results:

No. 1.....	7,200	ohms	per yard.
No. 2.....	8,067	"	"
No. 3.....8	16,000	"	"
No. 4.....	7,333	"	"
No. 5.....	3,702	"	"
No. 6.....	3,300	"	"

As the result of these tests, No. 3 is now used almost exclusively on the Lawrence electric light circuits; and at this writing, after nearly a year of out-door exposure, the insulation seems as perfect as at first.

THE SEPARATION OF FOUCAULT AND HYSTERESIS LOSSES.

BY GISBERT KAPP.

The total loss of power taking place in the armature of a continuous current dynamo beyond the unavoidable loss due to copper resistance, is made up of the following:

(*a*). Loss through mechanical friction.

(*b*). Loss through hysteresis in the armature core.

(*c*). Loss through Foucault currents; either in the armature core or in all the conductors, or in the conductors under commutation only, if the setting of the brushes is faulty.

A further loss of power is due to air resistance, but this is so insignificant that it may be neglected.

It need hardly be pointed out that any simple method by which we can separately determine these losses is of practical value, and I propose to describe such a method in the hope that some reader may find a way to further develop it, so as to become applicable to alternators and transformers, a class of apparatus in which the exact determination of Foucault and hysteresis losses is of even greater importance than it is in continuous current dynamos.

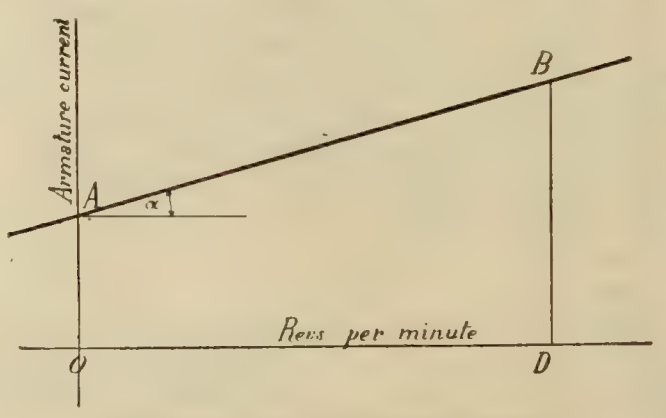
The method is based upon the supposition that the torque required to overcome hysteresis and mechanical friction is independent of the speed, and that, therefore, the work lost through these two causes (if the field strength remains constant) is simply proportional to the speed. Since both mechanical friction and hysteresis are assumed to follow the same law, it is clear that a method based on such an assumption cannot be used to separate these two losses, but can only give their sum. The loss by friction can, however, be determined with a fair degree of accuracy from the dimensions of the bearings, weights, magnetic attraction, speeds, the lubrications, etc., and thus we can, at least approximately, get the hysteresis alone, provided we can separate the Foucault losses. It should also be remembered that the purely mechanical loss by friction is generally very small as compared with the other two losses, and an error in the estimate of the friction has only a small effect on the correct determination of the hysteresis loss, and no effect whatever on the determination of the Foucault losses.

For the same excitation the Foucault losses must obviously increase as the square of the speed. We have, therefore, the following equation for the total number of watts wasted in the armature, other than by copper resistance:

$$W = n\,H + n^2\,F.$$

n being the speed in revolutions per minute, and H and F co-efficients which depend upon the excitation, but do not vary with the speed. The co-efficient H refers to the loss due to hysteresis and friction, and the co-efficient F refers to the loss due to Foucault currents.

Mr. W. Mordey was probably the first to make use of this equation in order to determine and separate the various losses which occur in the armature.* His method is as follows: He drives the armatures by means of a belt from an electro-motor, and notes either the electrical power supplied to the motor, or by means of a transmission dynamometer the mechanical power given to the armature with its field inert, and also with its field excited to various degrees. Provided the transmission dynamometer is correctly calibrated, or the efficiency of the motor is accurately known for these various conditions, and the loss of power in the belt is also known, this method can be used to separate not only Foucault losses from losses due to hysteresis and friction, but also the initial friction loss when the armature is revolving in a non-excited field from the hysteresis and friction loss when the armature is revolving in an excited field. Keeping the excitation constant, Mr. Mordey varies the power supplied to the armature under test, and thus gets a series of values for W and n, which are plotted in a curve. Selecting any two points on this curve (not too near each other) it is easy by a trial and error method, or by the solution of a quadratic equation to determine the values of H and F, which will satisfy this curve throughout its range, and having found these values, the above equation enables us at once to separately determine the losses.



FOUCAULT AND HYSTERESIS LOSSES.

There are, however, some objections to this method. In the first place, it pre-supposes the possession of a reliable transmission dynamometer or an exact knowledge of the efficiency of the motor and of the loss of power in the belt, both points on which legitimate doubts may be entertained. In the second place, and this is the more serious objection, the necessity of using a second machine as a motor and rigging up a belt transmission, involves an amount of labor and expense which one would be glad to avoid. In the new method no second machine is required, but it has the disadvantage of being only applicable to armatures which have already received their winding; whereas Mr. Mordey's method can be used to investigate an armature core before it is wound. The method about to be described is also based on the above formula, but the power W is supplied to the armature under test electrically instead of mechanically; in other words, the dynamo to be tested is run light as a motor, and note is taken of the speed and armature current while the excitation is kept constant. At least one reading of the pressure at the brushes (preferably at the highest speed and armature current) must also be taken, but more such readings may be taken as a check. Since the dynamo is running light, the armature reaction on the field will be small enough to allow us to neglect it, or, in other words, we are justified in assuming that the field strength remains constant for all speeds. It should, however, be remembered that this is only an approximation, and that the Foucault currents, if they are very strong, will produce a distortion of the field, quite apart from the very small distortion produced by the armature current proper. In fairly good machines such a result need, of course, not be expected.

Assuming, then, a constant field of z (English) lines, and donating by r the number of external armature conductors in a two-pole machine, we have the E.M.F. at the brushes given by

$$e = z\,r\,n\,10^{-8}$$

if we neglect the very small E.M.F. lost in armature resistance. The power supplied by the current c is

$$W = e\,c,$$

or

$$c\,z\,r\,n\,10^{-8} = n\,H + n^2 F,$$

from which it follows that

$$c\,z\,r\,10^{-8} = H + n\,F.$$

Since z and r are constant, the current is equal to the sum of a constant, $\frac{H}{z\,r\,10^{-8}}$ and another factor, which varies directly with the speed. The curve representing the current as a function of the speed must, therefore, be a straight line, as shown in the annexed diagram. The height O A at which this line intersects the vertical axis is a measure of the current required to overcome the torque of friction and hysteresis, and the inclination of the line is a measure of the influence of Foucault currents, or in symbols

$$\tan a = \frac{F}{z\,r\,10^{-8}}.$$

Let c_0 = O A be the initial current, then we find directly from the diagram the value of the co-efficient $H = c_0\,z\,r\,10^{-8}$, and inserting this in the formula given above, the value of

$$F = \frac{W - n\,H}{n^2},$$

where n and w are observed values. It should be noted that in practice it is not even necessary to know the winding and field strength. All we need do is to observe the current and speed, in order to determine the position of the straight line A B, and take an accurate reading of the pressure e and current c = D B observed at a particular speed O D. The ratio c_0/c at once gives the ratio of loss due to hysteresis and friction to the total loss which includes the Foucault losses, and since we know the total loss ($w = c\,e$) its two component parts can be found by a simple rule of three, and a subtraction. If the current curve A B is not a straight line, it is a sign that the Foucault currents are strong enough to produce a distortion of the field.

The proposed consolidation of the electric light interests of St. Louis will not be consummated without some opposition. Voluminous objections to the proposed deal have been filed in court, to prevent if possible, the purchase of the Missouri and Municipal electric light plants by the Laclede Gas Company.

* Electrician, London.

ELECTRICITY IN THE PRODUCTION OF ALUMINIUM.*

PROF. FRANCIS B. CROCKER:—Mr. President nd gentlemen of the Institute: There are two oints in connection with aluminium which I wish o consider particularly.

The first relates to the properties and the sec- nd to the production of aluminium. I think hat Mr. Brown spoke very truly in regard to the xaggerated ideas of the advantages of alumin- um, but I do not think he went quite far enough. The popular idea of aluminium is that all the good properties of all its alloys are attributed to aluminium itself. It is like one individual having all the good qualities of all his relatives attributed to him personally. This is, of course, an absurd fallacy. Nevertheless, it is one that is made in every newspaper article on the subject, and I am sorry to say it is frequently made in technical journals. The most common mistake of the kind is to attribute to aluminium itself the tensile strength of aluminium bronze, which exceeds that of wrought-iron, and is about as high as good specimens of steel. It is really one of the most tenacious metals known, but its composition is about nine parts of copper to one part of alumin- ium; yet its tensile strength is almost invariably attributed to pure aluminium, having a specific gravity of 2.6, which is only one-third that of iron. They take the low specific gravity of pure aluminium and the high tensile strength of alum- inium-bronze. As a matter of fact, the specific gravity of aluminum-bronze is higher than that of iron. Therefore we do not have lightness com- bined with high tensile strength. Turning again to aluminium itself, its tensile strength is about 26,000 pounds per square inch; in other words, about one-third that of iron. This just balances the difference in specific gravity, but still leaves the advantage in favor of iron, because one-third of the volume has the same strength and the same weight as a rod of aluminium. Now the same exaggeration is applied to its other qualifications; for example its chemical properties. Aluminium bronze is remarkably free from tarnishing. A bright surface of aluminium bronze may be ex- posed to the atmosphere for several months and retain its polish. That property is attributed to aluminium itself. Aluminium, as Mr. Brown said, is not particularly liable to corrosion, but if it is subjected to salt water or alkaline water, or even ordinary moist air, it does tarnish and oxi- dize rapidly. Salt water is quite hurtful to it. Therefore, freedom from oxidation is another property that is wrongly attributed to it; and the objection to all this is that it gives a very wrong impression in regard to what would other- wise be a good and legitimate object of admiration. I am not prejudiced against the metal aluminium and would be very glad to see it used extensively, but I do not think its extensive use will be hasten- ed—in fact I feel quite sure it will be retarded—by absurd exaggerations of its good qualities, because when people do come to use it they will be great- ly dissapointed. This common idea, for example, that it has 100,000 pounds tensile strength per square inch, and about one-third the specific grav- ity of iron, would lead anyone to serious difficul- ties. Taking the general public, ninety-nine per- sons out of every hundred have entirely wrong ideas respecting it. There are certain things that seem to have a glamour about them—a word which Mr. Brown uses and which expresses the fact perfectly. Storage batteries and aluminium seem to be particularly favored by the public, and it has occurred to me that a combination of aluminium and storage battery—that is an alum- inium storage battery—would be simply irresisti- ble. [Laughter.] This sensationalism is really I think, a bad thing for a new enterprise, because it is only destined to severe dissapointment, but aluminium really has excellent qualities and can live down this gross exaggeration of its good qualities.

Now, taking *seriatim* the actual properties of the metal, and considering them as mechanical, chemical and electrical, we have under the me- chanical head a specific gravity of about 2.6, which is almost exactly one-third of iron, and its tensile strength is 27,800 pounds, according to Mr. Brown, which is again almost exactly one-third of ordinary wrought iron. Therefore, iron and aluminium have equal strength, weight for weight, but iron has, as I have said, the great advantage of one-third of the bulk for the same strength and weight. Furthermore, any metal which "can be easily cut with a knife" is not particularly good for structural purposes as a metal. In my opin- ion it is too soft altogether. It is very much such a metal as zinc or tin. In fact one can hardly tell the difference except by the weight, in filing or cutting it; and certainly tin and zinc are seldom used for structural purposes, and I do not think they would be, even if they were very much lighter than they are.

Taking up the chemical properties I have al- ready alluded to, the ease of oxidizing, which, as I say, is not excessive, but still about equal to other metals, such as tin, zinc and iron. It is easily, in fact, eagerly attacked by acids. It is not much affected by sulphur or sulphureted hydrogen, which is a great advantage, it is very freely dis- solved by alkalies, whereas most other common metals are not. In an ordinary alkaline solution aluminium is dissolved, as most metals are, in acids, with the evolution of hydrogen. This is quite a serious disadvantage for a common metal, which is liable, for example, to have soap used upon it. We do not expect metals to be attacked by alkalies.

As to the electrical properties, of course conduc- tivity is about the only one. The electrical con- ductivity is about twice that of copper for equal weight, and is about half that of copper for equal volume. Where it is important to have a light wire, and the size is not to be considered, you can use an aluminium wire, because you get an advant- age of 2 to 1 in weight. But when you consider size, for instance, a wire which has to be covered with insulating material that is expensive, then you would have a disadvantage. The figures happen to be very simple in all these cases.

In regard to the manufacture of the metal, that, I think, is an electrical monopoly, for the simple reason that I do not think anything else can suc- cessfully compete with electricity in the production of a metal the chemical affinities of which are as high as those of aluminium. Aluminium has great chemical affinities, ranking about half way between the ordinary metals and metals like so- dium and potassium. These chemical affinities exhibit themselves when it is attempted to separ- ate aluminium from chlorine or oxygen, for example. The ordinary smelting process does not seem to have ever been successful in the reduction of aluminium. So far as I know, aluminium has never been successfully reduced as iron or other ordinary metals are reduced by merely smelting in a furnace with coal. The nearest approach to this is smelting in presence of carbon, but with a very high temperature obtained by the electric current, higher than can be obtained by smelting. Therefore, even if we employ the process of smelt- ing we still have to employ electricity. In any electrolytic reduction of the metal, of course we have to employ electricity. Such a process seems to be a very simple and effective method, *i. e.*, the plain electrolysis of some compound of aluminium, the electrolyte being in a fused state between two electrodes. Now the fused state is necessary in- stead of the ordinary aqueous solution, because if you attempt to separate aluminium in an aqueous solution, you will get hydrogen instead of alumin- ium, in other words, water is more easily decom- posable than the aluminium compound.

Thus we have the electrolytic process as a very successful process, and the fused state as appar- ently necessary, and not really objectionable, be- cause the temperature of the bath may be kept up by the electrolytic current itself.

Then we have, as the only other likely substi- tute for these two electrical processes, the ordinary chemical method of reducing, by means of metallic sodium, some compound such as the chloride or double chloride of aluminium and sodium. But even then I think we had better make our sodium by electricity; so it would still be an electrical process. So far as I can see, and experience in the past few years seem to corroborate this view, electricity is the only commercial means of pro- ducing aluminium at the present price. In the old days, when the chemical process was used, aluminium was $12 or $15 a pound. Now it is about $1, and I doubt if any chemical process could compete on this basis. Therefore, the reduction of aluminium seems to belong to electrical science, and it is certainly a very in- teresting and important application of electricity, and is, I think, destined to be perfectly successful. The purity of the metal does a great deal, as Mr. Brown says, towards improving its quality. It does make a very much better metal of it. The impure aluminium is really a poor metal in almost every respect except mere lightness. But empty space is much lighter than aluminium. So there is no particular object in paying a dollar a pound to fill up space with something that is merely light, if it has no other desirable qualities.

MR. F. L. POPE: "I have always felt a good deal of interest in aluminium as a metal, ever since the time, many years ago, when the now venera- ble Moses G. Farmer said to me: 'There is seven dollars worth of aluminium in every brick, if we could only get it out, but,' he continued, reflec- tively, 'I suppose if we should finally get it out it would no longer be worth seven dollars.' So it was not without gratification that a little over two years ago I accepted a commission in behalf of the parties who subsequently established the plant at Boonton of which Mr. Brown has told us this evening, to visit the works where the Heroult pro- cess was then being carried on, at the Falls of the Rhine in Switzerland, and make a careful investi- gation of it. I had thought to report here to-night some of the results of my observations at that time, but Mr. Brown has treated the subject so exhaustively from every point of view, that he has left me nothing to say other than to corroborate his own statements. I paid careful attention to the cost of production and examined the items in great detail at the time, and I think I can corro- borate the statement of Mr. Brown, that aluminium can now be produced in large quantities by elec- trical processes at a price very nearly as low as the equivalent bulk of copper. One thing that struck me very forcibly was the small amount of manual labor required in the works in proportion to the value of the product. They were turning out at the Rhine Falls a good many hundred pounds a day of aluminium-bronze, and employed only six men, five of whom were ordinary day laborers. I was also particularly impressed with the admira- ble performance of the dynamos used in Switzer- land, which are precisely the same as the one at Boonton which Mr. Brown described. There were two of them coupled together and to a vertical turbine, and rated at 150 horse-power each—a very moderate rating I should say. I saw the ammeter, on one occasion when I was watching it, indicate 27,000 amperes. The current heated the loop of the conductor which surrounded the ammeter, which was a copper bar three and a-half inches square, very hot indeed, yet very little sparking was perceptible at the brushes of the dynamo. The machine gave a sort of a grunt when this great load was thrown on, but that was about all

* Abstract of discussion on paper read by Mr. A. S. Brown before the Institute of Electrical Engineers, April 21st, 1892.

the effect that was observable. In preparing a report of my observations in Switzerland, I was considerably surprised at the limited number of industrial uses that I could think of, or could discover, for pure aluminium, and this circumstance led me to much the same conclusion that Professor Crocker has expressed here to-night, namely: that the commercial utility of pure aluminium as a metal has been very greatly exaggerated. His remarks, however, bring to mind one of Mr. Edison's characteristic observations, to the effect 'that there is nothing quite equal to the storage battery for developing one's latent capacity for lying.' I think in that respect the metal aluminium has been a close second to the storage battery."

THE MANUFACTURE OF CARBONS.

To give our readers an idea how electric light carbons are made, our representative visited the Partridge Carbon Company, of Sandusky, O., to gather all the data possible for such an article.

This company started to manufacture carbons and carbon specialties last September, since which time they have built up a flourishing business. Every department seemed to be overrun with orders and the manager stated that they would soon start double turn.

The factory consists of four large buildings, covering 1½ acres of ground. The building containing all the heavy machinery, and where the making of the carbons is carried on, is 60 x 120; the two buildings containing the furnaces are each 30 x 100, and the finishing building, where the material is plated and packed ready for shipping is 30 x 60.

The carbons are made from petroleum coke, pitch, etc. The company get the petroleum coke from Cleveland, Oil City and Pittsburg, where oil is refined. They first grind the coke with a large crusher, to the size of peas; it is then calcined by burning out all foreign matter and leaving it as near pure carbon as possible. The pure carbon is then ground in a mill until it is as fine as flour, when it is taken to the mixing kettles, where it undergoes a treatment with pitch, etc., until it has the consistency of a pill mass. It is then put in moulds and pressed in large balls at 80 to 100 tons pressure. From this hydraulic machine it is taken to another where the pressure is 3,000 to 4,000 tons, and the carbon is forced through a hole $\frac{7}{16}$ of an inch to 3 inches in diameter. The plastic carbons are then cut up into suitable lengths and packed in cans ready for baking.

From this building the cans are taken to the furnace building, hermetically sealed and packed into furnaces, each of which has a capacity of 100,000. The natural gas is then turned on and the carbon left five or six days to bake. There are but two other companies using natural gas, and their experience is that the gas gives a much more even heat and bakes the carbons more uniform than any other fuel. After they are baked they are ready for pointing. One boy can point from ten to fifteen thousand a day. After they are pointed they are transferred to the plating room, where the finishing touch is put on by electrolysis. The carbons are suspended in large vats where they receive a coating of copper. It requires eight or ten minutes to cover each carbon. They are then packed in boxes that will hold just 1,000 each, and they are ready for shipment.

The company have a 100 horse-power boiler, one 80 horse-power engine, and one Thomson-Houston dynamo with eight lamps used for testing the carbons before they are put on the market. For the copper plating, a United States dynamo is used.

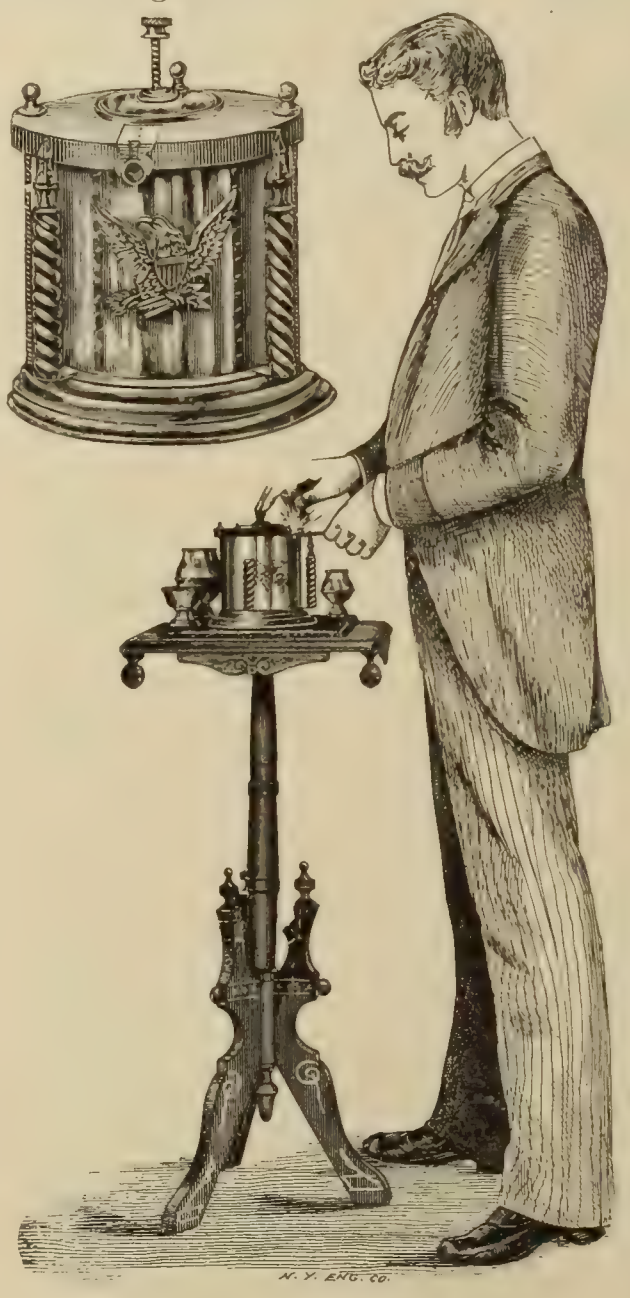
The manufacture of carbon brushes for motors and dynamos is getting to be quite an industry, and the orders for them takes up a great deal of time. The process is similar to making the electric light carbons, excepting the mixture and labor requires more time to turn out a fine brush.

The company is working up quite a reputation for all kinds of brushes and battery plates. They expect to increase their capacity to 100,000 carbons per day in the near future, as the combination that is forming has awakened a great many electric light men to a realization of the practical results of a combine. The Partridge Carbon Company claim to be on the outside, with sufficient encouragement to stay.

PORTABLE ELECTRIC LIGHT.

The utilization of electrical devices of one kind and another is one of the conspicuous and remarkable features of human progress at the present time. An incessant succession of new and ingenious applications of electricity leads one to wonder what the developments of the next ten years will be.

The majority of inventions using or generating electricity are practical, common sense devices, designed not only for use, but for the comfort of those using them.



A HANDY ELECTRIC LIGHT.

Among the latest and handiest in this class of inventions is the useful electric light shown in our illustration, which is being introduced by the Barr Electric Manufacturing Company, of 17 and 19 Broadway, New York. Those who are continually looking for matches to light their cigars will appreciate this little device. It is complete in itself, requiring no extra power, wires or connections, the current of electricity being generated by chemical action. It can be taken to pieces at will and is just as readily adjusted. To use it a button is pressed, the apparatus does the rest.

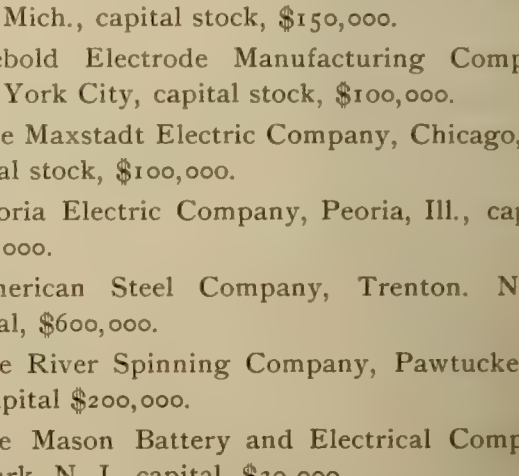
The material to charge the battery can be obtained at any drug store for a few cents, and it will run 30 to 60 days, giving 5,000 lights with one charge. With ordinary care it will last a lifetime. Any part can be replaced at a small cost.

The apparatus occupies a space of but six square inches, and it is handsomely constructed and highly ornamental, and will take a prominent place among the bric-a-brac of reception rooms, parlors, offices, etc.

Aside from lighting purposes, this instrument is a complete and perfect medical battery, neat, portable and powerful, producing an electric current of the finest or greatest intensity; or it may be used for electric gas lighting, and burglar alarm or call-bell purposes. Great pains have been taken to make it as perfect and as cheap as possible.

REVOLVING STORE FIXTURE.

The Bush Revolving Store Fixture Company, 24 Park Place, New York, has just completed and put on the market their triple spool motor, with one armature, to be run by a battery of two volts of current, consuming but two-tenths of one ampere per hour. It has a magnetized armature, which gives it four times the power of any other similar motor, the armature circuit being completed through this armature.



REVOLVING FIXTURE FOR SHOW WINDOWS.

Instead of a commutator, which they used in their old motor, they now use contact points, which is an improvement, and the motor has no dead centre. They use them principally on their revolving store fixtures, and one motor will propel three to five tables on two cells of Edison-Lalande "G" battery. They have also gotten out a new window sign, together with other novelties on which they are using this motor, and will doubtless meet with the success they deserve.

NEW COMPANIES.

Among the new electrical concerns recently organized and incorporated, are:

The Consolidated Electric Company, of Birmingham, Ala., capital stock, $500,000.

The Phœnix Electric Light Company, Phœnix, Arizona, capital stock, $100,000.

The Shaw Electrical Crane Company, of Muskegon, Mich., capital stock, $150,000.

Siebold Electrode Manufacturing Company, New York City, capital stock, $100,000.

The Maxstadt Electric Company, Chicago, Ill., capital stock, $100,000.

Peoria Electric Company, Peoria, Ill., capital, $100,000.

American Steel Company, Trenton. N. J., capital, $600,000.

The River Spinning Company, Pawtucket, R. I., capital $200,000.

The Mason Battery and Electrical Company, Newark, N. J., capital, $30,000.

The Direct Electric Company, New York City, capital, $5,000,000.

The White Electrical Improvement Company, Kalamazoo, Mich., capital, $10,000.

The Illinois Pulsion Telephone Company, Chicago, Ill., capital, $500,000.

The LaRoche Electric Works, Philadelphia, Pa., capital $100,000.

We have received a copy of the proceedings of the 12th convention of the National Electric Light Association, which was held in Cape May, N. J., Aug. 19, 20 and 21, 1890. This volume is a departure from its predecessors. It is printed in large type and bound in a very substantial and neat manner. It contains 595 pages, and the top edge is gilded.

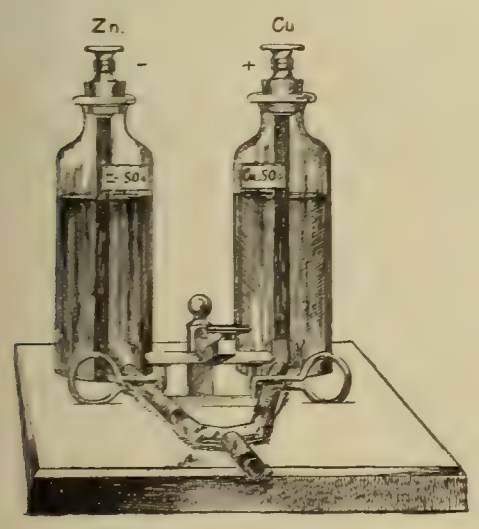
Continued from page 311.

water and filtered, being diluted to the required amount after filtration.

Such a cell may be kept standing indefinitely, and is always ready for use. The only remaining objection is that the copper electrode does not remain clean. It should be freshly electroplated, before using, which is readily done in a test tube with a platinum anode. To overcome this, the writer suggests to amalgamate the copper, and when not in use to keep it in a tube of mercury. Whether this introduces other objections has not yet been tested.

Another modification suggested is to place in the bottom of the bottle containing the zinc solution, a quantity of pure zinc scrap, not in contact with the electrode. Similarly, copper scrap in the other bottle. Should any mixture of the liquids take place, they will be freed of their impurities by these metals, which, not being in contact with the electrodes, will not affect the E. M. F.

In experimenting with this cell a curious phenomenon was noticed which does not appear to be known. It was found that the slight pressure produced in the bottle by inserting the corks at the top produced decided differences in the E. M. F. of the cell; this was noticed for each of the liquids, and was different in the two cases. It was therefore found essential to use a cork with a hole through it, so as to prevent this pressure from being exerted. The effect of this pressure has since been investigated by a very extended and interesting set of experiments made by Prof. Hermann Hering, and will form the subject of a paper to be read by him following this one.



NEW STANDARD CELL.

MAGNESIA SECTIONAL COVERING FOR STEAM PIPES.

The Magnesia Sectional Coverings are said to be the most approved styles of insulation for steam pipes, and are no doubt almost universally used by Electric Light and Power Companies on account of their efficiency and sightliness.

As is generally known, these covering are made from a pure carbonate of magnesia with a small per cent. of fibre to make it compact and firm. The coverings are made in hollow cylinders for pipe, and in blocks for boiler, flue, heater, etc.

Many of the most elegant and practical stations now erected and under course of construction are using, or about to use this material, the superintendents and expert engineers realizing the economy of so doing. In fact, it is hard to find a fair minded man who is up to and abreast of the times who does not insist upon its use. The company keeps constantly on hand, in New York City, a very large stock, having increased their storage facilities this spring, so they can fill orders promptly.

Their representative is always ready to talk business and submit propositions. He should be consulted when you want steam pipe insulations. Address him at 58 Warren street. His name is Robert A. Keasbey.

THE TELEPHONE.

A case of much interest to the users of telephones was brought before court in Portsmouth, England, on May 15. According to a press despatch from that city, the Western Counties Telephone Company sued a subscriber, a solicitor, for $50, being the rent for the use of a telephone. The defendant set up a counter claim of $50 on the ground that the service had been frequently interrupted. He claimed that he had been subjected to much annoyance in the practice of his profession owing to the irregularity with which the plaintiffs had performed the work they had contracted to do. The justice awarded the plaintiff $50, and the defendant $25, on the respective claims, on the ground that he considered the defendant had not received the service the company had contracted to supply.

The Annual Meeting of the Mexican Central Telegraph and Telephone Company, was adjourned from May 13 to May 27, at No. 7 Nassau street, New York.

STANLEY FAN MOTOR.

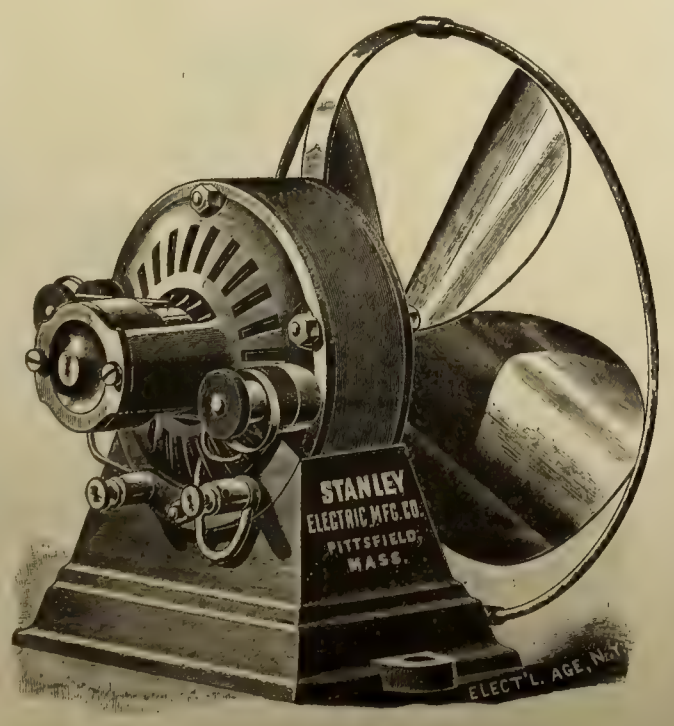
The name of Mr. Wm. Stanley, Jr., of the Stanley Electric Manufacturing Co., of Pittsfield, Mass., has become so intimately connected with alternating current machinery that anything from him in this branch of electrical engineering has ceased to be surprising. His many scholarly contributions to electrical literature has helped to make his name familiar to electrical engineers, who will be pleased to see his latest development in alternating specialties, an illustration and description of which we present to our readers herewith.

The illustration shows an alternating current fan motor, small, compact, and handsome, and yet very efficient.

The dimensions of the base of the motor are $3\frac{1}{2}\times5\frac{3}{4}$ inches, and the fan is $6\frac{1}{2}$ inches in diameter. Its complete weight is but 9 pounds, making it portable. From its extreme lightness it is easily moved to any place where a cool breeze is needed.

Every part of the machine is made of the best materials and by first-class workmen, the whole making a useful ornament for use on the desk.

The commutator is large but not out of proportion to other parts of the motor. The machine



ALTERNATING CURRENT FAN MOTOR.

has a heavy steel shaft, the bearings of which are self-oiling, reducing the care of the machine to a minimum. It is wound for $1\frac{1}{2}$ amperes on a 50 volt circuit.

As the breeze from the fan is refreshing without being sufficient to blow the papers from ones desk, it will be a great boon to those confined to close offices during the warm season.

ELECTRIC SHOCKS FROM HIGH PRESSURE CONDUCTORS.

During the discussion which followed the reading of the paper on "A few Calculations on Electric Shock from Contact with High Pressure Conductors," by Major P. Cardew, before the English Institution of Electrical Engineers, on April 23, last, Dr. Fleming gave some interesting facts on the subject.

Referring to the question as to how the body acts toward the current, whether like a condenser, voltameter, or resistance, he said that the condenser effects were small, but, undoubtedly, it acted like a voltameter or secondary battery, for it could be polarised and a current subsequently obtained from it. Measurements of resistance depended greatly upon the character and humidity of the skin. At Cambridge, here many experiments were made, it was found that the resistances of boating men from hand to hand were unusually high, and to eliminate, more or less, the difficulty of obtaining good contact, Maxwell suggested that the hands be blistered and connection made by pushing needles through the skin. The experiments were not continued. On the subject of whether a person making a joint in active high pressure mains, on an insulated chair, he said that if the body acts like a condenser, serious physiological damage might result from a contact under such circumstances, particularly if the current be alternating. The theory that some such condenser action existed is supported by the fact that moderate alternating or fluctuating pressures produce more painful sensations than equal continuous ones. If, however, physiological damage was the result of the electrolysis of some vital tissues, then direct currents would be more likely to prove fatal than alternating currents of the same strength.

UNIVERSITY NOTES.

Some extensive improvements are being made with a view to the enlargement of facilities at the University of Pennsylvania. There are eleven buildings at present, and these will be heated from a central heating station with a boiler capacity of 1,200 horse-power. In addition the buildings are to be lighted throughout by electricity, and to be thoroughly ventilated by the use of large ventilating fans, which are to be driven by steam or electric motors. The engine and dynamo room is to be located in the basement of the Mechanical Engineering Department. There will be two 100 horse-power compound engines and two engines of the high speed type. The electric lighting will be partly on the alternating and partly on the direct current systems. Two 500-light, 1,000 volt alternating, and four 500-light direct current dynamos are to be employed. The alternating currents will be connected to a separate switchboard, and so arranged as to run either singly or in parallel, or one may be run as a motor. The direct current machine will be compound, but so arranged that by throwing a switch they become shunt machines. These will also be connected to their switchboard so as to run separately or in multiple. It is said that this plant will be larger and more comprehensive than that of any like institution in the country. The Electrical Engineering laboratory will be situated on the third floor, and will occupy a space of 1,600 square feet. It will be provided with all the instruments necessary for electrical, magnetic and photometric measurements and electrical apparatus in general. The feeder wires, which run to the various buildings from the dynamo room, will be carried underground.

The offices at New Scotland Yard are now lighted by electricity, with 1,100 lamps in present use.

BIOGRAPHICAL SKETCHES.

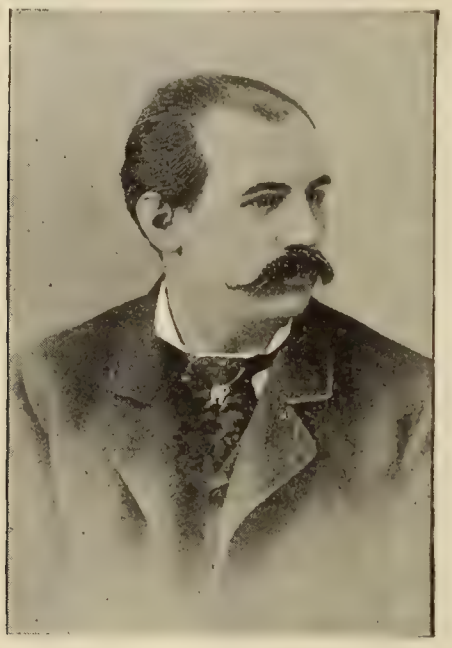
CHARLES J. HIRLIMANN.

The subject of our sketch, Mr. C. J. Hirlimann, has come into prominence of late in the electrical field, through his improvements in batteries.

Mr. Hirlimann was born in Strasburg, Alsace, in 1849. In 1864 he was in the employ of Brequet, the well-known electrician, in Paris, and held this place until 1869. After the Franco-Prussian war Mr. Hirlimann was engaged by Mr. Leclanche, the inventor of the famous battery of that name, and continued in Mr. Leclanche's employ until 1873.

In that year Mr. Hirlimann's first appearance on American soil is recorded. He came to the United States under an engagement by Mr. Frank Roosevelt, the manufacturer of the Leclanche batteries, and for eleven years afterward applied himself solely to making batteries of different sizes and makes. He then became connected with J. H. Bunnell & Company, the well-known electrical supply house, and was with this firm three years, being engaged in the same class of work. On leaving the service of J. H. Bunnell & Company, he organized the Improved Battery Company, limited, and soon afterwards bought out the interests of his partners and still continues the business in his own name.

There is probably not another man in America who so well understands batteries as Mr. Hirlimann. From the above facts it will be seen that a good portion of his business career has been spent in the manufacture of batteries, and the result is, his knowledge on the subject is extensive. Much of his practical work was done in Paris, where so much has been accomplished in the development of batteries of many kinds.



CHARLES J. HIRLIMANN.

When Messrs. J. H. Bunnell & Company, the well-known electrical supply house of this city, contemplated the manufacture of the Leclanche battery they quickly recognized the importance, if not the necessity, of Mr. Hirlimann's lore in this line, and secured his services for a period of three years, with the success that the electrical world is now well acquainted with.

About this time, with increasing years and mature judgment, and under the spur of increasing responsibilities, Mr. Hirlimann awoke to a realization of his status in his peculiar and almost exclusive field, and with a view to reaping the harvest of his own knowledge in this branch, organized and established in this city the Patented Improved Battery Company, who located their offices and factories at 91 Greene street. Of this corporation Mr. Hirlimann was always the central and chief figure, and it was not long before he found himself in a position to purchase the interests of the remaining shareholders, which he did, and now continues the business in his own name as the sole proprietor thereof.

During his residence in the United States and particularly since the production of the latest improved batteries bearing his name, Mr. Hirlimann has made for himself many friends, both through his personal qualities and the excellence of the batteries that he manufactures.

Mr. Hirlimann is one of those progressive spirits who are bound to make a success of everything they undertake, and his name as well as his batteries are now well known throughout the length and breadth of the land.

Mr. Hirlimann is a Member of the Academie Parisienne de Inventeurs, from which Society he has received a gold medal, the first one awarded for batteries.

FOREIGN NOTE OF INTEREST.

The telephone service in Manchester, England, was demoralized during the prevalence of the recent epidemic of influenza. The exchange operators were incapacitated from work, and the telephone officials were compelled to ask the forbearance of their customers.

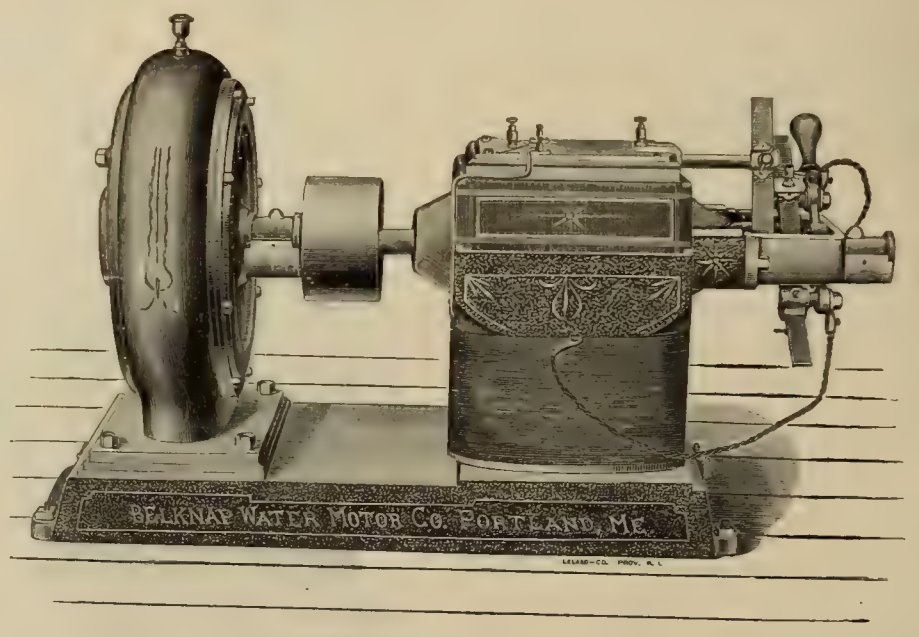
A COMBINED WATER MOTOR AND DYNAMO.

Many places have no regularly established plant for electric lighting and many residences are so located that they cannot obtain light from local plants. In order to enjoy the benefits of such a system of lighting, they must make use of some power for running dynamos, and as steam or gas cannot be used without a constant attendant and great danger from fire, explosion, etc., there seems to be nothing on the market to fill this long felt want with the exception of a water motor.

Few water motors are adapted to this work; they do not furnish the desired power or are deficient in speed, but the motor illustrated herewith has shown itself capable of filling all requirements and fills the niche for which it was designed.

The Little Giant Water Motor, specially adapted for running dynamos, is now manufactured in combination with a dynamo, built as one machine upon one shaft, and has proven itself to be a valuable institution.

By repeated experiments the Belknap Water Motor Company, of Portland, Me., have finally constructed a machine that is first-class in every way and which is sold at a reasonable price. It has many improvements over the machine as previously constructed. These machines are made in 10, 20 and 30 light sizes and are capable of bringing these lights to full candle power under a maintained pressure at the motor of 65 lbs., to give speed required by the armature. Many water companies are putting these machines in for lighting their stations. The cost of pumping water is so small that water companies can make it a profitable investment to sell water for motors, making a low rate for water and thus increase their revenue. They can also aid small manufacturing industries to a great extent by making low rates for motors.



DYNAMO RUN BY WATER MOTOR.

The Belknap Company also build these dynamos and furnish them with pulley for belt connections to be run by motors where the pressure is below the point where they can be in direct connection upon the same shaft, or to be used in connection with steam or other power. These machines are wound for 50 volts unless otherwise ordered.

In the dynamo special attention has been given to the working parts with a view to reducing the amount of wear and the expense of the wearing parts. The armature consists of an iron core, square in cross section, mounted on a steel shaft. The shaft bearings are provided with self-oiling boxes. The commutator consists of a cylindrical piece of hard insulating material keyed to the shaft and pieces of metal attached to its surface. They may be taken off and replaced by new ones when worn, by simply removing one screw in each segment.

One coil of wire on the armature, called the "exciting coil," has its two ends connected to two fixed commutator segments and the other coil, called the "working coil," is connected to collector rings and to the shaft of the machine. The special advantage claimed for this arrangement is the simplicity and the fact that the make and break of the working current of the machine is not made by passing it through brushes.

The current from the "exciting coil" passes through the segments and brushes that press on them. This current is but a very small fraction of the working current and the brushes are therefore subject to a very small load and sparking is entirely avoided.

The centrifugal force of the armatures of high speed dynamos is great and provision must be made to avoid destruction thereby.

GENERAL ELECTRICAL NOTES.

Winchester, N. H., is agitating the question of lighting that town by electricity.

Cuero, Tex., desires an electric light plant.

The Wilkinson Electric Light Company, Wilkinson, Pa., will shortly increase its plant.

A company with a capital of $2,500,000, has been incorporated in New York City. It proposes to purchase the Weems Electric Railway System and develop its good qualities.

The Watertown, N. Y., electric railway has been put into operation. The motor cars and trailers are of the best design, and the system used is the overhead trolley. The dynamos are run by water-power, and it is claimed that this is the only electric railway in the United States operated by water-power. The electric system used is that of the Edison General Electric Company.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOMS 7-12, "WORLD" BUILDING,
NEW YORK, May 16, 1891.

The Pittsburg Reduction Company will have an exhibit of aluminium at the general meeting of the American Institute of Electrical Engineers, May 21.

P. C. Ackerman, agent for the American Electrical Works, manufacturers of Insulated Wire, 10 Cortlandt street, has lately returned after a two months' tour to 'Frisco. He reports an excellent sale of his goods, and a bright outlook for the future.

The Knapp Electrical Works, of Chicago, report that the sales of their Safety Insulated Wire is away above their expectations. They received an order a few days ago for 20 miles of covered wire of various sizes.

Geo. C. Baillard, a representative of Alexander, Barney & Chapin, last week sold 5,000 "A. B. C." lamps for the Plaza Hotel, New York, to run on the Edison system, and secured other orders. The outlook is very propitious for a duplicate sale of 5,000 to another large concern.

R. T. White, the well-known street railway supply man of Boston, Mass., is now located in the Mills Building, this city. Mr. White has established a construction and financial department, the purposes of which are to construct and build roads and electric light plants.

The Calumet & Hecla Mining Company have just received a large Stratton separator, to carry 185 lbs. working pressure on a 21-inch steam-pipe. The separator is 15 feet high. These separators are manufactured by the Stratton Separator Company, of 32 Cortlandt street, this city.

Among the callers at the Electric Exchange of Alexander, Barney & Chapin, 20 Cortlandt street, last week, were: E. C. Kilbourne, General Manager of the Home Electric Company, of Seattle, Washington; J. Frank Morrison, of Baltimore, and D. A. Andrews, Jr., of Pettingell-Andrews Company, Boston.

Mr. David Morey, treasurer of the National Electric Manufacturing Company, Eau Claire, Wis., was in town this week, and was in excellent humor. The representatives of that company seem to be very happy in their new offices, at 136 Liberty street, and well they may be, as they have a perfect observatory of the surrounding country and New York Bay.

The Jenney Electric Company, of Fort Wayne, Ind., with headquarters at 115 Broadway, under the management of H. C. Adams, are meeting with wonderful success in the introduction of their Wood arc dynamos and lamps. They have just sold four 60 arc light dynamos and 240 arc lamps, also five 1,000-light (16 c. p.) Slattery alternating dynamos to the Manufacturers' Electric Light Company, of Philadelphia; two 650-light Slattery alternating dynamos to the Asbury Park Light and Power Company, Asbury Park, N. J. He also sold a 1,300-light Slattery alternating dynamo to the Richmond Light, Heat and Power Company, St. George, S. I., and a 1,650-light Slattery alternating dynamo to the Alumbrado Electro, Savanilla, United States of Colombia.

Zimdars & Hunt, 127 Fifth avenue, city, have received the contract to fit up the yacht "Corsair" with electric lights, storage battery, a complete bell outfit, annunciator and brass speaking tubes. The yacht is owned by Pierpont Morgan, the well-known banker. It will be the most complete electrical outfit on any yacht in the world, and will cost over $6,000. A slow speed Crompton dynamo will generate the current for the lights.

Thomas J. Fay, expert electrician, lately associated with the Hunt Engineering Company, of Brooklyn, N. Y., has taken the New York management of the Maine Electrical Improvement Company, of Brunswick, Me., recently incorporated in that State, to do a general electrical engineering and development business. The officers of the company are all gentlemen of prominence and connected with large commercial houses in Brunswick.

Mr. J. Wilbur, 907 Filbert street, Philadelphia, Pa., agent for the Jenney Electric Company, of Fort Wayne, Ind., sold the Diamond Electric Company, four 60 arc light dynamos.

The Otis Tubular Feed Water Heaters, manufactured in Buffalo, N. Y., are meeting with unusual success. The offices of the company are at 112 Liberty street. A 600-horse power heater was lately sold to the Conway Steel Company, of Pittsburg, Pa.; a 200-horse power heater to the Astoria Silk Mills, this city; one of 1,000-horse power to the Thomson-Houston Electric Company, of Buffalo, N. Y.; and one of 600-horse power to Rathbin, Saird & Company, of Albany, N. Y. Other sales are as follows: A 200-horse power heater to the J. L. Mott Iron Works; one 200-horse power heater to the Trenton Iron and Steel Company; one of 100-horse power to the Barber Asphalt Company, of Newark, N. J.; and one of 50-horse power to Morgan & Purdy, Tarrytown, N. Y.

The National Conduit Manufacturing Company, of the *Times* Building, this city, are under contract with the Hudson River Telephone Company, to furnish all their conduits throughout their service, and are now at work in Albany, N. Y., digging trenches, laying their wrought iron, cement-lined conduits, and building manholes for their system throughout that city. This company are also under contract with the New England Telephone Company, for their conduit work throughout the New England States this season, involving hundreds of thousands of feet of conduit. They are also about closing several large contracts, and the outlook was never more promising. J. P. McQuaide, secretary and selling agent of the company, seems to be hustling up business this spring, and much credit is due him for the successful manner in which this system has been introduced in the past few years.

The Standard Underground Cable Company, of Pittsburg, Pa., with offices in the *Times* Building, this city, under the management of Mr. G. L. Wiley, whose fame for procuring large orders for underground cables has become celebrated, on May 17th finished laying, jointing and connecting to the branch office of the Postal Telegraph Company, Fifty-ninth street, from 187 Broadway, 4½ miles of 60-wire cable, and began at the same time the laying, jointing and connecting a 100-wire cable for the Western Union Telegraph Company, from 195 Broadway to the elevated station, Fulton and Pearl streets. They are also laying a 40-wire cable for the Western Union Telegraph Company, to Leonard street and Broadway, and one of 60 wires for the same company to Twenty-third street. The Standard Company, a short time since, laid 25,000 feet of 15 conductor, 14 B. & S. gauge; 10,000 feet of 6 conductor 15 B. & S. gauge, and 46,860 feet of various sizes for the fire and police departments in New York. 8,090 feet of No. 0 B. & S. wire, seven miles of No. 6 B. & S. wire have also been laid in conduits in New York, under the supervision of Mr. Wiley.

E. P. Hampson & Company, 36 Cortlandt street, the agency for the Armington & Sims automatic high speed engines and Eclipse Corliss engines, as well as all appliances, including steam boilers, for complete steam power installations in conjunction with electric light, power and railway plants, have lately received an order and have the engines in waiting for a 150-horse power plant to be shipped to South America, including a 150-horse power Armington & Sims automatic high speed engine. Two 100-horse power Armington & Sims engines were lately installed in the Hotel Chamberlain, at Fortress Monroe, for the Edison plant. They lately duplicated two 110-horse power Armington & Sims engines, for the Soldiers' Home and Eckington Railroad, Washington, D. C. Two 110-horse power Armington & Sims engines are to be shipped to Savannah, Ga., for the Edison Illuminating Company; one of 135-horse power for the Charlotte, N. C., Electric Railway; one 120-horse power and two 110-horse power Armington & Sims engines for the electric railway steam plant at Chattanooga, Tenn., and two of 150-horse power for the Scranton Electric Railway, Scranton, Pa. A 1,000-horse power Tandem Eclipse Corliss engine, was recently installed in the Tacoma Electric Light, Railway and Power Plant, at Tacoma, Wash., and a 200-horse power Eclipse Corliss Engine was lately installed in the Cicero and Proviso Railway, Chicago, Ill.

Alexander Henderson, formerly Superintendent of Construction for the Hunt Engineering Company, of Brooklyn, N. Y., has been elected to the presidency of the Maine Electrical Improvement Company, of Brunswick, Me., and the management of the home office. Mr. Henderson is also the General Manager of the Brunswick Electric Light and Power Company, of the same city. The Maine Electrical Improvement Company is already interested in the improvement and enlargement of several electric light and power stations throughout the country, and are prepared to develop any new electrical enterprise of promise. Mr. James L. Doolittle, the well-known banker and financier of Brunswick, Me., is secretary and treasurer of the company. He is a gentleman well qualified to push to a successful point the enterprise with which he is connected, and more particularly with the aid of his assistants, Mr. Alexander Henderson, the president, a gentleman of high standing and integrity in New York, and his old associate, Mr. Thomas J. Fay, the expert electrician, and a gentleman who has already made himself famous through his inventions, as well as his connection with many prominent electrical plants in the State, which have been installed under his supervision. Mr. Fay has considerable literary ability and has contributed valuable articles to the columns of this paper, to which we have called especial attention, and of which our many readers have spoken in high terms.

The New Haven Electric Light Company, a local institution at New Haven, Conn., have been, until recently, annoying the neighborhood, so it seems, with their exhaust steam. It became a nuisance to the people surrounding their works, so that they were several times notified to abate it. The people, I also understand, proceeded against them under the law. This last move was the means of inducing the company to make some effort to overcome the noise, when their attention was drawn to the Wainwright Manufacturing Company, through this paper. Mr. Aspinwall, of the New York office, was requested to investigate the matter, and with the assistance of Mr. Radway, a gentleman of well-known engineering ability, investigated the cause of the noise, and notified the Electric Light Company that he could stop it, which they ordered him to do to the best of his ability. By putting in a system of piping, and placing a 16-inch Lyman & Warren exhaust steam head, he entirely abated the noise. The Electric Light Company were well pleased with the result, and have testified to this effect. One of these 8-inch heads was shipped on May 16th, to the Passaic Electric Light Station, Passaic, N. J. Mr.

Radway had just completed the installation of a 150-horse power Wainwright heater last Saturday, and was somewhat exhausted from his labors when your representative met him. They sold last week in the neighborhood of 2,000-horse power of heaters. The Hoffman damper regulators sold by this firm, are meeting with excellent success. About a dozen of them have been installed in the past month.

Mr. Louis Walsh, of Alexander, Barney & Chapin, 20 Cortlandt street, this city, left on Monday last for a three weeks' trip East. He will visit Boston and all of the large Eastern cities. Mr. Walsh took with him a full line of batteries, carbons and fibrone goods and, no doubt, will succeed in convincing the Eastern dealers of their excellence.

Mr. H. McL. Harding, General Manager of the Westinghouse Electric Railway Department, of Pittsburg, Pa., was in town the present week, and was looking unusually well considering the amount of work that he is required to perform. Mr. Harding should be credited with the success of the electric railway business, as he is, without doubt, the pioneer in the successful introduction of electric railways.

Mr. Geo. Westinghouse was in the city during the week, compiling and preparing the way for the reception of the 40% of the old stock, as was reported in the daily papers the past week, and making arrangements for the completion of the new deal of $4,000,000 preferred stock. There is every reason for believing that this work will be successfully carried to completion. Most encouraging reports are received, and every one about town comments favorably upon this arrangement.

Mr. George F. Shaver, vice-president of the Shaver Corporation, thinking that "all work and no play makes Jack a dull boy," has decided to devote a little leisure to his old-time favorite amusement, cruising; and to this end has purchased the steam yacht "Amy Robsart" and the cruising canoe "Aloha." It will be remembered that Mr. Shaver is the inventor of the self-bailing and relf-righting surf boat, now used by various governments all over the world. The earnings of the Shaver Corporation during the first quarter of 1891, equaled 55 per cent. of the capital stock which is now selling at eight times its par value.

The John Stephenson Company, the well-known builders of cars, on East Twenty-seventh street, this city, have purchased some property, 35 acres in extent, between Larchmont and Mamaroneck, on which they will erect extensive works. Work will be begun at once on the new plant, which, it is said, will probably be the largest of its kind in the country. Owing to the great increase of business and the need for larger manufacturing facilities, this course was necessary. The new factory will have every facility for the building of larger electric and other cars, for which the demand is constantly increasing. The company expect to have their new factory running within two years' time.

Mr. Henry Hine, of the Stanley Electric Manufacturing Company, Pittsfield, Mass., was in town this week looking hale and hearty, and speaks most favorably of the introduction of his convertors for the alternating systems of electric lighting. Mr. Hine, as will be remembered by our readers, was formerly connected with the United States Electric Lighting Company, and was very successful in the introduction of their system. There is no doubt of Mr. Hine's success in his new enterprise, as his new system is already meeting with appreciative orders. The Stanley transformer is said to be more efficient, safe and convenient than any other, and it is adapted for the Westinghouse, Thomson-Houston, Fort Wayne and National systems. It is said to represent the highest development in alternating current apparatus. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	4 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	115 00
Averell Insulating Conduit	3,000,000	100 00	6 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	203 00
Bell Telephone 7's			112 00
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5s	6,000,000		par
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	50 00
Brush Illuminating (N. Y.)	1 000,000	100 00	60 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	10 00
City Electric Street Ry. Co., 6's	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	106 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's.	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80.000		par
Cons. Gas Co. Batavia	100,000		
Cons. Subway Co. (N. Y.)		100 00	
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Detroit Electric L. & P. Co.	300,000		12 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	2,000 000		*99
Edison Illuminating (N. Y.)	4,500,000	100 00	99 00
Edison General	14,000,000	100 00	102 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co. (N. Y.)	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Empire City Subway Co. (N. Y.)		100 00	
Erie Telephone			49 00
Essick Printing Tel.	5,000,000	100 00	50 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	13 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500.000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50.000		par
Kansas Elec. Co., 6s, Mo.	20,000		*95
Laclede Gas Co.	7,500,000	100 00	16 00
Laclede Gas pref.	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*75
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50.000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		par
Long Branch Electric Light	50,000	100 00	78 00
Manhattan Elec. Light Co. Lmtd 5's	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light (N.Y.)	500,000	100 00	90 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	97 75
Nat'l Cordage, pref.	5,000,000	100 00	104 00
Nat'l Lead Trust	9,000,000	100 00	18 00
Nat'l Elec. Co., Wash., D. C.	250,000	100 00	
New England Butt Co.	100,000	1,000 00	1,000 00
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 00
N. Y and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	97 50
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's	50,000		par
North American Phonograph	6,000,000	100 00	20 00
North New York, Lighting	150,000	100 00	60 00
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. D. T. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	65 00
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s			*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Sawyer-Man Electric Light Co	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100,000	1 00	3 00
Swan Incandescent	800,000	100 00	4 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L., H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	47 00
Thomson-Houston Pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100.000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	2 50
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Welsbach Inc. Gas.	10,000,000	100 00	5 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	10 00
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co.	7,000,000	50 00	15 75
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			22 50
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

The New York Stock Exchange has just passed through the throes of an exciting election campaign, and after a few days' breathing spell, should be able to formulate a plan to get the public excited over the speculation in the goods it deals in. The election proper was a quiet affair. President Dickerman, Secretary Ely, Treasurer Hays and Chairman Mitchell, were re-elected quite without contest. The fight was on the Governors, and when the debris was cleared away it was found that the following gentlemen were elected: F. T. Adams, W. B. Beekman, J. B. Dumont, F. L. Eames, P. W. Harding, H. C. Kretschmar, C. Minzesheimer, D. D. Parmley, James Weeks, T. B. Williams, Henry G. Campbell and W. Howard Gilder, all good men and true. At the Maritime Exchange the "Young Men's" ticket was successful, the officers elected being Richard Gurney, president; Clayton Platt, vice-president; Henry Stadelmair, treasurer; Daniel Bacon, William W. Beattie, Frederick B. Dalzell, George T. Hay, Hugh Kelly, and Henry T. Knowlton, inspectors of election; George O. Lord, James A. Walsh, Jr., Frank S. Parker, and W. T. Brand, auditing committee; Jacob R. Telfair, M. C. Gasper, and John B. Woodward, directors. The vote was an unusually heavy one. One hundred and twelve business men have subscribed $1,000 each toward a capital of $1,000,000 to organize a Bourse in Philadelphia. A board of directors has been elected, and in a very short time we hope to see it in full working order. This is intended as a general, practically a National Exchange.

Public steam heating is so closely allied to electricity that its discussion in this article is pardonable, especially when its life seems to be involved. In this city the steam generated at a central station and distributed by mains is extensively used to run dynamos for all purposes, while at the same time it is extensively cursed by all who are constructing underground conduits for electric, gas, water or other purposes. Just how the investment will result in New York is yet an open question. The patient fights hard, and the powers opposed have not diagnosed the case to the satisfaction of any one. In Boston the business has assumed a different phase. It has been rumored for some time that the mains were worn out, and both useless and dangerous, but that the company did not intend to replace or repair them, and now comes a crisis in their affairs. The Massachusetts courts are asked to declare invalid their life blood to the extent of $750,000, the plaintiffs claiming the mortgage was not legal, inasmuch as the property consisted almost entirely of a simple franchise in the public streets, and this could only be used as collateral by act of the legislature; further, that the meeting authorizing the mortgage was irregular, and that the election of some of the officers voting on it is questionable. There is no doubt the result of the suit will settle many points for our local company and the conflicting elements, as well as other steam heating corporations, all over the United States. It strikes me we must be educating a large corps of practical subterranean engineers in New York, whose achievements will a little later on be compiled by some theoretical scientist for the benefit of future generations. Weaving one's way beneath a large

city, respecting by necessity the rights of other occupiers present or future, restricted only by the bold conceptions of the engineer himself, who only cares to acknowledge that an electric wire must not be run through a gas main, or either of them perforate a water conduit, feeling that the money of the widows and orphans depends on his accuracy, accountable to a bureau or board who must await his report, after completion of its subject, before they can possibly have an opinion, in this age and with this people, must and will produce a result equal, though on a different level, to Baron Hausman's grand surface engineering success in Paris.

On the 13th inst. chosen possibly by some member of the Thirteen Club as a congenial day for occult purposes, the daily press contained the advertisement of the reorganization committee who will steer the Westinghouse Electric Manufacturing Company safely into port. The scheme is so thoroughly "English" that it is safe to say some gentleman conversant with London methods is its parent. The investing public on the other side of the pond would very much prefer to surrender 40 per cent. of their holding to secure such names as are connected with the reorganization than retain all, and work out their own salvation. There is little doubt but that the shares which were quoted at 12 at the time the reorganization was conceived, will, before the new stock is distributed, advance to a point equal to or above the 40 per cent., but it remains to be seen with what grace the American investor will take the medicine his cousin John has learned to love. The scheme lacks that broad public explanation so necessary to its exploitation. Can it be possible there will never be any new stockholders in the concern, and if new ones are desired in the future, is it not politic to educate them now, as all other business people do, and let them study the matter over in their own way; such investors absorb a lot of stock on the quiet. Give them a chance and you will soon have cause to congratulate yourselves.

It is said that oil and water won't mix, but here is something far more serious in the shape of the water-works and gas-works securities' corporation, ltd., just incorporated in London with a capital of £2,000,000 in £1 shares for the purpose of buying, holding, selling or loaning on the bonds and shares of water-works, gas-works and other lighting companies, obtaining and dealing with such concessions, principally in the United States and Canada. The directors are all men of very considerable business standing, with Messrs. Brown Bros. of New York, and the Bank of Montreal, Canada, as bankers in America, Benj. S. Church late chief engineer of New York City water-works, as one of the engineers, and Messrs. Inman Bros. & Low, of New York, the American agents of the corporation. There is plenty of highly remunerative business ready for this company, and if their charter permits them to construct and furnish machinery, we may see not only electric generators and lamps, but full foreign electric systems competing with our parent corporations in their own field, before the end of the century. It is within reason that with their experience in lighting such large cities as London and Paris satisfactorily, with a cordial feeling between the Municipal and Stock Corporations, they may consummate a similar contract in New York and light the city, even "Greater New York," to the mutual satisfaction of all concerned. Why not? they have the brains, experience, machinery and money requisite.

At the fourth ordinary general meeting of the Metropolitan Electric Supply Company ltd., which was held on April 30, Sir John Pender, the chairman, stated that the accounts were for the first time submitted, in accordance with the requirements of the Board of Trade, which under the "Electric Lighting Act" have power to prescribe in what manner they shall be furnished for public information. "During the fifteen months covered by the report, the direct capital expenditure has been £195,000, while the total turn over revenue has been only £27,000. The revenue is increasing rapidly; our total lamp connections, on October 1, 1889, 6,111, is to-day 60,000; from 37 customers we have raised to 480; our revenue for quarter ending Dec. 31, 1889, was £2,866, and for corresponding time 1890 was £10,726, an increase of 275 per cent. We are using the alternate current transformer system which we work at the pressure of 1,000 volts; we adopted it after receiving the very best practical and scientific advice. We charge by means of a meter and find the revenue obtained from an 8 c. p. lamp is about twelve shillings per year. We have now 40 miles of underground conduits into which we have drawn 90 miles of mains; an interim dividend of two shillings per share was paid in March last, and our income has increased since then, notwithstanding brighter weather." The accounts were adopted from Oct. 1, 1889, to Dec. 31, 1890.

BOOKS AND CATALOGUES.

ALTERNATING CURRENTS OF ELECTRICITY, by T. H. Blakesley, M. A., has just been issued. The following is the contents of the book by chapters: Self-Induction, Mutual-Induction, Condensers, Condenser in Circuit, Several Condensers, Combination of Condensers with Self-Induction, Condenser Transformer, Distributed Condenser, Telephony, The Transmission of Power, Upon the Use of the Two-Coil Dynamometer with Alternating Currents, Silence in a Telephone, On Magnetic Lag. The price of this book is $1.50.

ELECTROPLATING, by J. W. Urquhart (second edition). A practical hand-book on the deposition of copper, silver, nickel, gold, aluminum, brass, platinum etc., etc., with descriptions of the chemicals, materials, batteries, and dynamo machines used in the art, has just been issued. Those who have been waiting patiently for the past year for copies of this book, can now have their orders filled promptly by sending them in to the ELECTRICAL AGE, *World* building, New York, N. Y. The price of this book is $2.

The above named books, and all others on electrical or kindred subjects can be obtained at the ELECTRICAL AGE office, World Building, New York. Send for book catalogue.

Mr. William Maver, Jr.'s new book on American Telegraphy, upon which he has spent several years in preparing the subject matter, is now passing through the press. The book will comprise about 600 pages, including nearly 400 diagrams and engravings.

In this work the systems of telegraphy now in use in America, their apparatus, method of operation and electrical laws involved therein, are exhaustively treated, clearly, exactly and fully described by the aid of very complete and original diagrams, and everything brought up to the present time—1891.

The book is being published by Messrs. Bunnell & Co., No. 76 Cortlandt street, New York, who hope soon to announce its readiness for sale at a moderate price.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73,
BOSTON, MASS., May 14, 1891.

A municipal plant is in contemplation at Biddeford, Me.

At the State House, Wednesday, the Senate refused to concur in the application of the town of Everett for authority to construct and maintain a system of electric lighting.

The Lowell city fathers have given permission to the Lowell Street Railway Company to double track their road, and erect the overhead electric system throughout the city.

Little Compton, R. I., will have an electric road in operation in three months, which will connect it with Tiverton. At the present time Little Compton is practically isolated from the outer world. The Westinghouse overhead trolley system will be used. Freight and passengers will be carried, and cars of the vestibule pattern will be run.

Elliott O. Johnson, formerly with the Standard Electric Supply Company, has connected himself with the Redding Electric Company. Extensive changes have been made in the governing board of the latter company and new capital has been added. The company are preparing to enlarge and increase their business, and it is probable that at an early date they will remove to quarters more convenient to the trade.

Joseph A. Phillips, formerly bookkeeper for R. T. White, the well-known manufacturer of railway appliances, was arrested in New York and brought to Boston on a warrant charging him with forging the name of R. T. White to a check for $2,205. The forgery was committed in 1884, since which time the whereabouts of Phillips has been unknown, until Mr. White met him in the Astor house, New York, last Friday.

An explosion at the station of the Malden Electric Company, last Tuesday night, made considerable noise and caused a great deal of consternation about the town. The 12-inch main steam pipe which has been in position some four years burst with a deafening noise, but beyond ruining the belts, straining the steam-pipes, and defacing the painted walls, no damage was done. Luckily no one was injured. The lights were all burning Wednesday night, and the entire damage will not exceed $500.

It is reported that tests have been made at the shops of the West End Street Railway Company, in Allston, with a storage battery said to be the invention of Mr. Frank J. Sprague. The apparatus is kept carefully concealed, and will not be exhibited until it has been proved to be of commercial value. It is said that the battery is of an entirely new and novel construction, the main feature of it being its lightness. It is also reported that Mr. Sprague has designed a motor with some new features. Report has it that the tests so far have been of such a character as to encourage the West End people to proceed with the experiments.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
417 CHAMBER OF COMMERCE,
CHICAGO, Ill., May 15, 1891.

Mr. F. W. Cushing, of the Central Electric Company, is making a trip throughout the Northwest.

The Central Electric Company, the general western agents for Bryant sockets and switches, report very large sales of these goods during the past week.

Mr. William Habirshaw, the inventor and manufacturer of the well-known Habirshaw Wires, made a flying trip West last week, for the purpose of getting better acquainted with his western agents, the Electrical Supply Company. After several hours spent in meeting the department managers, the evening was pleasantly disposed of by a banquet at the Auditorium.

The Short Electric Railway Company, of Cleveland, O., is putting a strong and energetic force of salesmen into the field for the purpose of covering territory in a way that has not yet been done. They are securing some of the best trained

railway agents in the business, and within a very short time the company expects "to be in at the death" on every street railway contract.

We are in receipt of a letter from the Ryland-Robinson Company, San Francisco, stating that they have just incorporated their new company for the sale of electrical supplies of all kinds. They have made arrangements with several of the large eastern manufacturers to represent them on the Pacific Coast. They have fitted up an elegant suite of offices where they will be pleased to see any of their Eastern friends.

The Belding Motor and Manufacturing Company, of Chicago, made an assignment on March 11. Its liabilities amount to $75,000, and it is said that the assets will more than clear the indebtedness. The suspension is caused directly by two disastrous fires, which ruined the company's stock and shops at Hermosa, and by the failure of eastern capitalists to fulfil their promises of financial support. The company's offices are at No. 6, "The Rookery," this city.

The Thomson-Houston Electric Company report the following recent installations made by its Western Isolated Lighting Department: Thos. Kane & Co., 137 Wabash avenue, Chicago, 50-light incandescent plant to run in connection with Regan Vapor Engine. Wm. Rushl Brewing Company, 224 West 12th street, Chicago, 200-light incandescent plant. Hagar & Johnasen Manufacturing Co., Marquette, Mich., 250-light incandescent plant. Banken & Fritsch Foundry and Machine Co., St. Louis, Mo., 18-light arc plant. Morrisson, Plummer & Co., 200 Randolph street, Chicago, 250-light incandescent plant.

Messrs. McDougall & Cummings, representing the C. & C. Electric Motor in the West, are just installing a 20 horse-power motor to run the large printing presses of the Chicago *Saturday Blade;* also a 200 light plant in the works of the Congdon Brake Shoe Co., operating both arc and incandescent lamps. This lighting plant is giving great satisfaction. They are also installing a 15 horse-power motor, and a 2 horse-power and a 5 horse-power motor in Des Moines, Ia.; a 7 horse-power, and a 5 horse-power in Keokuk, Ia.; two 50 horse-power generators for power circuit work in Des Moines, a 5 horse-power and a 2 horse-power motor in Sioux City, and also a 15 horse-power motor as an increase to the coal mining plant recently installed at Mystic, Ia. The fan business and sale of small motors is rapidly picking up, and this promises to be a good season for this class of work.

A recent test of the gearless motor made on the private track of the Short Electric Railway Company, and also in the streets of Cleveland has demonstrated its high efficiency. Although the E. M. F. of the line was low, the current taken was very small considering the service to which the motor was put. On a level and at a voltage of 400 to 450, the ampere readings ranged from 7 to 15. On severe grade and curve-work the amperes ranged from 35 to 50, but with a voltage of less than 300, showing that the true ampere readings should not have exceeded 20 to 30. At the end of the long and rapid run the motor was quite cold, the heat developed being very small. The remarkable current efficiency of the gearless motor is due to the fact that the wire on both fields and armature is large, and the counter E. M. F. is obtained by enormously increasing the intensity of the field.

The "Gearless Motor," the sole invention of the Short Electric Railway Company, is meeting with universal commendation. Already the first factory order is completely pledged, and The Short Company is at the point of closing large orders which will tax the capacity of their shops for a long time to come. The first gearless motor has now fairly entered on its eleventh week of service with a remarkable record. Although subjected to the severest tests—tests which can never come upon it in ordinary street railway service, there has not been one particle of trouble with it from beginning to end; neither armature nor field coil has burned out; the motor runs perfectly cold with very high efficiency and pulls heavy loads over severe grades with entire ease. The motor has enormous reserve power and it is practically impossible to burn it out. The first motors of the first factory order are beginning to come out, and were placed in regular service May 15. The Short Company proposed then to demonstrate to the world its ability to make an absolutely successful gearless motor, simple, efficient and strong, perfectly protected, thoroughly reliable, and the standard for street railway service.

The McGuire Manufacturing Company, of this city, report a large demand for their well-known trucks. Among the many large orders received during the present month are the following: City Electric Railway Company, Little Rock, Ark., 28 No. 19 A. trucks; Lincoln Electric Railway, Lincoln, Neb., 30 No. 19 B. trucks; Toledo Consolidated Street Railway Company, Toledo, Ohio, 18 trucks, 10 No. 19 B, and 8 No. 19 A.; Villard Syndicate, Milwaukee, Wis., 80 No. 19 B, steel trucks; East Harrisburg Passenger Railway Company, Harrisburg, Pa., 20 trucks, No. 19 B, steel; Lawrence Electric Railway Company, Lawrence, Mass., 15 No. 19 B, steel trucks; Springfield Electric Railway, Springfield, Ohio, 4 No. 19 A trucks; Galveston City Railway Company, Galveston, Tex., 10 No. 19 B, trucks; Worcester and Spencer street Railway, Worcester, Mass., 10 No. 19 B, steel trucks.

The Great Western Electric Supply Company have put upon the market a Sun Arc Lamp, which is meeting with general favor everywhere. It is beyond doubt the best arc lamp for incandescent circuits on the market to-day. The lamp will burn singly, or in series, and has one unique device—a controlling switch, which enables the lamp to be instantly adjusted, to suit any voltage from 75 to 125 volts. It is very artistic in its finish, simplicity itself in its construction, and is cheaper than any lamp of the kind on the market. This company report a very large business in their railway department. They have lately introduced a few novelties, including an aluminium bronze trolley wheel, with a self oiling bushing, a clamp for trolley hangers and their new railway lamp. They report very large sales in trolley wire and construction supplies of all sorts. The same concern has just introduced a new weatherproof wire, known as the Eagle Brand. This wire is of superior insulation and is sold at such a price as to meet any competition. It is said to be the best low priced weatherproof wire in the market to-day.

The Great Western Electric Supply Company report a phenomenal business in their lighting department during the last month. Their "K. K." wire, which is the standard weatherproof wire, is in large demand, and their many specialties are being received everywhere with the utmost favor.

H. C. W.

Mr. Frank A. Magee, the electrician of the Engineering Equipment Company, of this city, has just returned to New York after an absence of some time, during which he traveled through the States in the interest of his company. He was very successful in increasing the reputation of his house, and reports that the outlook for the future is extremely encouraging. He found his people settled in their handsome new offices in the Central Building, 143 Liberty street.

In increasing the size of dynamos the output per pound weight is usually increased.

BUSINESS NOTES.

The Ball Engine Company, of Erie, Pa., manufacturers of Automatic Cut-Off Engines, have issued a circular informing the trade that, owing to the large increase in the demand for Automatic Cut-off Engines, (which has compelled the company to run night and day for a long time to keep up with the orders), they are now erecting a large addition to their works, which will nearly double their present capacity. This extension will be equipped with special tools for the manufacture of the company's high-class engines. In this extension they will set up their large engines; the building being built and equipped with special reference to heavy work, and will give facilities unexcelled by any other builder of high-speed engines. The types of engines built by the Ball Engine Company range as follows: Single Cylinder, Cross Compound, Tandem Compound, Triple Expansion from 25 to 700 horse-power, and also special Vertical Engines arranged to be directly connected to the dynamo, and suitable for use in electric lighting on ships, etc. The company's mechanical superintendent has designed several important improvements on their engines, and those hereafter turned out will excel anything they have ever built in mechanical construction, economy in steam and general excellence. All engines are subjected to a rigid test before leaving the factory.

An application has been made for permission to construct a single track electric road in Warren, O., to extend to Niles, O. The Warren Council have invited proposals for carrying passengers on the proposed road, and the proposals will be received until 12 o'clock on May 22.

The Maine Electrical Improvement Company, of Brunswick, Me., makes the following announcement:

N. Y. Office, Electrical Exchange Building,
Liberty St. cor. Washington,
May 10, 1891.

We take great pleasure in advising you that we have entered into the Electrical Arena with a complete and well-equipped organization, for the purpose of engaging in engineering enterprises of every character connected with modern electrical developments. Our main office is at Brunswick, Me., under the management of Alexander Henderson, the president, and James L. Doolittle, as secretary and treasurer, with general business office in the "Electrical Exchange," New York City, under the management of Thos. J. Fay.

We are prepared to undertake the improvement and development of patents and specialties; to superintend the erecting and equipment of electric light and power plants, to furnish detailed drawings, specifications and electrical tests, and to make reports on all classes of engineering work. Our connections with manufacturing and supply houses are very complete, while from time to time we intend to place at your disposal many apparatuses of our own design and manufacture.

We trust you will favor us with a portion of your patronage, while we assure you we will employ our utmost endeavors to please you.

Very respectfully,
Maine Electrical Improvement Company.

Mr. G. Blumcke, a well-known mechanical engineer of Hamburg, Germany, who represents the Westinghouse Machine Company, of Pittsburg, Pa., in the Empires of Germany and Austria-Hungary, has devised and put into very successful operation, on a number of freight vessels entering the seaports of North Germany, an invention for rapidly and cheaply unloading coal, iron ore and low-grade freights. The whole apparatus, consisting of two small Westinghouse engines and the four shafts, is easily put in place on deck in thirty minute's time. Steam is furnished from portable boilers on the docks at Hamburg as an article of merchandise, and is therefore readily available for sailing vessels, such as these colliers are. The invention accomplishes the same amount of work with less than half the usual number of men and in half the time.

The Boston office of Westinghouse, Church, Kerr & Co., reports business as active. Their recent sales of the larger sizes of Westinghouse engines include one 250 horse-power Compound to the Fairchild Paper Co.; one 100 horse-power to Frank Jones, president of the B. & M. R. R.; two 75 horse-power to the Olcott Falls Paper Co.; three 80 horse-power Compounds to Howland & Ellis, for an electric railway in Burlington, Iowa, and five, 5 horse-power, six 10 horse-power, four 15 horse-power, one 25 horse-power one 35 horse-power, one 45 horse-power, one 60 horse-power, one 100 horse-power, one 125 horse-power, two 150 horse-power, and one 200 horse-power, for a complete sub-divided power plant in the bleachery and print works of the Dunnell Manufacturing Co., at Pawtucket. They are meeting an active demand for their new specialty, known as the steam-loop, having entered orders for a large number of systems from the Dunnel Manufacturing Co.; Flint and Pocasset Mills at Fall River; Forest Paper Co., of Yarmouthville, Maine; the Grosvenor Dale and Peace Dale Mills, Woonsocket Rubber Co., and others.

Business is booming with Robert A. Keasbey, 58 Warren street, in the sale and application of his Magnesia Sectional Covering. His stock is constantly being increased, but it melts away like "dew before the morning sun." During the two weeks from May 4 to May 18, he has disposed of some 1,900 square feet of Magnesia Sectional Covering alone, not counting the felt and plaster orders. He is still ready for business, however.

In 1885 the Reading railroad acquired control of the Philadelphia and Atlantic City "narrow gauge" road, and has since that time completely changed its character. It is now said to be ranked among the finest pieces of railroad property in the United States. It is double track from the Delaware River to the ocean and of standard gauge, the heaviest steel rails being used. Elegant cars are run on this route, and the time has been shortened from two hours or more to an hour and fifteen minutes. This line, through the elegance of its equipment, has acquired the title of "The Royal Route to the Sea."

The Thomson-Houston Electric Co., New York, Isolated Lighting and Motor departments, reports the recent installation of the following named plants, some of which are yet under process of construction: Carnegie Music Hall, New York, 5,000 incandescent lamps; H. C. F. Koch & Co., New York, 1,200 incandescents; Tiffany & Co., New York, 150 incandescents, and motors of 45 horse-power; Sanderson & Sons, Brooklyn, 30 arcs and motors of 135 horse-power; *Sun* Building, New York, 900 incandescents; Union Ferry Co., New York, 100 incandescents; American Manufacturing Co. Brooklyn, 1,000 incandescents, and motors of 60 horse-power; Consumers' Brewing Co., New York, 600 incandescents; Palisades Amusement Co., Hoboken, 150 arcs; Offerman building, Brooklyn, 2,000 incandescents (Excelsior Electric Company's apparatus) 20 arcs; Lidgerwood Manufacturing Co., Brooklyn, electric traveling crane; New Jersey Steel and Iron Co., Trenton, electric traveling crane; T. P. Howells & Co., Newark, 25 horse-power motor and generator; Havemeyer & Elder, Greenpoint, 15 horse-power motor and generator; E. T. Copeland & Co., New York, 100 incandescents; Clarendon Hotel, Brooklyn, 650 incandescents; New York Jockey Club House, Morris Park, 1,000 incandescents.

McCauley & Co., the well-known electricians and dealers in general electrical supplies and novelties, of Port Arthur, Ontario, are doing an immense business in call bells, annunciators and burglar alarms. They report a steadily increasing use of electrical devices in that section of Canada.

Every electrician should have for ready reference a copy of Workshop Receipts. It is in four volumes—1st relates to Mechanical subjects, 2d, Chemical Manufactures, 3d, Electrical and Metallurgical subjects, 4th, Handicrafts and Mechanical subjects. The volumes are sold separately, price $2 each. E. & F. N. Spon, 12 Cortlandt street, New York.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

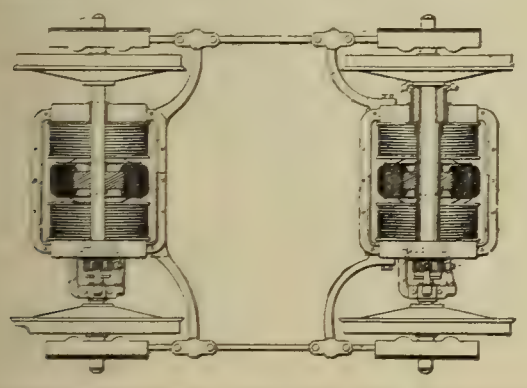
Issued Tuesday, May 12th, 1891.

451,909. Brush Holder. Harry H. Blades, Detroit, Mich. Filed Aug. 14, 1890.

The combination, with a commutator-brush holder and its upporting shaft, of a collar journaled on the shaft below the holder, and a spring engaged to the collar and having its free ends projecting in each direction, whereby a spring-pressure may be exerted on either side of the holder.

451,921. Secondary Battery. Julius Emmner, Jr., Washington, D. C., assignor, by mesne assignments, to Philip T. Dodge, trustee, same place. Filed July 9, 1889.

An element composed of aluminium provided with an active material.



451,981—MOUNTING FOR ELECTRIC CAR MOTORS.

451,933. Coupling for Electric Wires. Andrew M. Hunt, Newark, N. J. Filed Dec. 29, 1890.

A coupling for electric wires, consisting of a metal sleeve having an internal diameter not less than the combined diameters of the wires to be joined and adapted by twisting to bind the inclosed wires together and conform to the external surfaces of the wires.

451,941. Conduit for Electric Wires. Thomas T. La Point, James H. Flanagan and Charles A. Thompson, New Haven, Conn. Filed Dec. 30, 1889.

A conduit composed of the following parts: an internal lining of hydraulic cement, a cylinder of sheet metal firmly riveted at the seam to form a tube inclosing the lining of hydraulic cement, and strips of tarred paper coated with a composition of asphalt, resin and fatty matters wrapped externally around the tube.

451,942. Motor-Truck. Francis M. Lechner, Columbus, O. Filed July 23, 1890.

451,948. Galvanic Battery. George C. McCullough, Richmond, Ind., assignor of one half to William P. Cook and William A. Baumer, both of same place. Filed Sept. 3, 1890.

A galvanic battery cell provided with positive and negative elements and supplemental positive and negative elements, by means of which one pair of elements may be used while the other pair is permitted to rest.

451,950. Electric Insulator. Samuel Oakman, Melrose, Mass. Filed Aug. 17, 1889.

An insulator having a screw-threaded interior chamber and an exterior provided with a groove for receiving the wire, and a member forming an eye adapted to receive a line-wire.

451,951. Printing-Telegraph. Edwin Pope, Quebec, Canada. Filed Feb. 18, 1888.

451,960. Machine for Covering Electrical Conductors with Lead. Lewis W. Tracy, New York, N. Y., assignor of one-half to James E. Granniss, same place. Filed Aug. 4, 1890.

A pipe-forming chamber constructed of a narrow trough shape, with upwardly-flaring sides and ends and a bottom curved concentrically with a die and core-bar projecting across its shorter axis.

451,980. Electrically-Propelled Car. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Nov. 6, 1890.

An electric propelling-motor comprising an armature mounted on and directly secured to a car-axle and non-rotative field magnets mounted on springs independently of the armature.

451,981. Mounting for Electric-Car Motors. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Dec. 1, 1890.

451,997. Fusible Cut-Out for Electric Connections. Willard E. Dow, Braintree, Mass. Filed Dec. 4, 1890.

In an electric cut-out, an insulating-block and its annular insulating enlargement having radial slots in combination with metallic plates on opposite sides of the block and enlargement and electric-circuit and fusible cut-out wires held on the plates; the latter lying in the slots.

451,999. Electric Railway-Signal. Willie Cowles Walter, Richmond, Va.; Sophia Lee Walter, executrix of said Willie Cowles Walter, deceased. Filed Dec. 23, 1889.

A vehicle containing a circuit connected with a line conductor, in combination with an electric alarm in the circuit and a continuously operating circuit maker and breaker, consisting of a stationary contact on a clock and a spring movable contact arranged to be intermittingly lifted from engagement with the stationary contact by a hand of the clock.

452,003. Electro-Magnet. Charles E. Lipe, Syracuse, N. Y. Filed Nov. 20, 1889.

A practically solid coil of substantially rectangular naked wire having its individual convolutions and its layers of convolutions separated by layers of hard, insulating, fire-resisting material.

452,005. Driving Mechanism for Electric-Motor Cars. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Nov. 1, 1890.

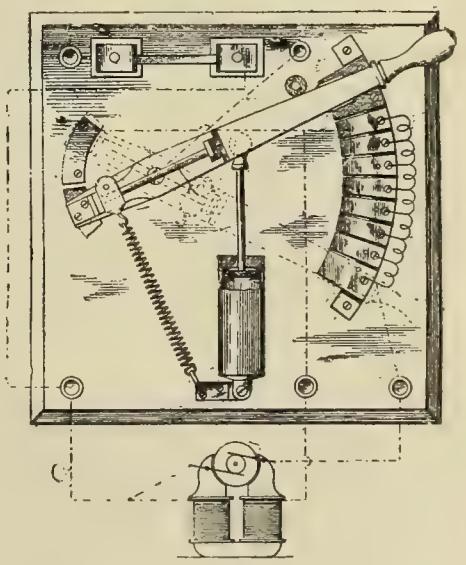
An electric propelling motor comprising a ring armature mounted axially upon and secured directly to a driving axle and non-rotative multipolar field-magnets, the pole pieces of which are arranged to produce a field-of-force crossing the armature parallel to the plane thereof.

452,017. Electric-Wire Suspender. Charles A. Lieb, New York, N. Y. Filed Nov. 8, 1890.

A suspender for electric wires, comprising, essentially, an insulating body part having at each end a hook-like device, insulated from each other, and by means of which it may be hung to another wire or support, and insulated means for attaching the trolley or other wire to it.

451,026. Electrical Signaling Device. Charles J. Kintner, New York, N. Y., assignor to the Electric Secret Service Company, same place. Filed July 15, 1890.

A signaling instrument having one or more transmitting discs secured to a power impelled shaft, and one or more circuit making and breaking arms adapted to make and



452,151—SELF-CONTROLLED MOTOR-SWITCH.

break the circuit through the transmitting discs, in combination with a stop device carried by the shaft, and mechanical connections operatively connecting the circuit-breaking devices with the power-impelled shaft, whereby the signal is first automatically transmitted and the application of the power then checked.

452,035. Motor-Car for Electric Railways. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Nov. 26, 1890.

A directly-connected armature mounted on a driving-axle and field-magnets directly journaled on the axle, and a connection with another car-axle, whereby the magnets are held from rotating.

452,036. Machinery for Propelling Electric Cars. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Dec. 9, 1890.

452,042. Electric Riveting Apparatus. Elias E. Ries, Baltimore, Md., assignor to Ries & Henderson, same place. Filed June 25, 1889.

An electric riveting apparatus with a heading-die, and an anvil adjustable to and from the die and an electric circuit including the die and anvil.

ELECTRICAL PATENTS—Continued.

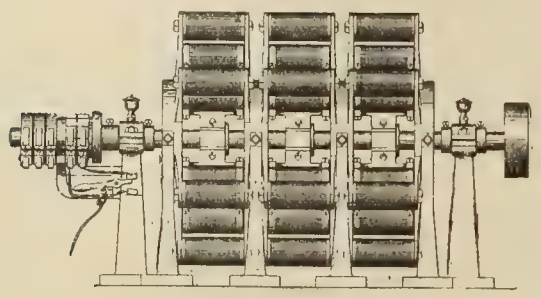
452,056. Apparatus for Heating by Electricity. Chas. Zipernowsky, Buda-Pesth, Austria-Hungary. Filed Sept. 16, 1890.

Two conducting bodies so arranged relatively to each other that an imperfect contact of high resistance shall exist between them; the bodies to be included in the circuit of an electrical conductor.

452,072. Automatic Railway Signaling Apparatus. Stanislaus J. Doucet, Shippegan, Canada. Filed Oct. 22, 1890.

452,099. Electric Railway. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed Dec. 20, 1890.

452,151. Self-Controlled Motor-Switch. George H. Whittingham, Baltimore, Md., assignor to the Automatic Switch Company, same place. Filed April 25, 1890.



452,214—ELECTRIC MOTOR.

The combination of a single rigid pivoted hand-lever to which is connected one of the wires of an electric circuit and which is provided with two contacts, with a rheostat and a contact device, the rheostat connected to the armature of an electric motor and the contact device with the field, the conacts of the hand-lever engaging the rheostat and contact device, and a holding device for the lever, consisting of a reciprocating slide mounted upon the lever and reciprocating across its pivot and to which is connected one extremity of aspring, the other end of which is fixed to any suitable point.

452,160. Electric Railway. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston, Electric Company, of Connecticut. Filed Nov. 23, 1888.

452,176. Electric-Car Motor. John Christiansen, Quincy, Mass. Filed May 21, 1890.

452,185. Wire-Clamp. Robert M. Jones, Salt Lake City, Utah. Filed Dec. 17, 1890.

A lineman's wire-clamp comprising an integrally-constructed body, having a longitudinally undercut tapered slot or way to receive the wires, and a wedge and apertured lugs for the attachment of the straining rope, and a tapered wedge adapted to fit into the tapered way and clamp the wire within it.

452,186. Trolley-Stand. Robert M. Jones, Salt Lake City, Utah. Filed Dec. 29, 1890.

In a trolley-stand, the combination, with the base-plate mounted elastically on the car-body, of an upright casing mounted to turn thereon, and a trolley and its pole mounted elastically upon the rotary upright, whereby the trolley is permitted to adjust itself to the wires in both a vertical and lateral direction.

452,211. Crane for Electric Lamps. Emilio Cardarelli, Sumter, S. C. Filed Aug. 22, 1890.

The combination, with a fixed arm, of a lever pivoted thereto and provided with a sheave on its outer end, a rope or chain for supporting a lamp passed over the sheave and having its end fixedly secured below the pivot of the lever, and means for holding the lever in a horizontal position, whereby when the outer end of the lever descends, the rope or chain will be slackened and drawn over the sheave by the weight of the lamp and the latter lowered.

452,214. Electric Motor. Daniel J. Chisholm, New York, N. Y. Filed Sept 27, 1890.

An electric motor comprising a hollow frame having a series of radially extending arms or pole pieces arranged in pairs and carrying coils, an armature consisting of a common shaft carrying independent pulleys to move between the pole pieces, the pulleys having coils held in sockets on their faces and means for closing the circuit successively through the several series of armature and field-magnet coils.

452,220. Surgical Electrode. Josephus H. Gunning, New York, N. Y. Filed Nov. 20, 1890.

A bipolar surgical electrode having its two poles, which form component parts of the instrument itself, adjustable to vary their distance apart.

452,250. Electric Belt. Charles D. Williams, Silver Lake, Kan. Filed Jan. 17, 1891.

A cell for galvanic or electric belts made up of an outer casing of copper, the ends of which are bent to form eyes, a zinc element cruciform in cross section maintained centrally within the casing by an interposed absorbent pad, the zinc element being extended above the pad and copper element and perforated for the engagement with the hooks of the conductors.

452,255. Tubular Pole for Electrical Railroads. Thomas J. Bray, Warren, O., assignor of one-half to the Paige Tube Company, same place. Filed Feb. 14, 1891.

A tubular pipe composed of sections of different diameters, the larger section provided with longitudinal kerfs for clamping the smaller section when in place.

452,276 Electric Meter. Herbert W. Miller, London, England. Filed Nov. 21, 1890. Patented in England.

In an electric meter, the combination, with a counter or register, a single clock-work, and differential gear mechanism actuating the counter or register, of a coil arranged to receive the current to be measured or a portion thereof, and a rotating device connected with one gear of the differential gear mechanism and coacting with the coil to retard the differential gear mechanism and thereby render the movement of the counter or register proportional to the strength of the current.

452,288. Holder for Portable Electric Lamps. William W. Savage, Toronto, Canada, assignor of one-half to Frederic Nichols, same place. Filed Feb. 20, 1891.

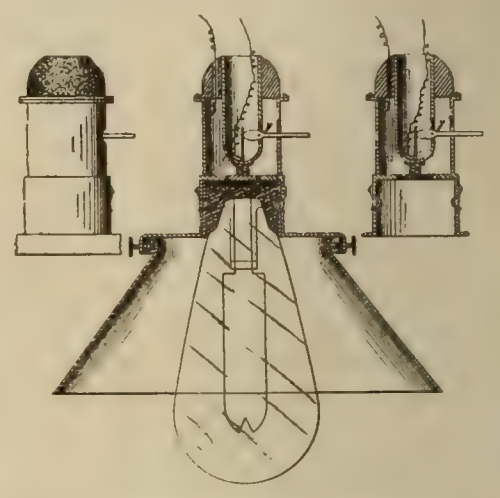
452,296. Electric Reciprocating Engine. Charles J. Van Depoele, Lynn, Mass. Original application filed June 26, 1889. Divided and this application filed June 11, 1890.

452,299. Clock-Synchronizer. Arthur G Wiseman, Webster Groves, Mo Filed Dec. 17, 1890.

The combination of a magnet and an armature, the armature being attached to a lever pivoted in a plane which is at the side of the centre of the face of the magnet, and having a compound movement.

452,303. Primary Battery. Walter Hanson, London, England, assignor of one-half to Frank Aldrich, Washington, D. C. Filed Feb. 4, 1891.

452,305. Incandescent Electric Lamp. William M. B. Keen and William F. Haarmann, New York, N. Y., assignors of one-fourth to Egbert Le Fevre, same place, and said Haarmann assignor of all his remaining interest to said Keen. Filed June 19, 1890.



452,305—INCANDESCENT ELECTRIC LAMP.

452,306. Incandescent-Lamp Socket. William M. B. Keen, New York, N. Y., assignor of one half to William Hodgkiss, same place. Filed Sept. 15, 1890.

452,326. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed July 8, 1890.

A magnet having one pole in annular form and the other pole concave, with its surface in proximity to the periphery of the annular pole, a rotary shaft or pivot extending through the annular pole, and a coil supported by the shaft and extending between the poles.

452,340. Electric Cable. William A. Conner, Pittsburg, Pa., assignor to the Standard Underground Cable Company, same place. Filed July 24, 1890.

An electric cable having its wires covered with saturated fibrous material so applied as to form an open mesh, thus providing air-spaces.

452,341. Electric Cable. William A. Conner, Pittsburg, Pa., assignor to the Standard Underground Cable Company, same place. Filed July 24, 1890.

452,342. Electric Cable. William A Conner, Pittsburg, Pa., assignor to the Standard Underground Cable Company, same place. Filed July 24, 1890

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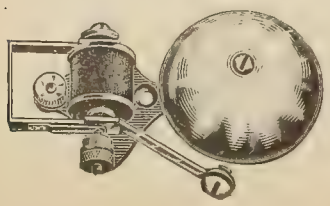
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WEEKLY.

Vol. IX NEW YORK, MAY 30, 1891. No. 22.

SMALL EDISON SLOW SPEED MOTORS.

1891 TYPE.

The field of application of the electric motor is constantly and rapidly broadening, owing to the great convenience, economy, cleanliness, compactness and almost noiseless running of this new form of power. The list of machinery that is at present operated by the small type of electric motor is much larger than would appear possible. In that list will be found small pumps, drill presses and other tools, small fans and blowers, sewing machinery, small lathes, buffing wheels, cloth and paper cutting machinery, organ bellows, printing presses, etc., etc. In a word, wherever power is required the electric motor is the ideal means of supplying it.

The uses for small motors, that is, from $\frac{1}{16}$ of a horse power to ½-horse power, inclusive, are surprisingly numerous. Work formerly performed by hand is now, for the first time, done by power, and every day some new application of the small electric motor is made.

Most of the small motors on the market are merely small machines of the same type as the large ones. But there are a great many considerations which apply to small motors and not to large ones, and by a proper design a great many advantages are obtainable which cannot be obtained in the case of larger motors.

Appreciating these facts, Mr. Edison has designed a motor with special reference to its use in small sizes, and has embodied in it to the highest possible degree, all the essential features of a perfect small electric motor, viz:—

1. Minimum of Attention and Repair.
2. High Efficiency.
3. Small First Cost.
4. Slow Speed.
5. Perfection of Mechanical Detail.

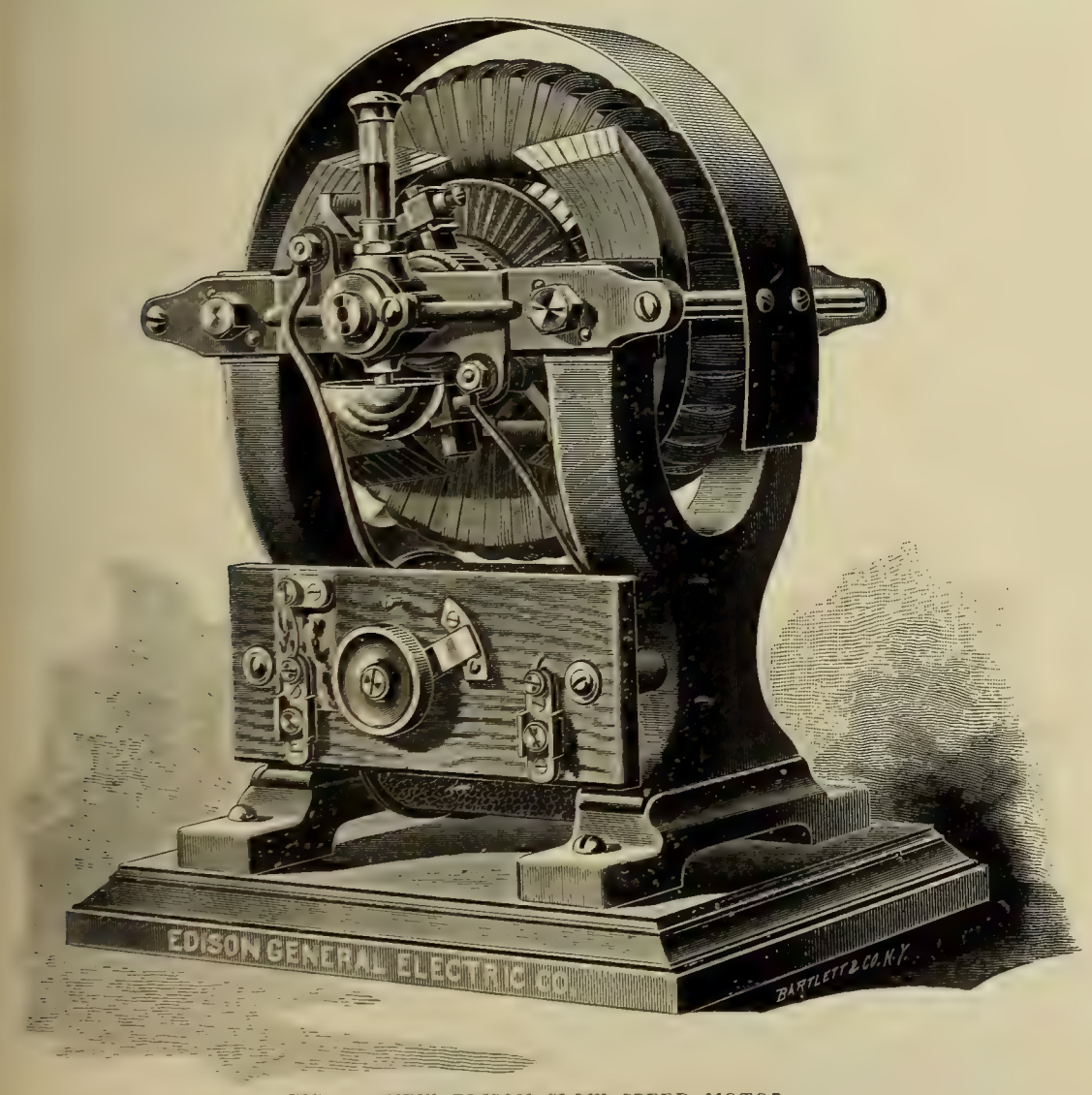


FIG. 1—NEW EDISON SLOW SPEED MOTOR.

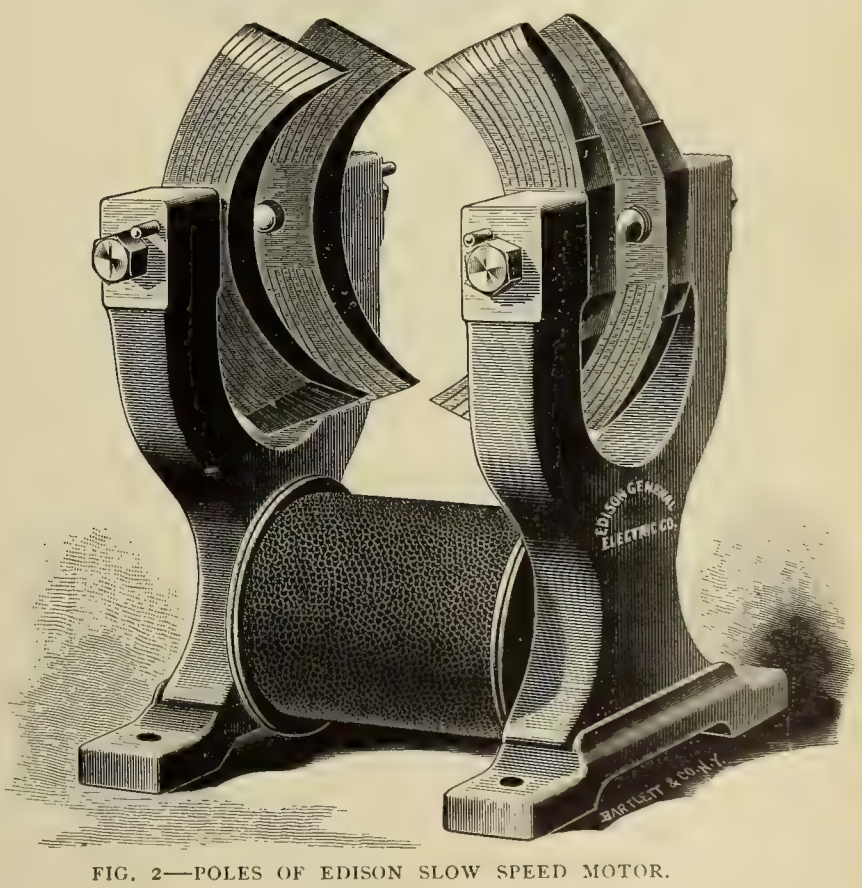


FIG. 2—POLES OF EDISON SLOW SPEED MOTOR.

MINIMUM OF ATTENTION AND REPAIR.

Perhaps the most important benefit which the electric motor secures to the user of power is the great reduction of wearing parts, and the very small amount of attention which is needed for its operation. These advantages are more completely realized in the Edison motor than in any other.

By connecting the coils of the armature with the commutator by German Silver wires, the sparking which has heretofore been found so objectionable in small machines is entirely eliminated. This is a feature which will be at once appreciated by power users.

The motor has been so designed that no adjustment of the brushes whatever is required, the brush holders being fixed in position and requiring no attention after being once adjusted.

Lubrication being accomplished by the use of grease instead of oil, very little attention is needed in that particular.

As each coil of the armature is wound independently of the others, it can be replaced with the greatest ease, and without disturbing any of the others.

The bearings of the armature shaft consist of removable brass sleeves, which are adjusted to permit of perfect alignment. Upon the wearing of the brass bearings by continued use, they can be readily slipped out and new ones substituted in a few minutes, placing the motor in as good running condition as if it were new.

HIGH EFFICIENCY.

The general arrangement of the motor is shown in Fig. 1. The armature revolves in a magnetic field, the lines of force being brought through the armature on both sides of the ring, by means of specially shaped pole pieces made of the softest Norway iron.

The poles, shown in Fig. 2, being built in strips, secure a lamination which prevents the heating of the fields, thus permitting the motor to run cool even when overloaded. These wrought iron pieces are attached to the magnetic frame, which at the same time forms the base upon which the machine is mounted.

The single field magnet coil is placed below the armature. This brings the centre of gravity down low, and hence adds to the steadiness and solidity of the machine. The armature (Fig. 3) is built of the softest laminated wrought iron, and is provided with teeth. The coils are placed in hollows formed

by these teeth, which secure them firmly in position, give them a positive driving arrangement and prevent slipping of the coils.

This construction also allows the projecting teeth to be brought in the closest possible proximity to the pole pieces, so that the field magnets can be brought very close, lessening the air gap, without the slightest danger of abraiding the winding of the armature.

SMALL FIRST COST.

These motors have been designed to meet the demand for a highly efficient machine which would be at the same time of low cost, and this object has been accomplished in the adoption of a type employing the smallest number of parts with the lowest possible weight of material.

SLOW SPEED.

The great desirability of slow speed in the operation of the electric motor has been recognized by the Edison General Electric Company and their experiments have resulted in the construction of motors having lower speeds for their power than any other machines ever produced. Thus the ¼ horse power has but 1,300 revolutions per minute.

This reduction results in a great saving in the wear of commutator, bearings and brushes and allows of the application of these machines to purposes where the use of motors has heretofore been impractical.

It also greatly reduces the noise and vibrations which have been found so annoying in the older forms in general use.

PERFECTION OF MECHANICAL DETAIL.

The mechanical construction of the new Edison motor has been as carefully considered as the electrical features, and both material and workmanship have received the same care and attention as the largest machine built by the Company.

Thus the commutator is made with large wearing surface, and the segments are insulated with mica.

Lubrication is thoroughly provided for, grease and drip cups being fitted to all bearings. Experience has shown that grease is far more convenient and cleanly in practice, and better suited to the uses of these small motors than oil. No spattering nor soiling takes place when grease is employed.

The armature of the motor is provided with a guard, shown in Fig. 4, which protects it from accidental injury and also forms a partial cover for the machine.

All parts of the motor are made interchangeable so that new parts can be fitted without trouble.

The machines are equipped with a mahogany switchboard upon which are mounted the terminals for making circuit connections and also a strong and simple switch, together with a safety fuse for protecting the motor from excessive current.

This type of machine is built in sizes from $\frac{1}{16}$ to ½ horse-power. (See table on page 331, which gives the various speeds, currents and weights)

It will be noticed that the weights of these motors are far below those of any other type now on the market. This at once demonstrates their superior efficiency, both mechanical and electrical.

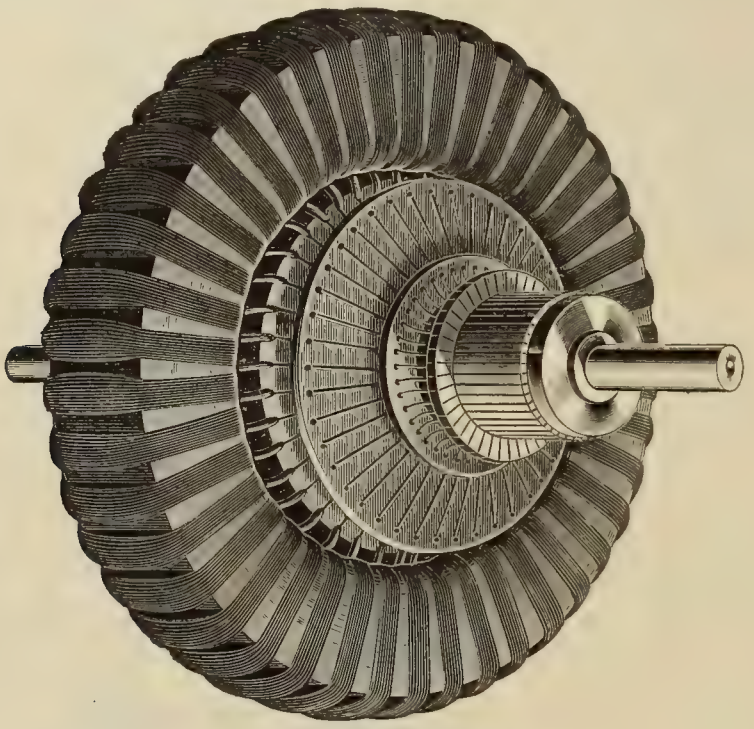


FIG. 3—ARMATURE.

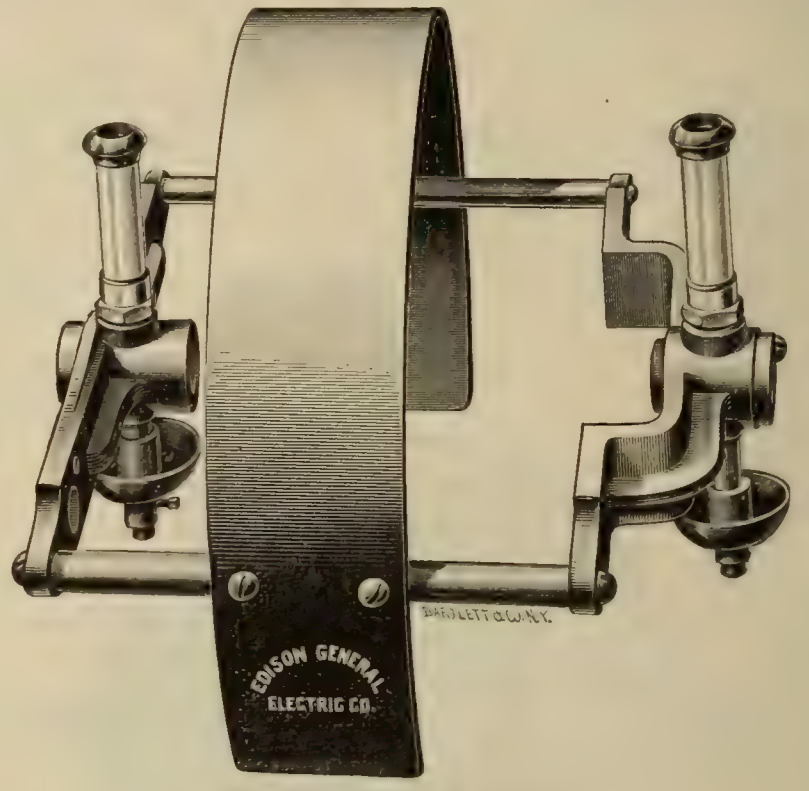


FIG. 4—ARMATURE GUARD.

NEW CORPORATIONS.

The Iron Mountain (Mich.) Electric Light and Power Company has just been incorporated with a capital stock of $50,000.

The Watseka (Ill.) Electric Light Company has been formed with a capital stock of $8,000.

THE PORT-ELECTRIC SYSTEM.

The port-electric system, about which considerable has appeared in the electrical journals during the past year or more, has, since the close of the exhibition of the model in the "Old South Church" in Boston, been subjected to very exhaustive tests, with a view to determining all the conditions necessary for the construction of a commercial line for practical business purposes.

The port-electric is an electric automatic system of rapid transit for mail and express matter, etc., and the ultimate object of the system is to carry on and maintain communication between cities for the transmission of mail and express matter at high rates of speed.



FIG. 1—PORT-ELECTRIC STATION, DORCHESTER, MASS.

President John T. Williams of the company has just rendered a report to the stockholders on the test made of the system by Prof. A. E. Dolbear, the electrician of the company, and F. L. Pope, of New York. The reports of these experts are extremely interesting. The tests were made with an experimental car and track at the New England Protective Station in Dorchester, Mass.

Prof. Dolbear in his report says: "The oval track is 2,784 feet long, and the curves are much too short to obtain the high speeds attainable on a straight line. When the car was first sent round the track, it made the circuit in about two minutes; now it has made it in fifty-one seconds. The hinderances to still swifter travel are only the mechanical ones of proper track and alignment. That this is so, is evident from the fact that an acceleration of six feet per second has been observed upon the iron car, which weighs about five hundred pounds; an acceleration which if maintained for thirty seconds would give it a speed of 180 ft. per second, —a little more than two miles a minute. The friction of the present structure is, therefore, the only impediment; and it is equally obvious that the strap rails used, the lack of stiffness in the beam carrying the upper rail, and the severe wedging of the wheels as they go round the sharp curves, are the factors. These, of course, can all be entirely remedied.

The experimental car is hollow and has an interior capacity of about five cubic feet, and is therefore capable of holding about ten thousand letters, which would weigh 180 lbs., or the space could be filled with other packages needing transportation. It is probable that a still greater capacity in the car could be had with as great efficiency in power and speed.

On account of the fact that the car closes its own circuit in the coil where it chances to be, it happens that numbers of cars can be running upon the same track at once, each one taking its supply of electrical energy independent of the rest."

In conclusion Prof. Dolbear says: "The work in Dorchester has demonstrated that the Port-electric apparatus is simple, easy to construct, and durable.

That with it exceedingly high speeds may be attained.

That its cost per mile need not exceed $20,000.

That its cost of running and maintenance is low

That it is automatic, and may be trusted.

The propelling power is derived from a series of hollow helices of insulated copper wire, each of which encircles the track and carrier. These are fixed along the permanent way at intervals measuring six feet from centre to centre. Each helix is composed of 630 turns of No. 14 copper wire, in five layers, weighing about 20 pounds, and having a resistance of about five ohms. A contact wheel, mounted upon the carrier, and running in contact with the upper track-rail (which is divided into sections, and utilized as an electric conductor), connects the several helices in succession with the source of electricity as the carrier moves forward upon the track.

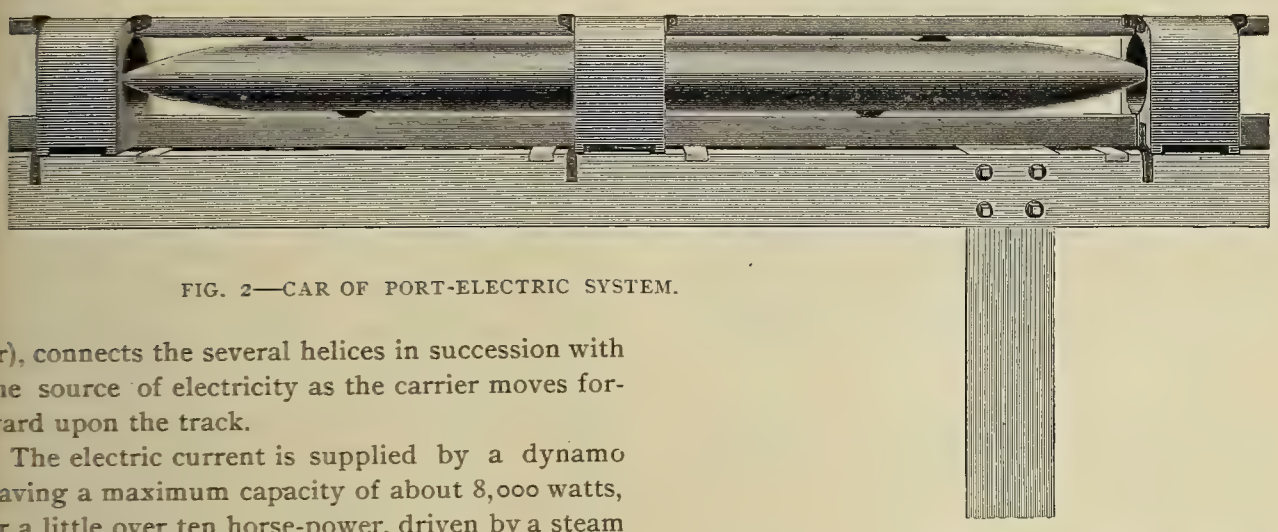


FIG. 2—CAR OF PORT-ELECTRIC SYSTEM.

The electric current is supplied by a dynamo having a maximum capacity of about 8,000 watts, or a little over ten horse-power, driven by a steam engine rated at ten horse-power.

The average electrical energy supplied represented about 8,000 watts and the efficiency of the helices and carrier, considered as an electric motor, was estimated by Mr. Pope to be at about 60 per cent., and the actual cost of the electric power required to propel the carrier at the rate of 150 miles per hour is given at about five cents per horse-power hour. This would be 75 cents a trip between New York and Boston.

Fig. 1 shows the Dorchester station of the New England Port-electric Company; Fig. 2 shows the car and section of the structure, and Fig. 3 gives a view of the Dorchester line from the station.

EXHIBITS AT THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

An interesting display of aluminum goods in all stages of manufacture and finish was made at the headquarters of the American Institute of Electrical Engineers during the general meeting of that society, May 20 and 21.

The aluminum was made by the Pittsburg Reduction Company and the finished articles were manufactured by the same company or its customers.

Samples of soldering by the Page-Anderson process were exhibited. There was a great variety of articles made of this aluminum, including medallions, plaques, foil, buttons, spoons, wire, horse shoes, thimbles, etc., etc. The exhibit included many samples of goods made by the Cincinnati Pure Aluminum Company, 125 Vine street.

Parvin & Co., 133 South 4th street, Philadelphia, selling agents for the Spring Garden Metal Works, showed some seamless aluminum tubes made by the latter company, from metal produced by the Pittsburg Reduction Company.

A set of aluminum spoons was shown, which had been in constant use during the past year in the home of Mr. A. E. Hunt, President of the Pittsburg Reduction Company. They had often been used in mixtures of salt and vinegar and gave no visible evidence that the metal had been acted upon injuriously or otherwise.

The Thomson Electric Welding Company exhibited a show board with samples of electric welding. These included chains, bars, shells, etc., etc., and was a very attractive exhibit. Wheels, in the construction of which the electric welding process had been used, were also exhibited.

ELECTRICITY IN THE DALMATIA MINE.

Of the numerous mines in California it is said that but one, the Dalmatia, uses electric power for mining purposes. This mine, situated seven miles northeast of Kelsey, El Dorado county, Cal., enjoys the distinction of being the pioneer in the use of electric power.

The company owns the water rights of Rock Creek on the American River, where the power station is situated. At this station is a 100 h. p. Brush generator, driven by a specially constructed seven-foot Pelton water-wheel of 125 h. p., using 400 inches of water with 110 feet of pressure. The current is carried nearly two miles to the mills at an elevation of 1,400 feet by a No. 3 insulated wire, supported on poles 100 feet apart. Here the wires are connected to a 60 h. p. motor which drives the entire plant. In addition to the power furnished, the electric plant also lights the mill and works by a system of seventy 16 c. p. lamps.

The company has a large excess of power and can increase their plant to 1,000 h. p. But one-half of this is used at present and another mine is about to be opened five miles from the power station to utilize the excess.

The electric system has proven so successful that the company intends to increase the plant sufficiently to enable it to work all the mines within a radius of twelve miles of the generating station.

The entire plant is connected by a telephone system, placing every part of the works under the immediate control of the superintendent.

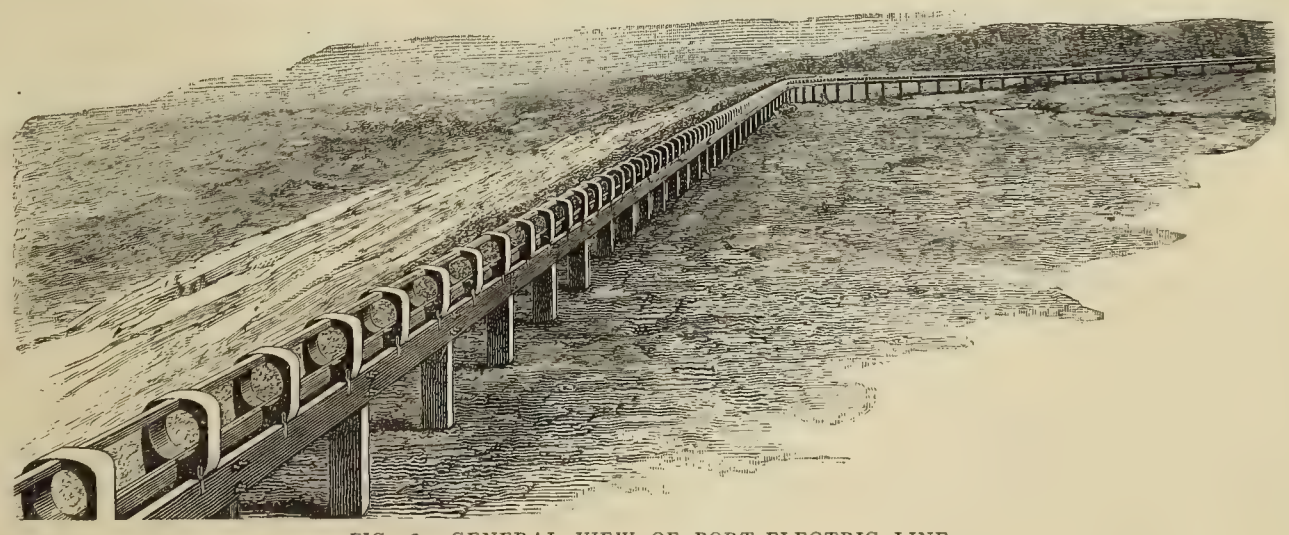


FIG. 3—GENERAL VIEW OF PORT-ELECTRIC LINE.

Christiania, the capital of Norway, is to be lighted from a central station with a capacity of 4,000 lamps. The three-wire system will be used.

The Philadelphia Electric Service Company of Camden, N. J., has been incorporated with a capital of $100,000.

VULCANIZED FIBRE.

Vulcanized Fibre has now been upon the market for over ten years, and is recognized as a staple article of commerce in all portions of the civilized world, being used largely for railway, electrical and general mechanical purposes, and possessing peculiar qualities which render it entirely different from any other known material.

It is produced by treating specially prepared vegetable fibre with powerful chemical agents, whereby the exterior portion of each separate fibre becomes glutinous, and while in this condition the whole mass is consolidated under very heavy pressure and becomes practically homogeneous. After this the chemicals are extracted, the mass manipulated, rolled, pressed, and cured by various methods, and the result is Vulcanized Fibre. Being an extremely delicate chemical process, liable to vary with the different conditions of atmospheric moisture and temperature, it requires the utmost skill, care and experience to produce uniformly good results. The machinery required for its manufacture is cumbersome and costly, and requires to be kept in perfect adjustment at all times.

It is a material of great strength, elasticity and durability, which is applicable in some form to almost every branch of mechanical industry. It is absolutely insoluble in all ordinary solvents and it is not injured by contact with alcohol, ether, ammonia, turpentine, naphtha, petroleum, or any of the animal, vegetable or mineral oils. It absorbs water, either hot or cold, but it is not injured thereby, except that it swells when wet, and resumes its original size when dry. It is made of two classes, hard and flexible, as desired, according to the uses for which the goods are intended. The hard fibre closely resembles horn in its consistency, is exceedingly tough and strong, resisting an enormous compressive strain, and retaining its elasticity under all ordinary temperatures. The flexible fibre has the appearance of a very close grained sole leather, and is used for a great variety of purposes. Both hard and flexible fibre improve by seasoning, and both are entirely free from grit.

Among the various uses to which it is applied is electrical insulation. It is an excellent insulator in all dry positions, and is largely used as a substitute for hard rubber by most of the principal electric light companies and manufacturers of electrical instruments in the United States and Europe.

It can be used in dynamos for commutators, magnet heads, etc., for switchboards and switch plugs, wall insulators, bases of telegraph and electrical instruments, push buttons, electrical gas lighting appliances, electric fire and burglar alarms, electric lamps, and a variety of purposes.

As the insulating properties of Vulcanized Fibre have been thoroughly tested all over the world for

(*Continued on page* 335).

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NEW YORK, MAY 30, 1891.

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ELECTRICAL WORLD vs. ELECTRICAL AGE.

The proprietor of the *Electrical World*, W. J. Johnston, has seen fit to bring a suit against us for exercising our right to change our title from the ELECTRIC AGE to the ELECTRICAL AGE. Mr. Johnston seems to claim a proprietorship of the English language. He fancies that he has an inalienable right to the word "Electrical," and that any person using it commits a wrong and ought to pay damages to his paper. When he was invested with this sovereignty over the English tongue he does not inform us. Fortunately for our esteemed contemporaries, the *Electrical Engineer*, the *Electrical Review*, the *Electrical Industries*, the *Electrical North West* and the *Electrical Enterprise*, we resisted this remarkable claim, and in an action brought by Mr. Johnston against us, we have been sustained by the courts. The *Electrical World*, in its suit against us for an injunction, made a motion to enjoin us before Hon. George P. Andrews of the Supreme Court, and Judge Andrews not only denied their motion, but wrote the following opinion:

"Andrews, J.: It is certainly very doubtful whether the plaintiff will succeed in this action, and I do not think an injunction should be granted before the trial. Motion denied, with $10 costs to defendant to abide the event of the action."

Not content with this, Mr. Johnston appealed to the General Term of three judges, who sustained the Court below and also denied his motion with costs. The Appellate Court deemed his complaint so little worthy of attention, that they did not deign to write an opinion upon so contemptible an insinuation.

The general meeting of the American Institute of Electrical Engineers, held in this city last week, was extremely interesting and successful, more so, probably, than any of the former ones. Both in point of numbers in attendance, and the quality of the papers read, nothing more could be desired. The entertainment of the members in various ways was an exceedingly pleasant feature of the meeting, and the reception at the Electric Club, Thursday evening, was a fitting termination of so successful a gathering. The reception was an exceedingly pleasureable one; everybody felt easy, and there was a total absence of formality. A thoroughly enjoyable time was had.

The reception at the Electric Club, last Thursday night, was a remarkable one in at least one respect. As of one accord, many of the electrical stalwarts and pioneers came together, and talked over their many experiences and trials during the early days of electric development, as represented to-day in the electric light, electric motor, etc. Their stories were abundantly corroborated by the exhibits, which in themselves told wonderful tales of tireless energy and zeal on the part of these men. It was a happy combination of circumstances that brought these shining lights together, and every one present had a good time.

The Fire Commissioners of this city have acted wisely in deciding to place the fire department wires in the subways and connecting hospitals with the fire department. The fire department wires, above all others, should be placed where there is the least danger from interruption. A vast amount of valuable property is dependent upon the maintenance of the fire alarm service. Impair this service and property is placed in jeopardy.

The most recent noteworthy event in the world of electricity, was the loan exhibition at the Electric Club during the past week. It was a revelation to most persons who had the good fortune to be present at the reception given by the club to the members of the American Institute of Electric Engineers last Thursday evening. Few electricians ever dreamed that there were in existence so many old works on electrical subjects as were seen on this occasion. Antique volumes, printed in French, Latin and English, were seen for the first time by many members of the electrical fraternity, and they possessed great interest to those present. The books were time-stained, and there was an air of the musty past about them that had considerable of a charm for the electrician. The exhibits of early apparatus, too, were extremely interesting, and each piece was regarded with the utmost reverence by those in a contemplative mind. If this exhibition could be continued for some time, no doubt it would be much appreciated by the electrical fraternity in general. It was a successful display of historical works and apparatus, which has never been equalled.

The paper read by Prof. F. B. Crocker, before the American Institute of Electrical Engineers on May 20, entitled, "The Perfection of Stationary Electric Motors," was an interesting one. Prof. Crocker's treatment of the subject was concise and complete, and the manner in which he considered the various parts of the electric motor in their design and relation to each other was masterly and finished. It was a clear and able exposition of the motor in its parts and complete, and no doubt will be read with much interest and profit. We publish the paper elsewhere in this issue.

As warm weather approaches our minds are naturally filled with thoughts of cool breezes; but where can they be had? Even at the sea shore, which is supposed by many to be the home of cooling winds, they are frequently conspicuous by their absence. Thanks to electricity, however, we can produce cool breezes at our offices or homes, at will, and need not go to the mountains or sea shore in search of them. Any one with a little spare cash can purchase a fan-motor outfit and keep cool under most all circumstances in hot weather. That these outfits are greatly appreciated is evident from the fact that so many of them have been put upon the market in the past couple of years. The latest machine of this class to compete for public favor is described and illustrated in this issue. It used to be said that it is easy to keep warm in the winter time but not so easy to keep cool in the summer. This no longer holds good, in these days of fan and motor outfits.

Aluminum has enjoyed a very large share of attention in the electrical and daily press lately, and much light has been thrown on the valuable properties of this interesting metal. The beginning of the present extensive movement in favor of the metal dates back to February last, when the ELECTRICAL AGE aluminum medals made their appearance at the Providence convention of the National Electric Light Association. These medals were the direct means of giving a boom to aluminum that has been enlarging in proportions ever since, and the aluminum industry in this country has been brought to the attention of the people in a way that could not have been accomplished through any other instrumentality.

We publish in this issue an interesting description of the new Edison low speed motor, which will attract considerable attention. The motor possesses some novel features, which will be of practical value in many directions. It is pretty well settled now that the low-speed motor is the railway motor of the future, and it is interesting to note the development being made from time to time in this and other directions.

At the meeting of the American Institute of Electrical Engineers last week the papers read were of extreme interest and value. Owing to the press on our columns of other interesting matter we cannot print them all in one issue. We propose, however, to print one or more of them in each issue until they are all used, and a valuable collection of papers they will be.

Quite recently we published a paper read by Mr. O. T. Crosby before the American Institute of Electrical Engineers, on High Speed Railroading, which attracted widespread attention. It is interesting to note the experiments being made in this direction at Dorchester, Mass. The latter system contemplates carrying express and mail matter at high speeds, with electricity as the motive power. We publish on another page some interesting facts concerning these experiments. There seems to be a great future for the system.

LECTURE.—Mr. Hiram Maxim is booked to give a talk on "The Tools of Modern Warfare," at the Electric Club, No. 17 East 22d street, at 8 P.M., Thursday, May 28.

THE PERFECTION OF STATIONARY ELECTRIC MOTORS.*

BY FRANCIS B. CROCKER.

Introduction.

A study of the history of the electric motor shows us that from the very beginning to the present time there has been a great tendency toward complicated, fanciful and unpractical designs, including outlandish forms of field magnets and unnecessary multiplicity of field cores and coils. In most cases also the mechanical construction has been very bad, the shaft being too small, the bearings being weakly supported, and the general finish and workmanship being rough and not up to the standard of first-class machinery. From the electrical standpoint the insulation has been very poor and shares equally with imperfect mechanical construction, the responsibility for the numerous troubles and failures which have occurred with electric motors. The magnetic circuit of motors has also been designed in a way that indicates entire ignorance of the laws governing the production of a strong magnetic field. In all these respects the electric motor has been worse than the contemporaneous dynamo electric machine, the reason being, I think, that the men who have studied and designed the dynamo have been more competent than those who have turned their attention to the electric motor, electric power being comparatively a more recent development of electricity than electric lighting. There have been, of course, notable exceptions to the general badness of motor design and construc tion, but in the case of all of these exceptions, which are few, I think it will be found that the superiority of the motor in each particular case was directly due to the presence of an electrical engineer of recognized ability.

Electric motors are used for three different classes of work. First, transmission of power over considerable distances, for example, from Niagara Falls to Buffalo; second, distribution of power, for example, in a district of a city from a central station, and third, electric railway work.

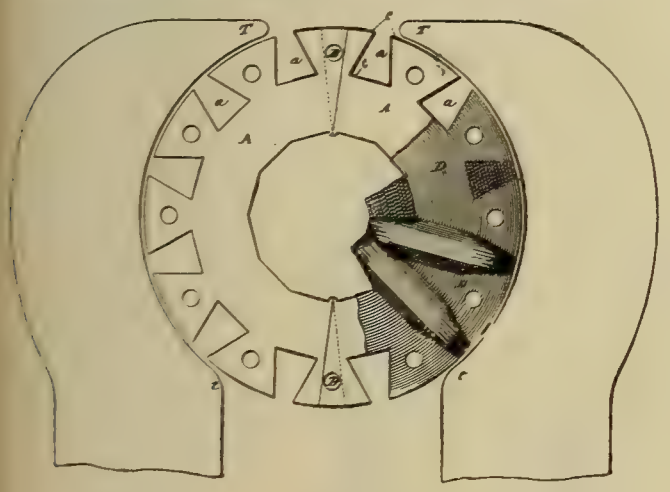


FIG. 1.

The first of these classes of work usually requires large motors, over 50 or 100 horse-power; the second requires comparatively small motors, ranging between ⅛ and 10 horse-power; the third requires motors from 20 to 100 horse-power, and a peculiar construction adapted to their special purpose. I purpose to consider in this paper motors of the second class for distribution of power especially.

It has long been my opinion that the proper way to design a good electric motor is to consider very carefully and systematically each part, first by itself, and then with reference to the other parts, and thus collect and build up the elements which are best not only in themselves but also in combination with each other, so that finally by putting and fitting these parts together with the best possible workmanship, the best result will certainly be obtained. The correctness of this procedure is so self-evident that it seems hardly necessary to uphold it, but everyone familiar with electric designing of all kinds will admit, that the usual process has been to invent some peculiar form of armature or field and then attempt to fit the rest of the machine to this particular part, producing all sorts of anomalous and awkward constructions. It will also be admitted that experience has taught us, that the simpler and less extraordinary forms of machine have usually been more successful. In fact I believe there is no kind of electrical apparatus in which

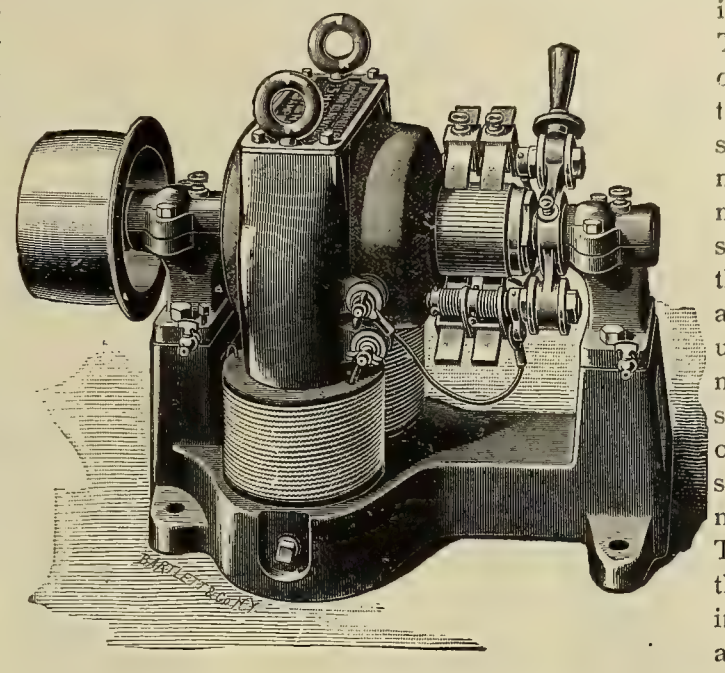


FIG. 2.

sensationalism in design has been successful, except perhaps in arc light dynamos. Let us now take up the various parts of the electric motor, and consider each as a simple problem in designing.

BASE.

This should be a solid iron casting, flat and simple in form, and resting directly and squarely upon the base, frame or floor, which latter should preferably be of wood to secure insulation. The base should be heavy to bring the centre of gravity low; in fact, this is the only part of the machine where weight is not only not objectionable, but very beneficial, and since it is merely of plain cast-iron the extra cost is insignificant.

FIELD MAGNETS.

The field magnet should be *bipolar* except in the larger machines, above 10 horse-power, on account of the great complication caused by the increased number of armature sections, commutator bars, field coils, etc., necessary in multipolar machines, and the narrowness of the neutral or non-sparking space on their commutators; for example, multiple brushes or cross-connected armatures are particularly objectionable in small machines. The field should also be a single magnetic circuit rather than the consequent pole type, because the former is more economical in wire and current required. For example, one turn of wire around a 7 in. core is equivalent to two turns of wire around two 5 in. cores, the cross-section of one 7 in. core being nearly equal to that of two 5 in. cores, whereas the length of wire is only 70 per cent. as much with the single core. In other words, a single circuit requires only 70 per cent. of the weight of wire and 70 per cent. of the energy of magnetization that is required by a double magnetic circuit. A triple magnetic circuit or quadruple magnetic circuit—that is, three or four cores magnetically in multiple arc, are still more objectionable, requiring about twice as much wire as a single core of the same total cross-section.

The field magnet may be arranged with respect to the base described above in three general ways: First, the pole pieces may be set upon the base (Edison type); this form requires non-magnetic material, usually a zinc plate, to be interposed to prevent magnetic short circuiting through the iron of the base; even with a zinc plate Hopkinson found 10.3 per cent. magnetic leakage through the base of the Edison-Hopkinson dynamo.

Second, the iron base may form one of the pole pieces (Manchester type). This is also objectionable on account of the greatly increased magnetic leakage, which is practically proportional to the surface exposed to the air, and the extension of the base necessary for the bearings, etc., greatly increases this surface, and also allows the magnetism to leak up into the shaft, pulley, etc., causing various troubles. This form has the further objection that it is of the consequent pole type, the disadvantage of which I have just pointed out.

Third, the iron base may form the yoke of the field magnet with the cores and pole pieces extending upward (Kapp or "inverted horseshoe" type). This plan has neither the leakage nor other faults of the other forms, and possesses the great advantage that the pole pieces are removed as far as possible from the base, bearings, etc., thereby avoiding magnetic leakage; and the base being purposely made heavy for stability and strength, as already stated, is therefore exactly suited to being used as the yoke, thus performing two functions to the best advantage. There is moreover, no objection to using a cast-iron base as the yoke to complete the magnetic circuit, since the heavy base I have insisted upon is of large cross-section and therefore of ample magnetic permeance and the increased size of the iron yoke does not aggravate the magnetic leakage because it is magnetically neutral. The field cores should be of wrought iron because the field wire surrounds them and the use of cast-iron, which is of low permeability, would require a core of almost twice the cross-section, and therefore a much greater length of wire to obtain the necessary magnetizing force. With the smaller wrought cores the magnetic leakage would also be less. The pole pieces should also be wrought iron to reduce their size and therefore their magnetic leakage, they being at the highest magnetic potential of any part of the machine. In regard to magnetic leakage, I would call attention to the fact that it is objectionable not only on account of wasting lines of force, but because it affects electrical instruments, watches, etc., in a very troublesome manner.

The field magnet cores and pole pieces being preferably of wrought iron, the question of uniting

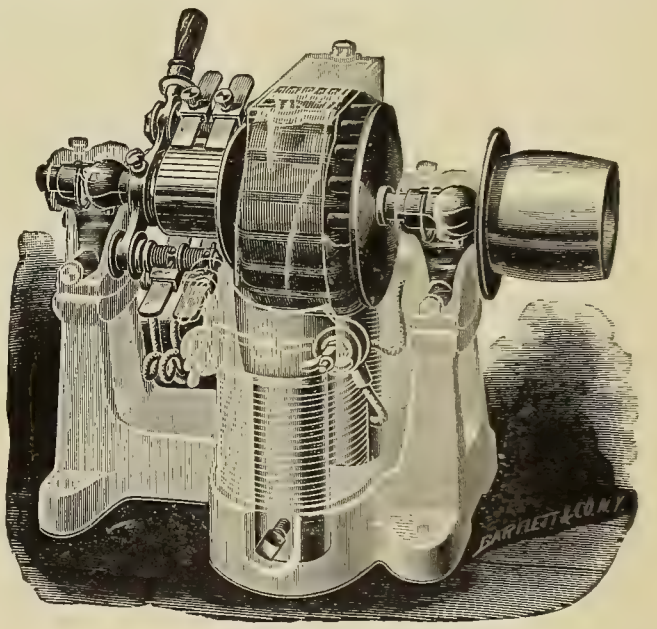


FIG. 3.

them to the base and to each other next arises. Since any considerable fitting or working of wrought iron is difficult and costly, the best solution of this problem certainly seems to be to forge (*i. e.* drop-forge) the core and pole piece in one piece. This also permits the bore or space for the armature to be perfectly formed at the same time. In connecting these cores to the cast-iron base, it is practically essential to set them into it in order to get sufficient contact and strength; since the ordinary butt joint between wrought and cast-iron limits the magnetic conductivity almost as much as if cast-iron were used throughout. This method of putting the magnetic circuit together reduces the work of fitting wrought iron to a minimum, which work is the only objection to the use of wrought iron. The supposition that cast-iron is cheaper than wrought for magnets is a fallacy, as its permeability is as much below that of wrought iron as is its price, both being about one-half.

FIELD COILS.

These should, of course, be perfectly insulated, a result which can be accomplished with certainty by winding them on a solid spool of material which

*A paper read at the General Meeting of the American Institute of Electrical Engineers, New York, May 20, 1891.

is fire and water proof and highly insulating. These spools should never be made of material that softens by accidental heating of the wire, as this would allow the wire to cut through and make a "ground" on the core which is just what the spool should prevent.

ARMATURE.

In regard to the choice between the ring and drum forms of armature, the advantage of the drum is that it is easy to support mechanically, but it is difficult to wind as the wire is apt to slip out of place and heap out on the ends of the drum, and more serious than anything else is the fact that the wires of a great difference of potential cross or approach very near each other, causing great liability to short circuit. The ring armature is somewhat hard to support mechanically, but the winding does not tend to slip out of place or pile out on the ends, and wires of the greatest difference of potential come at the greatest distance apart, that is on opposite sides of the armature. This is of the utmost importance in the case of high voltage machines. In the case of large ring armatures or those with few turns of wire there is little trouble in winding; but in the case of the small ring armatures or where a great number of turns of wire are used, the ring should be split in halves to facilitate winding and put together afterward when wound.

TOOTHED ARMATURE.

The armature should have teeth or projections upon it in order to secure the following advantages:

First, to reduce the reluctance of the magnetic circuit and the weight of wire and energy of current required to magnetize it.

Second, to hold the wires in place and prevent them slipping tangentially on the core, the tendency to which is much greater than is usually supposed, there being a tangential pull of about 160 lbs. on the wires of a 10 horse-power armature 8 in. diameter running at 1,000 R.P.M.

Third, the teeth protect the wires from mechanical injury since any blow or pressure which the armature receives comes upon them instead of upon the armature wire, which is very easily injured and the machine thereby ruined.

TRAPEZOIDAL TOOTH ARMATURE.

A certain form of teeth I have found to possess decided advantages over the ordinary parallel sided teeth and slots heretofore used. This form of teeth is considerably wider at the top than at the bottom which, of course, makes between the teeth a slot which is wider at the bottom than at the top. This shape of tooth and slot has the following additional advantages over those of the ordinary toothed armature—first, the wire is more completely held in place, being held against centrifugal force as well as against tangential force; second, the wire is also more perfectly protected mechanically since it is almost entirely surrounded by iron; and third, the armature presents an almost unbroken magnetic surface to the pole pieces, thereby reducing to a minimum the reluctance of the air-spaces in the magnetic circuit and the magnetic leakage and avoiding Foucault currents and loss of energy in the pole pieces. This trapezoidal form of slots and teeth can be still further taken advantage of by giving the former a shape which exactly agrees with the form of a section of winding on the inside of the ring, as shown in Fig. 1, the interior spaces for winding being divided into the necessary number of sections by radial lines. This exact conformity between the inside and outside of the winding makes a perfectly symmetrical coil, with no tendency for a single turn of the wires to cross at any point and the coils on the inside occupy the whole space with the greatest possible advantage, whereas ordinarily the interior of the ring is liable to be overcrowded with wires. The trapezoidal form of slot is particularly economical as regards winding, for the reason that there are a greater number of turns in the inner layers, which are shorter, and fewer turns in the outer layers, which are longer, as shown in Fig. 1.

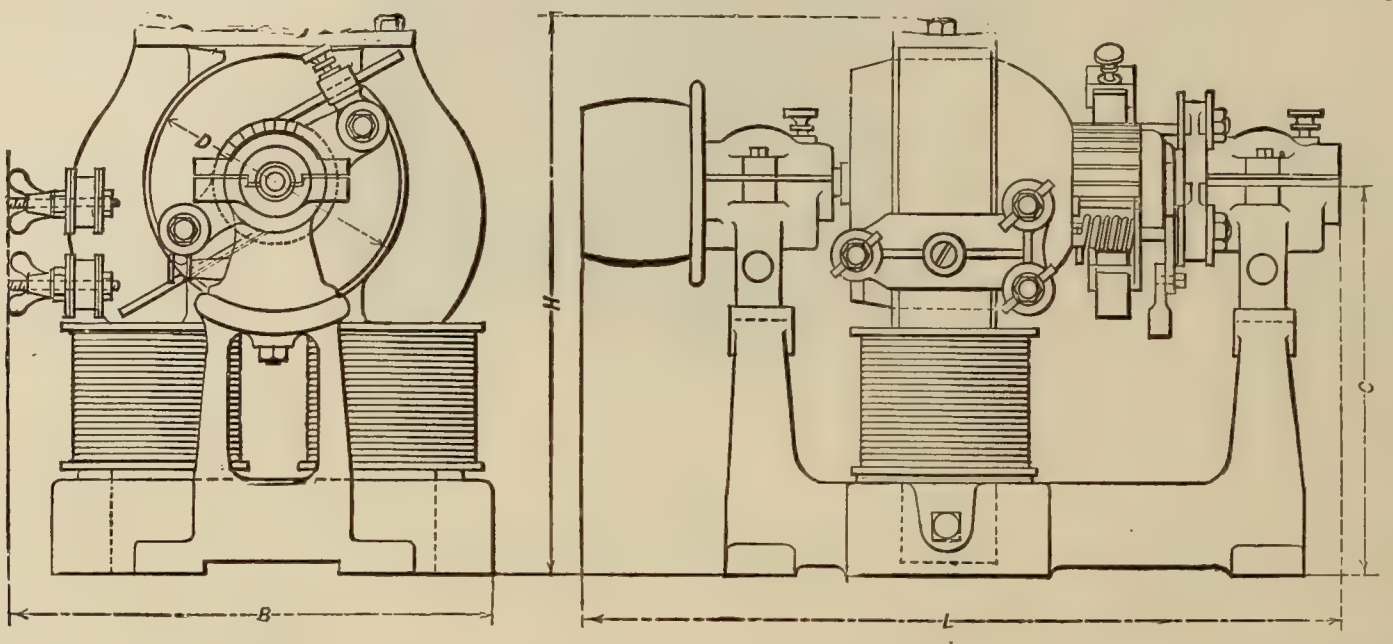


FIG. 4a. FIG. 4b.

The armature teeth make it easy to support the ring perfectly, since the bolts for carrying it may pass through the teeth without interfering with the winding. These bolts being held at the two ends by brass spiders or supports, make a very strong and convenient means of mounting the ring upon the shaft and thereby overcome the objection to the ring armature. In the trapezoidal form of teeth which I have described, there is even more space than in the ordinary form of teeth for the bolt-holes, and in this way larger bolts and stronger support can be obtained. The perfect insulation of the armature core is of the utmost importance. The best material and the most complete covering should be used and the greatest possible care should be exercised to avoid short-circuits, "grounds," or broken wires.

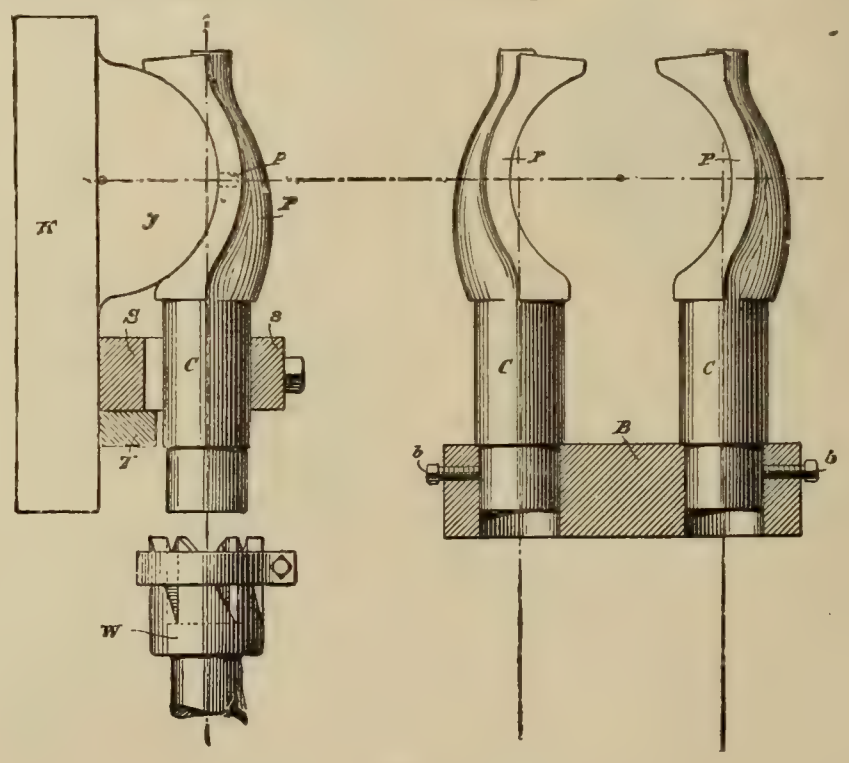


FIG. 4c.

EFFICIENCY.

This should, of course, be as high as possible, and is made a maximum by reducing all elements of loss as far as possible. These losses are, current to magnetize field, loss due to armature resistance, friction resistance of air, Foucault currents and hysteresis. It has always seemed to me that the efficiency is necessarily high if the machine is properly constructed, and if the efficiency is low it must be due to some loss, which is more objectionable in itself than because it involves a reduction in efficiency, because this loss must necessarily manifest itself in the form of heat in some part of the machine, for example, the field-coils, armature or bearings. This heat is liable to do more harm by its direct effect upon the heated parts, causing a burn-out or charring of insulation in the winding, or cutting of the bearings, and any effect of this kind is much more serious than the inefficiency from which it results. The same fact can be expressed in another way, by stating that if a machine can be run for one or two hours at full load without any part becoming overheated, the efficiency of that machine must be high, unless the machine is very large and heavy for its power, in which case the surface for radiation and conduction would be great. This fact is more absolute than any efficiency test can possibly be, and very small losses which an efficiency test might not disclose would be indicated by local heating, if, for example, the effects are allowed to accumulate for a half hour of steady running.

THE MOTOR AS A WHOLE.

I can best illustrate the foregoing statements and recommendations by describing the set of electric motors designed by Dr. S. S. Wheeler and myself. They were developed by precisely the same process of reasoning as that given in this paper. Fig. 2 shows the general view of the motor; each of the parts and the putting together of the whole follows exactly the statements I have already made, and it is, therefore, only necessary to call attention to a few points.

The fields are put together according to a method, illustrated in Fig. 4 *c*, which consists in

drop-forging the core and pole piece in one piece and exactly to shape; then mounting it upon a holder in such a way that the ends of the cores are trimmed with exact reference to the armature bore, and holes being bored in the cast iron base the proper distance apart, the cores are set into it to the depth they are trimmed off and produce a space for the armature exactly suited to it. This is much simpler than fitting the field magnets and base together and then boring out the armature space, the operation of boring being a slow one and requiring heavy machinery. The field cores set into the base are shown in the skeleton drawing, Fig. 4.

The magnetic circuit produced by this method is excellent. In the first place, there are only two joints and these are of very large surface and fit very perfectly, being where the cores fit into the base. The surface of contact of each of these joints is about four times the cross-section of the core, and therefore, about twice the cross-section of the equivalent cast-iron. The core and pole piece being made integral, avoids any joint between them, as well as any necessity for expensive work in fitting them together. In fact, the only machine work required in fitting the fields to the base is simply trimming off superficially the ends of the cores and reaming the two holes in the cast-iron base, these holes being cored out in the casting.

The armature is made with trapezoidal teeth, as shown in Fig. 1, and having an almost unbroken surface of large extent exposed to the pole piece with a clearance of only one-sixteenth of an inch, the magnetic reluctance of the air gap is reduced to the lowest possible value. This exceedingly low reluctance of the magnetic circuit reduces the amount of wire required to excite the field to such an extent that only very short field coils and cores are needed, being only about one-third or one-quarter of the length required with armatures having no teeth and the ordinary air gaps in the magnetic circuit. This small quantity of wire on the field amounts to only twelve pounds in a 3-horse power machine and sixteen pounds in a 5-horse power machine. It has not only the advantage in economy of wire, but also makes the machine very efficient as regards current consumed in the field, being less than two per cent. in the two machines referred to. The reduction of field wire and length of coil required is particularly important in bringing the shaft of the machine down sufficiently near the floor to give the machine stability and steadiness in running. In fact, the only objection to the "inverted horseshoe" type of field is that heretofore it has involved the use of long field coils, which brought the shaft almost twice as high above the base as it is desirable to have it, giving a top-heavy and unsteady result. In the type of motor described, the shaft centre is less than a foot from the floor in the 3-horse power size, and is just about the proper height to make the pulley, belt, gear wheels or other mechanical connections clear the floor and have sufficient room to work properly. This complete overcoming of the heretofore serious objection to the "inverted horseshoe" type, makes a thoroughly satisfactory field construction without any of the disadvantages of all the other forms.

The actual results obtained from these motors, which, of course, is the most important and conclusive thing to know, are given in the following table and include the various mechanical, electrical and magnetic constants of the machine. All the sizes of this type of motor are made almost exactly the same in design, proportions and construction and differ only in scale, hence a description of one machine applies to all, with proper allowance for difference in size.

Data of 3-horse power Crocker-Wheeler motor, designed for 115 volt constant potential circuit.

Total weight	350	lbs.
Weight of field wire (No. 24, A. W. G.)	12	lbs.
Weight of armature wire (No. 13, A. W. G.)	11	lbs.
Resistance of field	310	ohms
Resistance of armature	.4	ohms
E. M. F. of circuit	115.	volts
Total current at full load	24.3	amps.
Current used to excite field	.37	amp.
Percentage of current used in field	.015	
Total current required to run free	1.9	amps.
Percentage of total energy to run free	.08	
Commercial efficiency	.80	
Armature speed	975.	r.p.m.
Total magnetic leakage or waste lines of force	.17	
Magnetic efficiency = Lines through armature / Total lines of force	.83	

The above data for the most part explain themselves, but I desire to call attention to several particularly interesting points.

The weight of field wire is extremely small, being only 12 lbs., compared with about 40 to 50 lbs. in most machines of this size. I actually found the weight of field wire to be 60 lbs. in a type of motor of equal capacity, which is claimed to have the best possible magnetic circuit.

The table also shows the current used in field to be only 1½ per cent., which is remarkably low for machines of this size, which usually require about 5 per cent.

The current required to run free, at full speed, is also exceptionally small, being only 8 per cent.

The commercial efficiency is high for a motor of this size, particularly when the very low speed is considered, because an increased number of turns of wire on the armature is required to make up for the reduced speed, and this augments the armature resistance and causes loss. The efficiency does not vary more than about 1 per cent. from half to full load, which is quite an interesting fact.

The speed, it will be noticed, is very low for this size of machine.

The magnetic leakage or loss of lines of force is extraordinarily small, amounting to only 17 per cent., and giving what may be properly called a magnetic efficiency of 83 per cent.

This small magnetic leakage is due to the facts already stated in this paper in regard to the design of the field magnets. In this connection it should be remembered that Hopkinson in his classical investigations of the magnetic circuit found that there was 24.24 per cent. magnetic leakage in the Edison-Hopkinson machine. I may also state that Mr. A. S. Ives, student in Electrical Engineering at Columbia College, found 40 per cent. leakage in a well-known dynamo (400 light) of a recent though not the very latest type.

In conclusion, I would state that it is obviously impossible in one paper of reasonable length, to completely treat the subject of motor design, but I have attempted to bring out the most important points, and lay before the Institute the best results of considerable study and experimental work on the part of Dr. Wheeler and myself in the direction of improving and perfecting the design and construction of stationary electric motors.

There is one single merit in the paper to which I lay claim, and that is the fact that the ideas I have advanced are embodied in a large number of actual working machines, which are open to any one for examination and criticism, whereas the design of electric motors is usually given on paper only, and is therefore very intangible, and correspondingly safe so far as the author is concerned.

TABLE DIMENSIONS, &c., CROCKER-WHEELER MOTORS.

Horse Power	Net weight lbs.	Speed	Pulley "P." Diameter ins.	Pulley "F." Face ins.	Size of Motor over all "L." Length ins.	"B." Breadth ins.	"H." Height ins.	"G." Length between bolt holes in base	"E." Breadth between bolt holes in base	Diam. Shaft ins.	"D." Diam. Armature ins.	"C." Height of shaft centre from base of Motor
½	13	2,100	Grooved, 1½ or Flat, 1½	⅜ 1	7⅜	5½	7⅞	4⅝	2¾	¼	3⅜	5 11/16
⅛	26	2,000	Grooved, ½ or Flat, 1½	⅜ 1	9¾	7½	8½	6⅜	3⅜	⅜	3 11/16	6⅛
⅙	26	1,800	2½	1¼	9¾	7½	8½	6⅜	3⅜	⅜	3 11/16	6⅛
¼	65	1,500	3	2	14¾	9½	10¾	9¾	4 5/16	5/16	4¾	7½
½	100	1,350	3½	3	18¼	11	13	11⅝	5½	11/16	5¾	9
1	157	1,050	4	3½	19	13¼	15½	12¼	7	⅞	7 1/16	10½
2	290	1,050	6	3	25	15⅝	18⅜	18¼	9¼	1	8¼	11 7/16
3	300	1,000	6	4	26¼	15⅝	18⅜	18¼	9¼	1	8¼	11 7/16
5	485	1,000	7½	4½	28	18¾	21	18¾	9¾	1⅛	9¼	12¾
7½ Special.												
10 Special.												

The power for an electric tramway between Pazzala and Lugano, Italy, is supplied by a waterfall, the water being conveyed in two iron pipes to two 300-horse power turbines in the generating station, where one drives a 1,500-light dynamo, and the other a 60-horse power generator.

An electric light company bearing the name of The Arc and Incandescent Light Company, of San Francisco, has been formed in that city with a capital stock of $1,000,000.

A company for the manufacture of electric carbons has been incorporated in Detroit, Mich., with a capital of $200,000. The name of the new firm is The Electric Fibre-Carbon Company.

TABLE OF SPEEDS, CURRENTS AND WEIGHTS, EDISON SLOW SPEED MOTOR.

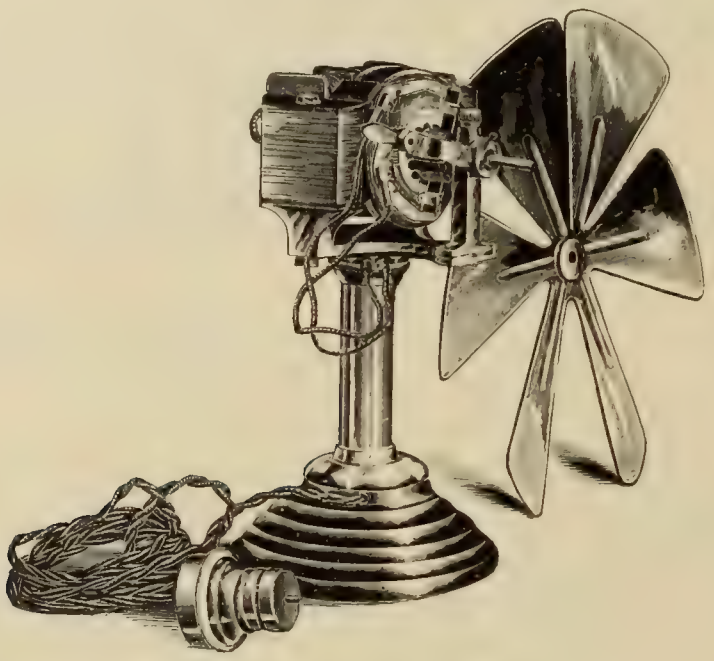
Type in H. P.	General Data. Rating in K. W.	Volts.	Speed.	Weight.	Over All. A	B	C	General. D	E	F	G	Base Frame. K	J	H	Pulley. L	M	N
1/16	.050	125	2200	14¾	8¾	7⅛	7¾	5½	2⅞	5¼	4½	7½	7	¾	⅞	1 15/16	5/16
⅛	.100	125	2000	20¼	10⅛	7⅞	7⅛	6 5/16	3	5½	4¾	8⅛	8	⅞	1	2 1/16	⅜
¼	.200	125	1300	28½	10 7/16	7⅞	9¾	6⅝	4⅛	5½	5⅛	8½	8½	⅞	1½	2¼	⅜
½	.400	125	1500	37⅝	10¾	8	10½	7	4¾	6	6	9	9	1	2	3	½

THE NEW WESTINGHOUSE FAN MOTOR.

During the last few years, a number of electric fan motors have been introduced and while some of them were tolerably fair ventilators, their operation, however, required a large amount of current, which made them so expensive that their general introduction for private use was never a success.

The Westinghouse Electric & Manufacturing Company, however, is now constructing fan motors which embody all the salient points required for an electric motor to be an economical and perfect ventilator. The device has been very thoroughly tested and has proved to have many advantages over the old style fan motors.

It can be successfully used on an alternating current incandescent circuit. Attached to any ordinary lamp socket, it will not use more current than one lamp. This is a point in its favor, which will be readily appreciated by the private consumer, who pays for the electric current according to the amount registered by the meter.



WESTINGHOUSE FAN MOTOR.

The armature coils and the wires leading from the armature to the commutator are completely imbedded in a cementing material. This method of imbedding the delicate parts of the apparatus precludes all danger of short-circuiting and it obviates any breaking of the wires by rough handling.

The speed of the Westinghouse fan motor can be varied in a simple manner. The motor has two carbon brushes, which are set so as to work automatically. A moving of these brushes to the left or to the right, causes the armature either to revolve fast or slowly.

Apart from the usefulness of this little apparatus it is highly ornamental. The fan is nickel-plated and the stand on which it is mounted is of brass. The fan motor can be carried about to any part of the room, as it weighs only about nine pounds.

SHALL "ALUMINUM" BE "ALIUM"?*

In accordance with the labor-saving tendency in regard to our tongues and pens, it certainly seems desirable that a shorter name than "aluminium," or even "aluminum," should be found for a metal which is destined to be so largely used in the further evolution of our modern mechanical life—and probably not a little in the electrical engineering of the future. In the paper before mentioned, reference is further made to the fact that the names of the commercial metals now in use are nearly all short, crisp words of one syllable, as gold, tin, zinc, lead, bronze, brass and steel, while the most common two-syllabled ones, nickel, silver and copper are also simple and easily spoken.

In further arguing the point regarding aluminum, I suggested as possible future names "Aluum," "Alium," "Alim" and "Alm," as being suggestive of the original word for which they might become substitutes and yet euphonious and easily pronounced.

It is earnestly to be hoped, if we are ever to have a shorter name than either of the two present ones, that some decided step will soon be taken by the proper authorities, if their existence and identity can be determined, to establish, once for all, a shorter and more convenient name. If the leading technical journals in this country and abroad could be induced to agree upon the word "Alium," or something better, if such can be suggested, and if, furthermore, the national engineering societies should see fit to endorse the same, the work of reform would practically be accomplished, as it is not probable that those who are strictly scientists only, would hold out against a popular verdict of the kind mentioned.

* Abstract of paper read at the General Meeting of the American Institute of Electrical Engineers, New York, May 21, 1891.

RECEPTION OF ELECTRICAL ENGINEERS AT THE ELECTRIC CLUB.

One of the most enjoyable affairs ever held in the elegant home of the Electric Club, 17 East Twenty-second street, was the reception given to the members of the American Institute of Electrical Engineers, on the evening of May 21.

There was a large crowd in attendance, including many gentlemen whose names will go down to posterity as the most brilliant lights in the electrical world.

Elegant music and refreshments were served in abundance, and every one present was made to feel at home. The rooms were brilliantly lighted and rendered attractive in every way possible.

The feature of the reception, however, was located on the second floor. It was a loan exhibition of early electrical books, apparatus, models and paintings. This was a most interesting display and the rooms were constantly crowded with the members of the Club and their guests admiring the rare articles, for the most part, shown to the electrical fraternity for the first time. The collection was of extreme historical interest, and the inscriptions on the various exhibits were read and re-read.

To describe every exhibit would require a good sized volume, and yet each has so much interest that we are constrained to indulge in the pleasure; but as we have so many good things to present to our readers this week, we must necessarily limit our description somewhat.

The exhibit of early electrical books was an extensive one, and completely filled two rows of show cases arranged down the centre of the room. These were loaned by Mr. Park Benjamin and others, and were indeed a revelation to many present, who never knew of the existence of so interesting and rare a collection of electrical literature.

Mr. W. Stanley, Jr., loaned the original transformer and alternator used for the parallel distribution of alternating currents.

In a show case was a collection showing the evolution of the incandescent lamp socket, and Mr. Louis Steiringer showed some early lamp sockets.

Mr. W. J. Hammer had an interesting exhibit of lamps, etc., being a part of his famous and valuable collection.

An alternating current transformer, made and operated by Edison in Menlo Park, in 1878, was an interesting exhibit. The celebrated electric motor of Thomas Davenport, which was described and illustrated in the ELECTRICAL AGE of March 21, attracted considerable attention. This quaint model, as far as we know, is the parent of the giant industry of to-day—the electric railway.

In a show case among the rare books were the remains of the battery used by Prof. Morse when he sent the first message by his own hand. It was loaned by the University of the City of New York.

Mr. T. C. Martin loaned several manuscript relics of Morse, and other interesting papers of great historical value.

An autograph letter of Prof. Joseph Henry was loaned by Mr. W. D. Sargent.

The loan from the collection of Mr. A. B. Chandler was a most extensive and interesting one, comprising letters, records and other manuscript connected with the early days of the telegraph and the telegraph service during the war of the Rebellion. There was a record from a Bain instrument dated 1856; a piece of telegraph register paper in use in the Confederate States in 1864; letters from various, now famous, persons, and one from the late William Orton, extending his compliments to the Japanese Ambassador.

Hanging from the centre of the ceiling was the first incandescent lamp chandelier, which was a clumsy looking affair compared with the beautiful fixtures we are accustomed to seeing these days.

ELECTRICAL RAILWAY NOTES.

The Atlantic Avenue Railroad Company, of Brooklyn, N. Y., have been making strenuous efforts to have their motive power changed to that of electricity, and made application to the Board of Railroad Commissioners for permission to make the change. They are meeting with considerable opposition on the part of the daily press and certain of the public who do not understand the subject, and who, thinking that "because under certain conditions electricity will kill, it follows that it is dangerous when used in the propulsion of street cars by the overhead system." The company hopes to counteract this fallacious reasoning and make the much needed change before long.

Two new Reynolds-Corliss engines of 250 horse-power each and two 125 horse-power dynamos are being placed in the Electric Railway Station at Youngstown, O.

Pittsfield, Mass., is to have an electric street railway.

The Thomson-Houston Electric Company have been awarded the contract for equipping the Portland, and Deering line by the Portland (Me.) Street Railroad Company.

The Yonkers, Mount Vernon, Pelham and New Rochelle Railway Company has made application for the privilege of constructing and maintaining a street surface railroad in, over and upon a number of streets in Pelham, N. Y. The Town Board of Pelham meets in that place on May 29th for the purpose of hearing and taking action on the application.

CORRESPONDENCE.

THE PROPERTIES OF ALUMINUM.

EDITOR ELECTRICAL AGE:—It was stated by Prof. F. B. Crocker in an article on the "Properties and Production of Aluminum," published in the ELECTRICAL AGE, of May 23, that ninety-nine persons out of every hundred have entirely wrong ideas regarding that metal. This statement I am the more inclined to believe since reading Prof. Crocker's own article. His statements regarding the properties of aluminum are so wide of the mark and so misleading that they ought, in the interests of sound information, to be corrected. My reasons for undertaking to do this are, that I have given a large part of the past five years to this subject; am largely interested in the production and sale of aluminum, and am familiar with its properties as shown by the experience of the past thirty years, and by what is being done with it at present.

The main idea of Prof. Crocker's article seems to be that most of the supposed good qualities of aluminum really belong to its alloys and are wrongly attributed to the pure metal. This may be true, to a certain extent, in regard to the mechanical qualities of aluminum; but it shows a lamentable lack of information to say the same of its chemical qualities. Aluminum bronze, of the best grade, possesses 100,000 lbs. tensile strength per square inch and correspondingly high elasticity. The saying that aluminum is as strong as steel may have arisen from confounding the strength of aluminum bronze with that of pure aluminum, or it might equally have arisen from what is the fact, that comparing equal weights, aluminum is as strong as good specimens of steel; thus, the tensile strength of aluminum, 26,000 lbs., multiplied by 3 for difference in specific gravity, gives 78,000 lbs., whereas the best structural steel ranges from 60,000 to 70,000 lbs. per square inch.

Again, Prof. Crocker says that aluminum has only one-third the strength of wrought iron. He must show a remarkable specimen of wrought iron with a tenacity of 3 times 26,000 lbs. per square inch. The best quality of wrought iron runs from 48,000 to 50,000 lbs. per square inch tenacity; so that aluminum has over one-half the strength of wrought iron, section for section, and weight for weight, is considerably stronger than wrought iron.

I am not trying to prove that aluminum is a suitable material for structural purposes, where strength is the main object. It is not, and neither is any other metal aside from iron and steel. But aluminum does compare well in strength with other metals, and for purposes where lightness combined with moderate strength is desired, not only will it become useful, but it is being largely used to-day.

It is doubtful if any one has been seriously mislead by any confusion between the strength of aluminum and that of aluminum bronze, or if any well-informed person has proposed to displace iron and steel for structural purposes with aluminum.

The most serious objections which Prof. Crocker urges against aluminum are on the score of its chemical properties, and here his information and reasoning are really unique. "Aluminum bronze," he says, "is remarkably free from tarnishing." "Therefore, freedom from oxidation is another property that is wrongly attributed to aluminum itself." It is true, aluminum bronze is the best of the copper alloys for resisting oxidizing influences; but for the vast majority of uses to which metals are put, it cannot compare with pure aluminum in this respect. Aluminum here ranks with silver and next to gold and platinum. The fallacy of Prof. Crocker's reasoning will be apparent to any one who possesses an aluminum opera glass, or who is acquainted with the fact that next to gold aluminum is the metal most preferred by dentists for dental plates, etc., or that for sign-painting and decorative purposes, aluminum leaf has the preference over silver leaf, because aluminum remains bright and silver blackens. What are the facts in regard to corrodibility of aluminum? In the first place, it is not true generally that "it is equally attacked by acid." Of the common re-agents, it is dissolved only by hydrochloric acid, and by the alkaline hydrates or caustic alkalies. Sulphuric and nitric acid act upon it with extreme slowness, not dissolving it appreciably after several days' exposure to their action. But for all ordinary uses, these facts are no more against aluminum than against gold, that it is dissolved by aqua regia or selenis acid. These strong chemical re-agents, the acids and caustic alkalies, are practically unknown outside the laboratory and chemical manufactory. Because of their strong affinities, they cannot exist in our common surroundings of air, water, food, etc.

The action of the weaker, organic acid, selina solutions, etc., upon aluminum is much less than any other metals except the noble metals. Alkaline carbonates do not dissolve aluminum, nor does soap, as Prof. Crocker states. Air, wet or dry, has absolutely no action on aluminum, nor has water. If it is true, as stated by Prof. Crocker, that "subjected to ordinary moist air, aluminum tarnishes and oxidizes rapidly," I am unable to see the pertinence of his further remark, that "it is not affected by sulphur or sulphureted hydrogen, which is a great advantage." For a metal that is oxidized rapidly by moist air, there would be small use in resistance to sulphur or sulphur gases. Prof. Crocker states that "the ease of oxidizing" of aluminum is "about equal to other metals, such as tin, zinc and iron." The absurdity of this statement would be almost evident to one who had even seen an article made of aluminum. Think of iron or tin dental plates, or of zinc leaf, or sheet iron used for decorative purposes, as aluminum sheet, foil and leaf are employed. Prof. Crocker constantly asserts that "aluminum really has excellent qualities." I am unable to see what they are on his authority.

One of my associates became interested in aluminum financially, largely because of an aluminum field-glass which he has possessed for twenty years. He has carried it all over the world. It has been wet with sea water and has been almost constantly exposed to "ordinary moist air" for twenty years, and it has never been cleaned or polished further than wiping it with a handkerchief, and to-day it retains its polish and lustre as perfectly as when new. The fact is that for resistance to all ordinary corroding and oxidizing influences, aluminum stands next to gold and platinum and ranks equal with silver, and the difference between it and the latter metal aside from difference in color (aluminum being of a bluish tint, which makes silver look yellow by comparison), is just this: For objects that require much handling, aluminum has the disadvantage of losing a portion of its polish, probably from coming in contact with perspiration; but where it is to be exposed to the air of a house or the weather, without much handling, there is no metal which will retain its lustre and polish better. Silver is blackened by exposure to the air, where aluminum is unaffected, while where aluminum is dulled and requires polishing, silver requires the same.

The foreign workers in aluminum seem to have succeeded in giving a more permanent polish and lustre to aluminum under handling than we have in this country yet, as I judge from some aluminum articles obtained abroad. Where polish is unimportant, as for dental plates and culinary utensils, aluminum has no superior short of the noble metals. As regards aluminum cooking utensils, I am not giving this statement off-hand, but from actual experiments extending over more than a year. Cooking utensils of aluminum have been in constant use for the time stated, have been daily subjected to boiling saline solutions, washing with soap, etc., and as a result they are preferred by the users to utensils of any other metal; one reason being that they always are clean and white, while the nickel rivets used for fastening the handle to some of them became perfectly black. In this connection, aluminum cooking utensils will soon be largely placed upon the markets. The same qualities of aluminum are shown by the fact that aluminum vessels have been used for a considerable time for the manufacture of jellies, where freedom from discoloration is important, and besides are now being largely used by one of the large canning concerns in Pittsburg whose name and products are widely known.

The perfect antiseptic qualities of aluminum should also be noticed, which render it the best metal for culinary uses on this account, and also recommend it for surgical instruments, for which it is largely used at present.

So far as the working qualities of aluminum goes, it is well known to be one of the most ductile and malleable of all metals, and, therefore, is very easily rolled into sheet or drawn into tubes of very finest wire. Naturally possessing such a high grade of ductility; the metal is of a tough nature, such as would not admit of easy working qualities in the lathe or in the planer; but this toughness or clinging tendency of its fibres can be readily overcome, and the metal very easily machined by simply alloying with 3 to 4 per cent. of metallic copper, which shortens the grain, but which does not interfere or change the other qualities or virtues of pure aluminum.

I am glad to see that Prof. Crocker truthfully gives aluminum credit for electrical conductivity, comparing equal weights, twice that of copper. This may be of great importance at no distant day, because comparing equal weights, aluminum has about 12 times the conductivity of iron, and while it may not soon compete with copper for insulated wire, it is quite likely to compete with iron for telegraph wire, especially when its perfect durability on exposure to the weather is considered; and as hard drawn aluminum wire can readily be made, having a tensile strength of at least 60,000 lbs. per square inch.

There is one of the electrical properties of aluminum of which no mention is made by Prof. Crocker, but which is interesting, although it has not been much investigated nor turned to any practical use. This is, its resistance to the destructive effects of the electric spark. Aluminum is superior in this respect to all other metals, and for this reason is employed by Prof. Crookes and others for electrodes in vacuum discharge tubes when electrodes of other metals are quickly torn to pieces. The question suggests itself as to its use for commutators and other electrical purposes, where such a quality is most important.

In the last of his article, Prof. Crocker makes the strange statement—a kind of "Irish bull"—that "the purity of aluminum does a great deal toward improving its quality," which indicates, possibly, that the aluminum upon which his article is founded is not aluminum at all, but that metal plus a considerable amount of iron, silicon, sodium, or zinc. His remarks would be very pertinent in regard to such a compound. In this connection, it may be stated that it was never easier to obtain aluminum of the purest quality than at present, since the electrical process has been fully perfected.

The conclusion of Prof. Crocker, is that aluminum "is not a promising material for practical use." My belief is just the contrary; and it is founded upon a careful study of the metal and upon the practical tests made of its properties extending over several years, and made with large quantities of metal. There is no more promising material for investigation for practical use; and it has been proved that for a multitude of uses the same results in utility, beauty, and durability can be obtained from aluminum, at a less cost than from any other metal whatever.

In a paper on aluminum, read last winter before the Boston Society of Arts, Mr. Alfred E. Hunt, president of the Pittsburg Reduction Company, in order to give a new turn to a discussion that had fallen into a rut ventured the statement that aluminum had been overrated, as it has by some of the unscientific papers. But now every one writing about the metal has taken the cue until aluminum has no good qualities left whatever; but is a weak, easily corrodible metal, like zinc or tin, and really "takes up more space than it is worth," and has

falsely appropriated the good qualities of its alloys. Aluminum has been overrated. There has been a kind of "glamor" associated with it, due to two facts: the first being that it is really useful, durable and beautiful, combined with the other fact which has little to do with its commercial importance, that is, its ores are more abundant than any other metal and constitute a large portion of the earth's crust.

The world has been centuries in learning to use other metals: in learning to roll, draw, temper, and polish them. Aluminum is new, but we are learning how to deal with it; how to secure the qualities of strength, hardness, ductility, lustre, etc., where required, much more rapidly than has occurred in the history of the other metals.

CHAS. M. HALL.

PITTSBURG, PA.

PRIMARY BATTERIES FOR ELECTRIC LIGHTING.

EDITOR OF THE ELECTRICAL AGE: In your issue of May 2, you call attention, editorially, to the subject of furnishing electric light for small plants when the dynamo is out of the question. The storage battery not being an independent generator but requiring a dynamo to charge it, if the latter is necessarily excluded from the field referred to in your editorial description, the storage battery, it seems to me, must go with it.

It would seem then that the only means now known to us to supply the field referred to above is the primary battery.

Can the primary battery produce the needed amount of electricity at a cost low enough to do the service required? It is said by some who claim to know that a battery that would furnish current for a 16 candle-power lamp at a cost not exceeding 2cts per lamp hour, would be largely adopted where the dynamo cannot be employed. The cost of zinc being already well settled, the only question would seem to be the expense of the other materials necessary to be used.

Two things must be done: waste of zinc must be prevented, which may be said to be accomplished, and polarization must be cheaply suppressed. This is not done in any batteries now advertised. Have we reached the end of invention in this vital part of the primary battery?

We agree with Niaudet that "the principal aim and effort of inventors worthy the name has been" and is "to depolarize the electrode," and lessen the internal resistance of the cell.

Upon the subject of how to suppress the polarization of the battery, we have by all the "authorities" very uniform instructions; yet we affirm and have *proved* that in one very important feature their instructions are certainly erroneous so far as batteries for *strong* and *constant current* are concerned. The directions given seem reasonable and are correct to a certain extent, but lead to serious error for strong and constant batteries.

By another method the cost of depolarizing the cell is reduced more than one-half and the consequent constancy is quite remarkable.

There is then a primary battery with diaphragm so perfect in its working as to prevent local action while the battery is at rest, and a method of suppressing polarization at such reduced cost that we can safely affirm that cost of furnishing current for light will come quite a margin within the figure named above.

We now simply make these general statements and will go more into particulars at some future time.

B. J. WHEELOCK.

NEW YORK, May 18, 1891.

ELECTRICAL ENERGY IN MINING OPERATIONS.

EDITOR ELECTRICAL AGE: I find certain errors in the table of formulæ accompanying my paper read at Montreal, which errors are typographical ones made at this office. Will you kindly make the following corrections?

1st. In the formulæ for Power at Motor Pulley, which is

$$M=\frac{D \times h.\ p. \times 1600}{V \times e \times P},$$

the number 1600 in the numerator should be 16000.

2d. In the formulæ of Weights for any Case, which is

$$T=\frac{C \times D^2}{V \times 746.0}$$

the decimal point following the 6 should be struck out.

3d. In the definition of G read "delivered to conductor," instead of "delivered by conductor."

Yours very truly,

H. WARD LEONARD.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The annual meeting of the American Institute of Electrical Engineers was held at the Institute headquarters, 12 West 31st St., New York, on May 19, 20 and 21.

The election of officers took place on the evening of May 19 and the following named gentlemen were elected: President, Prof. Alex. Graham Bell, of Washington, D. C.; Vice-Presidents, Thomas D. Lockwood, Boston, Mass.; Carl Hering, Philadelphia, Pa.; O. T. Crosby, Boston, Mass.; W. J. Hammer, New York; Managers: Dr. Louis Bell, Herbert Laws Webb, A. G. Compton, James Hamblet. After the adjournment the members visited and inspected the 26th Street Station of the Edison Illuminating Co.

The first general meeting was held at 10 A.M., on the 20th, at which papers were read on "The Perfection of Stationary Electric Motors," by Prof. Francis B. Crocker, of New York, and "Some Data Concerning the Photometry of the Arc Lamp," by Dr. Edward L. Nichols, of Cornell University.

At the afternoon session two papers were read, as follows: "A New Graphical Method of Calculating Leads for Wiring," by Mr. Carl Hering, of Philadelphia, and "The Practical Aspects of Electric Welding," by Frederic A. C. Perrine, D. Sc.

The evening meeting was held in the room of Prof. Dwight, at Columbia College, 49th St., and Madison Ave., at 8.30 P.M., at which Mr. Nikola Tesla delivered a most interesting lecture on the subject of "Alternating Currents of High Frequency." Mr. Tesla performed several beautiful and interesting experiments with induction coils and other apparatus in illustration of his remarks, and received hearty applause from the large audience present. Many ladies were in attendance, as were also many members of the New York Electrical Society and the Electrical Section of the Brooklyn Institute, to which bodies an invitation had been sent to attend the general meetings of the Institute.

On the 21st the members, on invitation, at 9.30 A.M. met at the factory of the Crocker-Wheeler Motor Co., on West 14th Street and inspected the improved machinery used in the construction of motors.

The members assembled at the Institute headquarters at 11 A.M., and a paper was read by Prof. George S. Moler, of Cornell University, on "An Alternate Current Potentiometer," which was followed by a paper by Mr. Frank J. Sprague on "A Proposed Electrical Equipment for the Coming Rapid Transit System of New York City."

After the reading of Mr. Sprague's paper, Mr. George W. Walker, of New York, read one on "Electric Meters."

At the afternoon session the discussion on Mr. Walker's paper took place, after which the following papers were read and discussed: "A Study of the Fluctuations of Electromotive Force in the Open Coil Armature of a Constant Current Machine," by Mr. M. E. Thompson, of Cornell University; "The Aluminum Problem: Retrospective and Prospective," by Dr. W. H. Wahl of Philadelphia, and "Shall Aluminum be Alium?" by Mr. Oberlin Smith.

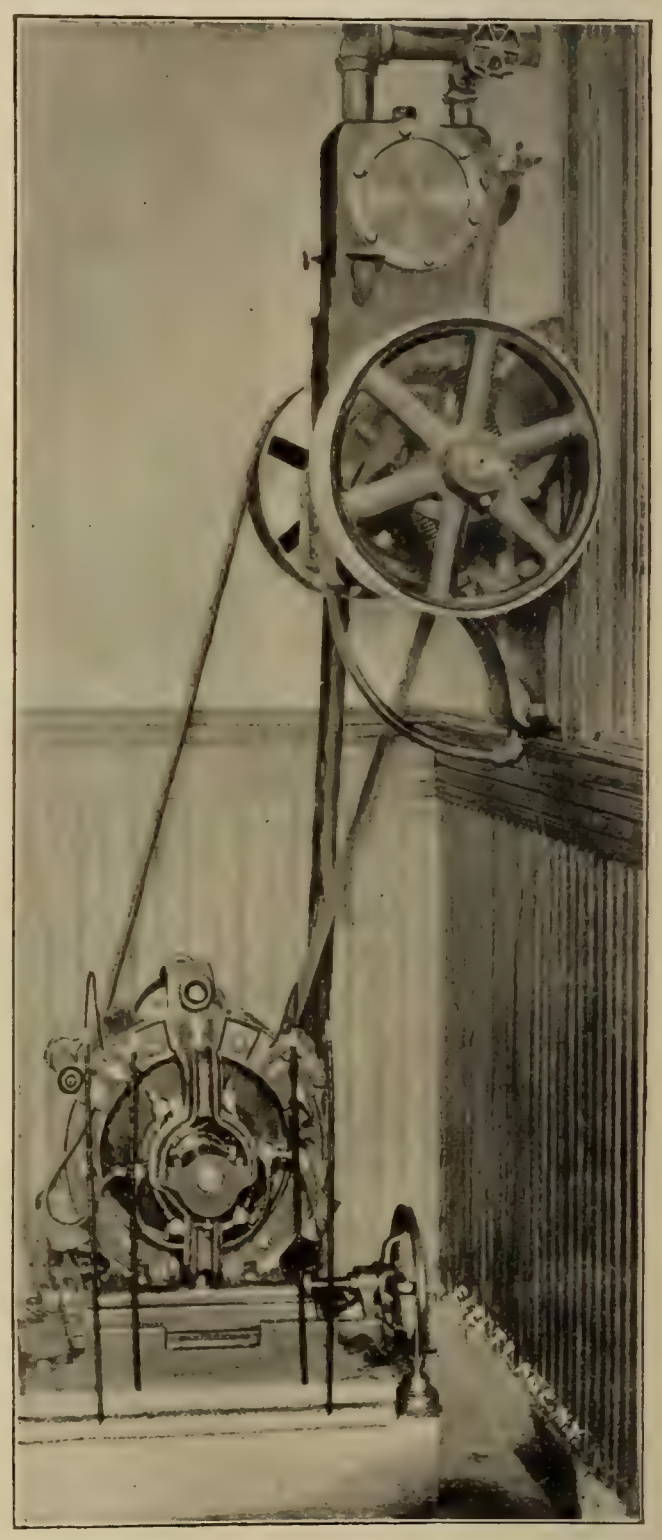
In the evening the members were entertained at the Electric Club. Particulars of the reception will be found elsewhere in this issue.

A NOVEL PLANT.

We illustrate below the rather unique lighting plant of the Staten Island Water Supply Co., Port Richmond, S. I.

The engine is an 8 horse-power J. T. Case high speed Bracket engine, running 550 revolutions per minute, furnished by E. T. Copeland & Co.

The dynamo is a 65 light Perret machine, running a few revolutions faster than the engine. Both are located in a corner of the elegantly finished pump house.



CASE ENGINE AND PERRETT MOTOR.

Floor space being a consideration, it could in no way be better economized than by using a high speed Bracket engine with a low speed dynamo and belting vertically, as the pulley diameters are nearly the same and are large enough to prevent any possible slippage.

The switchboard and moulding throughout are of selected ash. In the pump house ten 2-light polished brass bracket fixtures are placed at a height of twenty feet from the floor, each bracket being controlled by a polished push button switch on the wainscoting, and five lights are placed on fixtures in and underneath the pump. The remaining lights are located outside, and in the well and surrounding buildings.

Continued from page 327.

a number of years, and as it is much cheaper than hard rubber, and improves with age, the economy of using it is apparent. It is made in three colors: red, gray and black.

There is hardly any branch of mechanical art in which Vulcanized Fibre, either "hard" or "flexible" may not be used to advantage as a substitute for some other and well known material, but the precise application must necessarily be left to those familiar with the peculiar position in which it is desired to use it.

All the patents covering the process and products of its manufacture are owned by the Vulcanized Fibre Company, of Wilmington, Del., who are the sole manufacturers of this material in the world. The New York offices of the company are at 14 Dey street.

THE PAISTE SWITCH SOCKET.

In the new socket designed by Mr. Paiste of Philadelphia, he places one of his well-known 5 ampere switches in a socket to make and break the circuit. By an ingenious device the wireman can use his discretion between a binding post and a binding screw. When in the act of wiring, both shells can be removed from the socket, leaving a clear, unobstructed place to work in. By means of a yoke and collar the socket can be securely fixed to a chandelier, and under no circumstances can the shell short-circuit the wires. All insulating parts are made of Syracuse china, insuring a perfect insulation. Central Station men should appreciate this socket, as by its means one can, during Christmas festivities, substitute large candle power lamps for the normal ones, without fear of destroying the working parts of the socket.

ST. LOUIS NOTES.

The Western Electrical Supply Co. have removed to commodious quarters at 619 Locust St.

Articles of incorporation have been filed by the Underground Electric Traction Company of this city.

A few days ago bids were opened in the office of the Carondelet Electric Lighting and Power Company for the furnishing of dynamos and other necessary apparatus for central station use. The contract for furnishing dynamos, switchboards, etc., for the new plant was awarded to the National Electric Manufacturing Company of Eau Claire, Wis.

The Shultz Belting Co. report business brisk. They have just filled a contract for 600 feet of belting for New England. They also furnished the belting for the electrical plant in the new Western Union office here. The 450-light machine of that plant, with the Shultz woven leather belt, and the Noye engine are a most perfect combination of speed, smoothness in running, and silence.

The Western Union Telegraph Co. moved into their new offices on Pine St., between 4th and 5th, during the night of Saturday May 9th. At 8 A. M. Sunday every wire had been transferred and business was going on as usual. Everything worked smoothly, the new electrical plant doing its work perfectly. It consists of 15 generators of 70 volts each, 2 of 25 volts and 2 of 7 volts, and an incandescent machine of 450 lights capacity, of the Western Electric Co.'s make. The engines are from John T. Noye & Co., Buffalo, N. Y. The operating-room occupies the entire fourth floor, 40x125 feet, and presents a handsome appearance, especially at night when its 85 incandescent lamps are lighted. The switchboard is a particularly elegant piece of workmanship, and has a capacity for 250 wires and 200 multiplex local circuits. There are at present 161 wires and 116 multiplex local circuits in use. The entire electrical plant and arrangements were planned by Mr. L. L. Summers, Assistant Electrician of the Western Union Co. at Chicago, and the installation has been under his supervision.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73,
BOSTON, MASS., May 21, 1891.

The Erie Telegraph & Telephone Co., will hold its annual meeting in New York City, June 9.

The Globe Street Railway Company of Fall River, has sold its plant to a syndicate for $600,000. The capital stock of the company was $300,000.

The ordinance permitting the Union Railway Company, to use the single trolley system on its Pawtuxet branch, passed the Providence Board of Alderman at its meeting last Tuesday night.

Louis Magee, European agent for the Thomson-Houston Electric Company, with office in Hamburg, Germany, has been in town for a short season. June 3d he will again sail for Germany.

The Thomson-Houston Electric Company will put in the new electric plant at Springfield, Vt. At the start 20 street arcs will be furnished while arcs and incandescents will be provided for commercial use.

W. H. Blood Jr., who was for two years connected with the Thomson-Houston Electric Company at the factories in Lynn, is now foreman of the assembling room of the Franklin Electric Company at Kansas City, Mo.

An explosion at the works of the Electrical Forging Company, 163 to 167 Oliver street, last Tuesday noon, burned one man fatally and two seriously. The explosion was caused by a lighted candle placed in an empty oil tank.

In the construction of an electric railway being built in the City of Gloucester, Mass., the rails are to be used as a return wire instead of the earth. The rails are joined at the fish-plates and, with the trolley wire, will form a metallic loop.

The capitalists who petitioned for permission to construct and maintain an electric freight railway in and about Fall River, Mass., are meeting with considerable opposition from mill treasurers and the capitalists of the city not directly interested in the railway.

The electric light plant lately presented to Harvard College, will be installed during the summer vacation. This plant will be of great benefit for all the buildings concerned, but for none so much as the large library in Gore Hall. Hitherto no artificial lights have been allowed there, on account of the danger from fire.

At a meeting of the Board of Aldermen of Newton, Mass., evidence was given tending to show that the Newton Street Railway Company had attempted bribery in their efforts to have the order to relocate their tracks on River street, rescinded. After a lively and sensational session the hearing was adjourned without any action being taken.

An attachment in an action of tort has been brought by Joseph W. Vaughn, of Salem, against the Naumkeag Street Railway Company of Salem, for $50,000. Vaughn was struck by an electric car last fall while out riding, and considerably injured. He apparently recovered after a week's confinement, but subsequently was stricken with paralysis of the lower limbs.

The New England Printing Telegraph Company are endeavoring to secure an entrance into Boston, so as to connect with the lines they have established outside the city limits. The company has a number of lines from Providence to the city boundary following the New York and New England Railroad, and only need a location in Boston to extend its wires North and West.

A private party of about twenty gentlemen visited the works of the Bell Rock Electrical Conductor Company, at Malden, last Wednesday night, to inspect the working of their new wire-covering machine. Each one present was given a generous sample of the covered wire. This company expect to begin operations in a few weeks, and as they have a good thing, their success is assured.

The West End Railway Company are testing a new motor constructed on the principle of the steam engine, the armature being fitted with an eccentric rod attached directly to the wheels. As the wheels and armature revolve together the speed is very slow—about 200 revolutions per minute. It is thought the new motor will require about 15 per cent. less current than those using the gear system, and great things are expected of it.

A. A. Lawrence, president of the Cohasset Electric Company, has completed arrangements for the enlargement of the company's plant and system made necessary by the additional street lighting, authorized by the Town Council at its last annual meeting. The addition will require a new 750 light dynamo and exciter, about 300 planed hard pine poles and about twenty miles of wire. The work of constructing the new lines will be done by the company's employees, under the direction of Supt. Abbot of the Thomson-Houston Electric Company, who had charge of the original construction of the system. It is intended that the additional street light shall be turned on by July 1.

The Page Belting Company report recent orders filled as follows: A complete outfit for the Beaumont Furniture and Art Wood Manufacturing Company, Beaumont, Tex., including a belt 20 inches wide; also a complete outfit of belting for the Mohawk Knitting Company's new mill at Mohawk, N. Y.; a large amount of belting, complete outfit, for the Pennsylvania Steel Company, at Sparrows Pt., Md. Among the special belts of their make for running electric dynamos, shipments have been made during the last month to J. A. Grant & Co., Portland Me., National Sewer Co., Newport, Ohio, Forbes, Liddell & Co., Montgomery, Ala., and the Electric Forging Company of Boston. Among the large main belts furnished, have been some to the Des Moines Manufacturing and Supply Company, Des Moines, Iowa, to the McNeil Pipe and Foundry Company, Burlington, N. J., and to Gaines & Glover, Richmond, Va. Among the many patent Acme Link belts sent out during the past month, are the following: For the Catasauqua Electric Light and Power Company, Catasauqua, Pa., Edison Electric Illuminating Company, Boston (10 belts in all) one 20 inches wide to Chicago, Ill, and one 96½ feet long, 24 inches belt contained 70,000 links or separate pieces wide to the Electric Light and Power Company at Ellenburg, Washington. This very large of leather. Another large electric plant fitted up by this company during the past month, is the Hampton & Old Point Railway Co. Among the belts are two of their Acme Link 20 inches wide and two of their Eureka Dynamo belts, 13 and 16 inches wide.

The New York Concentrating Company has been incorporated in Albany, N. Y., with a capital of $100,000. The trustees are R. L. Cutting, W. S. Perry, Charles Batchelor, Thomas A. Edison, and Samuel Insull.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
417 CHAMBER OF COMMERCE,
CHICAGO, Ill., May 22, 1891.

The firm of Wetmore & Co., has been established to engage in the electric wire business in Marquette, Mich.

The Central Electric Company have their store on Franklin street, full of paper-hangers and decorators, cleaning house for the summer.

Mr. H. H. Pattee, of Monmouth, Ill., is in the city looking after the interests of his Lamp-Hour Recorder. This is being used by many in place of more expensive and slowly interpreted meters.

Geo. Cutter continues to fill orders from various parts of the West for tape and tubing, and especially for the black "elastic rubber" tape. This is made from pure gum, and when tightly wrapped makes joints thoroughly weatherproof.

In connection with the large arc lamp installation to be placed in the new Fair Building of this city, the Central Electric Company has secured the contract for furnishing the wire, and, of course, will supply their celebrated Okonite. This will probably be the largest isolated arc light plant in the country.

The Okonite Base Ball Club are getting into good shape for the summer campaign, and during Saturday afternoons in June they can be found sprinting around one of the diamonds in Jackson Park, and at other times are prepared to receive challenges at the office of the Central Electric Company, where they may be addressed.

The Electric Merchandise Company of this city has been awarded the entire order for the overhead electrical equipment, including rail bonds and poles, for the 40 miles of electric road in Memphis, Tenn. As it was necessary for all such material to have the approval of the electric company putting in the apparatus, this contract is a very strong endorsement of the line material manufactured by the Electric Merchandise Company.

H. T. Paiste, the enterprising electrical specialty manufacturer of Philadelphia, recognizing the want of a storeroom and office in Chicago, has opened out at 341 The Rookery, where his Western friends and patrons can be supplied without having to order from the factory in the East. The move seems a popular one among the supply men of the West, as it will save them the necessity of ordering in large quantities to save freight and express rates. Mr. Paiste still continues his Eastern office and factory at 1201 Market street, Philadelphia. The Western office will be managed by Messrs. Kohler Bros. and Grier, three enterprising young men, who will do all in their power to cater to the wants of the Western electrical trade in Mr. Paiste's line of specialties, which consists of porcelain base switches, china switches (which are decorated in all tints to match wall paper), sockets, cut-outs and gas attachments.

H. C. W.

PHILADELPHIA NOTES.

The electric street railway of Camden, N. J., is now running to the entire satisfaction of the Camden residents. It is much appreciated and well patronized by the public.

The electric light plant, now under course of construction in the Penn Mutual Life Insurance building of this city, will no doubt be one of the most complete plants in existence.

E. Ward Wilkins, of the Partrick & Carter Co., will meet their representative, T. L. Townsend, at Buffalo, N. Y., and will go with Mr. Townsend on a business trip throughout Canada. No doubt these two gentlemen will return to this city well supplied with orders, for their goods are having a world-wide reputation.

J. W. Parker has sold to Jno. P. Murphy, printer, No. 227 South 5th street, one 10 horse-power C. & C. motor, also to the evening *Bulletin* one 10 horse-power C. & C. motor, after a three months' competitive test in which several prominent motors took part. The C. & C. was adopted on a number of points of superiority. They have also sold to the Trenton, N. J. Lamp Company, one 35 horse-power Ball engine and one 45 horse-power boiler for their new lamp factory.

Messrs. Walker & Kepler of this city have been awarded the contract for installing an electric light plant in the new Empire theatre now under course of construction at Broad & Locust streets, this city. The plant will consist of four dynamos having a capacity of 2000 lights, which are to light both the Hotel Metropole (now under course of construction adjoining the theatre) and the theatre, each of which will have about 1000 lights. The switchboard will be one of Cushing's patent switchboards. The Interior Conduit & Insulation Company's system will be used throughout the entire work.

H. G. G.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOMS 7-12, "WORLD" BUILDING,
NEW YORK, May 23, 1891.

C. E. Beebe, and W. C. Stone, of Frankfort, N. Y., who are interested in the phonograph at that point, were in the city last week, and gave this office a call.

J. H. Wood, representing the Crosby Electric Company, New York, was in Chicago a few days ago, and reports large sales of that Company's improved dry batteries.

Mr. Milton Adams is now connected with the wire department of the Edison General Electric Company, with headquarters in the Edison Building, Broad street, this city.

Mr. J. S. Francis, of the Echo Telephone Co., was in town this week. This company are manufacturing electrical specialties, and are expecting to astonish the trade with something of great interest.

Among the recent installations of the New York Isolated Department of the Thomson-Houston Electric Company is a plant of 600 incandescent lamps capacity for the Palisade Amusement Company, Union, N. J.

Among the recent visitors at the Electric Club were Hon. Rowan Stevens, of Washington, D. C., accompanied by Harold Binney; W. H. Cargill, of Boston; H. J. Smith, of Brooklyn; A. R. Foote, of Washington; John I. Sabin, of San Francisco; F. B. Wilson, of Hartford, and E. C. Kilburn of Seattle, Wash.

Mr. R. C. Peabody, treasurer of the Edison Illuminating Co., of Brooklyn, N. Y., has lately returned from an extended tour on the continent, traveling through Great Britain, France, Italy, Austria and other countries, and returns with his brain full of interesting recollections of sight-seeing. He looks very much improved, so that he is able to settle down to the business before him.

The Hunt Engineering Co., of 238 Washington St., Brooklyn, have fully equipped their place with the latest machinery and tools for manufacturing their H. E. sockets for all makes of lamps, as well as their noted H. E. switches and other specialties. They are running their factory with one of the new Hill 3 h. p. motors. This motor is giving complete satisfaction. They speak in the highest terms of it.

The American Leather Link Belt Company, sole manufacturers of Patented American Joint Leather Link Belting, 46 and 48 Ferry St., this city, have shipped from their factory within the last month 600 feet of link belts. These include 10-inch belts for the Edison Illuminating Company's new station, Boston; two 10-inch and two 12-inch belts for electric light and elevator work in Bridgeport, Conn. One 12-inch link belt was shipped to Moscow, Idaho, for use in the electric light station. They have also received a large number of export orders.

The Conduit Wiring Company, the well-known electrical contractors of 12 West 29th street, are kept busy equipping electrical plants with the familiar interior and underground conduits for which they are authorized agents. The company have elegantly fitted up offices and show rooms at the above address, where arc lamps, conduits, and other electrical engineering specialties are to be seen.

Mr. J. Stanford Brown, who has been associated in the construction of a number of electric railway plants throughout the country, has just opened offices in the new Electrical Exchange Building, 136 Liberty St., this city, where he is prepared to act as consulting electrical engineer and expert for all electric railway and power companies. He is fully and thoroughly competent to supervise all kinds of electrical construction work, as well as to draw plans and give estimates on all kinds of electrical work, especially electric railway work.

At a meeting of the lately organized Waterford Electric Light and Power Co., Waterford, N. Y., held in that city, the following officers were elected:—F. B. Peck, postmaster in that city, president; J. E. Pike, treasurer; C. M. Kallor, secretary and general manager. The company intend to do a general light and power business, and are receiving estimates for complete arc and incandescent plants, through the Hunt Engineering Co., of 238 Washington St., Brooklyn, who are the consulting engineers for the Waterford company.

The Waddell-Entz Electric Co., formerly of Columbia Heights, Brooklyn, who lately brought out the storage battery and motor system for electric railways which was recently tested so satisfactorily in Philadelphia, are equipping their factory at Bridgeport, Conn., for the production of their specialties. Their office is now at 302 Produce Exchange, this city. These industrious young men have been experimenting in the past few years on their new motor and storage battery, and have also produced a new generator for a gentleman well-known in electrical circles.

At a meeting of the Tucker Electric Co., held lately at their offices, 14–20 Whitehall St., this city, the following officers were elected:—Chas. A. Tucker, president; Wm. E. Gavitt, vice-president and general manager; Jas. R. Strong, treasurer; Henry A. Sinclair, secretary. Since our last note in reference to this company, as to their installation of electric light plants and construction work, they have secured the contract for lighting Bradley & Currier's salesroom and factory, Hudson and Spring Sts., this city, with 250 incandescent and two Perkins arc lamps, including the Mather dynamos. The Perkins lamp is used by this company exclusively.

The following contracts have been closed by Mr. J. Harris, contracting agent for the Shaver Telephone Company: the Brooklyn Jockey Club, for a telephone circuit from the judge's stand to the inside of the betting ring—distance 1,000 feet—whereby they can give the names of the first, second and third horses in each race to the bookmakers; also a line for the Engineering Equipment Company, Central Building, to connect their office with the stock room at No. 73 Cortlandt

street; also a line for Buckley, Dunton & Company, the paper warehouse on John street, connecting their office with their stock room, No. 326 Pearl street, New York; La Commercial Cigar Factory, 345 Fulton street, Brooklyn, to connect with the store at 316 Washington street, Brooklyn. Mr. Harris expects to close several more contracts shortly.

Messrs. Curtis & Dean, of 115 Broadway, the New York representatives of the Thomson-Houston Electric Company, recently installed an electric light plant in the building of H. C. F. Koch & Company, West 125th street, New York, consisting of two low tension direct current dynamos, one of 800, and one of 400 16 candle-power lights capacity. Everything about the plant is of the best material and construction, the regulating and measuring instruments used being of the best type and greatest accuracy. Curtis & Dean have installed a large number of plants lately, the workmanship and engineering skill displayed showing them to be masters of electric light and power engineering.

The Safety Insulated Wire and Cable Company, of 234 West 29th street, the manufacturers of the well known Seamless insulated wires and cables, have gone into the electrical engineering business, equipping the construction with their own cables. The admirable service rendered by these cables since they were first placed underground in New York over two years ago, has been a source of great gratification to the manufacturers, and has warranted them in taking this new departure. The firm is fortunate in securing such an invaluable *aide* as Mr. E. T. Barberie as their electrician. As electrical engineer of its underground cable department, with his long experience in construction work, the new venture cannot be otherwise than successful.

The Thomas Murray Company, builders of electrical, steam and surface railways, Electrical Exchange Building, this city on May 20th, received from their superintendent at Charlotte, N. Y., who has charge of the construction of the Grand View Beach Railroad, a telegram stating that the cars were now very successfully running from Charlotte to Manitou Beach, a distance of eight miles. This firm was under contract for the complete construction of this road, embracing track work, grading, cribbing, bridging, overhead construction, cars, motors, generators, power house, and in fact everything in connection with an electric road, to be complete May 20. They had only sixty days in which to build this road, which is now in operation according to contract.

Mr. B. A. Hughes is the traveling salesman for the Peckham Street Car Wheel and Axle Company. He has just closed a contract with the Williamsport, Pa., Electric Railway Company. That company will start with eight new cantilever trucks with radial gear. Over forty electric roads are now using this company's trucks of all styles. Mr. Hughes has received the following letter:

"LANCASTER CITY ELECTRIC STREET RAILWAY CO.,
LANCASTER, Pa.

"B. A. Hughes, Esq., Dear Sir:—Yours received and contents noted. We did not run your new truck much since you were here, as we had some little trouble with the motor. However, I feel justified in saying that it will give entire satisfaction. We will have photograph of truck taken as desired by your Mr. Peckham first chance I get to do so. Yours very truly,

WILLIAM RING, Supt."

Among all the new enterprises which have, within the last few months, been inaugurated in the electrical field, none have brighter promise of success than the Engineering Equipment Company, who have moved from their temporary quarters at 73 Cortlandt street to attractive offices in the new and fine "Central Building," 143 Liberty street. They still retain the premises at 73 Cortlandt street for stock of belting, wires, etc., which they carry for convenience of customers who are not able to await shipments from the factories. It may be remembered that, as announced recently in these columns, Mr. F. L. Perine is general manager; Mr. A. L. Tinker is secretary and treasurer, and Mr. F. A. Magee is electrician. Each of the other gentlemen who are connected with the company devote themselves to various branches of the business; and we understand that the success of this new company to date has been excellent, and the prospects are of the best. The company has been formed to handle none but first-class steam and electric equipment materials, chiefly on large orders at close figures; and they are able to invariably quote terms not obtainable elsewhere on the materials they sell. Among the specialties which they control may be mentioned more particularly the following: The Underwood Cotton-Leather Belts and Belting Specialties, in which they have a large and growing trade; the well-known and first-class Anderson line materials, including the Boston trolley for electric roads; the Habirshaw Wires, Cables and Cores, the only wires recommended by the government; the Patent Indurated Fibre Pipe for electrical and other sub-ways, which is by many considered to be superior to any other pipe for such purposes, and which is now greatly improved in manufacture; and the new Kellogg steel centre and side poles. For the latter they are sole agents, and the announcement of these poles is now made for the first time. A description of the Kellogg pole will appear a week or so later. Besides the foregoing, they also handle the best boilers and engines, wooden poles, cross arms, cars, trucks, etc. It will be of interest to those who are in need of any of these materials to obtain a quotation from the Engineering Equipment Company, and it is advised that, if possible, a call be made upon the gentlemen of the company at their new offices in the Central Building, where they will be very happy to meet the trade. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	3 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	115 00
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	200 00
Bell Telephone 7's			112 00
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5s	6,000,000		par
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Illuminating (N. Y.)	1 000,000	100 00	60 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	10 00
City Electric Street Ry. Co., 6's	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	105 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500 000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's.	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80 000		par
Cons. Gas Co. Batavia	100,000		
Cons. Subway Co. (N. Y)	3,000,000	100 00	25 00
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co.	100,000	100 00	110 00
Detroit Electric L. & P. Co.	300,000		11 25
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	2,000,000		*99
Edison Illuminating (N. Y.)	4,500,000	100 00	80 00
Edison General	14,000,000	100 00	101 50
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co. (N. Y.)	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Empire City Subway Co. (N. Y.)		100 00	
Eric Telephone			48 00
Essick Printing Tel.	5,000,000	100 00	45 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	12 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	27 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	20 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	140 00
Hunt Engineering Co. (Brooklyn)	20,000	100 00	par
Interior Conduit and Ins. Co.	1,000,000	100 00	72 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*93
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7,500,000	100 00	15 75
Laclede Gas, pref	2,500,000	100 00	46 00
Laclede Gas 5s	10,000,000		*75
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	78 00
Manhattan Elec. Light Co. Lmtd 5's	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light (N.Y.)	500,000	100 00	90 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	100 25
Nat'l Cordage, pref.	5,000,000	100 00	105 50
Nat'l Lead Trust	9,000,000	100 00	18 00
New England Butt Co.	100,000	1,000 00	1,000 00
N. E. Tel. and Tel. Co.	10,394,600	100 00	51 50
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	97 50
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. Storage Baty. Co.	100,000	100 00	55 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,000,000	100 00	20 00
North New York, Lighting	150,000	100 00	30 00
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	115 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	70 00
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s			*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Sawyer-Man Electric Light Co(N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100 000	1 00	8 00
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	44 00
Thomson-Houston Pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100 000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	80 50
Westinghouse Electric Co.	7,000,000	50 00	14 25
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			21 50
Winston-Salem Elec. St. R.R. (N C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

FINANCIAL.

Away back in 1888, under a certain mortgage and agreement, the Metropolitan Telegraph and Telephone Company issued bonds secured by said mortgage. Proposals are now wanted for the sale of a limited number of those bonds. There is no doubt every one of them is held, as nearly all other electric securities are, by the subscribers and readers of the ELECTRICAL AGE. I hope none of them have met with reverses, but if they wish to realize and invest, the door is open; every turnover of your capital brings you nearer the millionaire mile stone. Remember, all electric bonds are restricted to a certain specified rate of interest, generally preference shares also, and to increase that income you must purchase at less than par and interest, as you can seldom sell for more than par; therefore, as soon as you can afford to take a reasonable commercial venture, sell your bonds in corporations earning sufficient to easily meet their interest and invest in the ordinary stock. A good rule is "if you are rich, buy Government bonds; if in easy circumstances, buy general bonds; if poor invest in the common stock of almost any electric company" and with fair judg-

ment a few years will place you in easy circumstances and if well followed will make you rich in not to exceed ten years.

The Produce Exchange of New York, has adopted a most reasonable and satisfactory rule in establishing its unit of trade at 5,000 bushels of all grains (except rye) instead of the odd number 8,000 heretofore in use. Electrical finance may not have been, or even be a factor in cereal negotiation, but with the experiments under active present test and the solution of the transmission of electrical power *un fait accompli*, capitalists will soon be called upon to invest in electrical securities in corporations whose profits must be connected with the sales at the Produce Exchange; planting, reaping, milling and shipping on a large scale, will utilize electric energy, which will be supplied when and in kind as desired by the above named incidents requisite to enable the broker to realize on his margins or fill his orders, by electrical supply corporations. There are several of our advertisers who are already prepared to furnish the necessary machinery.

The leak in the circuit which cut off the business of the Call system in London has been patched up and rewound with red tape insulation and a full current turned on under the name of the "Boy Messengers and Electric Call Company Limited," with a capital of £200,000 in £1 shares. The public are requested to subscribe this amount on the basis that after protracted negotiations they have obtained from the Post Master General the promise of a license, which will be granted in persuance of an agreement for valuable consideration, dated April 14, 1891, and signed by the solicitor of the Post Office on behalf of the Post Office and by Sir Thomas Paine, solicitor to the Boy Messengers Company, Limited, on behalf of the Vender Company. It is claimed that each messenger boy yields a net profit per week of 3s. and 8d. or about 80 cents. They anticipate employing 4,000 boys and with the £38,000 income be able to pay a nice dividend and grow up with the country. The Call system is an American innovation and it is pleasant to record its successful introduction abroad. Our readers must not forget to remember that by a specific act of Parliament and cash payments made, the British Government owns absolutely the whole, past, present and future, wire conducting systems within its borders and be governed thereby in case they desire to introduce such business over there.

The export of gold continues to have its effect on the price of our securities. The bears have used the fact on every possible occasion, and, while adding as part of their stock in trade starting rumors of dire disaster, the latest star in that character is the failure of the Messrs. Rothschild. What a day they would have were this a fact, but even that should not affect local electric securities; the business is cash, and daily increasing in volume. More light, heat and power, as well as the machinery too, great and small, is continually called for. Every respectable town in the country has its electric company, and outside of the large cities they all pay dividends. I note this week that our much-smiled-at eastern neighbor, Skowhegan Me., not only has a local Electric Light Company with a capital of about $50,000, but that they have declared a semi-annual dividend of 3 per cent. payable June 1st; other dividends are Southbridge, Mass., G. & E. L. Company, 3 per cent. semi-annual; Fort Wayne Electric Company, 75 cents per share; T.-H. Common, quarterly $1; Preferred pays 3½ per cent. semi-annual.

In our last issue we referred to the volume of the proceedings of the Cape May Convention of the National Electric Light Association, and commented on the artistic manner in which it was gotten up. Credit for the work is due entirely to Mr. Allen R. Foote, the ex-secretary of the association.

A HANDY LAMP HOLDER.

Incandescent lamp standards are inconvenient things to have on one's desk. They are liable to get knocked over, and do not possess the feature of portability that is much desired. A lamp holder that can be placed in any desirable position on a desk must therefore possess an advantage that cannot be claimed for a standard or hanging lamp.

We illustrate herewith a very simple and yet

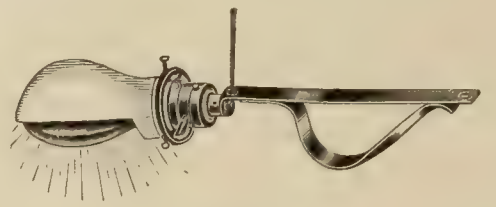


FIG. 1.

effective device which permits the placing of the lamp in any position, and yet be practically out of the way.

Fig. 1 shows the clamp, which is the feature of this device. It is made for slipping over the thin wooden partitions out of which desk pigeon-holes are made. It can be attached to any one of these divisons, and as the lamp bulb is screened by a McCreary "half-shade" the injury to the eye by the glare of the lamp is entirely avoided.

Fig. 2 shows the clamp as adapted for use on a



FIG. 2.

copy-holder for the use of typewriters, and it is equally applicable to pianos to throw the light on the notes.

The device can be applied to a great variety of uses, and the lamps may be fitted with the umbrella shade if desired, in place of fhe "half-shade "shown in the cuts.

These goods are handled by the McCreary Electrical Specialty Company, 136 Liberty street, this city.

A FINE WATER POWER PLANT.

The Maine Electrical Improvement Company, of Brunswick, Me., have secured the contract for the reconstruction of the power plant of the Brunswick Electric Light & Power Company, at Brunswick, Me. This plant is located on an Island in the Androscoggin River. This island is a part of the rock formation in the bed of the river forming one of the most beautiful cascades to be found upon the river, which is noted for its many water-falls. Owing to the abundance of water power available and the advantageous position of this power plant, an unlimited amount of power can be secured for the uses of the many enterprises for which Brunswick is fast becoming prominent, and that too at a nominal cost. The variation in the water level of the Androscoggin River during the different seasons of the year is nominal, and, therefore, the power secured therefrom is practically constant for all seasons of the year. In a place such as Brunswick, located as it is within a stones throw of "Casco Bay," this electrical enterprise cannot help but be a success, and the Maine Electrical Improvement Company are indeed fortunate in securing so valuable a contract, embracing as it does a combination of electrical, mechanical and hydraulic engineering.

HIGH GRADE ELECTRICAL INSTRUMENTS.

The E. S. Greeley & Company, 5 and 7 Dey street, New York, have a high reputation for the accuracy and high finish of the electrical measuring apparatus of their manufacture. We give below a few illustrations of some comparatively new instruments brought out by this firm which are worthy of special mention.

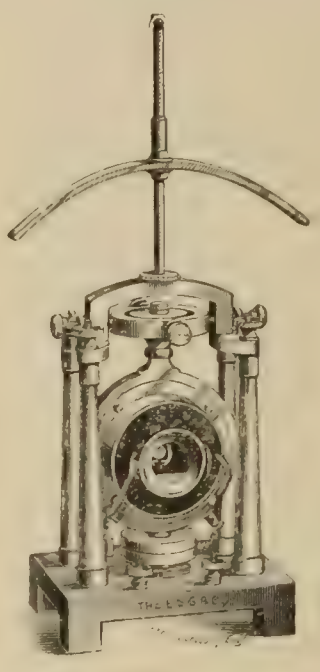


FIG. 1.



FIG. 2.

Fig. 1 represents the Frey Portable Self-adjusting Galvanometer. This instrument is made in the very best manner possible and is reflecting and direct reading. For working in inconvenient localities it has no equal, and it is especially adapted for subway testing. It is self-levelling and requires no adjustment. The pendant coils,



FIG. 3.

revolving mirror and pointer, are held securely for transportation by means of a device operated by a detachable key, securing the instrument from injury when not in use. These instruments are furnished with marine suspension if desired.

Fig. 2 shows the Roland, or J. H. U. galvanometer manufactured by this company. This is a simplified form of Thomson's Astatic Galvanometer. It has two coils, polished mahogany base,

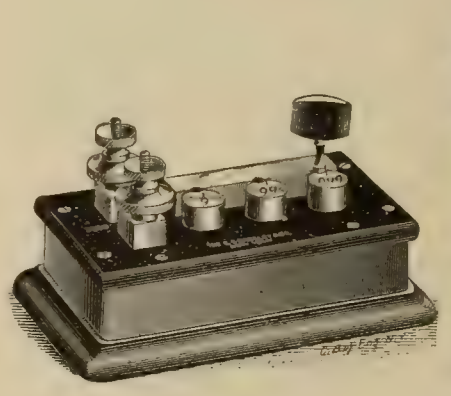


FIG. 4.



FIG. 5.

and coil frame. Coils can be replaced by others of a higher or lower resistance. This is a very convenient and serviceable form of instrument.

Figs. 3 and 4 represent shunt boxes for galvanometers. The oblong form shown in Fig. 4 is more convenient for use in connection with low base galvanometers; is accurate and is well finished. The round style, as shown in Fig. 3, is the form heretofore made, and is in every respect the same as the oblong, except in form. These shunt boxes contain three copper wire coils adjusted to

a resistance of, respectively, $\frac{1}{3}$, $\frac{1}{99}$, $\frac{1}{999}$ of the resistance of the galvanometer in connection with which they are to be used.

Fig. 5 is the single standard B. A. unit. These coils are constructed of platinum alloy wire, or German silver wire, as preferred, enclosed in a brass casing with hard rubber top and binding screws accurately adjusted at a given temperature.

Fig. 6 is an illustration of the standard B. A. unit as issued by the committee. The coils are

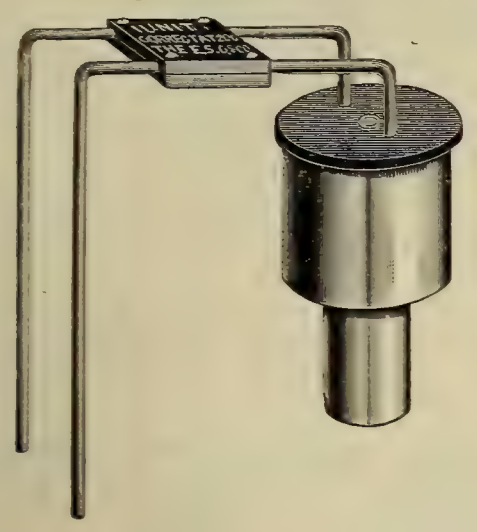


FIG. 6.

wound in the same manner as are the single standards shown in Fig. 5. All of these instruments are very carefully made and calibrated and are in every respect equal to the best imported goods.

ENGINEERING SOCIETIES AT THE WORLD'S FAIR.—A meeting was recently held at Chicago, Ill., for the purpose of arranging for the holding of an International Congress of engineers during the World's Fair. At the meeting what is known as the "General Committee of Engineering Societies, Columbian Exposition" was organized. A few of the societies represented on the Committee are: American Institute of Electrical Engineers; American Society of Civil Engineers; American Society of Mechanical Engineers; American Institute of Mining Engineers; Canadian Society of Civil Engineers; The Engineer's Club of Philadelphia; Civil Engineer's Club of St. Paul; Engineering Association of the Southwest, and many others.

NEW PUBLICATIONS.

MECHANICAL AND ELECTRICAL PROGRESS is the name of a new monthly journal just born in Philadelphia. It is devoted to the interests of manufacturers, tradesmen, inventors and electricians. Mr. J. Clinton Sellers is the editor, and the office is at 925 Chestnut street.

"CORNELL UNIVERSITY: Her General and Technical Courses."

This is the title of an artistically gotten-up book, by Mr. Frank C. Perkins, electrical engineer, Ithaca, N. Y. The book is profusely illustrated with illustrations made directly from photographs, showing the various buildings of the university, both inside and out, and it contains a full description of each. The electrical laboratory is illustrated in an excellent manner, showing it to be a most complete department. The book is bound in the college colors—red and white—and the price of the same is $1.50.

We have received a copy of the report of the eighth annual meeting of the Street Railway Association of the State of New York, held in Rochester, N. Y., September 16, 1890. It is neatly gotten up.

Amsterdam, Holland, is to be lighted by electricity. The work of construction has been placed in the hands of the Helios Joint Stock Company, of Cologne-Ehrenfeld, the agents of Ganz & Co., of Budapest, whose system of distribution will be used.

A CORRECTION.—In the article on the financial affairs of the Westinghouse Company, on page 306, issue, of May 16, a typographical error was made. In reference to the total unsold Treasury stock the figures should have been $5,920,000, instead of $57,920,000.

R. A. Metcalf, A.M., principal of the High School, Ottumwa, Iowa, writes as follows: "I take great interest in reading this scientific paper (THE ELECTRICAL AGE), and consider it an authority on all points on which it treats."

BUSINESS NOTES.

Westinghouse, Church, Kerr & Company recently installed an extensive steam plant for the Newport News Ship Building and Dry Dock Company, at Newport News, Va. The plant consists of seven Westinghouse Compound engines, independently situated in separate buildings at some distance from each other. There is one engine of 80-horse power, one of 130-horse power, four 200-horse power, and one 330-horse power, each protected by a separator and steam loop. The steam is supplied by a central boiler plant of high-pressure boilers, which also supplies steam to numerous other machines in the works. Overhead steam mains were impracticable, so a steel tube was laid underground, forming a subway large enough for not only all the steam and water pipes and steam loops, but also the hot air ducts for heating the different buildings. The subway is used for a variety of purposes and allows ample head room for inspection.

WONDERFUL EFFECTS OF THE KIDDER BATTERY.

D. B. Hillis, M.D., of Keokuk, Iowa, writes to the Jerome Kidder M'f'g Co., 820 Broadway, New York: "I have had and tried a number of other makes of batteries, none of which did the good *healing* service of the Jerome Kidder."

A. G. Williams, M.D., of Whitney, Texas, writes: "I am delighted with my battery. It is performing splendid service. I am perfecting cures with it that have for years resisted the best medical treatment."

S. E. Morrill, M.D., who has written a Treatise of "Practical Instructions in the Medical and Surgical Uses of Electricity," writes: "I am treating cancer successfully, and they cannot be cured, only with the Kidder Battery."

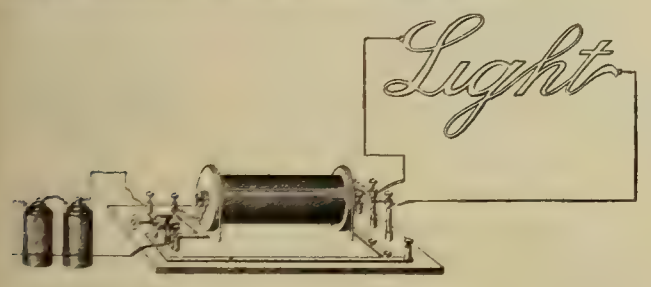
Inventors and draughtsmen will be interested in the Engineer's Sketch-book of Mechanical Movements, which gives nearly two thousand illustrations of movements, devices, appliances, contrivances and details employed in the Design and Construction of Machinery. By T. W. Barber, price $3.00. E. & F. N. Spon, 12 Cortlandt street, N. Y.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued Tuesday, May 19th, 1891.

452,359. Electric Switching Apparatus. George T. Briggs, Windsor, Conn. Filed April 7, 1890.

In a reversing and regulating switch, a circuit-controlling arm, in combination with a plurality of segmental contact-plates, one of which is divided into a neutral plate, and a series of short segments on each side of the plate, the corresponding segments of the two series being connected together, and the series on one side being connected to each other through resistance-coils, and a contact carried by the arm for connecting one of the plates with another.



452,514—LUMINOUS SIGN.

452,367. Electric-Light Fixture. John G. Fischer, East Saginaw, Mich. Filed Sept. 8, 1890.

452,397. Electric Push Button. Max Straus, Baltimore, Md. Filed Oct. 4, 1890.

452,422. Controlling Device for Electric Motors. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 13, 1889.

An electric motor having a section field and a variable resistance, by both of which agencies the motor is regulated, and a switch independent of the resistance-controller for cutting out or short-circuiting a section of the field.

452,423. Controlling Device for Electric Motors. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 13, 1889.

The combination, in an electrically-propelled vehicle, of a resistance located at an intermediate point thereof, two series of connections extending to separate points of the vehicle and there terminating in duplicate sets of contact-pieces, and a contact arm connected to reversing devices and acting on the duplicate sets of contact pieces in correspondence to opposite positions of the reversing devices.

452,424. Electric Synchronizing Device for Clock-Hands. Albert M. Church, Chicago, Ill. Filed Nov. 18, 1889.

452,429. Electric Motor. Elisha Gray, Highland Park, Ill. Filed July 3, 1888.

An electro-magnet with an armature made in two parts, each part being flexible at two points, so that the parts may move to and from each other and to and from the magnet.

452,494. Leading-In Wire for Incandescent Electric Lamps. Reginald A. Fessenden, Roseville, N. J. Filed Feb. 18, 1891.

A leading-in conductor for sealing in glass, consisting of silicon alloyed with a metal having a higher coefficient of expansion and contraction than glass.

452,506. Electric Signal Apparatus for Fire-Hose. Jacob F. Klumpp, Jr., Louisville, Ky. Filed May 17, 1890.

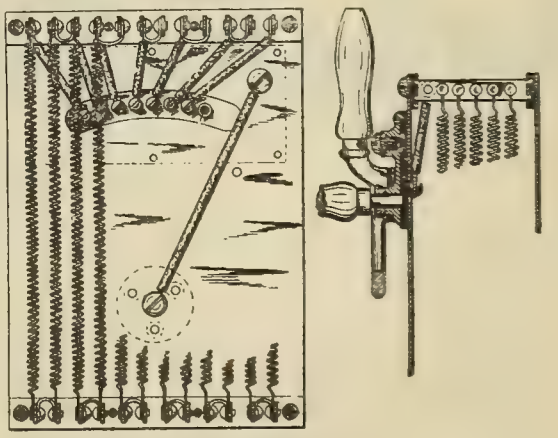
452,510. Insulated Electric Conductor. James B. Williams, Oakland, Cal. Filed Nov. 12, 1890.

The combination, with an electric conductor provided with a surrounding dielectric and an intermediate separating device forming air-spaces between them, of means whereby the raised portions of the intermediate separating device are re-enforced on their under side, by which means they are prevented from being flattened against the conductor by external pressure.

452,515. Electric Railway-Train Signal and Recorder. Fred. H. Brown, Chicago, Ill. Filed Dec. 3, 1890.

452,516. Joint for Electric Conductors. Edward Carroll and Thomas P. Lambert, Chicago, Ill. Filed Nov. 18, 1890.

In an electric-conductor joint, the combination of a block of insulating material, containing a chamber opening at a side of the block, contact-heads in the chamber, a contact removably inserted into the chamber between the heads, and conductors entering the chamber from different sides of the block and engaging the contact-heads to maintain them apart, and to the outer ends of which the severed ends of the conductor are to be secured.



452,574—RHEOSTAT.

452,523. Electric Insulator. Byron Jennings, San Jose, assignor of one-half to James Brusie, Oakland, Cal. Filed Sept. 12, 1890.

In an insulating and suspending device for the conducting-wires of electric railways, a two-part ear or bail channeled to receive and clamp the wire and having a ring formed in two parts, one of which is attached to each part of the clamp, the ring inclosing the insulator through which the suspending wire passes.

452,542. Trolley Device for Electric Railways. David N. Cook, Salem, Mass. Filed July 18, 1890.

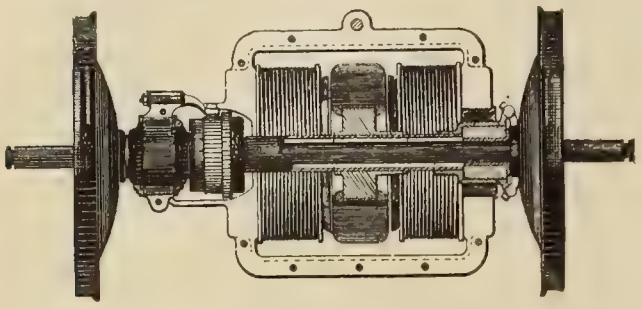
The combination with the trolley-lever of a bearing-piece, having in its upper end a vertical cylindrical bore containing anti-friction balls or rollers; a vertical axially-rotating trolley spindle resting on the balls or rollers and provided with a rotating trolley-roller, and a cap engaging the bearing-piece and retaining the trolley-spindle in position.

ELECTRICAL PATENTS—Continued.

452,546. Wind Apparatus for Generating Electricity and Charging Secondary Batteries. James M. Mitchell, Lawrenceville, assignor of one half to William A. Camp, Greenway, Ga. Filed Dec. 15, 1890.

452,561. Brush-Holder for Commutators. Isaac H. Bartholomew, Northford Conn. Filed Jan. 19, 1891.

The combination, with a shaft, of a brush-carrier having two depending perforated lugs by which it is loosely mounted on the shaft, a bearing-piece frictionally mounted on the shaft and located between the lugs of the brush-carrier, a spring arranged to exert a constant effort to throw the brush-carrier forward toward the commutator, and a stop mounted upon the shaft and arranged to limit the forward rotation of the bearing-piece, thereupon, the brush-carrier, bearing piece and stop being independently movable on the shaft.



452,621—MOTOR MOUNTING FOR ELECTRIC CARS.

452,565. Glass-Covered Electric Wire. William Curry, Baltimore, Md. Filed March 5, 1891.

Electric wires for underground conduits, covered with glass in short tubular sections strung loosely on them, with their ends in contact, each section comprising two half-tubular parts, one on each side of the wire, and provided with an exterior encircling groove, the half-tubular parts bound together by a wire engaging the groove and wholly contained therein.

452,571. Electric Device for Harness. Albert B. Holson, Chicago, Ill., assignor of thirty-seven-fiftieths to Robert J. Zorge and S. Whipple Gehr, both of same place. Filed Oct. 6, 1890.

452,574. Rheostat. Charles D. Jenney, Indianapolis, Ind., assignor to the Jenney Electric Motor Company, same place. Filed June 14, 1890.

The combination, in a rheostat, of the back and front plates of the frame, having insulating strips secured to them at the top and bottom, a series of bars mounted thereon, and resistance coils connected to the bars.

452,576. Crossing for Overhead Trolley-Wires. John Kuehnle, Detroit, Mich. Filed Jan. 2, 1891.

452,585. Annunciator-Drop. Howard C. Shivler, Brooklyn, N. Y. Filed Feb. 11, 1891.

452,611. Conductor for Electric Railways. Edward W. Mitchell, Spokane Falls, Wash., assignor, by direct and mesne assignments, of one-fourth to Russel Parker, James H. Stearns and Benjamin F. Sutton, Brooklyn, N. Y. Filed Feb. 5, 1891.

An electric cable comprising a conductor extending within an insulating tube or covering, the latter being provided with contact-pieces at suitable distances apart throughout its length, normally out of contact with the conductor, the latter being adapted to engage the contact-pieces when the cable is compressed or thrown out of its normal position.

452,621. Motor Mounting of Electric Cars. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Nov. 15, 1890.

A motor comprising an axially mounted and directly connected armature and non-rotative field-magnets mounted on a driving axle through springs independent of the main springs of the car, and roller-bearings.

452,622. Electric-Railway Car. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Dec. 17, 1890.

A propelling motor having an armature surrounding the driving-axle directly connected therewith by rigid arms and mounted in journal-bearings formed in the yokes of the field-magnets.

452,633. Electric-Arc Lamp. Frank Buchanan, Lima, O. Filed Jan. 9, 1891.

452,638. Sectional Shade for Incandescent Electric Lights. Albert F. Gartner and John C. Harris, Savannah, Ga. Filed Aug. 30, 1890.

452,645. Insulator-Holder for Electric Railways. Byron Jennings, San Jose, assignor of one-half to James Brusie, Oakland, Cal. Filed Nov. 5, 1890.

452,701. Shade for Incandescent Electric Lights. Albert F. Gartner and John C. Harris, Savannah, Ga. Filed Aug. 30, 1890.

The combination with the bulb of an incandescent light lamp, of a supporting collar and a shade formed of sections pivoted to the collar, the sections being arranged in two opposite series, and each section being overlapped by that immediately above it.

452,717. Electric Motor or Generator. Andrew L. Riker, New York, N. Y. Filed Feb. 18, 1891.

A continuous magnetic frame for the field-magnet, built up of interlocking sections connected at their ends by a single bolt, each section composed of a series of blanks all of the same pattern and each blank comprising an inwardly projecting core with an inclosed coil-space on each side, and a polar extension on one side.

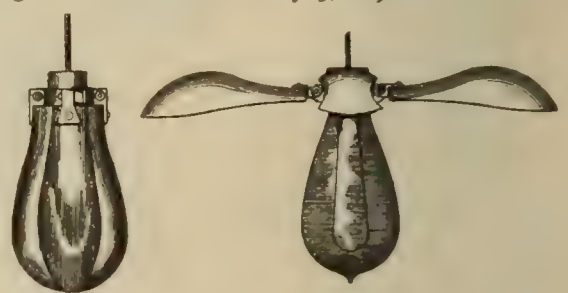
452,718. Bipolar Dynamo or Motor. Andrew L. Riker, New York, N. Y. Filed Feb. 18, 1891.

A field-magnet having a continuous laminated frame composed of core-sections and pole sections connected by lap-joints, the core section and pole section being respectively composed of blanks all of the same pattern assembled together.

452,725. Insulated Electric Conductor. James B. Williams, Oakland, Cal. Filed Nov. 12, 1890.

The combination, with an electric conductor and its surrounding insulating layer or dielectric, of means having insulating properties interposed at intervals between the conductor and the insulating layer, whereby isolated or non communicating air-spaces are formed between the conductor and the insulating layer.

452,735. Electric Alarm. Charles H. Shaffer, Rockford, Ill., assignor to the Electric Alarm, Co., Muskegon, Mich. Filed May 5, 1890.



452,638—SECTIONAL SHADE FOR INCANDESCENT ELECTRIC LIGHTS.

452,741. Electric-Railway System. David G. Weems, Baltimore, Md., assignor to the Weems Electric Railway System, of West Virginia. Filed March 13, 1890. Renewed Oct. 25, 1890.

A stationary axle or shaft, in combination with a sleeve mounted to revolve upon the axle and bearing wheels, and an armature fixed to and revolving with the sleeve.

452,758. Microphone. August C. F. Muller, Berlin, Germany, assignor to Mix & Genest, same place. Filed May 31, 1889. Patented in France, Belgium, Sweden, England, Austria-Hungary, Italy and Germany.

In a microphone, the combination with a diaphragm, a rolling electrode, and suitable contacts, of a spring operating to hold the electrode to its contacts, and a sound-deadening material interposed between the spring and the electrode.

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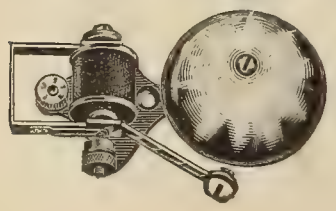
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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

WEEKLY.

Vol. IX NEW YORK, JUNE 6, 1891. No. 23.

ELECTRIC WELDING.

The process of electric welding and working of metals, as invented by Professor Elihu Thomson, has already been so far developed as to produce the most satisfactory results. Welding machines capable of uniting various sections of metal have been placed upon the market, giving manufacturers ample proof of their efficiency and economy, and already becoming a part of the necessary machinery required in the various industries with which they are associated. In no instance has there been a failure of a machine to do satisfactorily the work required of it, and the works of the company at Lynn, are now taxed to their utmost to fill orders coming from different parts of the United States and Europe, for welding apparatus for various purposes.

The principle involved in this new art is that of causing currents of electricity to pass through the abutting ends of the pieces of metal which are so welded, thereby generating heat at the point of contact, which also becomes the point of greatest resistance, while at the same time mechanical pressure is applied to force the parts together. As the current heats the metal at the junction to the welding temperature, the pressure follows up the softening surface until a complete union or weld is effected, and, as the heat is first developed in the interior of the parts to be welded, the interior of the joint is as effectually united as the visible exterior. With such a method and apparatus, it is found possible to accomplish not only the common kinds of welding of iron and steel, but also of metals which have heretofore resisted attempts at welding, and have had to be brazed or soldered.

Pieces of such metals and alloys as wrought iron, silver, copper, brass, lead, tin, zinc, bronze, German silver, platinum, gold, aluminum, and even cast iron, are not only welded to each other, but different metals can be welded one to another in many combinations, extending the applications of the process to the attainment of results heretofore impossible in metal working; while the tensile strength of the welds, as shown by mechanical tests under the direction of the U. S. Ordinance Department, are all that can be desired.

With Thomson's welding process it is possible to weld both wrought iron and steel, so that the weld is as strong as the same cross-section in another part of the bar; that the appearance of the fracture is fibrous for iron and generally granular for steel, the strength of this granular steel being on some samples as high as 125,000 pounds per square inch; that the process is such that the welding is homogeneous from necessity. In similar bars welded by a blacksmith, and by the electric process for comparison, the electrically welded bars were much stronger than those welded by the ordinary process.

The machines built by the Thomson Electric Welding Company are generators of electricity, so constructed as to produce the low-pressure currents essential for welding and for similar work. They are of sizes and types suited to the kind and section of the metal to be worked. Fig. 1 shows a constant potential dynamo of 60,000 watts capacity, used in this process, and Fig. 2 a welder for steel wire cable, rods or bars of iron. The dynamos are built to take power from any source, and the welding machines are connected with them by wires to operate wherever it may be convenient to locate them.

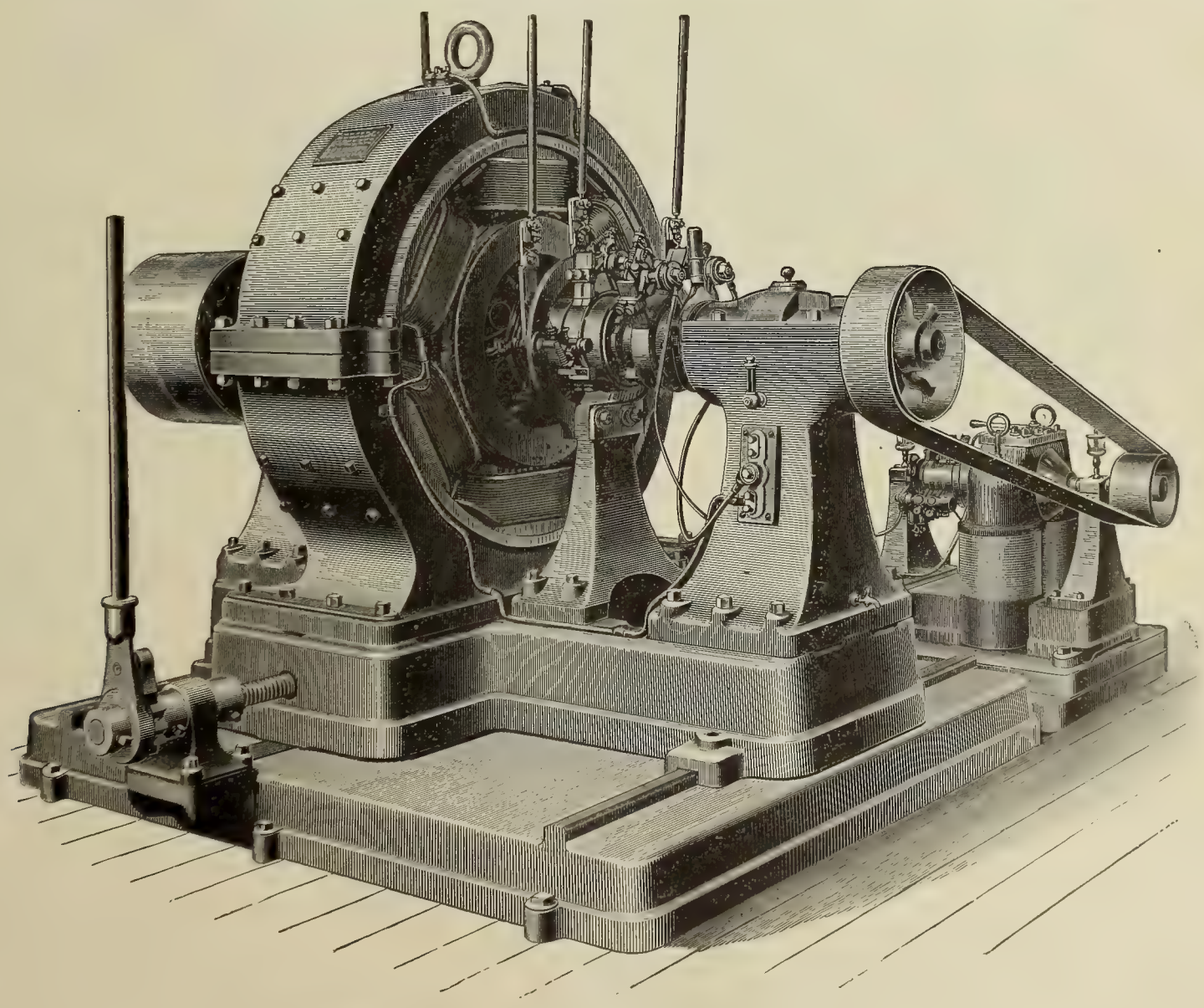


FIG. 1—THOMSON CONSTANT POTENTIAL DYNAMO FOR ELECTRIC WELDING.

The machines now being manufactured are so graded as to apply to various kinds of work, from the smallest wire to bars of over three inches in diameter. For heavier work, such as large forgings of locomotive frames, car axles, shafting, etc., special forms of machines adapted to the purpose will be supplied in the near future by the company, while by the use of specially adapted holders and clamps applied to the standard forms of machines,

various shapes and irregular sizes of metal pieces may be united without difficulty. There seems to be no limit to the application of this method, as anything from the smallest links of a watch chain to the heaviest forgings of locomotives can be welded with equal facility.

The welding or working is much more economical and far superior to that produced by the ordinary methods, while the currents used are of such low pressure as to render any danger of shocks impossible.

THE FUTURE OF THE ALUMINIUM PROBLEM FROM THE CHEMICAL STANDPOINT.*

BY DR. WM. H. WAHL.

Mr. President and Gentlemen of the Institute—I propose to invite your attention in the following remarks to the consideration of the possibility of cheapening the cost of producing aluminium by improvements in chemical processes.

It is obvious at the outset that the selection of the aluminous compound to serve for reduction, is of the highest importance. The compounds available for the purpose are three in number:

1. The halogen compounds (chloride, fluoride, etc.)
2. The sulphide.
3. The oxide.

Thus far the compounds first named have been the only ones that have yielded satisfactory results on the commercial scale and it would seem probable that if a substantial advance in the metallurgy of aluminium may reasonably be expected, it should be looked for in connection with these compounds that have heretofore proved to be the most pliable in the chemist's hands. It will be most instructive, therefore, to examine these processes and to endeavor to ascertain to what extent the economies already realized in practice bar the way to further improvement.

These processes which held the field alone until driven from it by the remarkable development of the electrical methods are based upon the reduction of the chloride or fluoride of aluminium by means of sodium. For practical purposes it is found preferable to employ, in place of the simple chloride or fluoride of aluminium, the corresponding double salt of sodium.

First in order, let us consider the Deville-Castner process. This embraces three operations—the manufacture of the double chloride of sodium and aluminium, the manufacture of sodium, and the reduction of the double chloride by sodium.

*Abstract of paper read at the 9th Meeting Am. Inst. Electrical Engineers, Thursday, May 21st, 1891.

The statement will not be questioned by chemists, that the use of the chloride as the aluminous compound to be reduced, is attended with difficulties. It cannot be produced in the wet way either by precipitation or by the evaporation of its aqueous solution, and a roundabout furnace process is the only method by which it has thus far been produced, commercially. Furthermore, it is so readily decomposed that it must be carefully preserved against the access of moisture. Also, though its reaction with sodium takes place with great energy, it has been found practically impossible to obtain by its use more than about 75 to 80 per cent. of the contained aluminium for physical reasons inseparable from the conditions under which the reaction occurs.

Its advantages are its ready fusibility, in consequence of which the reaction with sodium begins at a comparatively low temperature and the fact that it may be obtained entirely free from silicon and almost free from iron, the two elements that exert the most deleterious influence upon aluminium.

It is a just tribute to the skill and ingenuity displayed by the able chemists in charge of the Deville-Castner plant, at Birmingham, to give them credit for having succeeded in reducing the cost of sodium-aluminium chloride from about 22½ cents (which is believed to be a fair estimate of its cost before the improvements of Webster and Castner) to about 6 cents per pound. You will doubtless have heard much of the claims of several processes for the direct production of the chloride, by passing gaseous mixtures containing chloride and carbon over heated alumina contained in retorts suitably connected with a condenser. By one of these described in Richard's admirable treatise on aluminium the cost of production is affirmed to be as low as 1½ cents per pound. By another process which appears to be exceedingly plausible, hydrochloric acid vapors are passed into an electric furnace, in which aluminium is being decomposed by carbon, the chloride formed being condensed in a suitably connected chamber.

Either of these plans, so far as one may form a judgment from their general features, appear to possess decided advantages over the older one employed in the Deville-Castner operations. Thus far, however, none of them, so far as I am aware, have been put in practice on the commercial scale and, promising as they appear to be, I incline to the belief that the fluorides present decided advantages and that if there shall prove to be any future for aluminium processes based on the use of sodium as the reducing agent, the fluoride compounds of aluminium and not the chlorides, will be used for the purpose.

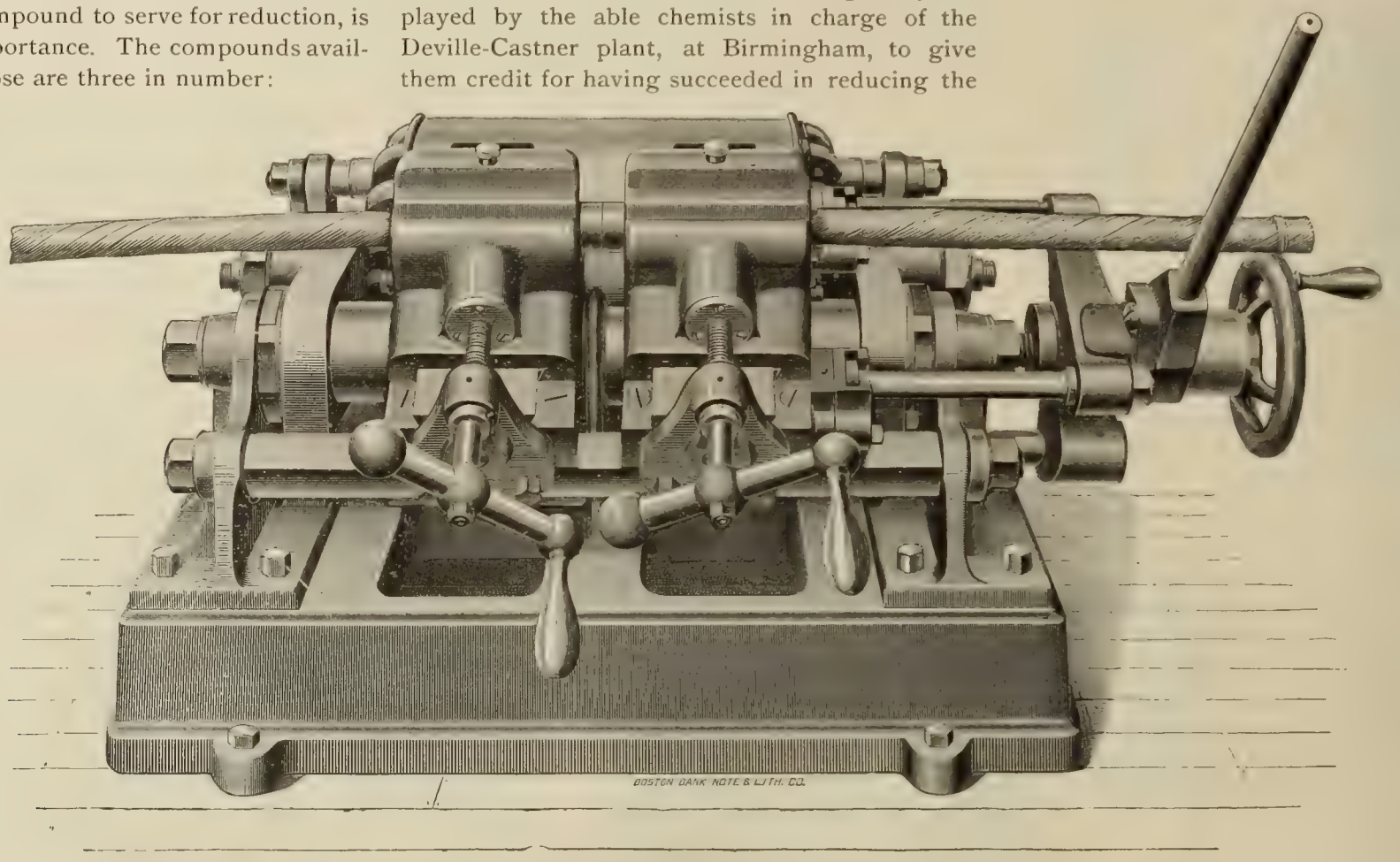


FIG. 2—THOMSON ELECTRIC WELDER.

It may be true that the sodium processes have had their day, in the metallurgy of aluminium, but I am confident that the prospects for much cheaper sodium in the near future are decidedly brighter than those of cheaper aluminium. Without underestimating the great difficulties involved in the production of sodium, and duly appreciating the value of the services of Deville, Castner, Netto, and others who have contributed meritoriously to the problem of reducing the cost of its manufacture, I have been impressed of late with the belief that all the methods hitherto proposed and employed for the production of sodium are extremely crude in conception and imperfect in practice. For one, I think it would be entirely possible very greatly to reduce the cost of making sodium by the metallurgical way, but to do so, it must be manifest to all who are familiar with the past and present methods of manufacture that these will have to give place to others operated on a radically different plan.

The second available compound named as a possible source of aluminium by chemical methods is the sulphide, including therein, of course, the double sulphide with sodium or other alkaline metal. I refer to it only because of the fact that its use for the purpose was originally suggested by one of the ablest chemical engineers of our day, the late Mr. Walter Weldon. Thus far, however, nothing has been accomplished with it, and I am satisfied that the probabilities are very slight indeed, that it will ever prove sufficiently useful as a source of aluminium, to be able to compete with other chemical methods.

Not only is its manufacture attended with unusual difficulties, but its reduction also, so far as I am able to judge from personal experience, cannot be effected as readily as that of the chlorides and fluorides, and the resulting product is much less pure than that obtained from the other aluminous compounds just named.

The sulphide, I believe, is much better adapted for the production of aluminium alloys than for aluminium, but the difficulty of obtaining the product free from serious contamination is probably the reason why the sulphide method has never made a record for itself.

I consider the case of the sulphide to be so impracticable as to be hopeless.

The third aluminium compound which the chemist may hope to make available as a source of cheaper aluminium is the oxide. Considering the subject from the chemical standpoint,

I am persuaded that the attack of the problem, with this compound as a starting point, offers even greater possibilities of ultimate success than the sodium-and-fluoride method we have just passed over, and for the reasons that it involves the possible application of the cheapest of all reducing agents—carbon—in the production of the metal, and the employment of much more direct methods and simpler and less expensive apparatus than is demanded by the method with sodium.

The fundamental fact that alumina can be reduced to the metallic state by carbon is established. It is proved beyond peradventure by the operation of the electric furnace of the Cowles Bros., in which heat developed by the transformation of electric energy upon the passage of the electric current through a fragmental resistance material of carbon and alumina (with copper or other metal present as a solvent) is believed to be the principal agency in affecting the reduction. The same action may probably take place, to some extent, in the operation of the Herault furnace, and certainly so, if the statement can be verified that the output in this furnace is greater than can be accounted for by simple electrolytic action.

The reduction of alumina by carbon, therefore, may safely be stated to be simply a case of temperature, and this temperature is probably not far above the fusion point of alumina. This, unfortunately for the practicability of the direct reduction process lies enormously high, so high, indeed, that it does not admit of instrumental measurement, but can only be approximately estimated as somewhere between 2000° and 2600° C.; a point which cannot be reached save by the intervention of electric heating.

There is an alternative, however, that offers a ray of hope to the chemist. There are other methods besides that of fusion for obtaining alumina in the state of a liquid. We have, or at least very good reasons to believe that we have, solvents for alumina, and if the condition of fluidity is as important a factor as we have reasons to believe it to be in inducing chemical reactions, we have the possibility open to us of establishing conditions favorable to the reduction of alumina by carbon, at temperatures perhaps far below the fusion point of alumina. I can only affirm my belief that the thing is within the range of possibility. On another point, however, I can speak more confidently, namely, as to the practicability of producing the alloys of aluminium by some such method. Of this I have not the slightest doubt. I will go even further, and venture a prediction that in the near future the alloys of aluminium will be produced at least as cheaply by chemical methods as by the present electrical methods.

AN ALTERNATE CURRENT POTENTIOMETER.*

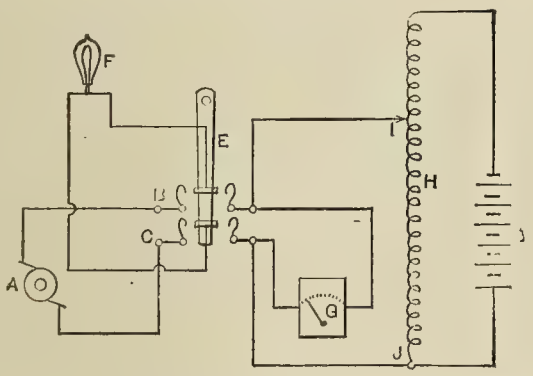
BY GEORGE S. MOLER.

This device is designed for the purpose of determining what values of the potentials of alternating currents will produce given effects, and is intended to be used mainly in calibrating alternate current voltmeters. It may also be used as a voltmeter, applying it directly to the alternate current to be measured. By means of this apparatus we may determine whether the instrument which is being calibrated changes its reading for other rates of alternations. This is shown by comparing the calibration curves obtained by using widely different rates of alternations.

The instrument, briefly described, is as follows: An incandescent lamp is so arranged and connected that it can be switched back and forth from the terminals of an alternating current line to those of a direct current line, which can be altered in voltage till the lamp glows with the same intensity when fed by either line. Then, while switched into the direct current line, the voltage of that line is measured by a direct current standard voltmeter or potential instrument, and the voltage so read is equivalent to that of the alternating current, which produces the same effect in the lamp. The switch is so constructed that it snaps back and forth, making the change of connection so quickly that the slightest change of intensity of the light can be easily detected. The lamp has a blackened hood with an opening in one side through which it is viewed while the sliding resistance is being adjusted. This enables the observer to make a much closer setting than otherwise. A very close setting may also be made by observing the slight reflection of the light from the blackened surface of the hood.

The lamp and switch are arranged and connected in the following manner: Referring to the diagram, A is the alternate current dynamo, or line, of which we wish to determine the effective difference of potential in volts between its two terminals, B and C; D is a storage battery or direct current dynamo of higher voltage than the alternate current to be measured. A switch, E, made to snap back and forth by means of a stiff spring, changes the incandescent lamp, F, from the alternating current to the direct current and *vice versa* By connecting the two extremities of a resistance, H, to the battery, D, and sliding the contact point, I, such a place can be found that the intensity of illumination will be the same for both currents.

After the contact, I, is adjusted, the standard voltmeter, G, is read while the direct current is flowing through the lamp, and this voltage is taken as the equivalent voltage of the alternate current.



ALTERNATE CURRENT POTENTIOMETER.

A series of lamps of different voltage affords a greater range to the instrument than could be obtained with one lamp only. These may all be connected to the switch and, beginning at the one of highest voltage, one after another may be tried till the best one is found.

For higher voltages than the highest voltage lamp will stand, a number of lamps may be used in series, and the fall of potential for all, or for each individual lamp, can be measured by means of its voltmeter.

The resistance, H, must necessarily be great enough in amount so that only a small current will be allowed to flow through it, so that the consumption of energy will be small.

Instead of having the switch and lamp connected in a shunt line to the resistance H, it may be connected in series with H, which must then be arranged so that it can be varied in amount. If a source of constant potential large enough in amount is available, the apparatus may be used for a voltmeter for direct or alternating currents. To use it in this manner, we calibrate the apparatus to find the potentials at the terminals of the lamp for different positions of the contact points I and J and construct a curve, using the positions of J and I as abcissæ and the differences of potentials of those points as ordinates. Then, when using the apparatus as a voltmeter, we read the values from this curve instead of from a voltmeter, connected to the switch.

The apparatus was tested in the following manner to determine its sensitiveness, and to what extent its indications can be relied upon: The terminals B and C were connected to the same resistance H by two other contact points, and these connections were changed several times to include different amounts of that resistance. Each time this was done the contact point I was moved along till the lamp seemed to indicate the same candle-power for both positions of the switch. The readings of potential for both positions were then made upon a standard potential galvanometer which has a scale graduated to millimetres, and upon which a double deflection of one cm. means one volt. Upon this instrument readings could be estimated to one tenth of a mm., giving volts to the second decimal place. The accompanying table of results was the first part of the first set taken in this manner and which were consecutive. They were taken without any preliminary practice. From this it will be evident that the adjustment of the light can be made to within one-tenth of a volt.

LEFT CONTACT, VOLTS.	RIGHT CONTACT, VOLTS.	DIFF.
29.95	29.85	+.1
29.62	29.60	+.02
33.07	33.11	—.04
37.56	37.55	+.01
42.52	42.60	—.08
60.95	60.90	+.05
74.68	74.72	—.04

Physical Laboratory of Cornell University, May 9, 1891.

*A paper read at the General Meeting of the American Institute of Electrical Engineers, New York, May 21, 1891.

NOTES OF MEETINGS, ETC.

ELECTRIC CLUB.

The rooms of the Electric Club, on the night of May 28, looked like an arsenal. On a table in the front parlor were several glass jars containing samples of various kinds of gunpowder, including the smokeless kind, and on another lay several guns of many patterns, varying from the old-fashioned flint lock to the modern firearm. In the centre of the room stood a weapon on wheels, which looked as if it might annihilate New York's population if its mighty power was let loose. The occasion of the warlike demonstration, however, was entirely peaceful in its character, and these death dealing instruments were for no other purpose than to illustrate a lecture delivered by Mr. Hiram S. Maxim, the celebrated electrician and inventor of the rapid firing gun, which bears his name. The subject of Mr. Maxim's lecture was "The Tools of Modern Warfare," and he began by describing the various makes of powder, and illustrated his remarks by igniting a small quantity of each kind. The smokeless powder, about which much has been printed in recent times, burned with a brilliant light, but evolving no smoke whatever. Mr. Maxim then briefly described firearms from the flint lock down to the present time, and showed the main features of each gun. Machine guns were next described, and finally the Maxim gun. This was the one already referred to that stood in the middle of the room. The idea that he should give a practical demonstration of its operation was rather startling, but it was done in a highly interesting manner and no one was hurt. It created considerable racket, however, and aroused the neighborhood, who probably imagined a riot had broken out. In order to demonstrate the shooting capacity of the gun, Mr. Maxim had constructed a piece of apparatus, consisting of a wrought iron gas pipe about 10 feet long and 8 inches in diameter. At one end of it was screwed a heavy cap, while at the other was inserted a wooden plug with a hole in it to admit the muzzle of the gun barrel. By shooting into the pipe the bullets were stopped by the cap, and the smoke was carried into the chimney by a tube tapped to the under side of the main tube. Mr. Maxim fired and successfully showed what his gun was able to do, and the rapidity with which it shot was astonishing to all. Shots

Continued on page 349.

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NOTES.

The question of improved rapid transit is the all-important one in New York at the present time, and the paper read by Mr. Frank J. Sprague before the American Institute of Electrical Engineers at the general meeting, on May 21, is both timely and full of valuable suggestions. Mr. Sprague therein analyzes the objections raised against the use of electricity as the motive power on the proposed road, and comes to the conclusion that about the only one that can be put into the form of a definite statement is that electricity has not yet been used on so large a scale as would be required in the proposed system. "This same view," Mr. Sprague says, "was taken of the application of electricity to street car propulsion only three years ago;" now "there is not probably a street railway manager in the United States who does not thoroughly believe in electricity," both as to the present and future requirements. In proof of this it is interesting to state that capital to the extent of over $50,000,000 is already invested in this industry. In regard to the statement that electric power cannot be developed on a sufficiently large scale to accomplish the work that would be required to be done in the proposed system, Mr. Sprague refers to a London road which was opened last year. There the motor equipment is composed of 100 horse-power units, and by simply connecting four motors of the London type to the circuit instead of two, more power is thus obtained than from any elevated road engine. By increasing the dimensions of the machines only one-third two of them will perform as much work as the type of steam locomotive now in use on the elevated road. In support of his assertion that electric power can be successfully used, Mr. Sprague points to the fact that in London another underground electric road is about to be constructed on plans already approved by a Parliamentary committee. The paper throughout is a most interesting one and the discussion of the many questions involved is complete and conclusive. In this connection it is interesting to note the remark made a few days ago by Hon. Chauncey M. Depew, the president of the New York Central Railroad Company, in speaking of the underground rapid transit system, recommended by the Rapid Transit Commissioners last week. Mr. Depew, in referring to the power best suited for the proposed line, said he had great faith in electricity. "Such marvellous results have been shown by experiments," he continued, "that I wouldn't be surprised at anything that might come of it." With such an advocate as Mr. Sprague, and such a powerful ally as Mr. Depew, electricity certainly stands as a mighty rival of the steam locomotive.

Mr. Thomas A. Edison unbosomed himself one day last week to the reporters of some of the daily papers in this city and the next day these journals appeared with long articles, under display headlines, about the "Kinetograph," to which Mr. Edison is said to have been giving his attention at odd times lately. The "Kinetograph" is a combination of the phonograph and a series of photographs, which are so arranged as to give the effect of motion when they are presented to the eye in rapid succession. Mr. Edison claims he can reproduce at a distance, a view of a stage for instance, in which all of the motions of the bodies and features of the actors and the sounds of their utterances are faithfully duplicated.

Anything that will save time and is reliable is always welcomed by a business man, whether he be engaged in any of the trades or professions. It is absolutely necessary these days to utilize every minute of time to the best possible advantage, and every means of reaching results with the least possible labor and as directly as possible is therefore a boon to the man of business. Electrical work involves the use of mathematical formulæ and much calculation, and in the matter of wiring the frequent use of dry figures becomes very tiresome at times. It is natural therefore that efforts should be put forth to relieve those who have many wire calculations to perform of much of this uninteresting work, by the use of some graphical method which will at once give results. Mr. Carl Hering read a paper at the general meeting of the American Institute of Electrical Engineers, on May 20, in which he described such a method for the calculation of leads in wiring for electric lights. We publish elsewhere in this issue the substance of this paper, also a diagram in illustration of the same. This chart will, no doubt, be found very useful to those desiring a short method of arriving at results in wire calculations, and Mr. Hering points out how the principle may be extended to cover the entire range of such computations. The use of the chart must be thoroughly understood to be appreciated. It will save both time and labor, and that is what electricians want.

We learn from the Montreal papers that interest is daily increasing among the prominent citizens there in the forthcoming convention in that city of the National Electric Light Association. Lord Stanley, Governor-General of Canada, expressed his fullest sympathy with the holding of the Convention in Montreal, and hopes that he will be able to attend in person. The Montreal *Herald* says: "With the extended patronage of His Excellency, the Governor-General, the convention cannot now be anything but a grand success."

At the meeting of the Board of Electrical Control on May 27, Mayor Grant once more had a little tilt with the representatives of the subway companies. He thought the latter were too slow in the construction of the subways, and a resolution was passed requiring that all the subways be completed by Dec. 31 next, under penalty of a forfeiture of the bonds of the constructing companies. There is always a good deal of feeling displayed at the meetings of the Board of Electrical Control when Mayor Grant is present.

On May 26 a suit was brought in the United States Circuit Court before Judge Wallace, by the Edison Electric Light Company to enjoin the United States Electric Lighting Company from the manufacture or sale of incandescent lamps. This case is one of the most important that has been tried since the great telephone suit, and the interests at stake are of great magnitude. One of the counsel for the Edison Company, stated that a verdict in favor of his company would be an equivalent to an income of $2,000,000 per annum. Fifty thousand lamps are said to be manufactured every day. Both sides have been engaged for several years in taking testimony, and the printed records amount to seven volumes of about 50,000 words. The defendant company disputes the Edison Company's claim that Mr. Edison is the sole originator of the modern system of incandescent lighting, also that he is not the original inventor of the incandescent lamp. This latter claim of the Edison Company is the one on which the suit is based, and they aver that Edison's patent covers all forms of high resistance incandescent lamps.

In our issue of March 28th last, we published a paper by Mr. J. J. Carty on "Inductive Disturbances in Telephone Circuits," read before the American Institute of Electrical Engineers on March 17th. Mr. Carty therein described a series of very interesting experiments made by himself as to the nature of inductive disturbances in the telephone. His experiments apparently proved that a metallic circuit did not overcome the disturbances and he suggested that the metallic circuit might be abandoned in the future and the earth used as the return instead. We publish on another page in this issue a record of some experiments made in this same direction by P. Chr. Dressing and K. Gulstad, which will be of interest to electricians in general, particularly those engaged in the telephone service. The nature of the disturbances in the telephone are not yet fully understood but by the prosecution of experiments, such as those referred to, the truth is gradually being revealed and after having determined the cause of the effect the remedy may be more intelligently applied.

We publish in another column a digest of the new incorporation laws which went into effect in New York State on May 1st. These laws are important and as yet have not been much studied. They affect corporations of future organization, and deal specifically with electrical enterprises. It is therefore of the utmost importance to all interested to familiarize themselves with its provisions.

Judge Ingraham has refused the Brush Electric Illuminating Company's application for a perpetual injunction restraining the Consolidated Subway Company from removing the plaintiff's cables and conductors from the subways.

A NEW GRAPHICAL METHOD OF CALCULATING LEADS FOR WIRING.*

BY CARL HERING.

The general principle may be laid down that for any formula containing three variable quantities, one of which is the product or the quotient of the other two, the "curves" representing their relative values may always be represented by a series of straight diagonal lines drawn through the centre or zero point. Such a set of lines will therefore enable one to make any calculations graphically for that formula. For instance, horse power is equal to volts multiplied by amperes; the constant 746 does not concern us at present. A series of diagonal lines properly spaced will therefore give directly either the horse power, the volts or the amperes, when the other two are given. The curves may also be made hyperbolas, but it is evidently absurd to draw hyperbolas when straight lines answer just as well and are even more accurate, as they can be laid off and drawn with great precision. Notwithstanding this, such diagrams are often published as hyperbolas. The difference lies in the disposition of the scales. One scale is vertical, the other horizontal, and the diagonal lines (or the hyperbolas) each represent one unit (or number of units) of the third scale. To make the "curves" straight lines, the diagonals must be made to represent one of the two quantites which is equal to the quotient of the other two, and not the one which is equal to the product of the other two because the curves would then be hyperbolas. In the example given the diagonals must represent volts or amperes, but not horse powers. The constant in such formulæ affect only the positions of the diagonals; although they increase considerably the work of arithmetically calculating the results, they do not affect in the least the graphical calculations after the diagrams are once drawn. For this reason alone the graphical calculations are that much simpler.

Now, the general formula for wiring is as follows:

$$\text{Cross-section} = \frac{\text{current for one lamp} \times \text{number of lamps} \times \text{distance} \times \text{constant}}{\text{loss in volts.}}$$

containing six quantities only, one of which is always constant, being equal to twice the mil foot resistance of copper, if the cross-section is in circular mils. As we have just seen, calculations involving three of these five quantities may readily be made graphically by means of a single set of diagonal lines. For instance, for any one make of lamp the current per lamp is a constant, and may therefore be combined with the other constant as one; if, furthermore, the number of lamps and distance be multiplied together mentally and then used as one quantity, lamp feet, there are then only three variable quantities to the formula, and calculations can then be made by one set of diagonals. This will give the diagram mentioned in the early part of this paper. But a universal diagram must be equally well applicable to any lamp; and as graphical calculations are so much simpler, more rapid, and less liable to errors than arithmetical ones, it is preferable to multiply the lamps by the feet graphically also. Both of these may be accomplished by splitting up this formula into smaller ones, each of which contains no more than three variable quantities. Each formula can then be calculated separately by a simple diagram, as described, thus permitting the whole formula to be calculated graphically.

To do this, let the first diagram perform the calculation,

$$x = \frac{\text{current for one lamp}}{\text{loss in volts.}}$$

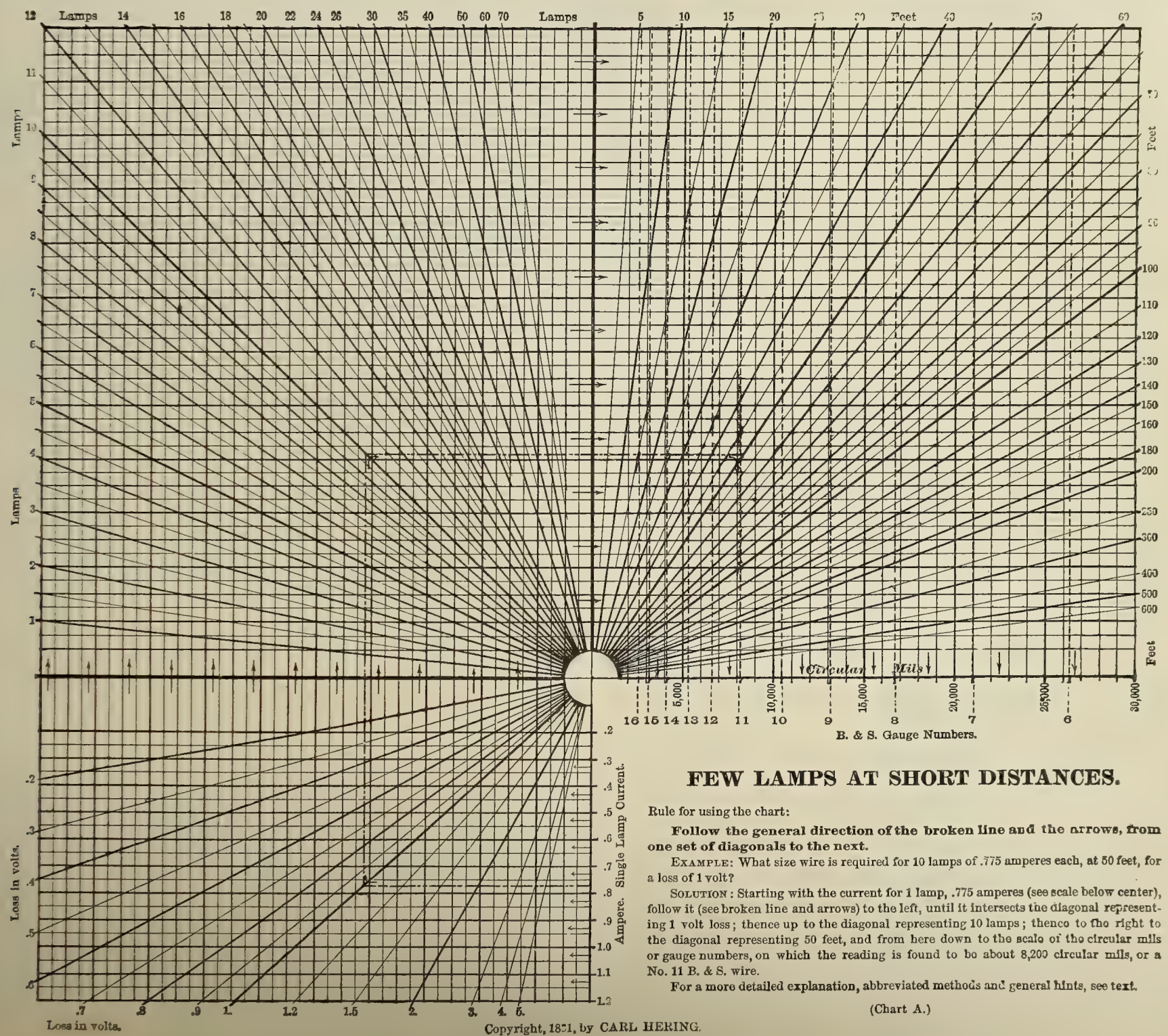
In which x is a mere auxiliary quantity. Let a second similar diagram perform the next calculation:

$$y = x \times \text{number of lamps};$$

and a third diagram the final calculation:

$$\text{Cross-section} = y \times \text{distance}.$$

The constant may be combined with any one of these, it is immaterial which one. This triple calculation may at first seem to complicate matters on account of the new quantities, x and y. These, however, are easily eliminated by the simple device of placing the three diagrams together, side by side, in such a position that the two x scales coincide, and similarly the two y scales. By doing this, one has merely to pass directly from one set of diagonals to the next to perform the successive steps of the calculation, without being concerned about the intermediate auxiliary quantities. These intermediate quantities correspond, and are equal to the successive products or quotients which are obtained in the successive arithmetical multiplications and divisions of these five quantities in the formula, which cannot, of course, be eliminated in making the calculations arithmetically, showing another great advantage of the graphical methods. This particular method of performing the successive calculations is, of course, not limited to this formula, which is used here merely as an illustration. Any other formula which may be split up into smaller ones, each



FEW LAMPS AT SHORT DISTANCES.

Rule for using the chart:

Follow the general direction of the broken line and the arrows, from one set of diagonals to the next.

EXAMPLE: What size wire is required for 10 lamps of .775 amperes each, at 50 feet, for a loss of 1 volt?

SOLUTION: Starting with the current for 1 lamp, .775 amperes (see scale below center), follow it (see broken line and arrows) to the left, until it intersects the diagonal representing 1 volt loss; thence up to the diagonal representing 10 lamps; thence to the right to the diagonal representing 50 feet, and from here down to the scale of the circular mils or gauge numbers, on which the reading is found to be about 8,200 circular mils, or a No. 11 B. & S. wire.

For a more detailed explanation, abbreviated methods and general hints, see text.

(Chart A.)

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* Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, New York, May 20th, 1891.

involving one multiplication or division, can be calculated graphically by the same method.

In the accompanying diagram the formula just given is represented graphically as described. It will be seen to consist of three right angles each with its set of diagonals and a common centre. Each two right angles have one side in common which represent the quantities x and y, and which thereby drop out of consideration. The lower left-hand diagonals represent *loss in volts*, the upper left hand, *number of lamps*, and the upper right hand, *distances*. The remaining two of the five variables are represented by the starting scale vertically below the centre, which represents the *amperage of a single lamp*, and the last scale, to the right of the centre, which represents the final result, namely the *cross-section*. The constant is included in any one of these three sets.

To perform the graphical calculations, simply follow from one scale to the next on the cross-lined background up to the last scale, the cross section, which is the final result sought for. An example is worked out and illustrated by the broken line on the diagram. Starting first with the amperage of the particular lamp, .775, on the first scale, follow to the left (see the broken line) to its intersection with the required volt diagonal, 1.0 volt; thence up to the next diagonals, the lamps, 10 lamps; thence to the right to the feet diagonals, 50 feet; thence down to the scale of cross-sections, where the reading is about 8200 circular mils, or about a No. 11 B. and S. wire; the whole operation requiring about as much time as it would take to start the arithmetical calculations.

The relative disposition of the scales is also of importance in such a diagram. For instance, the amperage of the lamp is generally the same for a great many computations; it has therefore been made the first scale, so that it can be eliminated from all those computations by drawing a horizontal line, say in red ink, through this value and then starting all the calculations from this line, thus saving that first part of the work. Next to the amperage of the lamp, the loss in volts is often the same for many calculations; the volt scale has therefore been made the second one, so that it also may be cut out of these calculations. To eliminate this part, draw a vertical red line through the intersection of the ampere and the volt lines. All such calculations are then started directly from the intersection of this line with the lamp scales. Finally, by the dotted lines drawn through the last scale, as shown representing the cross-section of the standard wire gauge sizes, the last part of the work is also saved. The only operation left to be performed, therefore, is to follow a horizontal line from the number of lamps to the number of feet; it would hardly be possible to have it simpler. As the majority of calculations are made for the same amperage and loss, this represents the most frequent conditions under which the diagrams would be used.

The range of such a diagram can evidently be made very great by having several sets of numbers on the scales, each set being say ten times larger or smaller than the other, the position of the diagonals will remain the same.

POLICE SIGNAL SYSTEM.

Mr. Frank Mason, the superintendent of the telegraph of the Brooklyn police department, has given further evidence of his appreciation of a good thing by selecting the new fire alarm signaling apparatus made by Frederick Pearce, of 79 John street, New York, in equipping the stations over which he has charge.

The registers made by Mr. Pearce have earned a well-deserved reputation, but those of the latest design merit a special reference.

Fig. 1 shows the Central office register as made for 16 lines. These registers are made for any number of lines and have an independent pen for each circuit. They are self-starting, so that one or all the pens may work at once. It is fitted up with reel and paper winder to take up the paper as it is used. It is an excellently constructed and finely finished instrument, inclosed in a glass case and mounted on a marbleized slate base.

Fig. 2 represents a twelve-dial, or four-dial combination transmitter. The instrument is mounted and finished similar to the register. Each dial is capable of sending any combination of three figures, from one to 999, as many times as may be desired. Each dial, after sending its signal automatically, releases the next dial, and so on till every one of the four signals are sent out, should they all be set.

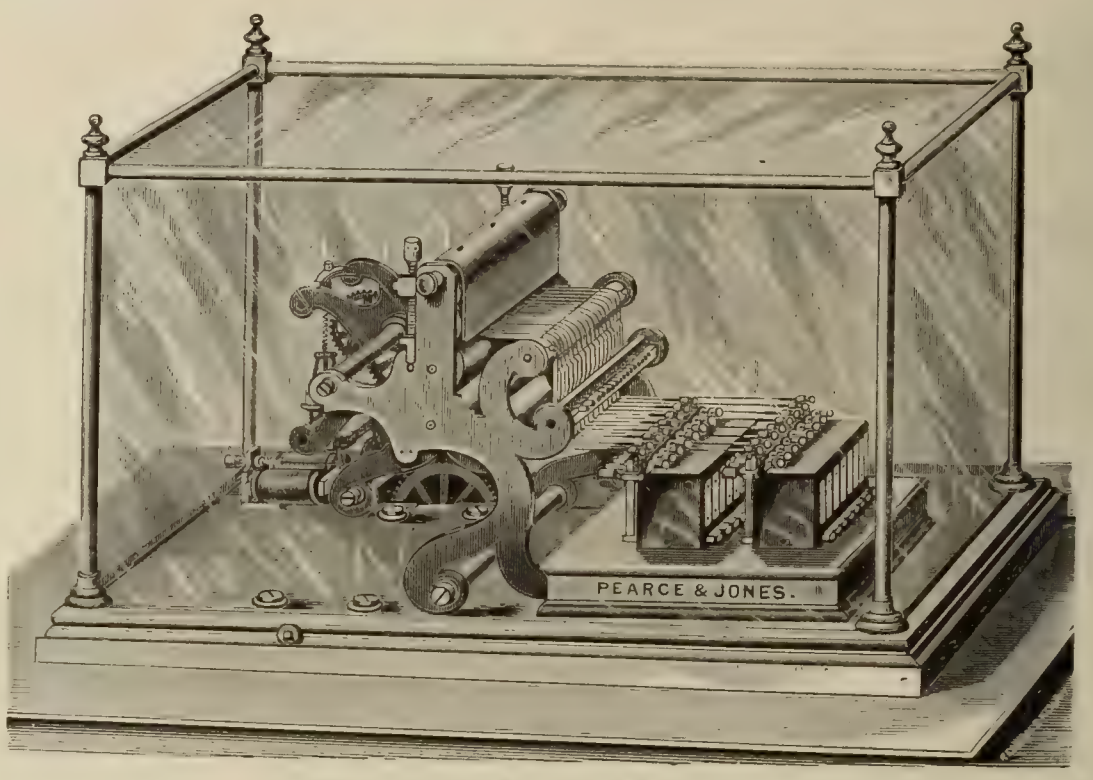


FIG. 1—CENTRAL OFFICE REGISTER.

The top dial is used for sending out general fire alarms of any combination of three numbers or any number of rounds. The other three are only used where companies are sent out of their regular districts or for special calls for ambulance, etc.

It is said that the Brooklyn police department stations will be one of the most finely equipped in the country, as regards the electric signaling apparatus, and much credit is due to Mr. Frank C. Mason, the superintendent, for the high state of efficiency of the service. Mr. Mason was among the first to adopt the telephone in connection with the police service. There are a dozen precincts in which the police signal system of Mr. Frederick Pearce will be used.

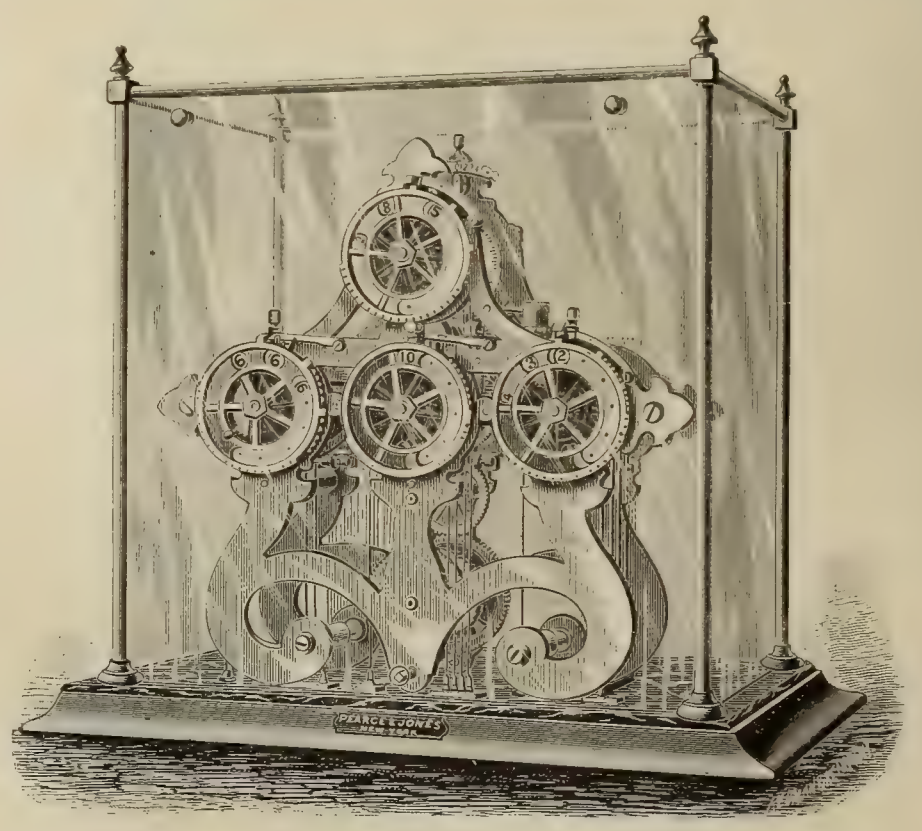


FIG. 2—FOUR DIAL COMBINATION TRANSMITTER.

The centrifugal force of the armatures of high speed dynamos is great, and provision must be made to avoid destruction thereby.

OBITUARY.

DAVID BROOKS.

Mr. David Brooks, the well-known old-time operator, electrician and inventor, died at his home in Germantown, Pa., on May 30, of pneumonia. Mr. Brooks was born at Brooksvale, Conn., in 1820. In 1845 he engaged in the construction of telegraph lines and was connected with putting into operation the first commercial line in America after the Baltimore line to Washington had been established. Mr. Brooks extended a line from Lancaster to Harrisburg and received the first message sent over it. A year later he constructed the line of the Atlantic and Ohio pany between Philadelphia and Pittsburg.

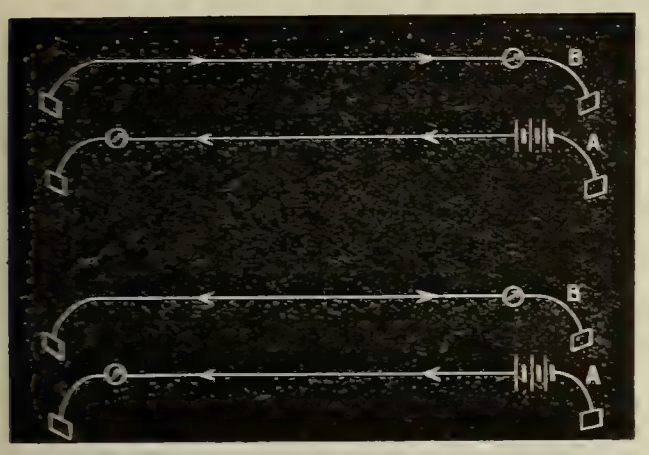
Mr. David Brooks received a college education, and after leaving his *alma mater* took a position of instructor of mathematics in the U. S. Navy. He and Hon. James D. Reid, now U. S. Consul at Dunfermline, Scotland, were associated in the building of the line between Lancaster and Harrisburg, Pa. Mr. Brooks constructed the first telegraph "repeater," and among his many inventions was the well-known Brooks' insulator, which was very extensively used on telegraph lines some years ago. Since 1867 Mr. Brooks has devoted his time almost exclusively to the development of his inventions.

Mr. Brooks was a direct descendant of Henry Brooks, who fought under Oliver Cromwell. The presence of Henry Brooks in England after the Restoration was offensive and he came to America.

INDUCTION IN MULTIPLE CORE CABLES.*

BY P. CHR. DRESSING AND K. GULSTAD.

Having been engaged for some time in investigating the inductive effect between the cores in a two and three-core cable, with a view of finding some means of diminishing or neutralizing the disturbance from core to core, we have had occasion to carry out a number of experiments in connection therewith, which, we hope, will prove of interest to the readers of this paper. We also think that the result of our work is such that it may, to some extent, throw light on the disputed



FIGS. 1 AND 2.

question, whether one mainly has to do battle with electrostatic or electro-magnetic (dynamic) induction between wires suspended on the same poles or cores in the same cable.

Several experimenters have been at work from time to time, and the subject has been ventilated from several points of view; but it would appear that the *electro-magnetic* effect has been considered the principal one, and until lately, when Mr. J. J. Carty published his papers, "A New Work of Telephone Induction" and "Inductive Disturbances in Telephone Circuits," very little was heard of the *electrostatic* induction between wire and wire. All our experiments which relate more especially to cores and cables prove beyond doubt that the electrostatic effect is by far the most important; we may say that it is in reality the one felt in practice, and the one which has to be compen sated for in some way or other. As the difference between the two kinds has been fully explained by Mr. W. H. Preece, F. R. S., Prof. Ayrton, F. R. S. (the latter has also given a formula for

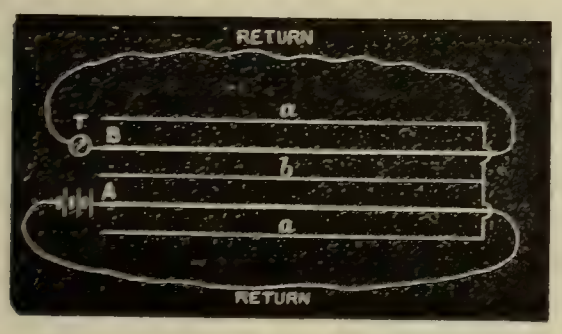


FIG. 3.

calculating the value of each), and others, we do not intend to enlarge further on the subject. Suffice it to point out here that a current due to electro-magnetic induction has the same direction throughout the secondary wire, whereas electrostatic induction causes a current of opposite direction at each end of the secondary wire.

In Figs. 1 and 2, where A is the primary and B the secondary wire, the arrows in 1 show the dynamic, and in 2 the static effect when currents are sent from the battery at A. It is also evident that in B, Fig. 2, there is a point which is neutral, and where no current is felt.

As a matter of fact, all the phenomena as represented above will not appear in multiple core cables of considerable length, simply because the inductive capacity of the secondary core will destroy the relatively weak inductive impulse long before it reaches the distant end, and also because the primary current is weak at that end compared to its first rush into the core at the near end. The consequence of this is that the disturbance in the neighboring wire, caused by induction, even when very delicate instruments are employed, is of no importance whatever when receiving at the same end of both cores simultaneously; but the very moment that A *sends* while B *receives*, great interference at once occurs between the cores, and the signals on B's instrument become distorted, until proper means of counteracting and neutralizing the induction are introduced. We shall treat of these later on.

In order to determine whether this induction is dynamic, and due to the powerful charges and discharges of the current in the primary wire, we made the following experiment with an artificial two-core cable, as shown in Fig. 3, where A and B represent the conductors prepared of strips of tinfoil; *a* and *b* are sheets of tinfoil, separated from A and B by paraffin paper.

By making or breaking the current in A, no sound whatever could be heard in the telephone, T; the weak dynamic effect could not be detected, and no other induction is possible in this case.

The arrangement was altered, and connections were made as shown in Fig. 4, viz., A and B got the same return wire. The telephone repeated now every manipulation of the battery key. The reason for this might be explained by saying that a minute part of the current found its way through B instead of through the return wire. This latter had, however, no appreciable resistance, and a very sensitive mirror galvanometer gave no deflection. But to make quite sure, and at the same time to prove that the induction was electrostatic in its nature, we connected *a* and *b* to the return wire by means of a copper wire (the dotted line). The sound emitted from the telephone ceased immediately, because the static induction between A and B was screened by the sheets, *a* and *b*. A and B were next insulated, as shown in Fig 5, which in reality means that the artificial cable was replaced by a condenser. In this way the inductive action was considerably increased, and the galvanometer could now easily take the place of the telephone.

From the above we conclude that the principal induction felt in multiple core cables must be electrostatic, and if it be said that the distance between the cores in a real cable is much greater than in an artificial one, and that the conditions are different, we need only refer to the induction between wire and wire in telephone cables, where each individual core is surrounded by tin foil, electrically connected throughout and with the earth. How could one possibly screen effectively the induction between two such conductors, if it were a question of dynamic induction, which could only be remedied by passing the return wire between the inducing (primary) and the induced (secondary) wire; and no one would surely assert that the tin foil acts as a return wire. The same view applies to submarine cables with three, or more, cores, and as it is a fact easily demonstrated, that the induction between two of the cores is considerably reduced when the third is put to earth, we consider that this would be quite impossible if it were a dynamic effect.

We now come to the question as to how it is possible that electrostatic induction can take place between cores submerged in water and surrounded by the sea.

The following experiment was made (Fig. 6):—*a* and *b* were connected by *c* with a return wire, *z*; *x* and *y* are short pieces of wire connecting *a* and *b* with *z*. In B a telephone was placed, the battery had an E. M. F. of about 90 volts, and the condenser a capacity of about .17 microfarad for one of the conductors, A or B. On closing or opening the battery no sound was heard in the telephone, neither was the galvanometer affected, although it was very sensitive and capable of showing induction representing about $\frac{1}{20000}$ of the capacity of A or B. The screening effect of *a* and *b* was very perfect indeed under these circumstances, but as soon as *x*, *y*, and *z*—more especially *z*—had any appreciable resistance, even a fraction of an ohm, the telephone emitted a sound whenever the battery was applied; and when *z* was equal to some hundred ohms the galvanometer was deflected also. From this it appears proved that whenever there is any, even ever so small, resistance in the earth connection, induction can be traced from core to core.

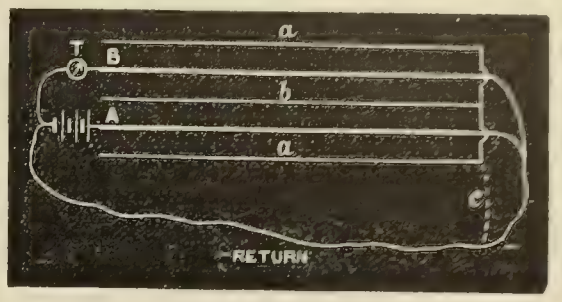
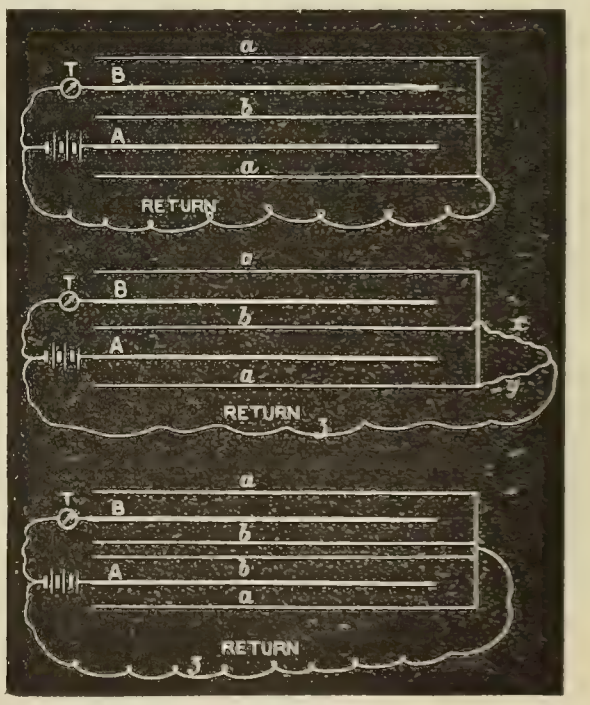


FIG. 4.

To explain this, we altered the connections in Fig. 6 a little by removing the resistances *x* and *y*, *z* being again the resistance of the return wire as before, and for simplicity's sake, we made *b two* sheets of tinfoil (Fig. 7). By manipulating the battery key the following now occurs:—The inductance in *z* will for some very short time retard the charging or discharging current through it, and the consequence will be that B is charged momentarily through the tinfoil sheets *a* and *b* (*vide* "Static Induction," by K. Gulstad, C. E.). This induction does in fact appear in the interval that elapses from the moment of inductive action between the cores, until this effect can be equalized through the earth, or perhaps better between the iron wires and the outside of the cores.

It is very instructive to observe this induction on a mirror galvanometer. The spot of light moves at first sluggishly, comparatively speaking, for the charging current, and being very suddenly stopped when the discharge passes through the resistance gets a blurring appearance. What is it that causes the resistance that gives rise to this in



FIGS. 5, 6 AND 7.

ductive effect? Where is the resistance situated, and how great is it? These are questions which we cannot answer satisfactorily, as we have never had opportunity of testing a multiple core cable since we commenced these investigations, but we hope to be able to offer our readers an explanation that seems feasible.

Our view is this, that the resistance in the earth connection is partly of an electrolytic nature, and that it consequently is situated between the cores and the iron wires. Different circumstances seem to point to this, more especially the fact that the induction varies a good deal in strength and

* *Electrical Review*, London

appearance, according as the copper or the zinc pole of the battery be connected with A in the case when z is representing water. From this it would also appear that a charging current, like any other current, must overcome a certain inductance, caused by momentary polarization; we may here refer to Sir William Thomson's experiments with semi-conductors, among which water in certain respects must be included, and where he points out that these semi-conductors after a little time only are able to act as conductors for static electricity. It may also be of interest to quote Mr. Latimer Clark's words in reference to the effect of mutual induction between cores in submarine cables—*vide*, the Society of Telegraph Engineers *Journal*, Vol. iv., 1875:—

"It is true that in the Wexford cable, with instruments of the most sensitive kind, I have witnessed a sensible induction from wire to wire. That current, I imagine, was caused in the manner I have indicated: that the sudden positive electrification of one of the wires threw off a small quantity of positive electricity from its exterior, and that electricity, before it could distribute itself from the cable into the sea would momentarily raise the tension of the whole core of the cable, and cause an inductive discharge."

AN INTERESTING PLANT FOR THE PRODUCTION OF ALUMINUM.

Probably the largest dynamos in the world used in the production of aluminum and aluminum bronze are located at Neuhausen, Switzerland, where the first is produced in large quantities by the Heroult-Kiliani, and the latter by the Heroult process.

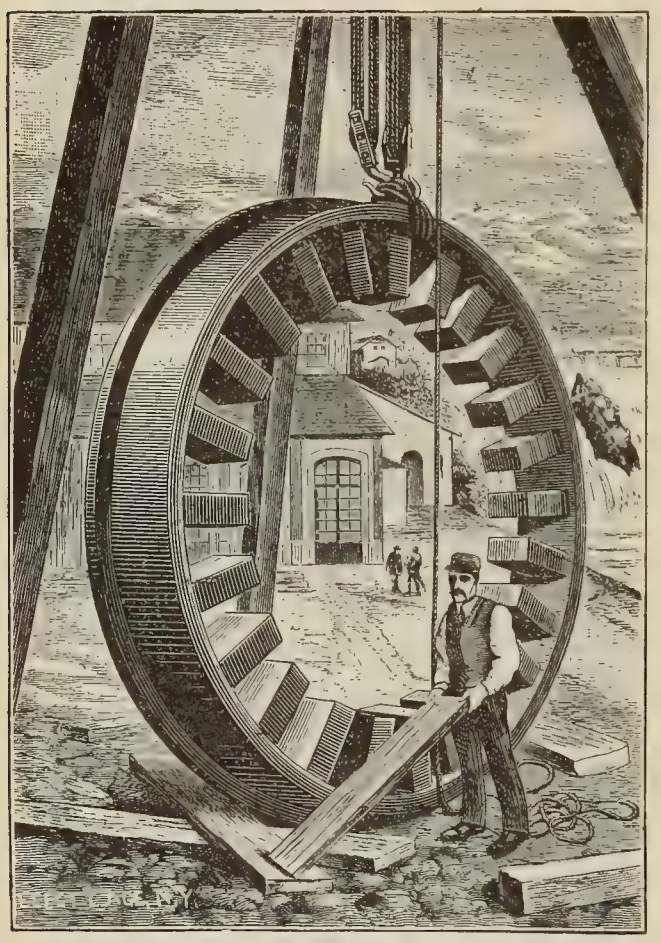


FIG. 1—FIELD MAGNET CORES, NEUHAUSEN PLANT.

The Neuhausen Company obtained from the Government of the Canton of Schoffhausen, permission to use part of the falls of the Rhine, securing large hydraulic power. The water which supplies the power has a fall of about 163 yards, giving about 4,000 available horse-power.

The dynamo plant consists of two gigantic continuous current Brown machines of 600 horse-power, each giving 14,000 amperes at 30 volts; and an exciting dynamo of 300 horse-power with a capacity of 3,000 amperes at 65 volts. The two first are used exclusively for electrolysis. The field has 24 poles, the core weighing about 25,500 pounds and resembling a huge toothed wheel, as shown in Fig. 1. These machines are placed in a vertical position, the axle of the armature being coupled directly on the turbine. Fig. 2 shows the installation of turbines and dynamos. The water comes in through conduits passing through the wall, and goes out through others passing through the floor. Between the two conduits is the turbine, the axle of which comes out through the top of the cylinder.

There are five corresponding brushes on one brush-holder at each pole, so that one or two of the same series may be stopped for a time for trimming, without inconvenience. A workman is engaged exclusively to inspect the brushes, keeping them trimmed and working so that no sparking occurs. As the potential is very low there is no risk in this.

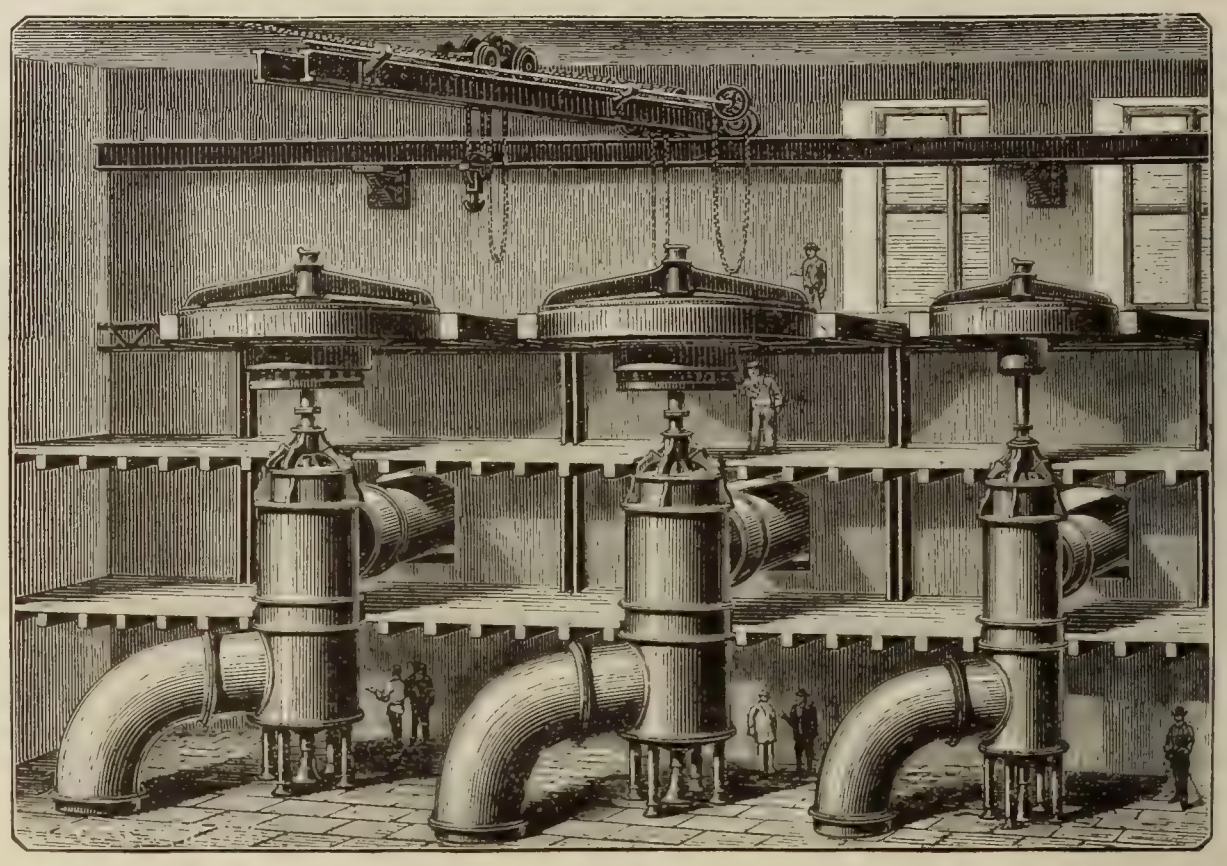


FIG. 2—DYNAMOS AND TURBINES, NEUHAUSEN PLANT.

The above facts and illustrations are taken from an article in *La Nature*.

The system above described is the same as that used by the United States Aluminium Company, of Boonton, N. J.

THE MONTREAL CONVENTION.

A meeting of organization was held at the Windsor Hotel, Montreal, a few nights ago, to inaugurate the work of receiving the delegates of the National Electric Light Association at their next meeting, which will be held in Montreal in August next. Many prominent citizens and all the electrical experts of Montreal were present. The proceedings of the meeting were recorded as follows in the Montreal *Herald:*

"The chairman in calling the meeting to order, spoke of the great benefits to be derived by the holding of the convention in Montreal and the pleasure it would give the citizens of Canada's metropolis in welcoming to our midst such a distinguished gathering of citizens of the United States. Many of those present expressed the same sentiment, after which the preliminary work of organization was begun.

"It was decided to appoint a citizens' committee, a reception committee, one on amusements, and others to be subsequently decided on, and for the purpose of deciding on the gentlemen to be named for these several committees an influential sub-committee was appointed. It was resolved that the citizens should secure as many attractions as possible, in the amusement line, during the visit of the members of the association.

"It was stated at the meeting that the electrical exhibition to be held during the sitting of the convention would be the leading feature, and certainly be the finest ever held in America. So far as the attendance at the coming convention is concerned, it promises to be very large and quite equal to that at any convention yet held by the Association.

"So far as public opinion can be judged everyone, the most prominent citizens included, are enthusiastic over the holding of the convention here, and claim that in every way it will be a grand success."

AN ELECTRICAL HYGROMETER.*

An hygroscopic substance, as chloride of zinc, is made the electrolyte in a galvanic cell. Variations in the amount of moisture in the atmosphere will alter the amount of this electrolyte and consequently the internal resistance of this cell. The cell itself is conveniently made by a strip of zinc and one of copper bridged by a piece of filter paper soaked in $ZnCl_2$. By connecting the poles through a sensitive galvanometer the deflections may be used as an indication of the amount of moisture present in the air. After five hours the polarization is about 20 per cent., hence it is practically *nil* during the time of an observation Comparisons have been made for about a week with a Regnault hygrometer. While the deflections followed the Regnault with regularity, as yet, the law connecting the amount of moisture and the deflections of the galvanometer has not been fully established. It is believed the instrument may be employed for a simple, inexpensive and fairly accurate method of hygrometric observations.

GENERAL ELECTRIC NOTES.

The Packard Lamp Company of Warren, O., is about to increase their plant by making additions both to its buildings and machinery.

The Northwest Electrical Engineering Company has been incorporated at Portland, Ore., with a capital of $40,000.

The Electrical Supply Company of Ansonia, Conn., are enlarging their plant by an addition of a 100 x 40 building.

The Cincinnati (Ohio) Electrical Supply Company has been incorporated with a capital of $100,000.

The Put-in-Bay Electrical Company has been incorporated at Toledo, O., with a capital of $150,000.

An electric company has been incorporated at Washington, D. C., under the name of the Potomac Electric Company.

*Abstract of paper by Lucien I. Blake, read before the Kansas Academy of Science.

(*Continued from page 343.*)

were fired at the rate of ten a second, or 600 a minute. Mr. Maxim described the capabilities of the gun, and gave an account of the tests made and experiences he had in European countries in connection with the demonstration of the gun's capacity. The lecture throughout was of extreme interest, and a vote of thanks was tendered to Mr. Maxim.

FRANKLIN EXPERIMENTAL CLUB.

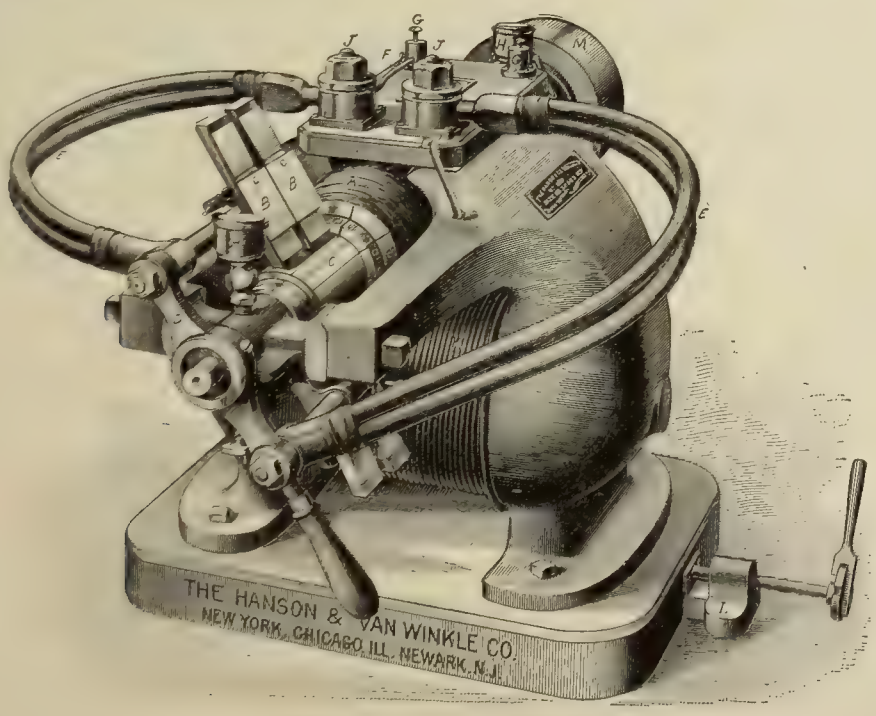
At the last regular meeting of the Franklin Experimental Club, Newark, N. J., May 19, 1891, Professor Geo. C. Sonn delivered an intensely interesting and instructive lecture on "Seismology" or the phenomena of earthquake disturbances and methods of studying the same. Professor Sonn dwelt upon the various theories prevalent upon the subject of earthquakes, tidal waves, etc., and explained the methods adopted from the earliest times to the present day in the study and recording of the various disturbances going on in various parts of the earth's structure. The lecture was illustrated by magic lantern views of the most important earthquakes and their effects; and also, by diagrams prepared by Professor Sonn, of the electrical and other methods employed in recording the time and duration of the disturbances, the number and general character of the movements. Professor Sonn sails for Europe shortly, and during his visit abroad will visit the Electrical Exhibition in Frankfort, and will prepare an interesting report for the Franklin Experimental Club.

The American Society of Mechanical Engineers will hold their Twenty-third annual meeting at Providence, R. I., June 16 to 19, inclusive. The different sessions will be held in St. John's Hall, and the Masonic Temple, and judging from the title of the papers to be read, the meeting will be interesting.

NEW ELECTRO-PLATING DYNAMO.

The rapid advances in the art of electro-plating in the last few years, have been co-extensive with the development of the dynamo and the class of machine designed for the use of the electro-platers is being constantly improved and brought to a higher state of efficiency.

We illustrate herewith a new dynamo electric



NEW H. & V. W. DYNAMO.

machine just brought out by the Hanson and Van Winkle Company of Newark, N. J., the well-known manufacturers and dealers in electro-plating outfits and materials. The machine is known as the "New H. & V. W." dynamo and will take the place of all the other machines the firm has handled. They claim that it is equal to the best machine in the market.

The field magnets are made of wrought iron and have a round core, which for a given amount of wire is more powerful; the magnetic circuit is very short. The commutator is very durable and so constructed that it can be repaired with great facility. The armature being situated above the base, is protected from the accumulation of dirt. The machine is clean as to lubrication and it requires attention but once a week; it is so constructed that no oil can get into the armature.

The manufacturers claim for this machine that it is 30 per cent. more powerful than any other sold at the same price. They make the "H. & V. W." in 5 sizes and place the machines on trial for 30 days with responsible parties.

A SIMPLE THERMOSTAT.

The demand for a simple and reliable thermostat has led many inventors to give a considerable degree of attention to this line of apparatus.

A very ingenious device of this class is that described and illustrated below. It is made by the Copenhagen Electric Alarm Company, of 92 Sycamore street, Cincinnati, and possesses the qualities of simplicity and reliability to an eminent degree.

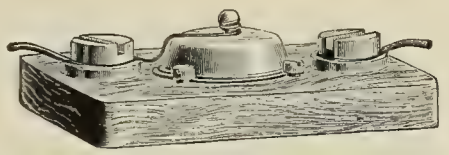


FIG. 1—COPENHAGEN THERMOSTAT, ACTUAL SIZE.

The illustration (Fig. 1) shows the actual size of the device. The capsule consists of a small chamber, made of copper on one (the upper) side with a silver diaphragm on the under side. This chamber is filled with a liquid which boils at a

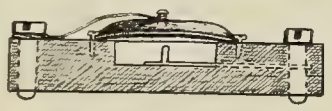


FIG. 2—SECTION OF THERMOSTAT.

certain desired temperature. The liquid is hermetically enclosed in the chamber and the vapor generated therein by the heat forces the diaphragm against the connecting screw, shown in the sectional view (Fig. 2). As soon as the temperature is lowered the vapor is recondensed and the diaphragm goes back to its original position, thus again opening the circuit.

There is no limit to the number of times the device may be tested. It can be furnished to act at any temperature, from 33° F. up, and the liquid is of such nature that it can never change; the life of the apparatus is therefore without limit.

The advantages claimed for this thermostat are absolute reliability, compactness and extreme durability. The contact is positive, as the diaphragm snaps out suddenly as soon as sufficient vapor is generated, and makes a firm contact until the diaphragm goes back.

The contact points are absolutely protected, and cannot be tampered with. The device is neat in appearance, which renders it desirable for use in private residences as well as in business houses or factories.

The diaphragm is concave when in its normal condition but becomes convex when forced out by the vapor.

Mr. C. G. Muller is the secretary and general manager of the company, whose advertisement will be found on another page.

ELECTRIC RAILWAY NOTES.

The electric street railway of Watertown, N. Y., which has been under course of construction for some time, was put into operation May 20, between Factory Square and the Watertown Steam Engine Company's works, a distance of about 1½ miles. It is intended to extend the line to Brownville. The company already have a large gang of men at work on that portion of the road, and it is expected it will be completed about July 1. The road is run by the overhead trolley system, and uses water power to run a generator of 110-horse power, situated at the Eames Vacuum Brake Works. Running this dynamo by water power is an experiment, and its operation is being watched with interest. The Edison General Electric Company, of New York, are contractors for the electric plant of both the city road and the extension to Brownville. The work is being done under the supervision of T. J. McComber, their expert, who was formerly a resident of Watertown. So far the company have three elegantly fitted motor cars, with all the latest improvements. They are similar in appearance to those they use on Broadway, New York, and they are equipped with the Eames Vacuum Brake. They are to be illuminated with electric lights.

The antiquated street car system of Baltimore has at last succumbed to modern ideas. On May 23d the new cable road of the Baltimore Traction Company was put in operation, and on the first day the new cars covered the same distance in 38 minutes that it used to take the horse car one hour and seven minutes to travel. The road is now in regular operation and on the first two days 75,000 passengers were carried. The improvements are thoroughly appreciated by the citizens. The success of the cable road has caused the other companies to consider the advisability of adopting more improved methods of propulsion. The Union Line Company is already negotiating for a loan of $1,500,000, to equip their lines with some propelling power superior to horses or mules, but are as yet undecided whether to adopt electricity or cable power. Here is a good chance for electric companies to do some good work. Baltimore is now ready for rapid transit, and the people want nothing but the best. Just what the physical conditions are along these lines we cannot say with certainty, but generally speaking, it strikes us that Baltimore is a favorable place for the electric system—the overhead trolley. A bill has already passed the city council granting permission to build an electric road on North street, in that city, and as the streets beyond the business centre are in general wide and straight, electric railway companies should find an excellent opportunity and field here for the introduction of the electric system.

North Carolina has been making rapid progress in electrical installations recently. With the electric railway just completed at Charlotte, N. C., they have street cars using this power at Charlotte, Winston and Asheville; and electric light plants at Raleigh, Asheville, Wilmington, Winston, Durham, Weldon, Henderson and Wilson.

Port Arthur, Ont., although only a small community, boasts of an electric light plant, an electric railway under construction, and an electric supply house.

CONSIDERATIONS WHICH SHOULD GOVERN THE SELECTION OF A RAPID TRANSIT SYSTEM.*

BY FRANK J. SPRAGUE.

Returning again to the question of motive power, it is important to know what are the objections raised against the use of electricity. About the only one made public is that it has not yet been used on as large a scale as would be required in the proposed system. This reason seems ultra conservatism and it is to be regretted that on a subject of such vital importance, there has not been a more thorough public inquiry made on this subject.

This same view was taken of the application of electricity to street railway propulsion only three years ago. There was scarcely an engineer, a street car builder, a street railway constructor, or a capitalist who did not laugh at the claims which were made for it and yet in this short time there has been a total revolution of feeling. There is not probably a street railway manager in the United States, who does not thoroughly believe that electricity is the present and coming power for street railways and who, if he were constructing a new road or re-equipping an old one, would not at once or in the near future, adopt electricity if he could get the necessary rights to do so and it should be borne in mind that the equipping of these roads has meant in very many cases the entire rebuilding of the track, the purchase of new cars, the building of costly stations, and in short the investment of a greater capital than had already been invested in the original plant, so that fifty million dollars is a small estimate of the sum which stands invested to-day in this one industry alone.

If, however the Rapid Transit Commission is still in doubt, then in order to get a more intimate knowledge of what electricity can do as a motive power, it would seem proper,

First, that a time be set apart for the public examination of electrical engineers and contractors.

Second, to require a private statement from electrical engineers, confidential if desired, as to any new developments not publicly known.

Third, to visit two or three of the prominent electrical establishments to see what has been, is being and what will be done in general electrical machine construction.

Fourth, to then state what duty would be demanded of electric motors and what guarantees of performance would be required under forfeiture.

If something like this be not done, then I think it safe to say that the rejection of electric motive power will be because of the following reasons:

Its novelty.

Allowing accidents incident to the early period of its development to outweigh in importance its demonstrated advantages.

A conclusion that it is limited in capacity and development, and

Lack of information as to its past, present and promised future.

Such a rejection would be upon technical advice relied upon by the Commission.

This it would seem, ought to be that of the Board of Engineers—not the judgment of one man—because no one has sufficient experience to warrant such reliance upon his dictum in a matter of so grave import and on a subject to which as many able engineers are devoting themselves and the development of which has enlisted so many millions of capital.

The motor equipment on, for example, the present London road is composed of one hundred horse-power units. That required on elevated railroads is one hundred and eighty-five horse-power. Attach four motors of the London type to the same circuit instead of two, govern them as is perfectly feasible, by the same controlling device and they will outwork any elevated road engine.

Increase the dimensions in these machines one-third only, and two of them will do the work of this engine. Duality may be objected to, but it should be borne in mind that duality of engines is absolutely necessary in a locomotive for successful operation. It is not essential in an electric motor equipment, although advisable for traction purposes. But for that matter double the dimensions of a London machine and it alone will outwork the two cylinders of the elevated locomotive.

Perhaps one of the most telling arguments in favor of electrical propulsion, is the fact that in London another underground road to be operated by electricity is about to be constructed on plans already approved by a Parliamentary committee. This road is about six miles long and connects the West End with the city. It forms approximately a diameter of the oval described by the present steam underground railways. A 5,000 horse-power station at the suburban end of the line will supply the current. The trains are to consist of six cars seating about 340 persons and will weigh with the electric locomotives 120 tons. The average speed is to be 14 miles an hour including all stops with a maximum of about 25 miles an hour. Since this weight, power and seating capacity exceed that now common on the elevated railroads, it is a somewhat practical answer to the objections made on this point.

There have been no demands for a two thousand horse-power steam locomotive, but there is not a builder in this country who, given suitable gauge of track and allowed dimensions of engine, would hesitate a moment to build a locomotive of that capacity.

So, too, with electric motors. Given the incentive, and before the first foot of roadway is ready on the proposed Rapid Transit system of New York, a 200-horse power electric locomotive will be built which will, under forfeiture, outwork any elevated road engine for speed, pulling capacity, steadiness of work, time of operation, and continuous mileage.

This statement is made from personal knowledge, and with an individual willingness to assume the risk.

Break a single part of the many in a locomotive and it is helpless. Break many of certain parts in an electric motor and it will, although crippled, still operate. In short, the near future will make the electric motor the most reliable machine constructed for power purposes.

What is the experience of other large cities in this matter of rapid transit?

In London the same interest which built the Greathead Tunnel has been granted Parliamentary rights for extensions, ordinarily most bitterly fought against, with an almost unexampled unanimity.

Paris is considering seriously the question of a great metropolitan underground electric system.

Boston has been advised after most careful investigation that the only proper system for the business portion of the city is an underground electric system.

As regards New York, while unnecessary delay is to be avoided, it is certain that no present delay is half so serious in its consequences as the adoption of an inferior plan by reason of immature consideration, lack of knowledge or information, or in response to popular clamor.

The demands of to-day can be best served by plans to meet the future wants of New York as well, while the needs of the future cannot be properly provided for by planning for present limitations.

In discussing a subject some time since in a communication addressed to the Commission, which contained the gist of much I have already said in this paper, I made the following suggestions:

It is possible that the Commission, while still in doubt about the availability of electricity as a motive power, may feel it incumbent upon them to announce some decision with regard to at least one route. Would it not then be possible to submit two alternative propositions, the preferable one of which could be determined by public comment and criticism, and the readiness with which a responsible Construction Company would bid for the necessary right and franchise?

First, questioning the availability of electricity, select the best system which can be devised other than an underground system, that is some elevated or viaduct structure. Specify the number of tracks, the route over which it shall run, and make steam the motive power.

Second, accepting the statements which are made in favor of electricity, select the best underground or combined underground and viaduct and surface system, which will answer as far as possible the demands which have been enumerated. Establish the route, the number of tracks, and make the use of electricity obligatory.

Third, demand as regards *Construction:* Earliest time of beginning; greatest freedom from interference, either with streets or existing systems of pipes; least damage to property; most rapid progress of work; earliest completion. *Results:* Mean and maximum speeds; number and weight of trains operated; approximate cost of motive power per train mile under these conditions. *Guarantees under Forfeitures:* Against construction damages to buildings or foundations; against future damage claims.

Then let the public discuss the merits of these alternative propositions, and let a construction company or companies bid on these systems, and on the franchise, accompanying such bid with a proffer of a certified check of sufficiently large amount, and then see which company will

a. Guarantee to build most quickly; *b.* Make the best offer for the franchise; *c.* Offer the highest guarantees, both as to progress, cost and satisfactory operation.

As I close this paper there comes news of most reassuring character, for the chairman of the commission is reported in Tuesday's *Commercial* and in Wednesday's morning papers, as stating in the most emphatic manner that the Commission is planning for future New York, and that it will under no consideration even consider the plans of the elevated railroad until after it has determined upon a route to satisfy the demands of that future.

This statement of the chairman is most opportune, and will go far to allay the anxiety which has been honestly felt by those who await the result of the Commission's deliberation.

It is also stated, presumably on the same authority, that a system and West Side route from the Battery to the Harlem River has been definitely settled, part underground and part viaduct, and the announcement of this decision will be definitely made next Tuesday. If so, then it would seem that electricity has now the victory, and the particular method of construction and the route selected will form the subject of discussion

* Abstract of paper read before the General Meeting of the American Institute of Electrical Engineers, New York, May 21, 1891.

An electric alarm company has been incorporated at Muskegon, Mich., with a capital of $48,000.

The Western Electrical Supply Company, of St. Louis, has been incorporated with a capital of $5,000

A telegraph company has been incorporated at Danville, Va., with a capital stock of $90.000. The new corporation is named The Danville and East Tennessee Telegraph Company.

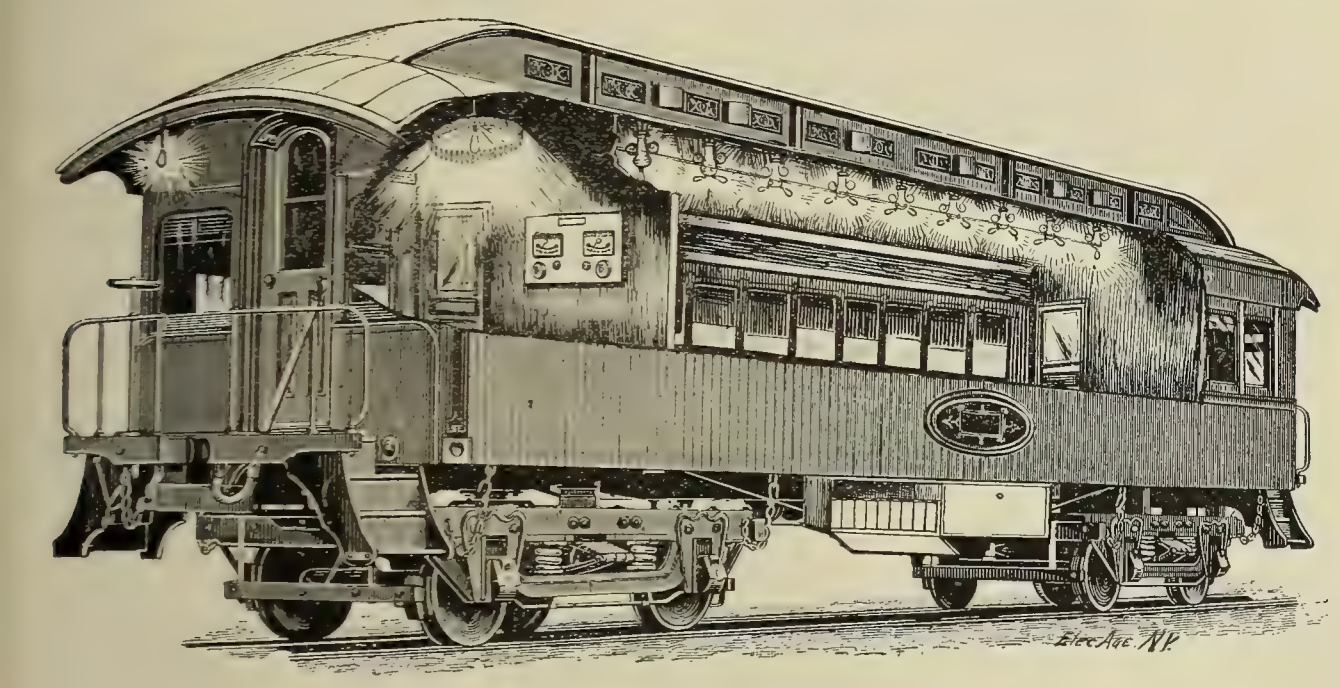
The Ocean City Light, Heat and Power Company has been formed at Ocean City, N. J , with a capital of $40.000.

NEW SYSTEM OF TRAIN LIGHTING.

The train which arrived from Boston at the Grand Central depot last Saturday morning included a coach that was lighted by electricity on a new system, and it may surprise many of our readers to learn that primary batteries were used for this purpose. It is said that the lighting was accomplished in a highly successful manner.

The system is being quietly exploited by the Simplex Electric Co., of Boston, and later on it is proposed to give a public demonstration of its practical value.

The main section of the coach was fitted with nine neat fixtures supported from the roof. Attached to seven of these were two 16-candle power incandescent lamps, and each of the other two fixtures had one 16-candle power lamp. In the rooms at the ends of the coach were pretty reflector fixtures, with one 16-candle lamp each, arranged so as to throw all of the light downward.



RAILWAY CAR LIGHTED BY PRIMARY BATTERY.

In one of these rooms was a switchboard by which the various circuits and the batteries are controlled. There were two 13-point switches and four smaller ones, as seen in our illustration. The latter controlled the lamps and the 13-point switches were used in cutting in and out the batteries, as required.

The batteries were placed in a box which was suspended from the floor of the car, between the trucks. The box contained two doors, which afford easy access to the batteries when it is necessary to remove or replace them.

NEW INCORPORATION LAW.

The following digest of the new law which went into effect on the first of May, 1891, repealing nearly all the prior laws, but not retroactive, is confined to the acts affecting the electrical industries in the State of New York.

Chapter 563, known as "The General Corporation Law," provides as follows:

A "Municipal Corporation" includes a County, Town, School District, Village and City. A "Domestic Corporation" is one incorporated under the laws of the State of New York, every other being a foreign corporation. A "Stock Corporation" is one having Capital Stock divided into shares. A "Monied Corporation" is one having banking powers, or the power to make loans upon pledges, or deposits, or authorized by law to make insurances. The term "Directors," includes Trustees or other persons, by whatever name known, duly designated to manage the affairs of a corporation. The term "Certificate of Incorporation" includes all written instruments required by law to be executed to effect the incorporation of a corporation.

Sec. 11 provides that any domestic corporation may acquire requisite real and personal property in other States or abroad and convey the same. Sec. 12. A foreign Corporation may do likewise in New York. Sec. 21. If business is not begun within one year, corporate powers shall cease. Chap. 564, Sec. 2. May issue mortgages, etc., not exceeding two-thirds of the current value of the corporate property, agreed to in writing by two-thirds of the stockholders and that filed in the county clerk's office. Sec. 7. No Stock corporation shall combine with any other corporation for the prevention of competition. Sec. 23. No dividends except from surplus profits of the business, not to impair the capital. Directors voting in favor of declaring or paying dividends in either such case shall be personally liable. Sec. 24. Confirms the personal liability of the Directors who vote as above. Sec. 29. The directors of every stock corporation shall cause to be kept at the principal office a set of books showing the condition of the business and a list of stockholders, open to creditors and stockholders under a penalty for the corporation of fifty dollars per day. If any officer or agent of such corporation shall neglect or refuse to make any proper entry in such books, or to exhibit them, the corporation and such officer and agent shall forfeit and pay to the party injured a penalty of fifty dollars for every such neglect and all damages resulting to him therefrom. Sec. 30. Full annual report by Jan. 20th, or if doing a foreign business, by April 20th, or the Directors personally liable for all debts, except such Directors as individually file with the Secretary of State a reason for the full report not being in. Sec. 42. Stock or bonds issued only for money, labor done or property received. Sec. 43. Sixty days' default in payment of any instalment forfeits prior payments. Sec. 49. Any stockholder may save his pro rata interest in case of foreclosure by paying as per his holding. Sec. 52. Stockholders owning 5 per cent. if capital $100,000, or 3 per cent. if more, may require sworn statement of affairs on twenty days' notice, which shall be kept on file for six months. Neglect of this gives the person making the request a forfeit of $50 and $10 per day until done. Sec. 56. Foreign Corporation on refusal or neglect to exhibit the books, is liable to a forfeit of $250. Sec. 57. Stockholders jointly, severally and personally liable to an amount equal to the amount of stock held. Sec. 58. Stockholders not liable until after execution against the corporation is returned unsatisfied, nor for any debt not payable within two years from the time it is contracted, nor unless suit is brought within two years from the time he ceased to be a stockholder. Chap. 565, Sec. 91. Street surface railroads must procure consent of one-half in value of the property bounded on, also the municipal authorities. Sec. 93. Municipal consent in cities of over 90,000 population must contain condition for sale of privilege at public auction for largest per cent. of gross receipts, with a bond, work to begin within one year and completed in three. The bidder must be a duly incorporated railroad corporation of this State, organized to construct, maintain and operate a street railroad in said city. Sec. 94. Failing to obtain consent, corporation may apply to any general term of the Supreme Court to appoint three commissioners, ten days' notice being given non-consenters, whose favorable report shall be taken in lieu of consent of the property owners. Sec. 95. Every corporation under this article or the law of 1884, Chap. 252, in every city having population of 250,000 or more, shall on each 1st of November for five years pay 3 per cent. of its gross receipts and after five years 5 per cent. to the city treasurer. Sec. 100. May use any power except steam. Sec. 101. Single fare of five cents over main line and all connecting branches or extensions. The legislature expressly reserves the right to regulate and reduce the rate of fare. Sec. 105. Charging more than five cents fare for one continuous journey the corporation forfeits $50 to the aggrieved party. Secs. 150 to 171. Board of Railroad Commissioners. Chap. 566, Sec. 60. Three or more persons may become a corporation for manufacturing gas or electricity for light, heat or power and supplying same to any one or more cities, towns or villages not over five miles distant from each other. Sec. 61. Additional powers, such as laying mains, conduits, make, sell and lease plant or machinery, construct circuits, etc. Sec. 65. Electric light and gas must be supplied on application to every applicant within 100 feet of any main or wire circuit with reasonable payment, regardless of debt of former tenant, or corporation may forfeit $10 to applicant and $5 per day for further refusal. Sec. 66. Every corporation may require two months payment in advance and shall allow legal interest on same. Sec. 67. Any duly appointed agent of electric or gas corporation may enter served premises at all reasonable times to inspect service. If interfered with directly or indirectly, party interfering forfeits to the corporation $25. Sec. 68. Agent may enter premises of delinquent customer between the hours of 8 A.M. and 6 P.M. and sever the connection, removing all corporation property. Sec. 69. No gas corporation in this State shall collect, directly or indirectly, rent for meters under penalty of $50 for each offense. Sec. 70. In any city in this State, population 800,000 or over, the price of gas not to be over $1.25 per 1,000 feet and shall have illuminating power of not less than twenty sperm candles of six to the pound, burning at the rate of 120 grains of spermaceti per hour, tested at a point not less than one mile from the place of manufacture by a burner consuming five cubic feet of gas per hour. Sec. 100. Seven or more persons may become a Telegraph or Telephone corporation wholly within or partly beyond this State. Sec. 101. Such corporation may own, use, lease or consolidate with any other Telegraph or Telephone corporation not described in the original certificate of incorporation. Sec. 103. Failure or refusal to impartially receive and transmit such dispatches or messages as are offered in good faith and on current terms, and in the order in which they are received, renders the corporation liable to the sender in the sum of $100 in each case, but press dispatches for publication may go out of regular order. Sec. 105. Such corporation at its expense may be supplied by any city with not more than 200 special policemen, who shall pass, and have full police authority and wear a badge and uniform supplied by such corporation, approved of by the Police Board.

Mr. A. J. Corriveau, president of the Canadian Electrical Manufacturing Company, has secured the contract for an electric light plant for Lachine, near Montreal. The Wood Arc System will be used. A plant on this system is now being installed in St. John, N. B. It is expected that the Lachine plant will be in operation by August.

ST. LOUIS NOTES.

The electric light plant at Venice, Ill., will, it is expected, be ready to begin operations in a few weeks.

The street railway lines which contemplate a change from mule to electric motive power, appear to be hesitating about adopting the overhead system, hoping that a successful storage battery or underground conduit system may come to the front this season.

The Equitable Building, at 6th and Locust, one of the largest office buildings in the city, is now being wired for electric lighting, the fixtures being a combination gas and electrolier. The current will be furnished by a plant in the basement, which will be ready in about 30 days.

Suit has been begun by the State of Missouri against the Laclede Gas Light Co., of St. Louis, for the purpose of preventing the acquisition by the Gas Company of the Missouri Electric Light Co., and the Municipal Electric Light Co. The case came up on May 21st but was postponed for two weeks.

Preparations are being made looking to an illumination of the city during the Fall festivities this year, which will be on a more gorgeous scale than ever before attempted. This feature has been omitted for the last two years, but this year it is proposed to largely utilize the electric light in the illumination. One plan is to place dynamos in private workshops in different portions of the city where power can be obtained, the machines to be loaned for the occasion, by the various electric companies. In this way, current sufficient for the illumination could be furnished at very small expense. Gas has heretofore been the only illuminant for these autumnal displays, which have in previous years excelled anything ever attempted in this country in the way of street illumination.

MINNEAPOLIS NOTES.

The first electric line on the east side of the river is about ready for business. The Hawthorn avenue cars will run through to the east side terminus, crossing the river by the new steel arch bridge.

The wiring of the Bloomington avenue line is nearly finished, and ties are now being distributed along Sixth avenue south. Several carloads of T rails have just been received from the Illinois Steel Company, of Chicago, which will be laid on Second street northeast and the Hennepin boulevard.

Twelve new 50 horse-power motors are in use on the inter-urban line, each hauling two trailers. It is expected this will relieve the pressure of travel on this line somewhat. More of these motors will be added as fast as they can be procured. Fifteen hundred feet of additional side track is being laid at the inter-urban car house.

The street railway company has begun work on additional tracks at the intersection of Third avenue north and Washington avenue. New tracks will also be laid between Washington avenue and the power house, over which damaged cars will be run to the repair shops. Two of the curves to be put in will be for the accommodation of the Bloomington avenue and Third street line.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73,
BOSTON, MASS., May 29, 1891.

An electric street railway is talked of in Hyde Park, Mass.

An electric light plant is soon to be erected in Norway, Me.

The work on the new station of the Holyoke Electric Light Company is progressing rapidly, and will be completed in a short season.

The Brocton & Abington Electric Railway Company have purchased four acres of land in Abington, on which to erect a power station.

An electrical locomotive is being built by the Thomson-Houston Electric Company at their Lynn factory. It will weigh ten tons and be of 60 horse-power.

The Cambridge Electric Light Company, have presented the Fireman's Relief Association, of that city, with $100, in appreciation of their services rendered at the recent fire in their station.

The Portland Electric Light Company, of Portland, Conn., which was chartered some two years ago, are about to erect a central station and begin business. They will light Portland and Gildersleve.

The Automatic Time Stamp and Register Company have enlarged their facilities for the manufacture of time stamps and employès' time registers and are better prepared to meet the great demand that has sprung up for these most useful inventions.

The railroad commissioners gave a hearing this week to the Union Street Railway Company, of New Bedford, on their petition for authority to increase their capital stock from $260,000, their present capital, to $500,000. The increase is asked for to enable them to put in an electric plant.

The executive offices of the New England Telegraph and Telephone Company have been moved from 50 Pearl street to the new building corner of Milk and Oliver streets. The work of connecting the subscribers with the new office is progressing rapidly and it is expected that the new exchange will be occupied some time in June.

Geo. B. Davis, who has for some time been connected with the Gethin's Electrical Manufacturing Company, is now representing the Eastern Electric Light and Storage Battery Company, and is located in new and elegant quarters at rooms 606 and 607 Sears Building. The success that has crowned the efforts of Mr. Davis in the past is a guarantee of the future.

The Redding Electric Company have moved from their old quarters at 48 Hanover street, and are now located at 41 Federal street. The location is an excellent one, being nearly in the centre of the electrical trade. The offices are commodious and attractive and although a large business was done at the old stand, there is no doubt but that a larger will be done at the new.

The Old Town Street Railway Company and Orono Street Railway Company, held a meeting in Bangor, Me., last Wednesday, and voted to consolidate the two companies. An electric street railway will be built from Old Town to Orono, and probably to Veasie. In this case the Bangor Street Railway will extend its line to Veasie to connect with the other line. This will make a continuous electric railway line from Bangor to Old Town, a distance of 12 miles.

Although the lights furnished by the Malden Electric Company were burning the next night after the explosion, which recently took place at their station, it will be some time before the station is again in as good condition as it was before the explosion took place. The painted and varnished work has to be all sand-papered and repainted and varnished and the station slicked up generally. Supt. Bliss is hard at work and proposes to have his station again a model.

The Consolidated Electric Manufacturing Company have added to their already large force of employès and are turning out large numbers of the famous C. E. M. sockets. This concern also manufactures a jack-knife switch for which there is a great demand. This company occupy a five story building equipped throughout with first-class machinery for the manufacture of all kinds of electrical goods. The demand for the Davis Arc Cut-Out, made by this company, is growing enormously.

The Johnson Electric Train Signal Company, of Woburn, Mass., have one of the finest equipped factories for the manufacture of electrical apparatus in New England, and are rapidly forging ahead as leaders in their line. Their sealed push button is meeting with great favor and the numerous orders are far beyond the expectations of the company. Their train signal apparatus has been adopted by a number of the leading railroads in the country, and the company is in a prosperous condition.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
417 CHAMBER OF COMMERCE,
CHICAGO, Ill., May 29, 1891.

As an indication that electrical construction is beginning to pick up in earnest, the Central Electric Company report a largely increased demand for soldering torches of various kinds. This company carries a large assortment of these goods and handle all the most approved styles.

The Bain Break Insulator, handled by the Central Electric Company, is having a ready sale and is fast growing in popularity with electric railroad men, who use it for insulating span wires. The electric light companies are also ordering them in considerable quantities to insulate suspended arc lamps.

The Electric Merchandise Company on the occasion of the first anniversary of its incorporation, June 1, sent out engraved cards, thanking its patrons for the favors liberally granted during the past year, and expressed a desire that the good will may be continued. In this connection it may be stated that though the company is but one year old, the management has been connected with a like concern (which the Electric Merchandise Company purchased), ever since the first practical electric road was put in operation in this country. Therefore, though young as a company, in practical experience they are the oldest, and it is believed the only exclusive electric railway house in the trade.

The Northwestern Electrical Specialty Company, 1017 Chamber of Commerce, Chicago, is making matters decidedly lively for competitors, with the Economic incandescent lamp. This lamp seems to have jumped into popular favor at a bound, and justly so, judging from the favorable comments that are daily being received from its patrons. The above named company has the exclusive right to sell these lamps, from the eastern boundary of Ohio to the Pacific coast, and have received orders from the extreme confines of their territory, beside placing them largely in neighboring States. This, surely, is a commendable record for two months' work and Mr. Geo. L. Kirkham, the manager of the company, is to be congratulated upon his success in his new departure.

The Thomson-Houston Electric Company report the following recent sales made through its Western Isolated Lighting Department: Smith Steam Baking Company, Kansas City, Mo., 50-light incandescent plant; Wainwright Real Estate Company, St. Louis, Mo., 3,000 incandescent lights; Iowa Agricultural College, Ames, Ia., 6 arc light dynamo, 35-light incandescent dynamo, one 1 horse-power motor and appurtenances for

laboratory use; Cudahy Packing Company, Sheffield and North avenues, Chicago, 125 incandescent lights; Carson, Pirie, Scott & Co., Franklin and Adams streets, Chicago, 35 arc light and 400 light incandescent plants; S. S. Badger, Ouray, Col., 100 incandescent light plant; Central Market Co., State and South Water streets, Chicago, 18 arc light plant and 200 light incandescent plant; Chicago City Railway Co., 150-light incandescent plant; H. H. Sheffield & Co., 23 Larrabee street, Chicago, 250-light incandescent dynamo to increase capacity of plant sold last November.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOMS 7-12, "WORLD" BUILDING,
NEW YORK, May 30, 1891.

A patent (No. 451,885) has been granted to Dr. S. S. Wheeler, of the Crocker-Wheeler Motor Company, of this city, on a method of constructing field-magnets of electric motors.

Mr. Frank Fuller, of the well-known house of Fuller Bros., Boston, has surprised his friends and taken unto himself a wife. The couple are stopping in this city at the Hotel Bartholdi for a few days. The writer is unable to mention the name of the happy bride.

The United Street Railway Improvement Co., formerly of 50 Broadway, have moved into the handsome new Columbia Building, 29 Broadway, where they are prepared to consult with street railway companies for the development of any intended improvement. The officers of this company, Mr. R. T. McCabe, president and W. R. Heath, treasurer, are men well qualified to undertake the development of any street railway company.

W. S. Norman, General Manager of the Edison Illuminating Co., Spokane Falls, Washington, is highly pleased with the development of business in his section. The representative of this paper, in discussing the improvement of their business, derived the following facts: They are using over 100 H. P. of C. & C. motors in all sizes for commercial and manufacturing purposes; 40 H. P. Thomson-Houston motors, as well as a variety of general motors, including the Crocker-Wheeler and others.

W. H. Gordon & Co., 115 Broadway, manufacturers and dealers in electric light and railway specialties. Their Mr. Sparling was found actively engaged the past week taking orders for electric light switches, cut-outs, Simplex wires and cables and general electrical equipment. This firm are meeting with excellent success with their various specialties. Mr. W. H. Gordon is now on the road, and the firm report the reception of some big orders at their office for specialties from that gentleman.

Mr. Chas. E. Bibber, general manager of the Consolidated Electric Manufacturing Company, 196 Summer street, Boston, Mass., was in town the past week, and took home with him some very fine orders. His jack knife switches, slate and wood bases, are meeting with universal success. This concern is also manufacturing lamp sockets in large quantities for the trade and light companies. For both these specialties the company are away behind in their orders, but expect to keep up to the demand very shortly. This company manufacture to order all kinds of electrical apparatus and supplies of every description, in large quantities.

The Hill Clutch Company, manufacturers of power transmission machinery, pulleys and couplings, mechanical engineers, with home office at 15 Cortlandt street. Mr. Irwin, the New York manager, has just completed the fitting up of his offices, which are well appointed. He was, when our representative called, arranging to put in several of their clutches and specialties. The lubrication of all bearing surfaces of their specialties is accomplished in a most ingenious manner. The oil is carried around the shaft and distributed around the top by a very neat device, so that the bearings are kept constantly oiled, and there is no danger of a drying or heating.

The Electric Railway Specialty Co., 29 Broadway, are general agents for R. D. Nuttall & Co.'s specialties, electric railway supplies, compression spring trolleys, swivel wooden pole and hinge. These goods are on the road for immediate delivery, and are said to be the most durable, simple and effective, and at moderate price. Nuttall's patent wooden tooth gear wheel, is meeting with a hearty welcome from street railway men, and it would be worth the while of all those not using Nuttall's goods, to investigate them before placing their orders for head insulating fixtures, span wire, trolley wire, ratchets, as well as rail bonds, tools, wooden and iron poles, etc.

The New York & Ohio Company, offices No. 1 Broadway, J. W. Peele, president and general manager. This company are meeting with well-earned success with their lamps. They report the burning of their lamps as A. 1., and the hours countless. Wherever the lamps have been placed they have given such universal satisfaction that none have been duplicated yet. We made a report a short time since from the Richmond Electric Light & Power Co.'s station using these lamps, that they burned 1,700 hours. We are in receipt of information from the Richmond Co. that we were in error; that the lamps have burned over 3,000 hours and are still keeping up their good work.

J. G. White & Co., of the Electric Railway Specialty Co., have moved from 50 Broadway to the new Columbia Building at 29 Broadway. They have a suite of rooms overlooking New York Bay. The view is most magnificent, as it is not cut off by surrounding buildings. It ought to be a great pleasure for electric and street railway men to consult these gentlemen on the engineering and construction of their work under contract. With their assistance, much better and more efficient equipment at less cost can be obtained, and the suggestion is made here, to write these people before making contracts, and give them an opportunity to prove their ability to carry forward successfully the equipment of electric railways in any part of the country.

The Field Engineering Co. are very happy in their new home in the handsome new Central Building, 143 Liberty street. This firm have equipped some of the largest electric railways in this country. They have been enlarging their force in the construction department, also in the designing department, and undertake full engineering, designing and equipment of electric railways under contract, including steam and power plants. They have two roads 175 miles of single track. The officers of this company are: C. J. Field, President and Chief Engineer; E. F. White, Vice President and Mechanical Engineer; G. H. Gale, Secretary and Treasurer. The two former gentlemen, particularly Mr. Field, the writer has known since he first began business, and can speak in the highest terms of his ability.

Messrs. Truex & Vail, electrical constructors and exclusive agents for the Accumulator Co. for New York, New Jersey and part of New England territory, also agents for the Walker Electric Meters, who lately moved to 136 Liberty St., in the new Electrical Exchange Building, report quite an active business in their line. These gentlemen are a team in themselves, and their capacity for undertaking large contracts cannot be excelled. They are placing an accumulator plant in the residence of G. B. Newton Braemer, at Tarrytown-on-the-Hudson. Several series of accumulator cells will furnish current for 80 lights. They are also equipping the steam yacht "Romola," formerly the "Catarina," owned by Mr. Pulitzer of the New York *World*, with 55 cells; also Commodore W. H. Starbuck's yacht "Tilly," and have made numerous other sales to the electrical trade. They are introducing plants in different parts of their territory.

Mr. T. J. Murphy, manufacturer of slate bases for electric light, power and railway switchboards, also bases and tops of all sizes made to order, has lately received orders to furnish a switchboard to the Western Electric Co., requiring 65 sq. feet of slate, to be made up for a board 7 x 6 feet. Mr. Murphy made the handsome switchboards for the Eureka Electric Co., which were installed in their plant in the Manhattan Building, 40 Wall street, New York. He is now making a very handsome board for the Electric Construction & Supply Co. of 18 Cortlandt street, for their big 189 arc light plant in H. B. Claflin & Co.'s store. It is 13 feet long, and 6 feet 1 inch deep, and is said to be one of the largest boards introduced in an electric light plant. On examining some of his samples of marbleized slate, it was hard to see any difference between that and marble, as the work is so well and handsomely done. The marbleizing is done under a special process, and will never deteriorate through the action of heat or other destroying agencies. Mr. Murphy is always glad to receive communications from those desiring goods in his line, and will be pleased to receive all inquiries at 96 Columbia ave., New York.

W. T. H.

FINANCIAL.

Hello!! Hello!! Connect me with Electric Investor, Central, please. Hello!!! Yes, sir, this is Mr. Ellery. I have your letter before me; you seem to have chosen securities which are not in the market at the moment, unless you pay fancy prices. I don't think Sawyer-Man shares can be obtained, or in fact have ever been issued. United States Drug Stores are sought for by several parties. Will advise you of first transfer. The negotiations have not reached the point at which shares are being delivered. The Gamewell is held by a few people who are so well pleased with it they are sorry there is not more for them. Pittsburg Reduction inform me they are too busy to even think of selling any stock at present; later on there will be a chance for you at a little higher price. New England Butt is sought after, and money is ready for the few shares out. Empire City Subway, not organized yet, will no doubt be ready for you within thirty days, when you will find it quoted correctly in the list. Edison General, like Western Union, you had better buy through a member of the Stock Exchange, and can have at current daily market price. There are, however, some good things being offered at list prices, among them I quote you 50 Brush-Swan of New England, 400 Averell Ins. Cond., 500 Elec. Sup. & Construction, 30 U. S. Volta Elec. Batty., 25 Essick Printing, 500 Burrell Elec. Signal, 34 North N. Y. Lighting, 100 Brooklyn Edison Ill., 25 Brush parent pref., $10,000 Hunt Engineering 6s, 200 Int. Conduit & Ins. Co., 300 N. Y. Storage Batty., 500 Winston-Salem E. St. Ry., 1,000 Welsbach —800 Welsbach of N. Y., 100 each Pennock Co.'s, $10,000 Kansas Elec. Co. 6s, $15,000 Livingston E. L. Co. 6s, 100 Richmond L. H. & P. (S. I.). I am trying to collect a list of the local electric companies outside of the large cities with the amount of dividends they pay, and advise you, if you can't satisfy yourself among the above lot, to wait its publication, the last heard from being the Edison E. Ill. of Lebanon, Pa., which paid, June 1, 4% semi-annual dividend, or at the rate of 8%. This is not only its third cash dividend but a 20%

stock dividend was paid about two years ago. The officers are Jacob M. Shenk, president; Geo. D. Rise, secretary; and E. H. Brooks, superintendent. If you have any U. S. Ill. of N. Y. to sell cheap let me know. If you want to make a regular Langtry plunge try Westinghouse. Good-bye.

At the meeting of the Manhattan Elevated Railroad Company on the 27th of May for the purpose of ascertaining the feeling of the shareholders on the subject of increasing the capital $4,000,000 to be applied to the extension of rapid transit, 218,408 votes, representing $21,840,800, were cast in favor of the increase. Would not this be a good time for the company to thoroughly test an approved electric motor on the new structure. There are few situations or conditions in the whole country, if any, which offers the requisite facilities, equal to the elevated road. If electric science has produced a method which practical engineers after the usual examination, prior to absolute proof by actual work, are satisfied will replace the present steam engine, the public are entitled to know it. There is no question about the trolley system. Companies with large capital invested are successfully enjoying it in a great many of our cities, and regular dividends are not only paid but are increasing annually. The trolley is here to remain. Having reached that point it is now seasonable to produce and introduce a system for service where the trolley is for any reason objectionable. We have had numerous specimens, yet for some reason none have been adopted. They were in many instances installed and a few interested people and a press representative or two were present at from one to half a dozen exhibitions; then the creature was relegated to the vacuum especially created to annihilate non-success. Surely the principle and the application has been discovered, the peculiar special device necessary to complete them will be easier found if a little confidence is given to each other. Long Island is happy with the Brooklyn City Railway Company's new electric road from the city line to Gravesend Bay. Under the new corporation law only five cents can be charged for a continuous journey on any road and its branches. When electricity is used within the city and connection at the city line complete, a through ticket will become a cheap seaside excursion, while the nimble nickle will grow sufficient to assure a satisfactory dividend.

Every electric light shareholder is interested in the suit now pending in the U. S. Court between the Edison and the United States corporations to establish ownership of the incandescent patents. In case the U. S. gain a verdict the incandescent lamp practically becomes public property. Should the Edison get the verdict there are other Richmonds in the field who have been keeping their powder dry for many years waiting for a grand tournament with the winner. Millions are involved, as aside from the question of damages is the profit on about 200,000 lamps pe rmonth, which is the present demand. The value of stocks will not change unless the Edison win the case, and enhance their shares to the amount collected and the prospective profit from lamps as sole manufacturers. It is hardly possible that either the opinion of the court or the verdict of the jury can vest the ownership in any other company.

The Rapid Transit Commissioners have practically settled upon the route for the west side line from the battery to the city line, and turned the business over to the surveyors. They estimate the cost below Central Park at $3,000,000 per mile, and the upper portion at $1,000,000 per mile. There is little doubt electricity will furnish the motor power, but two secondary requisites must be accumulated in the shape of capital and property consent before an invitation to ride upon that rail will be in order.

Rowland N. Hazard, whose name is probably as well known to electric stockholders in New York City as any other connected with stock corporations, was sued last week by the Saratoga Gas and Elec. Lt. Co. for $57,000, and after two days before Judge Andrews the jury rendered a verdict in his favor. As Mr. Hazard was arrested when the complaint was made and held in $10,000 bail, there is some plausibility in the rumor that he intends to bring suit against the company for $100,000 damages for false arrest and malicious persecution.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
American Electric Motor Co.(N.Y)	1,000,000	25 00	3 00
American Private T'phone (N Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Amsterdam Electric St. R.R. (N.Y)	250,000	100 00	75 00
Anglo-Am. Elec Light Mfg. Co.	2,500,000	10 00	40
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	115 00
Averell Insulating Conduit	3,000,000	100 00	4 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	200 00
Bell Telephone 7's	2,000,000		*112 00
Boston Electric Light.	1 500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5s	6,000,000		par
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Illuminating (N. Y.)	1 000,000	100 00	60 00
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N Y.)	500,000	20 00	10 00
City Electric Street Ry. Co., 6's	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	105 00
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co 6's	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80 000		par
Cons. Gas Co. Batavia	100.000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co.	100,000	100 00	110 00
Detroit Electrical Works	1,000,000	10 00	11 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600 000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000 000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	2,000 000		*98
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating(N. Y.)	4,500,000	100 00	80 00
Edison General	14 000,000	100 00	101 50
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Empire City Subway Co. (N. Y.)		100 00	
Erie Telephone	4,800,000	100 00	49 00
Essick Printing Tel.	5,000,000	100 00	45 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior (N. J.)	500,000	100 00	
Excelsior Electric Co., 6's	300,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	12 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	par
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500.000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7 500,000	100 00	16 50
Laclede Gas pref	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*75
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light.	50,000	100 00	78 00
Manhattan Elec. Light Co. Lmtd 5's	1,000 000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 6s (N. Y.)			*95
Mount Morris Electric Light (N.Y)	500,000	100 00	90 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	103 25
Nat'l Cordage, pref.	5,000,000	100 00	106 50
Nat'l Lead Trust	9,000,000	100 00	18 75
New England Butt Co.	100,000	1,000 00	1,000 00
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	90 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. Storage Baty. Co.	100,000	100 00	55 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,000,000	100 00	20 00
North New York, Lighting	150,000	100 00	25 00
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	75 00
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s	300,000		*86
Saratoga Gas and Elec. Light	325,000		
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
Sawyer-Man Electric Light Co(N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation, N. Y.	100.000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L. H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	44 00
Thomson-Houston Pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100 000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000.000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Welsbach Inc. Gas.	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	80 50
Westinghouse Electric Co.	7,000,000	50 00	13 50
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			21 50
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

BOOKS, CATALOGUES, ETC.

THE ARITHMETIC OF ELECTRICITY—A Manual of Electrical Calculations by Arithmetical Methods. By T. O'Conor Sloane, Ph.D., Norman W. Henley & Co., 150 Nassau street; pp. 138, several diagrams. Price $1.00.

This book may be classed among the most useful works published on the science of electricity, covering, as it does, the mathematics of electricity in a manner that will attract the attention of those who are not familiar with algebraical formulæ.

It is a very common habit to read symbolical formulæ as a woman reads a novel, that is it is "skipped," thus the very substance of the subject is missed. This little book by Mr. Sloane is exactly what was needed by those accustomed to "skip" and will be equally valuable to the practical engineer and the student. The numerous rules, examples and tables in the field of practical electrical engineering and experimenting are given in plain arithmetical language, not an algebraical solution of an example appearing in the whole book.

HANDY LISTS OF TECHNICAL LITERATURE, compiled by H. E. Haferkorn, Milwaukee, Wis. Part II*a* is devoted to publications on electricity and magnetism, and is a valuable work of reference for every electrician. All books and periodicals on electricity are systematically and conveniently classified.

The catalogue of the Hay-Horn Manufacturing Company, of 63 S. Canal street, Chicago, Ill., just received, is very complete and tastefully gotten up. It is filled with cuts and descriptions of nearly everything in the electrical line. The firm also make a specialty of experimental and contract work.

The new catalogue of the Mason Battery and Electrical Company, of 257 Broadway, New York, has just reached us. It mainly deals with their well-known Mason primary battery for electrical lighting and power plants, and gives data for different size plants run by these batteries.

PERSONALS.

Mr. D. H. Bates, of the Equitable Electric Manufacturing Company, will leave for Europe about the middle of July in the interest of his company.

Mr. E. V. Baillard now has charge of the Equitable Electric Manufacturing Company's factory, which is situated at No. 611 West Thirty-sixth street, this city.

BUSINESS NOTES.

The Hay-Horn Manufacturing Company has succeeded the Walter Hay Manufacturing Company of Chicago. The capital has been largely increased, and with the larger quarters which they have secured at the old number, 63 South Canal street, are better prepared to manufacture anything electrical.

Messrs. Vaslier & Mosquera, of Havana, Cuba, have just installed at the Western Railway Station, in that city, where Mr. Vaslier is chief of the telegraph department, fifty cells of Edison-Lalande batteries of the type "G," 300 ampere hours capacity, and they are giving the greatest possible satisfaction. The Western Railway is 120 miles in length, with 22 telegraph stations. The galvanized iron wire used is No. 9 gauge, with all contacts soldered. At each end of the line, 15 cells of the Edison Lalande battery have been set up for main circuit uses, while other cells perform the local work at each of the stations.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued Tuesday, May 26th, 1891.

452,771. Police Signaling Apparatus. Henry A. Chase, Boston, Mass. Filed July 18, 1890.

A signal-transmitter comprising a motor mechanism, a signalling key, and a removable signal-wheel fixed to a tubular shank, and a head on the shank, on which the number on the wheel is placed.

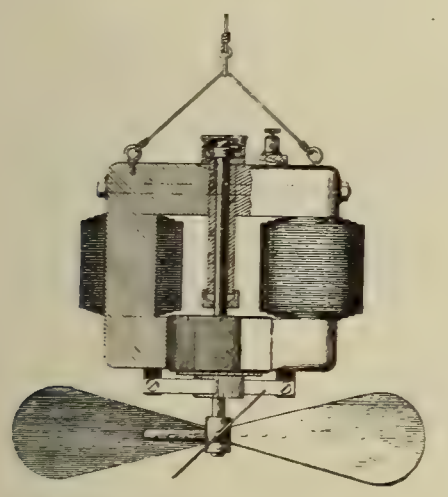
452,775. Telephone Receiver. Charles T. Dickson, Cincinnati, O. Filed Aug. 14, 1890.

452,780. Incandescent Electric Lamp. Isaac J. Flagg, Clinton, Mass. Filed Sept. 17, 1890.

An incandescent lamp having its bulb and socket in one piece of vitreous material and the insulated suspensory containing the conducting wires, combined with terminals for the lamp and with which the conducting wires are joined within the socket, and water and moisture proof insulation surrounding the terminals and the bared conducting wires at their point of junction within the socket.

452,785. Coin-Controlled Annunciating-Machine. Harry M. Hamrick, Philadelphia, Pa. Filed Feb. 24, 1891.

A coin-controlled machine having a slot for the reception of coins of different denominations, a series of spring actuated contact switches connected together by a conductor leading to one electrode of a battery, a series of contacts connected together by a conductor leading to the other electrode of the



472,795—ELECTRIC MOTOR.

battery, a movable plate, lugs for separating the coins and detaining those of like denominations above certain of the switches and beneath the movable plate, and means for shifting the plate in order to cause the coins to turn the switches into engagement with the contacts.

452,795. Electric Motor. Charles J. Kintner, New York, N. Y. Filed June 14, 1890.

An electric motor having a field-magnet core divided at its neutral point, in combination with an armature carried by a shaft having longitudinal movement in its journal-bearings, and a fan attached to one end of the armature shaft.

452,796. Hollow Braided Lightning-Rod. George R. Kress, Pittsburg, Pa. Filed Nov. 8, 1890.

A lightning rod or conductor, with a hollow plaited continuous cable, with a stiffener consisting of a solid rod inserted therein and connected therewith at its upper end, forming a stiff top section.

452,799. Hanger for Incandescent Lamps. James A. Matteson, River Point, R. I. Filed Dec. 24, 1890.

452,871. Automatic Safety Electric System for Locomotives. Edward Deming, Brooklyn, assignor of two-thirds to Adolph Kaufmann and Isaac Stern, New York, N. Y. Filed Sept. 18, 1890.

In a locomotive, the combination, with the throttle-valve, of a stationary piece provided with teeth, a handle provided with a movable catch having teeth engaging with the former named teeth a lever-crank carried by the handle and connected to the catch, an electric motor, and a rod provided with a hole through which pass the lever-crank and handle, the rod being connected to a crank upon the shaft of the motor.

452,872. Automatic Safety Electric System for Railways. Edward Deming, Brooklyn, assignor of two-thirds to Adolph Kaufmann and Isaac Stern, New York, N. Y. Filed Sept. 20, 1890.

452,873. Automatic Electric Safety System for Railway-Switches and Draw-Bridges. Edward Deming, Brooklyn, assignor of two third to Adolph Kaufmann and Isaac Stern, New York, N. Y. Filed Sept. 22, 1890.

452,874. Automatic Electric Safety System for Railway-Crossings. Edward Deming, Brooklyn, assignor of two-thirds to Adolph Kauffmann and Isaac Stern, New York, N. Y. Filed Sept. 24, 1890.

452,875. Multiple Fuse-Block. Lorenzo B. Favor, Gloucester, Mass., assignor to the Thermal Electric Company, same place. Filed Nov. 3, 1890.

In a thermal cut-out, the combination with a spring-actuated finger and conductor-bar insulated from each other and electrically connected with the respective ends of the line-wire, of pivoted contact dogs insulated from each other, tension wires connecting the dogs with the bar, and fusible plugs of paraffine, spermaceti, or the like interposed as a resistance to the tension of the wires.

452,913. Sextuplex Telegraph. Thomas A. Edison, Menlo Park, N. J., assignor to the Western Union Telegraph Company, New York, N. Y. Filed June 2, 1877.

452,920. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa, assignor to the Electric Car Company of America, same place. Filed April 28, 1886.

The combination of two or more electric motors, the power transmitting devices between the two motors and each of the axles of the vehicle, reversible commutator brushes for each motor, means controlled at will by the operator for actuating the brushes to change the direction of rotation of the motor, a resistance in the motor circuit, and means for automatically controlling the resistance

452,921. Electrical Switchboard. John B. Lyon, Brooklyn, N. Y. Filed Jan. 19, 1891.

A section of weight-guide tubes for electrical switchboards, consisting of a plurality or group of rubber tubes, each provided with electrical contacts or electrodes, and all the tubes secured together by vulcanizing the rubber.

452,931. Electro-Mechanical Gong. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed Dec. 9, 1890

A striking arm or lever and means for moving it positively in each direction to strike a blow, and controlling mechanism which engages the striking arm or lever after each movement, combined with releasing mechanism for the controlling mechanism governed by the armature of the electro-magnet.

452,932. Electro-Mechanical Gong. Frederick W. Cole, Newton, Mass., assignor of one half to Moses G. Crane, same place. Filed Dec. 9, 1890.

452,934. Electric Motor or Generator. Walter K. Freeman, Brooklyn, N Y., assignor to William S. Hadaway, Jr., trustee, Boston, Mass. Filed Jan. 13, 1891.

In a motor frame the combination of the end castings, each formed in one piece and having connecting portions, around which the field coils are wound, and the flanges at each end of the connecting piece on the outside.

452,935. Electric Motor or Generator. Walter K. Freeman, Brooklyn, N. Y., assignor to William S. Hadaway, Jr., trustee, Boston, Mass. Filed Jan. 13, 1891.

452,936. Electric Meter. Walter K. Freeman, Brooklyn, N.Y., assignor to William S. Hadaway, Jr., trustee, Boston, Mass. Filed Jan. 13, 1891.

A method of measuring and recording electric currents, consisting in ascertaining the characteristic curve of an electric motor, developed by observing the performance of the armature of the motor under the influence of a varying current, applying such characteristic curve to a form causing it to partake of the motion of the motor armature when the latter is actuated by the current to be measured, imparting to the form an independent motion proportioned to the speed or the armature, and operating a recording mechanism by it.

452,937. Electric Switch. Walter K. Freeman, Brooklyn, N. Y., assignor to William S. Hadaway, Jr., trustee, Boston, Mass. Filed Jan. 15, 1891.

452,941. Dynamometer. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Oct. 13, 1890.

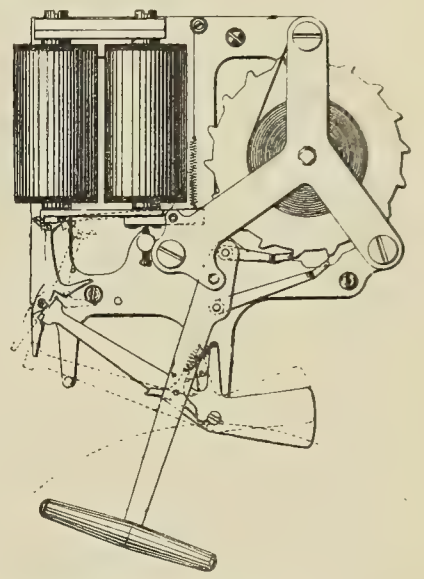
452,951. Armature for Dynamo-Electric Machines or Motors. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 5, 1890. Patented in England.

A ring armature core having a removable plug, with projections at its inner portion interlocking with the core ends to prevent spreading of the core and outward displacement of the plug, the remainder of the plug and core ends tightly fitting one another, but having no interlocking parts preventing inward movement of the plug.

452,955. Electric Transmitting-Clock. Henry S. Prentiss, Elizabeth, N. J. Filed June 6, 1890.

In an electric clock system, the combination of a transmitter, its escapement wheel and pallet lever, a primary clock provided with a cam or eccentric, a rod connecting the pallet lever of the transmitter with the eccentric of the primary clock, means for adjustment between the rod and the pallet lever, a series of secondary clocks, a generator of electricity and electrical connections.

452,956. Synchronizer for Electric Clocks. Henry S. Prentiss Elizabeth, N. J. Filed June 6, 1890.



452,931—ELECTRO-MECHANICAL GONG.

In an electric clock system, a synchronizing circuit closer adapted to repeatedly close the circuit through the synchronizing line at determinate intervals, in combination with switches for throwing the respective clocks into or out of the circuit.

452,992. Electric Motor for Wheeled Vehicles. Robert S. Dobbie, Jersey City, N. J. Filed May 9, 1890.

A wheeled vehicle having an electric motor elastically supported and having its rotary part secured to a hollow sleeve which surrounds an axle of the vehicle and is provided with elastic or yielding bearings at its opposite ends between it and the axle.

453,000. Electric Connection for Distributing Telephone Lines. William M. Goodridge, Highland Park, assignor to the Western Electric Company, Chicago, Ill. Filed Feb. 7, 1889.

The combination, with a switchboard, of a strip placed at the rear thereof and provided with spring terminals connected at the rear with the wires of the return portion of the cable, the front ends of the spring connectors being connected with the key-board apparatus.

453,002. Adjuster for Electric Lamp Reflectors. James E. Hamilton, Chicago, Ill. Filed Jan. 3, 1891.

453,029. Multiple Cut Out for Electric Distribution Systems. Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Feb. 16 1891.

The combination, with the supply conductors or mains on different sides of the generator, of cut outs consisting of binding posts or clamps for connection with the circuit to be supplied and each provided with a double cam-clamp, with which a U-spring connected with the main is adapted to engage.

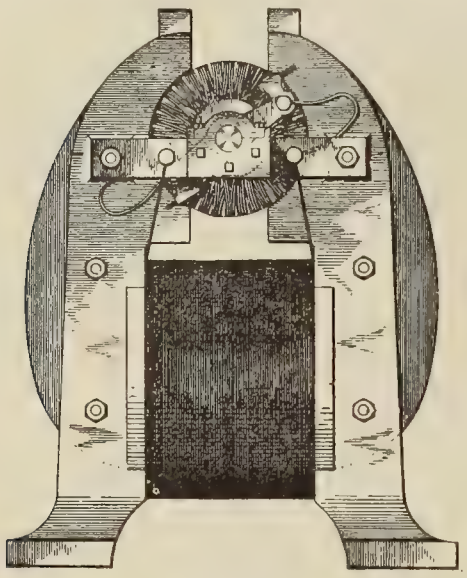
ELECTRICAL PATENTS—Continued.

453,031. Electric Motor. Elbridge Baker, Malden, Mass. Filed July 5, 1890.

An electric motor having its armature inclosed within the driving wheel and its field-magnet suspended beneath it.

453,032. Automatic Electric Switch-Mechanism. Harry H. Blades, Detroit, Mich. Filed Sept. 19, 1890.

An automatic switch mechanism for an electric motor, governing the admission of current to the motor, an electro-magnet on an independent shunt circuit, an automatic switch lever on the armature circuit, a series of resistances with



452,934—ELECTRIC MOTOR OR GENERATOR.

their terminals arranged to successively engage the switch lever, and a dash-pot to retard the motion of the lever which is actuated by the armature of the electro-magnet.

453,036. Adjustable Support for Electric Wires. Thos. H. Brady, New Britain, Conn. Filed Feb. 18, 1891.

A bracket for supporting wires, consisting of a socket piece having a base to facilitate fastening in place, a socket extending in a direction parallel to the base, a second socket extending substantially at right angles to the base, and a bracket-arm having a pin at its outer end for holding an insulator, a shank to fit the socket at its opposite end, and an angular body between the pin and shank.

453,041. Electric Display-Burner for Oil-Lamps. William A. Drysdale, Philadelphia, Pa. Filed Feb. 16, 1891.

An electric display-burner for oil-lamps, comprising an electric lamp, its socket, and an outer casing enclosing and hiding the socket, the whole being constructed for application to the reservoir of an oil-lamp.

453,046. Electrical Safety-Switch. George L. Hall, Lowell, Mass. Filed March 19, 1890.

The combination, in a closed electric circuit of a movable double switch consisting of two movable switches, one arranged in the line out and the other in the line in, the switches being insulated from each other but mechanically connected to each other an electro-magnet arranged in the same circuit and its armature secured to one of the switches, the magnet being arranged to hold the switches closed when the current is uninterrupted and at other times to allow them to be opened and the circuit to be broken in two places.

453,070. Support for Trolley Wires. George K. Wheeler, Chicago, Ill. Filed Nov. 21, 1890.

A support for trolley-wires, consisting of a trough provided with ears and a hanger extending away from the bottom of the trough in the same direction, and the outer surface of the trough opposite the ears being formed to serve as a track for the trolley wheel.

453,093. Trolley-Wheel. John Sullivan, Washington, D. C Filed Feb. 19, 1891.

A trolley wheel for an overhead electrical conductor, having toothed portions in the bottom of its peripheral groove.

453,097. Electric Railway-Signal. Willie Cowles Walter, Richmond, Va.; Sophia Lee Walter executrix of said Willie Cowles Walter, deceased Filed Nov. 11, 1889.

An electric railroad signaling system, consisting of a conductor extending parallel with the track and insulated from the ground, and a stationary contact insulated from the ground and located beside and normally out of engagement with a rail and electrically connected with the conductor.

453,104. Electric Contact-Brush. James R. Branch, Richmond, Va. Filed Oct. 28, 1890.

A contact-brush consisting of a bracket, a supporting rod carried by the bracket in vertical adjustment, a hollow holder rigid on the lower end of the rod, and a carrier removably located in the holder and carrying contact devices.

453,111. Electric Fuse Box. William Edson, Boston, Mass., assignor to the Beacon Vacuum Pump and Electrical Company, of Maine. Filed Jan. 21, 1891.

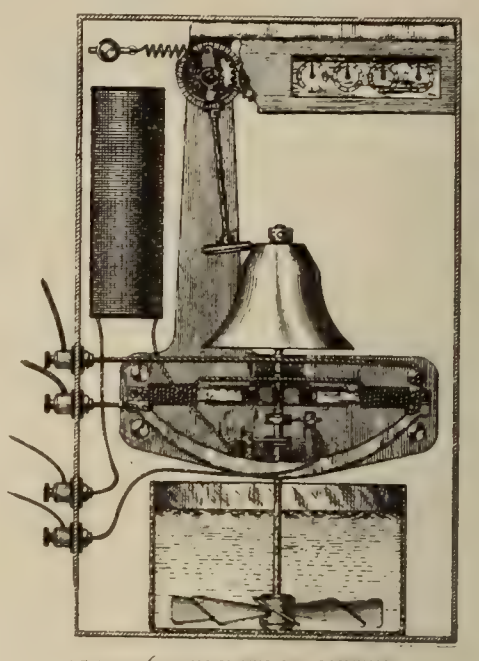
In a fuse block, the combination of a fixed part having a central pivotal post electrically connected with one end of the severed line wire, a circumferential post connected with the other end of the line-wire, and a contact plate electrically connected to the circumferential post with a rotating block having a series of contact-blocks and fuses electrically connected severally with the central pivotal post, the contact-blocks being adapted to be brought, as desired, into electrical connection with the circumferential post of the fixed block.

453,162. Apparatus for Hardening and Tempering Steel and Iron. Elias E. Ries, Baltimore, Md. Filed Oct. 31, 1888.

In an apparatus for hardening and tempering bands, webs, or rods of steel or iron, the combination of two successive sets of electrical contacts, constituting the terminals of a charge circuit, and a chilling medium arranged behind the last set of contacts, with means for independently adjusting the relative distances of the contacts from each other and from the chilling medium, and feeding devices for passing the steel or iron article uniformly and continuously between the contacts and through the cooling medium in uninterrupted succession.

453,163. Method of and Apparatus for Hardening and Tempering Steel and Iron. Elias E. Ries, Baltimore, Md. Filed Nov. 2, 1888.

A method or process of hardening and tempering steel or iron articles consisting in passing a current of the proper heating effect through the whole length of such article until



452,936—ELECTRIC METER.

it has attained a predetermined degree of incandescence, then interrupting the flow of current and simultaneously therewith immersing the article throughout its whole length in a chilling medium, and then reheating the chilled portions to the required temper.

453,164. Art of Repairing Metal Structures by the Aid of Electricity. Elias E. Ries, Baltimore, Md. Filed Nov. 9, 1889.

A method of repairing fixed metal structures, consisting in cutting out the defective or objectionable section, and then inserting a new section in place of the old and welding it at both ends electrically to the fixed structure.

453,167. Electric Locomotive or Street-Car Motor. Rudolph Eickemeyer, Yonkers, assignor to the Eickemeyer-Field Company, New York, N. Y. Filed Oct. 28, 1890.

In an electric street-car or locomotive, the combination of a slow-speed electric motor having an iron cored armature, field coils which surround and directly polarize the armature, and a shell or casing surrounding the armature and coil, springs which relieve the motor from strains and shocks imparted from the rails to the axles or driving wheels, and pitmen or links with cranks which directly connect the armature-shaft and the driving wheels or axle.

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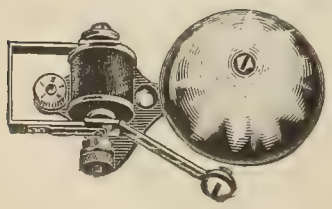
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WEEKLY.

Vol. IX NEW YORK, JUNE 13, 1891. No. 24.

A MODEL ELECTRIC LIGHT PLANT.

One of the handsomest and most complete electric light plants in this vicinity is that in the dry-goods house of H. C. F. Koch & Co., 125th street, New York, which was installed under the direction of Charles H. Davis, C.E. We give below an excellent illustration of this plant, which is located in the basement of the building.

The generating plant consists of two Thomson-Houston compound-wound dynamos, one of 800 light and the other of 400 light capacity. Each machine is driven by an independent high speed Harrisburg "Ideal Self-Oiling" engine of 80 and 40 horse-power respectively, having by an ingenious and extremely simple arrangement an antomatic continuous stream of oil flowing on every bearing. The foundations for the machinery are constructed in a most substantial manner, effectually preventing vibration from being transmitted to any part of the building.

The main switchboard is so arranged as to allow the generators to operate together or alone on any or all the circuits. It is made of enameled slate and has voltmeters, ammeters, rheostats and all necessary controlling devices upon it.

A separate circuit runs to each floor feeding a slate panel with local switches, by which means complete control of all the lights on each floor is secured. In the basement there are 136 lights, and the first floor is lighted by 246 ground glass lamps placed on beautiful fixtures arranged in seven rows running the length of the store.

The show window deserves special mention, being lighted as no other window of its kind in New York. The lights here are placed against the ceiling, with 12 inch double glass reflectors for each light. There are ten lights to each window, forty in all. These reflectors are the feature of the show window lighting, being made of glass front and back, the space between filled with a mercury compound, and hermetically sealed. They never tarnish, are extremely bright, and with ground glass lamps reflect a powerful but soft light. These reflectors are manufactured by the Thackera Manufacturing Company, of Philadelphia.

The second floor is lighted by 216 lamps all on fixtures, as on the floor below, except a few reflectors in fitting rooms and other dark places.

The lamps on the third floor, 200 in number, are mostly on fixtures, while on the fourth floor, 200 silk drops are used, the wiring being on insulators and all exposed.

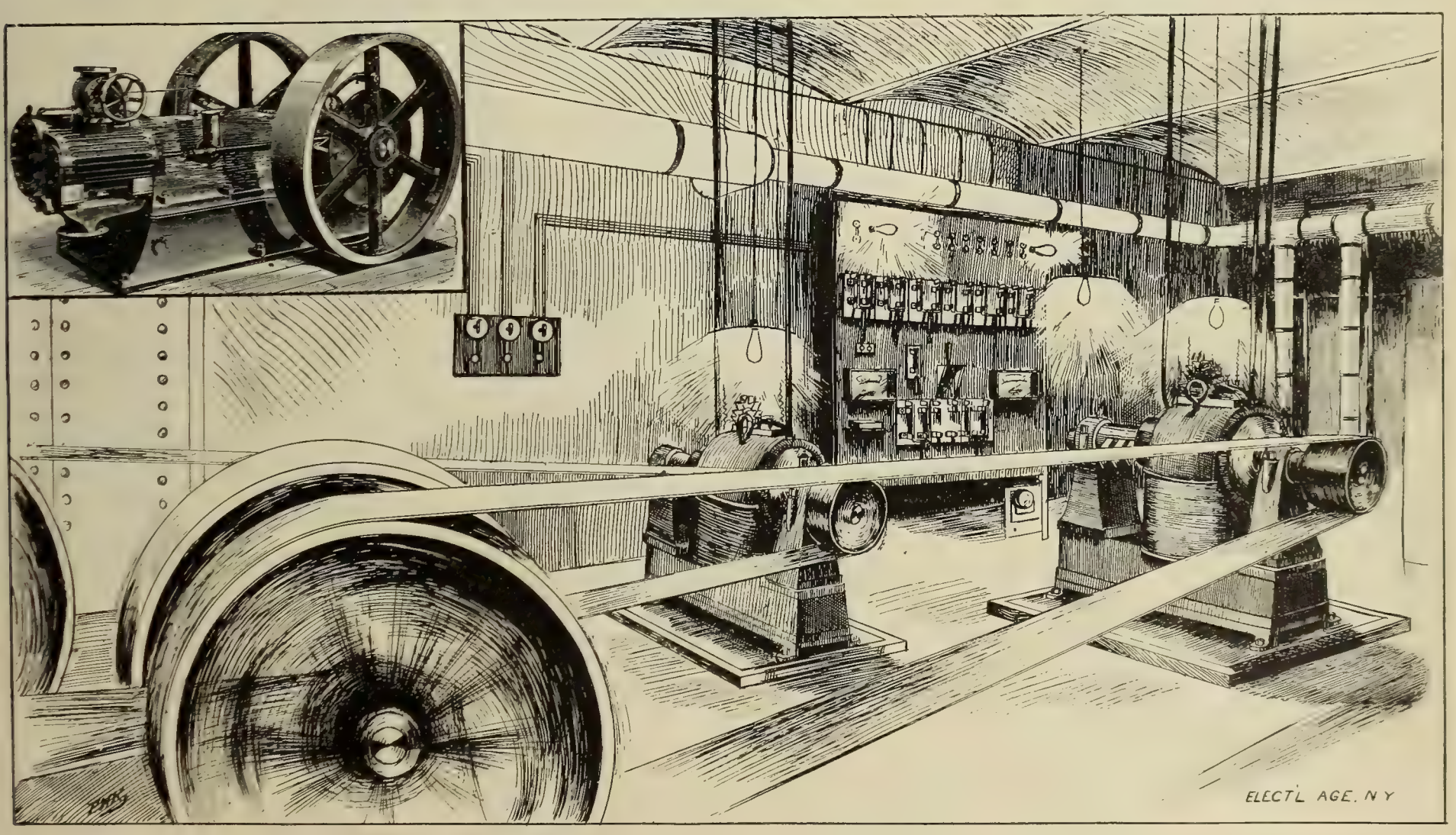
There is a total of 542 outlets and 1,007 16 candle-power lights. Such distribution and variety was used in order to place the lights advantageously for the purpose used.

There are 100 switches, giving absolute and convenient control to all lights. Grimshaw White Core wire was used throughout, it being placed in moldings run on stringers in the air spaces between the floors and iron ceiling.

The mains from the basement are run in moldings placed in position by plugging walls and screwing thereto. They are finished to conform with the surrounding woodwork. All concealed molding is painted inside and out with P. & B. waterproof paint, and all lights are controlled by switches located in the main pocket, one for each floor, where all fuses are also placed.

This plant is simple in its design and construction, and is especially flexible in its control. The work was designed by, and executed under the direct supervision of the Consulting Engineer, Charles H. Davis, C.E. The contractors were: Engines, W. R. Fleming & Co., 174, Fulton street, New York, electric plant and wiring, by Curtis & Dean, 115 Broadway, New York agents Thomson-Houston Electric Company, and fixtures, the Mitchell-Vance Company.

The larger dynamo delivers a current of 240 amperes at 125 volts at 900 revolutions a minute, and the smaller machine the same current and voltage at 1,170 revolutions. There are 74 Thomson-Houston vertical switches and 10 Thomson-Houston knife switches. The size of the main switchboard is six by four feet.



ELECTRIC LIGHT PLANT IN DRY GOODS HOUSE OF H. C. F. KOCH & CO., NEW YORK.

POLICE ELECTRIC SIGNALING APPARATUS.

In our issue of May 9 last, we gave an illustrated description of the Police Signal Telegraph system of the Gamewell Fire Alarm Telegraph Company, 1½ Barclay street, this city. That company has been making some recent and important improvements in their apparatus and accessories, a further description of which will be of interest to our readers.

The system complete includes a "stable outfit," an illustration of which accompanies this article (Fig. 1). This apparatus is placed at the various patrol stables, so that the signal may be received from headquarters instantaneously. Three records are made of each call, consequently it is hardly

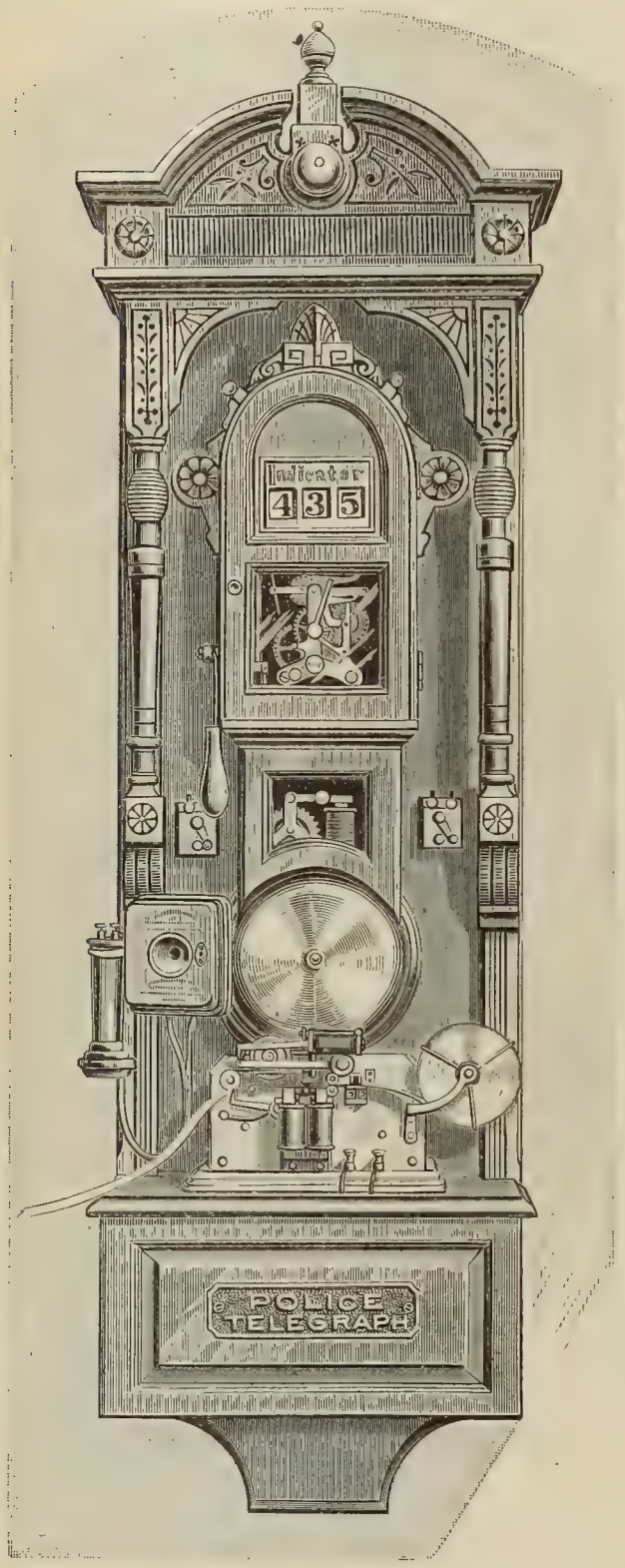


FIG. 1—STABLE OUTFIT.

within the range of possibility that a signal can be misunderstood. In the first place, each signal is sounded on the large gong shown in the cut. It is also recorded on the register, which is seen at the lower part of the illustration, and the numbers at the top also show whence the signal comes.

In addition to this there is a telephone signal which consists of a vibrator and a push button at each end of the line. When the signal is given, the operator at the patrol stable and the one at headquarters use the telephone to carry on conversation.

The outfit is most artistic in design and of the best workmanship. The case hangs up against the wall, and is consequently in plain sight of the attendants.

The record of each signal as it is received on the register is punched out on a strip of paper, and is therefore an indelible one. On the same strip and by the same instrument the time each, signal is received is printed, thus rendering the record complete.

Fig. 2 gives a view of the Central station outfit. The instruments are placed on a cabinet of elegant design and finish, and a glance at the illustration impresses one with a strong suggestion of simplicity.

The transmitting apparatus consists of a dial instrument shown on the top of the desk. The handle is turned until it points to the number which it is desired to transmit, and then the transmitting apparatus is put into operation by a lever.

The other dial shown in the cut is the telephone switch by which the office may be placed in telephonic communication with any one of the number of circuits in use, as well as with stable.



FIG. 2—CENTRAL STATION OUTFIT.

The register is a multiple pen instrument of excellent workmanship and finish. It is self starting, and the signal received is recorded on the paper ribbon in ink. The time of receipt of the signal is also recorded by an automatic time stamp.

The outfit includes relays, switches and galvanometers which are not shown. The galvanometers are placed elsewhere, to be beyond the influence of the operating instruments, and the relays and switches are also placed apart from the instruments on the desk, where they cannot be tampered with.

The telephone is for use in the manner already described, and this apparatus is so well known that a description of it here is unnecessary.

The cabinet is an elegant affair, and is produced at the wood-working department of the Gamewell Company's factory in Newton, Mass. The design and work is all their own, and its artistic appearance reflects great credit upon their taste and ability.

The Gamewell Company are constantly improving their apparatus, which is giving the best of satisfaction wherever it is used.

TELEPHONE NOTES.

The Tropical American Telephone Company of Boston has just been awarded the gold medal for its "Tropical" telephone sets, both for long distance and commercial uses, at the Jamaica Exposition. These sets are manufactured for it abroad, and are especially adapted for its export trade in tropical countries. Great care is taken to guard against corrosion of the exposed parts, the contacts being pointed with platinum, and the workmanship is first class in every respect. These export sets are sold outright, and many testimonials to their excellence are being received from its customers in South America and West Indies.

The Tropical American Telephone Company of Long Branch (the Boston company) began a suit against the Western Electric Company of Illinois in the United States circuit court a few days ago, to enjoin the use by that company of "electrical annunciator drops" for telephonic signals. An accounting is also asked for. The Tropical Company claims ownership of these drops by assignment. It is claimed that the Western Electric Company, the manufacturing concern of the American Bell Telephone Company, appropriated this drop and has manufactured and sold it in large quantities.

The Metropolitan Electric Railway, of Macon, Ga., has track laid to Ernest's, a distance of two miles from the foot of Cherry street. It is proposed to have cars running on this line by July 4.

Watkins, N. Y. is to have an electric light and power plant.

THE BURTON HEATER.

A railroad commissioner, in discussing methods of heating railway cars, recently said that electricity was as yet too dear to enter into the question. Similar opinion was expressed by a well known electrician some weeks ago in regard to domestic heating. If in one field the mechanical appliances necessary are not yet so perfected as to permit of its adoption and in the other the cost of current may be too great, yet for the heating of electric cars, it has been thoroughly established that electricity is not only an agent theoretically perfect but one whose use is economically practicable.

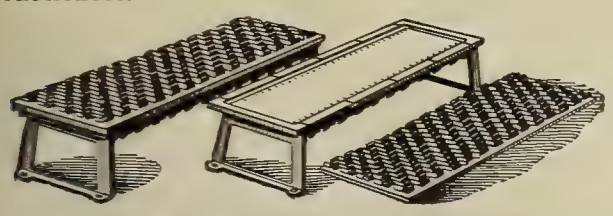


FIG. 1—IRON CASING AND COVERING.

This has been demonstrated beyond the possibility of a doubt, by the application on electric roads of the Burton electric heater, the invention of Dr. W. Leigh Burton. The history of this invention, in some respects remarkable, chronicles some marked triumphs, not unhampered, it is true, by the unusual suspicion in which a new departure is regarded. For some years Dr. Burton had devoted much attention to electrical science and had carried on a long series of experiments with electric heaters. Beginning with the well-known fact that the heat generated in a conductor is proportional to the resistance of such conductor and the strength of current used, the problem was to devise some arrangement whereby the wires when given current such as would heat them to a requisite intensity, would yet be in no danger of fusing. After much experiment, it was discovered that the platinum or any wire of refractory material, when of considerable length, if surrounded by finely powdered fire clay or similar substance, will, without danger of fusing, carry an electric current of such strength as would instantly destroy it if not thus surrounded. In this way the entire surface of the wire might be covered by a material which, although able to communicate the heat to the surrounding atmosphere, is of such high electrical resistance that it will not carry off a sufficiently large portion of the current to prevent its efficient action as a heat producer.

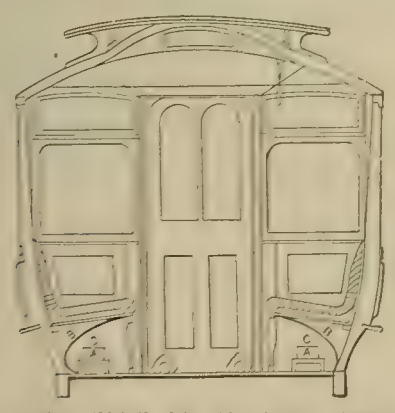


FIG. 2—END VIEW OF HEATERS UNDER SEATS.

A patent was granted to Dr. Burton upon the practical application of his invention in 1887 and some time later he secured another patent on an improved method of electrically connecting the heaters. Up to the present time, however, its use has been confined to electric cars. The apparatus used in street car work and the method of wiring will be readily understood by reference to the accompanying diagrams.

Figure 1 shows the iron casing with a corrugated covering to facilitate the radiation of the heat, which contains the German silver wire stretched back and forth across the case and embedded in the fire clay. In wiring the ordinary street car, two such heaters are usually placed on each side under the seats, as shown in figures 2 and 3. The wiring is very easily done. Connection is made to the trolley wire in one corner of the car and the current conveyed through the heaters under one seat and carried to the other side to a ground connection on the truck. The method of wiring adopted by the company is shown in Fig. 4 and for the street car service the electrical resistance of the heaters is so adjusted that on a 450 volt circuit they use three amperes of current. When, therefore, the handle of the switch A is turned on L "shunt" from line connection and B closed, the heaters are closed in series of two for a short time only, causing the use of six amperes of current in each set. When a sufficiently high temperature has been attained in these—which will be in fifteen or twenty minutes—the handle of A is turned on G ground connection and B opened. This causes them to be thrown in series of four, when the heat will be maintained in them for a long time without being appreciably lowered, with the use of only three amperes of current.

The process of warming the cars is supposed to take place in the morning before the car leaves the shed, when there is no other use for the current. The normal use of the current, however, being only three amperes, the cost would be calculated on that basis. As far as regards expense, it has been proved to the satisfaction of the officials on a number of roads that it is fully as economical and even more so when service and contingent expenses are considered, than the ordinary coal stove. Lieut. S. Dana Greene, the well-known electrician, and who is consulting electrician for the Burton Company, estimates the cost to amount to less than ten cents per day for each car, and in some cases this estimate has been found too great.

The Company are constantly in receipt of testimonials from various roads speaking of the heating in the highest terms as regards safety, comfort and economy. The patrons of the road using the heater, are even more enthusiastic than the officials, and to any one familiar by sad experience with the dirty and gaseous condition of the average coal heated car, the absolute cleanliness and absence of odors, together with the temperature of a car electrically heated, is a revelation in modern car heating.

The electric heater would find its warmest welcome, however, as a successor to that "deadly car stove" to whose account so many tragedies must be placed. Here the absolute safety of the electric heater should commend it, even though dividends were lessened somewhat by its use. By the employment of dynamos and storage batteries now carried on trains for incandescent lighting, the heater could be used and the increased safety and comfort would more than compensate for any expense involved.

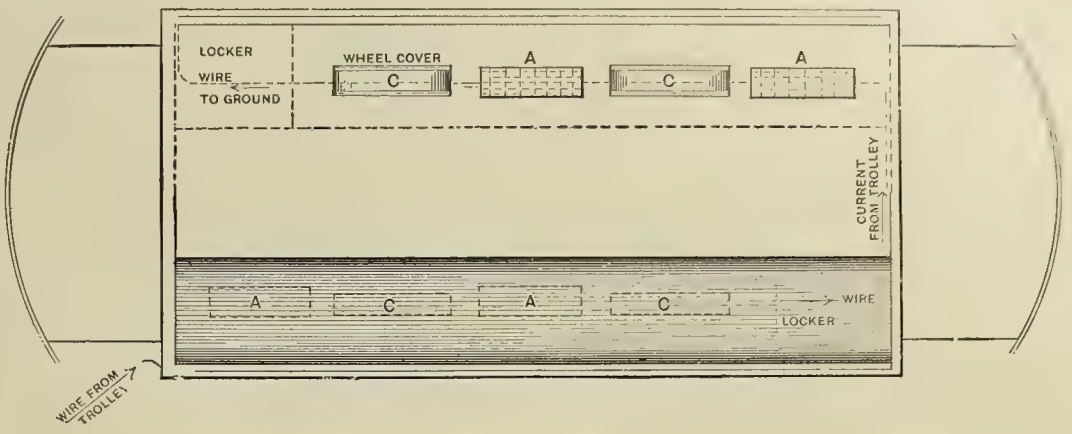


FIG. 3—PLAN VIEW.

Other uses for the heater are innumerable and suggest themselves at once. With its almost ideal qualifications, its general application is warmly urged by those familiar with its operation, and when once before the public, there can be no doubt of its rapid sale.

The John Scott legacy medal has been awarded the inventor for his electric heater, on the recommendation of the Franklin Institute, of Philadelphia.

The heaters are manufactured by the Burton Electric Company, Richmond, Va., for whom the Electric Merchandise Company of Chicago, are selling agents.

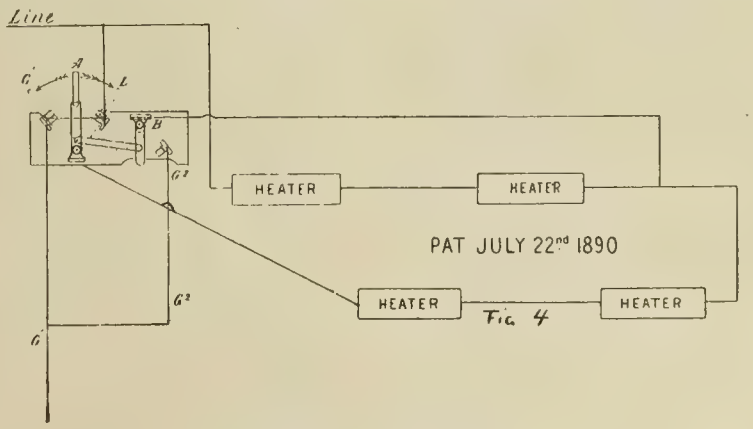


FIG. 4—METHOD OF WIRING.

THE PRACTICAL ASPECTS OF ELECTRIC WELDING.*

BY FREDERICK A. C. PERRINE, D. SC.

The plant with which I have been intimately connected, though not one of the heaviest, is still one making a great number of successful welds in a day, and is one in which the joints are required to be of the highest character, and are subjected to the severest tests. The first machine actually sold by the welding company was bought by the Roeblings, but on account of the delay of the engine builders it was not in place and running for some six months; three or four months after other machines were in satisfactory operation. This was of the direct type, having a double winding on the armature, and the welding done on an apron immediately above the collector terminals of the heavy alternating coils; the pressure was applied by a handle regulated by the workman, the projection also being regulated by a scale stamped on the cam of the handle. Though considered crude, this machine did satisfactory work, often for twenty-four hours a day, and six days in the week, for about two years, having made about 370,000 splices in telegraph wire during its useful life.

After the automatic machines were brought to a reasonable perfection, we purchased a generator capable of welding up to ½ in. copper (40,000 watts), and installed one large transformer, and seven smaller ones of capacity from No. 4 B. & S. copper to No. 18 B. & S. These have been at the works something less than one year, and show a daily record of over 1,000 welds in copper and iron wire.

*Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, New York, May 20, 1891.

Continued on page 361.

THE ELECTRICAL AGE.
DEVOTED TO ELECTRIC LIGHTING AND POWER, TELEGRAPHY, TELEPHONY, AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

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NOTES.

Governor Russell of Massachusetts has affixed his signature to a document which makes it legal for cities and towns in that commonwealth to supply gas and electricity to the inhabitants. In order to take advantage of this act, in the case of cities, a vote that it is expedient to exercise the authority which it confers must have passed each branch of the council by a two-thirds vote and received the approval of the mayor in each of two consecutive municipal years, and then be ratified by a majority of the voters at an annual municipal election. If the vote of the city council does not receive ratification no similar vote shall be submitted for ratification until after the expiration of five years. Except by written consent of the Gas and Electric Light Commissioners, the price of the commodities cannot be fixed at less than cost. The cost must include not only operating expenses, but interest on the net investment at the rate paid upon the bonds, together with the requirements of the sinking fund, and also depreciation of plant reckoned at not less than 5 per cent. per annum of its cost and losses. Private plants may be purchased.

We congratulate Prof. Elihu Thomson on the issue of the competitive meter tests held in Paris under the auspices of the Paris Municipal Council. The result of these tests, while extremely gratifying to the professor, might have been a little better. However, when it is remembered that the Thomson meter was a stranger in a foreign land, the award of half of the first prize of 100,000 francs is nothing more than a great compliment to and recognition of the genius of the inventor.

A large meeting of the members of the Chamber of Commerce was held in this city on June 4 and a report was adopted with reference to the Rapid Transit plans for New York. The Chamber of Commerce favors the construction of the four track underground road recommended by the Rapid Transit Commissioners as the most practicable, and recommends that electricity be used as the motive power and for lighting the tunnel. "It should be remembered, however," the report continues, "that this is comparatively an untried means of transit, the Greathead system in London not having as yet been sufficiently developed to give assurance that it is adapted for long distance and high speed; that the capital is not yet assured to build such a road and that there are many people who prefer the better light and ventilation of the elevated roads with somewhat slower speed than is contemplated by the tunnel system." The report also favors the extension of the existing elevated roads as an auxiliary system.

At a meeting of the Board of Electrical Control on June 2, Mayor Grant, in his usual style, turned his attention to the Subway Construction Company. He would not listen to any reason for the failure of that company to have the subways completed by June 1, so he introduced a resolution, which was passed, providing that counsel for the Board prepare "such resolution as may under the contract of the said Consolidated Telegraph and Electrical Subway Company be necessary for the forfeiture of the bond of said company as in the opinion of this Board said contract has become inoperative, it being the intention of the Board to declare a formal forfeiture by this resolution." The failure to have the subways ready lengthens the life of the overhead wires.

On the night of May 24, one of the cars on the Coney Island Electric Road was required to perform an unusual service, which it did successfully. There had been a fight that night at Gravesend, L. I., among a lot of Italians, during which one of them was severely wounded. The assailants made their escape from the scene, but the conductor of an electric car passing by hearing that they were running along the line ahead, put on full speed and overtook the fugitives and secured them.

It is reported that the Prussian Minister of Justice, Dr. Schelling, is interested in the new American method of execution by electricity, and has caused instructions to be sent for full reports as to its methods of working. Many Prussians are inclined to consider decapitation as too barbarous a method of execution, and the consequence of this sentiment is favorable to the criminal classes.

A striking example of the slowness of justice has just been revealed in Missouri. On June 2 the Missouri Court of Appeals affirmed the decree in the injunction suit of the Western Union Telegraph Company against the Guernsey & Scudder Electric Light Co. The action was begun in 1885, the plaintiff company alleging that the stringing of the defendant company's wires would seriously interfere with the working of the plaintiff' swires. Since the suit was begun the plaintiff's building and the defendant's electrical plant have been destroyed by fire; the defendant has ceased to do business, and the plaintiff has moved into another building.

LEGAL.

In our issue of May 30 we published a brief reference to the suit for an injunction brought against the ELECTRICAL AGE by the W. J. Johnston Co., Limited. It was stated therein that the motion was denied by Judge Andrews of the Supreme Court, and that an appeal from this decision was also denied. As it will interest many of our readers to know exactly the point at issue we print in full herewith the latter decision, which was rendered by Judges Van Brunt and Daniels:

"The plaintiff is the publisher of a newspaper devoted to the examination of electrical subjects, under the name of the *Electrical World.* The name has been combined with electrical structures and devices, to form and exhibit its title page. This was finally adopted from, and by way of improvement upon a preceding publication of the plaintiff, and likewise devoted to the consideration and discussion of electrical intelligence. The defendant has been the publisher of another newspaper devoted to the same subjects, and its title page has been changed from that which characterized and identified it prior to the present year. Early in 1891, it was designated by the name of the ELECTRICAL AGE, instead of the "ELECTRIC AGE," which was previously the name given to it. When this change was made in the early part of 1891 other structures and devices were combined with the name, producing a general resemblance to the title page of the plaintiff's newspaper, but still differing in the location of the objects, and printed in and upon other different colors. While there are points of general resemblance, there are also features of striking diversity, rendering the inference at least somewhat uncertain whether the defendant is publishing its newspaper under such a form of title page as is calculated to produce the belief in the minds of subscribers, or purchasers, that the defendant's is the paper of the plaintiff. If that could upon the affidavits and exhibits be concluded to be the fact, then the case would be one for an injunction. For that would be a violation of the plaintiff's rights, which no Court could permit to be successfully devised and followed. American Grocer Publishing Co. *v.* The Grocer Publishing Co., 25 Hun. 398. Koehler *v.* Sanders 122, N. Y. 65, 72–4. Vulcan *v.* Myers 11, N. Y. Supp., 663. But the conclusion that subscribers or purchasers will be deceived by the appearance of the frontispiece and title of the defendant's newspaper into the belief that it is in fact the plaintiff's publication has not been so certainly sustained as to present a case for an injunction during the pendency of the action. It is not intended to be intimated that after a full hearing of the evidence which may be adduced, the plaintiff may not be entitled to succeed, but simply for the present to say that the probability in its favor is not so free from substantial doubt as to entitle it to an injunction before the trial.

At no remote period the issue between the parties can be disposed of upon a hearing of their testimony, which will form a more certain criterion for definite and certain action than the complaint and affidavits now before the Court, and until then no serious injury can result to the plaintiff by allowing the situation to remain as it now is. The order denying the injunction should be affirmed with $10 costs and the disbursements on the appeal to abide the final result of the action."

The annual meeting ot the Association of Railway Telegraph Superintendents will be held at the Grand Hotel, Cincinnati, O., on June 17. Papers of interest will be read, and the exhibits promise to be more extensive than ever. These meetings are growing in importance and interest from year to year. The successful railway telegraph superintendent these days must be an electrical engineer in order to properly compass the requirements of the position.

(*Continued from page* 359.)

Our attention was drawn to the process at first as a possible solution of a very troublesome problem in preparing and packing iron telegraph wire. For the convenience of the telegraph companies this wire must be put up in bundles, measuring each exactly one half mile of continuous length. It is very easy to say that the proper weight billets be bought, and the pieces kept continuous through all the processes of manufacture, but, as a fact these pieces are necessarily irregular in original size, and are often broken in the process of manufacture, and, in consequence, it has long been the custom to make the proper weight bundles by recoiling and splicing with the common telegraph or Lippman's joint, after the wire has been galvanized, jointing before galvanizing having proved a failure on account of the acid carried over into the zinc pans by the great helix of the joints.

Singularly enough, the telegraph companies which had for so long accepted as satisfactory these cumbrous connections, immediately commenced to complain of the large burr left by the welding machine, and which we had thought unnecessary to remove. An emery wheel solved this difficulty, however, and we were then able to defy them to find the joint at all. After a very complete series of tests on the joints themselves, the telegraph companies have been finally satisfied, and we are now able to make our bundles of the proper weight and length before the galvanizing is put on, and thus save one rehandling of nearly our whole product, besides having removed one of the greatest difficulties and causes of complaint.

"Shorts," as they are technically termed, in copper, are, of course, a still more serious source of loss, not only on account of the greater value of the material, but also on account of the greater liability of this weaker metal to break in the process of drawing, and also on account of the necessarily defective character of a joint in the insulation with which copper wire is usually covered when sent out from the factory. Cables, as you all know, must be made in exact lengths, many of which are often very great, and though a twisted soldered joint might be satisfactory at the bottom of the sea, or covered by a lead sleeve in a manhole, it could not for an instant be tolerated in the body of a cable which must, before completion of the cable, be passed through exact dies for covering with rubber or lead. Before the introduction of these machines, our custom had been to carefully scarf and fit the joint, which was then brazed with silver solder. While this method makes a strong joint, but little increased in resistance, and thoroughly satisfactory in other respects, it has the disadvantage of being rather slow and difficult to produce, on account of the necessary care in fitting the scarfed ends as well as in soldering and finishing.

Besides using the electric welding machine for their telegraph wire, the Trenton Iron Company, of Trenton, N. J., have boldly attempted to make a weld in a wire rope to avoid the tedious, and, with their locked wire rope, impossible operation of splicing. The ordinary joint in a wire rope is from ten to twenty feet in length, and requires considerable skill on the part of the splicer and his assistants. The operation is to re-twist bunches of wire from opposite strands, and to tuck the loose ends under the adjacent complete strands, which then hold them in place. With the locked wire rope, which is itself but a single strand, the only successful method of joining opposite ends has been to fasten securely around each a cast-iron collar, and after abutting the ends in a welding machine, to cement the whole together and afterwards to break off the cast-iron collar leaving the rope as a solid bar for about two inches at the weld.

Among the new solutions of old problems accomplished by the electric welding process, is that of the manufacture of spinning rings by the Hopedale Machine Company, of Hopedale, Mass. The desideratum of these rings is a uniformly hard surface, to produce which the method has been to stamp the ring from a sheet of metal, and after finishing in a lathe, to case-harden the whole, involving, as one would naturally see, the loss of a considerable portion of the original sheet. With a welding machine it is possible to form these little rings, about 2½ in. diameter, from a piece of bar iron, and after the burr has been reduced by a series of dies, to finish as before, with the result of a decreased cost, and an equally satisfactory product.

One of the largest and most complete plants at present in operation is that of the Studebaker Bros. Manufacturing Company, of South Bend, Ind. They have at present nine machines; one of them for steel axles up to 1½ ins. square. After the weld is made it is quickly removed to a drop hammer, making about 300 blows a minute, then at the same heat the axle is set ready for the market. The test for these axles is to bend to 90° while hot, and then back to alignment. No instance has yet been reported of an axle breaking under this test, which is frequently made to insure perfect workmanship.

They have two machines for welding large car tires, about 4 ins. wide and ¾ in. thick, and smaller sizes. The weld is made in the usual way and then quickly removed to a hammer where, by vertical and side blows, the burr is quickly removed.

Probably the heaviest work done at present in electric welding, is that of the Johnson Rail Company, of Johnstown, Pa., who are not, as stated in the journals, welding long lengths of rails together, since with their continuous mill they already roll a rail too long to ship, but they find economy in the process in some details of their smaller manufactures. As to their results in general they say: "We would state that over a year ago we put in one welder for general work. The bulk of the work done on this machine was work we had totally failed to do by hand welding, not on account of the difficulty of the weld, but on account of the general unreliabilty of the result. The result of a year's use of the electric welder was, that we have not known one of the welds made by the method to fail, and we have closed contracts with the welding company for four 40,000 watt machines and two 89,000 watt machines, with the intention of adopting the method extensively in our works."

Three types of machines of importance are soon to be in use for the purpose of our army and navy, and the early recognition of the importance of this method of manufacture, speaks well for the ingenuity of our government designers.

In the new wire-wound guns one of the most important specifications for the wire was that it should be readily jointed by the electric welding process, and in the Crozier gun, now constructing, the wire will be wound in one continuous piece under a constant and heavy strain. This wire is one-tenth in. square, with 180,000 lbs. breaking strength, and 100,000 lbs. elastic limit, tinned as lightly as possible. The gun is to be made by winding the wire over a steel tube and shrinking a ring over the whole, for the purpose of longitudinal strength; the welding process is simply the same as that described for round wire, and is reported as having given satisfactory results.

For the Charleston Navy Yard there is about completed a machine for welding ship chains up to 2 in. diameter links. These links are formed in halves and fitted roughly to each other, the welds being made in both sides at once by the same heat, which can be regulated to force either side at the will of the operator. When completed, both welds are forged immediately in a die by the same hammer. By this method only the points to be welded are heated, and as these are immediately forged, one could expect from the process a nearer approach to the strength of rolled metal than where the whole link is heated in the ordinary fire to a welding temperature.

The latest development for government work is the manufacture of conical shell and shrapnell for the smaller armor-piercing guns. With the modern types of armor a cast shell is not of sufficient strength to resist the shock of impact, and in consequence a chrome-steel point is welded to a tool-steel body, embracing the powder cavity. This latter is but small in comparison with that in the old round shell of revolutionary days, consequently the accurate forging of the interior becomes correspondingly difficult.

Cast shells are made from the higher grades of crucible steel, but with these the casting is both difficult and uncertain, necessitating a large amount to be allowed for machining to a uniform wall in the probable case of a decentered core. The electrically welded shells are made entirely of forged point, body and base, which may be finished to approximate dimensions, these requiring after welding a minimum amount of machining. The tests on these shells have resulted in a contract for a large number under a guarantee of the manufacturing company.

ELECTRO-THERAPEUTICS.

A FEW WORDS CONCERNING THE SELECTION OF BATTERIES AND ACCESSORIES.

BY A. W. JACKSON, M.D., F.S.S.

Now that so large a proportion of the medical profession is beginning to give attention to electricity as a curative agent, and as the majority of working practitioners find their time too limited to go about making tests and inquiries, a few words concerning the armamentarium necessary to a successful employment of the galvanic current may not be amiss.

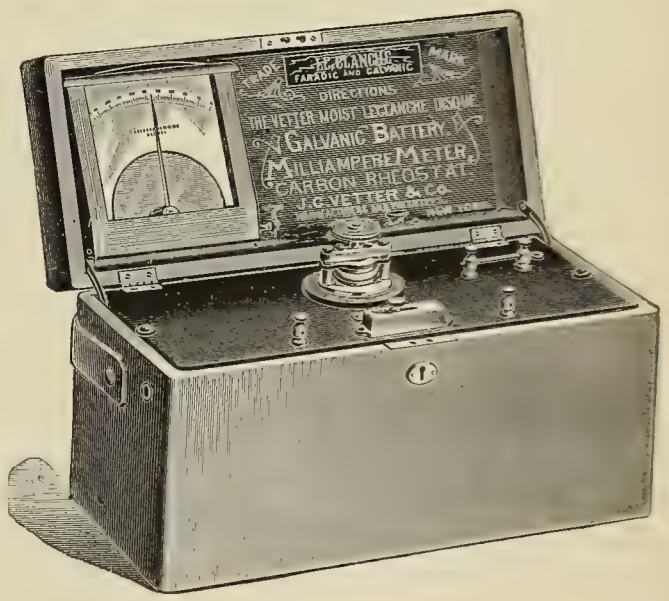


FIG. 1—MEDICAL BATTERY OUTFIT.

In a recent number of a high class technical journal, published in Paris, the writer was astonished to see a plate, illustrating one of the methods of procedure in the treatment of fibrous tumor, showing an antiquated apparatus, which I certainly would relegate to the lumber room. But, since time is precious, we will proceed at once to describe the apparatus which we are using at present, and which we have tested most crucially.

First, the battery: The cell is a so-called "Moist Disque Le-Clanche" cell. It is similar in its elements to the popular Le-Clanche porous cup battery, retaining all its merits, and in addition, no creeping of salts, no glass, no liquids, no evaporation, greater recuperative power, higher E. M. F., less internal resistance, and is always ready for use.

These batteries are made by Vetter & Co., of E. 47th street, New York, and can be had in three sizes. No. 2 I recommend for office cabinet use.

The size is just right for the purpose, and from 30 to 60 of these cells may be placed in a cabinet, or located on a convenient closet shelf, out of the way. The No. 1 cell is smaller, and can be put up in a case for portable use, as many as 40 being placed in one medium sized box. Having selected the cells, and arranged them in their place, the next step is to procure the means of controlling the current given by them. To me, this was always a matter of considerable trouble until within the past year. There are several popular contrivances for the purpose, the first and oldest being the switchboard on which a "cell selector" was used, risking a shock to the patient each time a cell was added. Then came the "Water Rheostat," the "Graphite Current Controller," and others, but none of these gave me full satisfaction, and I never felt entirely safe in using a rheostat of any kind until I obtained the "Carbon Rheostat," or "Current Controller," made by Vetter & Co. This "controller" is shown at the back of the case, in the centre, (Fig. 1.) It is small, and easily set up and detached. Unlike the older methods mentioned above, it is possible with this instrument to maintain the current throughout the entire series of cells of equal and uniform strength. The current is gradually increased from zero to full strength by slowly turning the milled disc, which is shown in the drawing.

Having provided our means of controlling the current, the next step is to provide a method by which we may know to a nicety the amount of electricity which is passing. It is of no use to tell about a current of so many cells, as I have so

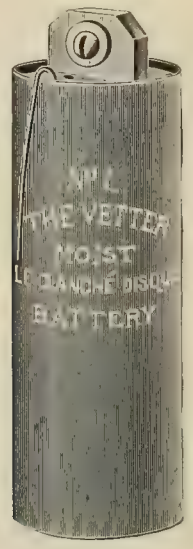


FIG. 2—VETTER MOIST BATTERY.

often seen done by writers on Electro-therapeutics.

The current from a given series of cells will vary immensely under various circumstances, so that such a criterion is worse than none at all.

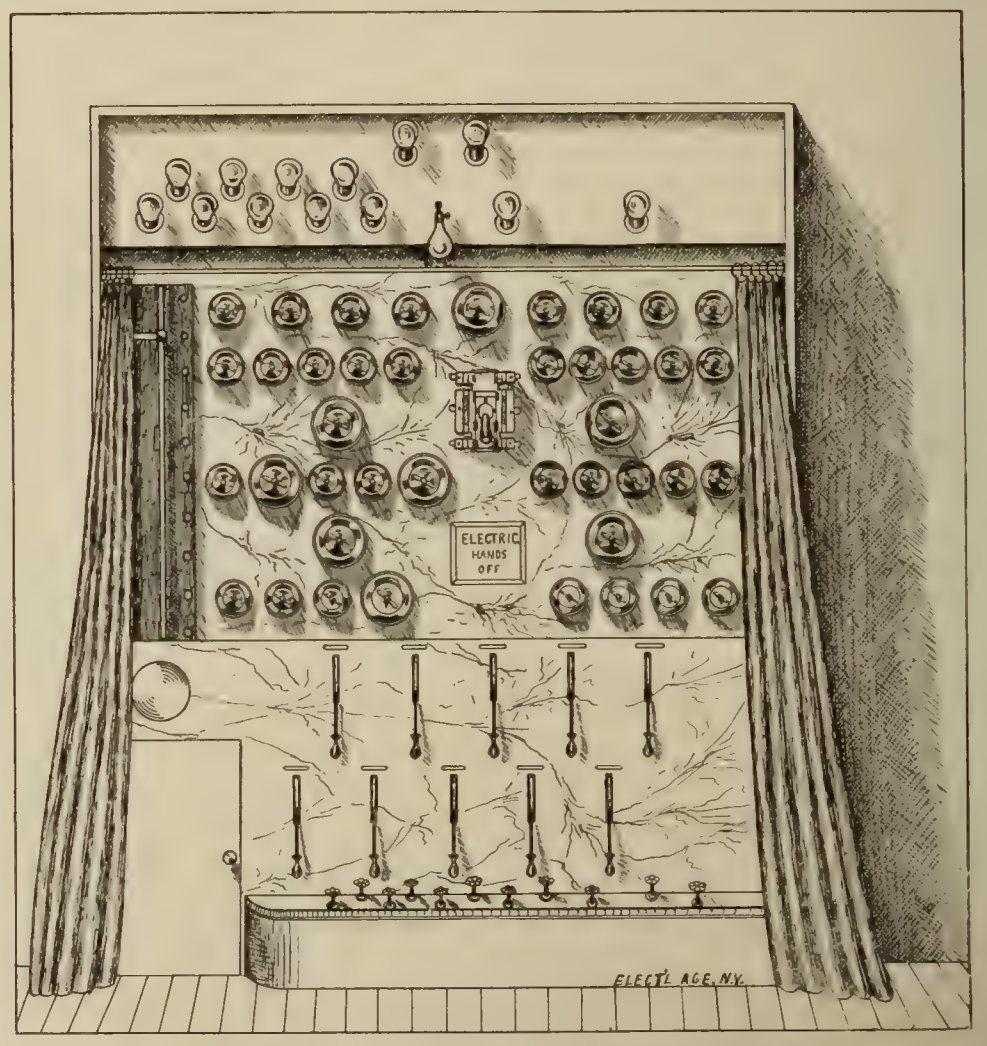
The Milliampere-Meter, then, is a necessity. Mine is accurate, and that is more than can be said of most of the instruments I have seen. It is a direct-reading contrivance, no time being required for adjusting, or waiting for the needle to come to zero, but the readings can be taken immediately the circuit is closed, the range being from ½ to 500 milliamperes. The drawing will give an idea of the instrument, which is shown at the left hand corner of the box cover. For portable use, I have 24 cells, (No. 1 size), enclosed in a rosewood box, with current controller and meter, and in other boxes I have two series of cells, 30 in each box. These can be easily carried from place to place, and one series of cells connected with the other, thus giving me a battery of 54 cells with two boxes, or 84 cells with the whole three boxes in circuit. Any practitioner who has used electricity needs no telling to inform him of the advantages here gained. This system is the only one by which it can be done, and Vetter & Co. the only firm who manufacture such an outfit.

The electrodes are a very particular factor in gaining good results, and each operator must choose for himself the instrument which he intends using. For large abdominal dispersing electrodes, I prefer "The Martin." The "Apostoli," clay electrode is also a good one, but not so clean. All the other accessories must be chosen after due consideration, and each practitioner has his preferences which actual experience has given him.

ELECTRIC LIGHT PLANT IN A THEATRE.

The Park Theatre, on Fulton street, Brooklyn, has a unique electric light installation. The plant is connected to Edison mains on the two streets, Fulton and Adams, on the former of which the theatre fronts, while the rear is on Adams street. The object of feeder connections on two mains is to be ready for every possible emergency, thus in case of trouble on one circuit the other can be cut in at once.

The switchboard by which the lights are controlled is shown in the accompanying illustration. It is made of solid marble and was installed by the Edison Illuminating Company. This elegant board was designed by Mr. James H. Smith, the electrical engineer of the theatre, and installed under his supervision.



SWITCHBOARD AT PARK THEATRE, BROOKLYN, N. Y.

The double contact main switch, shown in the middle of the board, is of the rocking class and is so arranged that the Fulton street or Adams street main can be connected at will. This is a great advantage in case one of the circuits is interrupted, as either one can be drawn from. The switches are all nickel plated.

The border lamps in the reflectors in the flies are red, white and blue, and any one of these colors can be turned on as desired. The footlights are also controlled in like manner. The lamps in the flies are arranged to throw the light down upon the stage; in this way the best effects are produced. This is the first theatre to introduce colored lamps for this purpose.

There are 1,500 lamps used throughout the building, of 16 and 32-candle power. In the auditorium the light is diffused by the use of ground glass bulbs.

On the left of the switchboard are the connections of the electric gas lighting circuit, which is operated by two cells of galvanic battery. This apparatus is always ready for emergencies, but during the past two years it has not been used once. There are 20 gas circuits, the valves of which are represented at the lower part of the illustration. The pilot lamps at the top of the board are for the purpose of showing whether the current is on or off their respective circuits. The central lamp is used for indicating the condition of the main circuit.

The rows of handles shown below in the illustration control a double set of rheostats, either set of which can be connected as desired in case of accident. A special lamp, designed by Mr. Smith, is being tested to take the place of the ordinary calcium light. It has a long lens which avoids all shadows.

It is said by theatre managers that this plant is the most complete of any theatre plant in this country or Europe.

All the wires are run through interior conduits and all the cut-outs are in a room behind the switchboard, out of the way of the stage entrance For the electric gas lighting apparatus a three inch spark coil is used.

Resistance can be thrown into the lamp circuits in order to vary the intensity of the light to suit the requirements.

The theatre, which is owned by Col. William E. Sinn and Walter Sinn, was entirely remodelled this season. The electrical plant was installed by the Edison Company, under Mr. Smith's supervision, at a cost of $11,000, and pronounced by Mr. Edison to be the most complete of any he has yet seen.

Mr. Smith has been connected with this theatre 21 years, and has never in that time missed one performance. He was, 30 years ago, connected with the Barnum Museum at the corner of Broadway and Ann street, New York, and recalls the day when they began to use gas, the many difficulties they had, and the disadvantages of the use of candles in those early days.

An 80 horse-power electric hoist has been placed at the top of a slope, 3,100 feet from the mouth of the Black Diamond mine, Seattle, Wash., to hoist coal from the mine. A 120 horse-power generator located at the mouth of the mine supplies current for the hoist. The plant was constructed and installed by the Electrical Engineering Company of San Francisco. At a recent test 12,000 pounds of coal were hoisted at one trip to the top of the slope in one and one-half minutes.

ELECTRIC ELEVATORS.

The American Electric Elevator Co., 15 Cortlandt street, New York, recently put in operation an electric elevator in the Grimes Building, Kansas City, which runs at a speed of 250 feet per minute, carrying an average load of 1,200 lbs., with nine horse power. This elevator is giving great satisfaction, and runs more smoothly and quietly than the average hydraulic elevator, and nearly equal to the very best of that make.

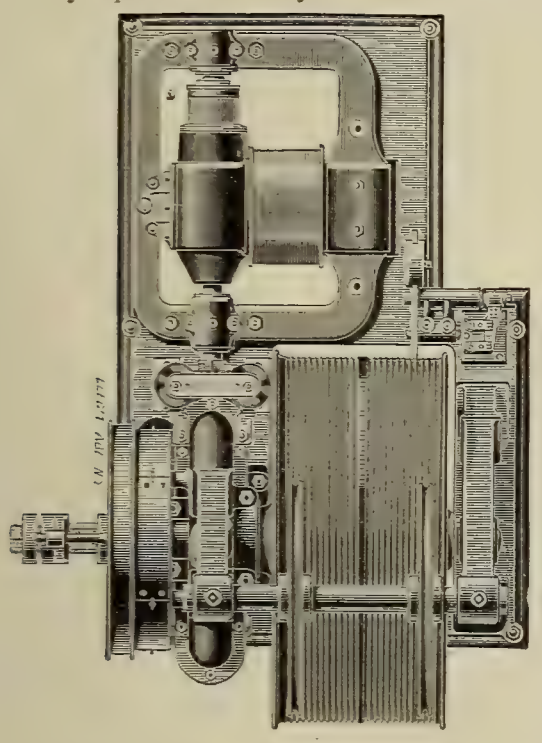
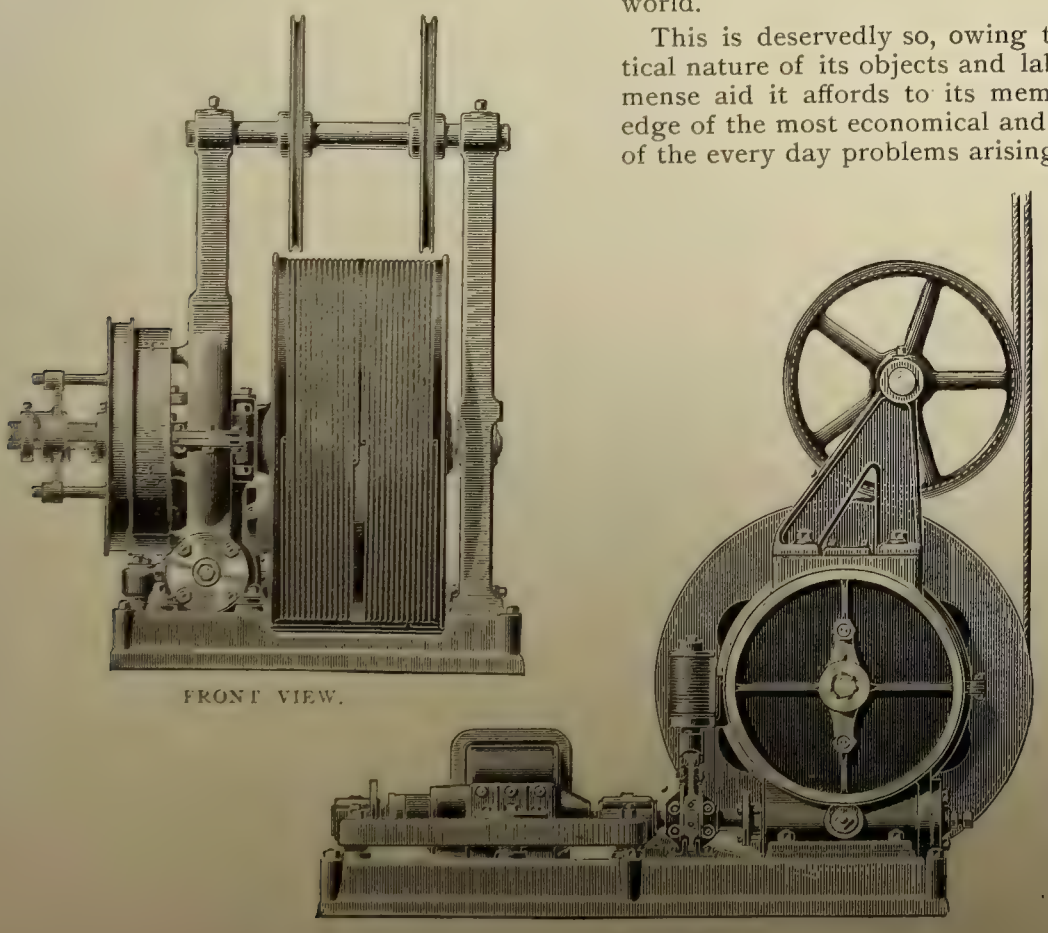


FIG. 1—PLAN.

The company is now installing a number of their elevators in important office buildings, in various parts of the country, from Minnesota to Texas, and are at present installing one in the Duquesne Traction Co.'s car house at Pittsburg, Pa., for the purpose of raising the cars, a load of 10,000 pounds, from the tracks on the first floor to the paint shop on the floor above. This elevator is expected to be in operation in a few days, and it will probably be the largest electric elevator at present in existence.



FRONT VIEW.

SIDE VIEW.

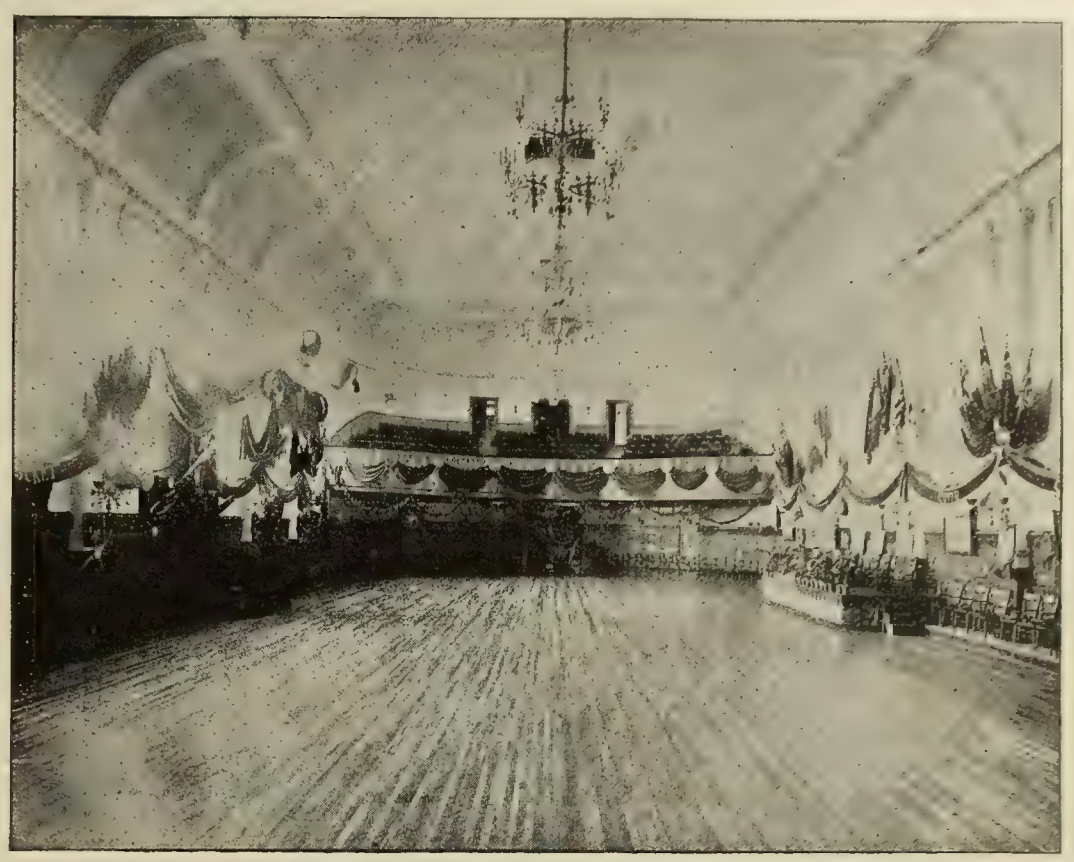
The elevator recently put in by this company in the building of Behr Bros. & Co., 81 Fifth ave., New York, is giving excellent satisfaction. The runs vary during the day, the average vertical lift being 66 feet. Very heavy loads are put upon the elevator, such as complete pianos. The car is 6 feet square and will carry a large number of persons with great facility.

The above cuts give different views of the elevator machinery manufactured by the American Elevator Company.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

A meeting of the executive committee of the National Electric Light Association will be held at Montreal, Canada, on the 8th inst., to arrange details for the coming convention.

An unusually active interest is being taken this year in the Montreal meeting by the electrical brethren, and it looks very much as if the attendance and objects of interest displayed will equal and even exceed those of former conventions. The popularity of this association has been growing with remarkable vigor during the past few years, until now the strength of the organization places it on a plane with the great societies, not only of this country, but of the world.



INTERIOR OF VICTORIA SKATING RINK, MONTREAL.

This is deservedly so, owing to the very practical nature of its objects and labors, and the immense aid it affords to its members in a knowledge of the most economical and efficient solution of the every day problems arising in the course of commercial work.

The immense Victoria Skating Rink at Montreal will be used for the purposes of the exhibition, as it has been found that a smaller hall would not be sufficiently large to accommodate the many who are anxious to obtain space.

The accompanying illustration gives an interior view of the Victoria Skating Rink in Montreal, in which the electrical exhibition will be held during the Convention of the National Electric Light Association in that city next August. At the time our picture was taken a fair had been in progress and the decorations still remained.

AN ALTERNATE CURRENT POTENTIOMETER.*

MR. GEO. W. BLODGETT: I would like to ask if it makes any difference what kind of a lamp is used, or whether one must use some particular lamp for a particular instrument?

PROF. E. L. NICHOLS: The lamp I think is a matter of no consequence, only in order to get the best result the lamp should be more than red hot. You will find the sensitiveness to increase as the brightness of the lamp increases up to a certain point. It is best to have a lamp the voltage of which is about that which is to be measured. Through a wide range of intensities in a lamp the accuracy is not materially diminished. Any constant current voltmeter can be used for reading the voltage on that side of the switch. In order that your result may be correct, you should have a constant current voltmeter which gives correct indications.

PROF. THOMSON: As to the degree of accuracy attainable in this way, if I remember correctly, some tests were undertaken some two or three years ago by us to determine how much variation was possible in a lamp; that is, if you should drop or raise the voltage what was the smallest increase or decrease of voltage suddenly brought on that would show in a lamp, and I think it was about one-tenth of a volt. It could be detected by watching the lamp very closely—simply putting in a resistance and slipping it in and out quickly. We could detect about one-tenth of a volt, which, of course, would confirm the method.

MR. WESTON: As I understand, the arrangement is that we are to have an incandescent lamp simply as an indicator—that the indicator lamp has to be brought from a normal value by a direct current and then you are to pass an alternating current of unknown electromotive force through it. Is that the proposition?

PROF. NICHOLS: Yes.

MR. WESTON: And determine the electromotive force in this way? I can say that that will work very nicely indeed. We have used that method in endeavoring to arrive at a somewhat difficult problem in connection with an alternating current instrument of great sensibility and portability. I think the method was used about three years ago. The accuracy is greater the greater the change of course in the electromotive force of current flowing through it. The method is undoubtedly susceptible of very close results indeed.

* Abstract of discussion of paper on this subject by Prof. Geo. S. Moler, read at the General Meeting of the American Institute of Electrical Engineers, May 21, 1891.

PROF. NICHOLS: I think that it will be found that there is a limit to the brilliancy of the lamp which you can use in practice, on account of the eye. If you have too bright a light, the eye is not susceptible to small changes. Probably there is a maximum brightness which should be used in order to give the maximum sensitiveness of the method. The change of the lamp will, of course, increase as you increase the intensity of the lamp. If you go to a point where the lamp dazzles the eye, the eye by its decreasing sensitiveness will overcome this. Our experiments thus far go only to confirm Mr. Weston's statement, that the lamp should be burned at quite a high temperature.

PROF. GEORGE FORBES: I would suggest that there is a very simple way of enormously increasing the sensitiveness of this method. As I understand it, the way in which you use it at present is to look at the lamp while the continuous current is serving it, and then switch it over to the alternating current and then judge which is the brightest, moving it rapidly back and forward. It seems to me that that method would be enormously more sensitive if you applied two lamps, and used them in a properly constructed photometer with a switch arrangement, which enables you to connect either of them with the alternating or continuous current. Thus you would adjust the potential of the continuous current until you get very near equality, but you would find that one of the lamps was always a little brighter than the other, owing to the sensibility of the lamp. You would then alter the distance of the lamps from the photometric screen slightly, so that on reversing the current you would get an absolute equality, and then you would be able to arrive at a much closer comparison, and it would not matter if there was a very slight difference in the illuminating power of the two lamps with different voltages. I feel perfectly sure that this would increase the sensitiveness of the method about ten fold.

ELECTRIC COAL CUTTERS.

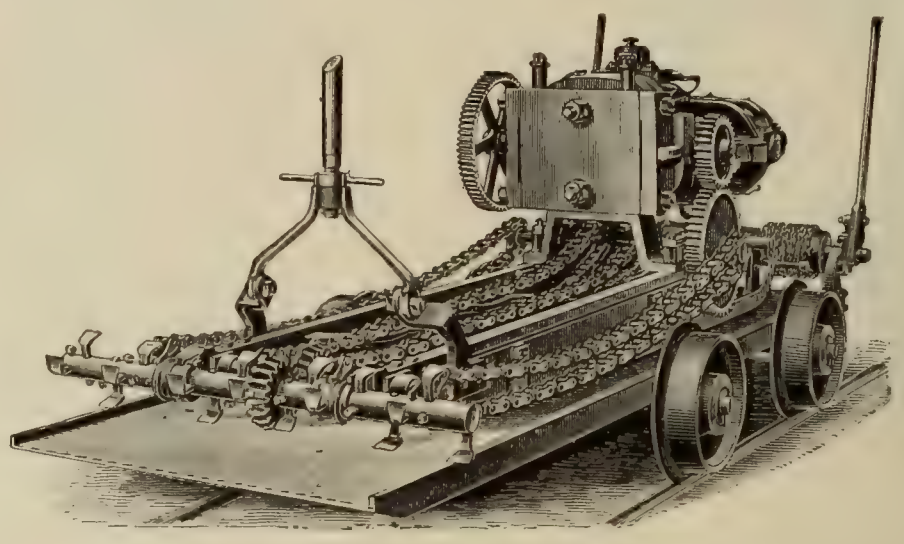
The Edison General Electric Company have just issued a pamphlet describing the new electric coal cutter manufactured by that company, from which we abstract the following interesting facts:

There are at present two general styles of coal cutters in use; those using rotary cutters and those using reciprocating cutters, both of which have special features, which make it advisable to use one or the other, according to the nature of the coal.

As the work in the mine progresses, the distances at which the coal cutters have to work from the power station will increase, and, therefore, quite an extensive part of the mine has to be equipped to allow coal cutters to be kept at work continuously, making it very important that the devices used for transmitting power to the machines should be small, flexible and efficient. A general comparison between the agents adapted to this purpose—electricity and compressed air—need hardly be given at this day, as the advantages of electricity for power purposes over compressed air and other agents are now too well-known. Nearly all mine owners who have heretofore used compressed air plants are seriously contemplating the advisability of changing their system, having reached the limit to which their compressed air plant can be used, and recognizing the fact that the amount of pipe already laid in the mine represents a cost nearly sufficient to cover the cost of an entire electric plant, not including the steam engine and boilers.

Outside of its well-known advantages for ordinary power transmission, the electric system offers some special features that make it well adapted for use for coal cutting. It has already been remarked that to avoid letting the machines stand idle a large territory in the mines has to be equipped for them, and this necessitates a number of bends and branches in the ducts which, with a compressed air plant, results in loss of efficiency. This has no effect on an electric system. It is also a very easy matter to lay the wires for the latter in such a manner that they are at all times easy to inspect and repair if interfered with accidentally.

But the main advantages are to be found in the machines themselves. The electric motor naturally has a rotary motion, and this removes from the machine, as experience has proven, the violent vibration met with in the use of the necessarily high speed reciprocating air engines.



EDISON COAL CUTTER.

The life of the coal cutter is, therefore, considerably increased, and annoying delays caused by breakdowns, and the frequent necessity of giving the machine a thorough repair are reduced to a minimum. The work of the machine men is also greatly reduced, as it is evident that with a machine subject to violent vibrations it is difficult to keep firm the braces which hold the machine in place. The shunt wound electric motor retains a speed practically constant under the greatest variations in the load, and more especially has not the tendency to race which an air engine has when its load is suddenly removed.

Of the many different coal cutters in use at present, those that have so far met with the best success are undoubtedly those using the cutter bar: that is, a shaft revolving parallel with the coal in a horizontal plane, and having knives distributed all around the surface, so as to cut a groove in the coal the entire length of the bar. The type of coal cutter adopted by the Edison General Electric Company has been in use for years, and has been thoroughly tested. This machine has the advantage of great strength, and excels other machines of the same class as regards the design and the distribution of the material to give the necessary strength and rigidity.

The motor used for the Edison General Electric Company's coal cutter is capable of giving 15 horse-power when doing steady work. When running off and on only, as would be the case when used with coal cutters, it is capable of giving by far larger power. This motor is especially well adapted to the work it has to perform; it runs entirely without sparking and has all its vital parts well protected. The insulation of the machine has been given especial attention, and in this respect the Edison Company has been greatly aided by its experience with the large number of its motors now running in mines and upon street cars.

The Edison Company builds coal cutters capable of making a cut four feet, five feet and six feet deep, by three and one-half feet wide.

All coal cutters are provided with a suitable truck, by means of which they can readily be moved from place to place. The devices on the truck to load and unload the machines are very simple and efficient, and each machine is supplied with a cable 150 feet in length, and provided with suitable devices to enable it to be readily attached to the main wires and detached from them.

PHILADELPHIA NOTES.

H. M. Sciple & Co., 3d and Arch streets, Philadelphia, agents for the Ide engine, are installing a 150 horse-power Ide engine at Shamokin, Pa.; two 125 horse-power boilers, made to order of special flange steel of 72 inches in diameter and 18 feet long, for the Shamokin Electric Railway Company. They have a number of estimates in for other plants.

Moore & White, 15th and Lehigh avenue, Philadelphia, manufacturers of friction clutch pulleys and couplings, are doing considerable trade among electric light companies. Their clutches are first class in every particular.

Mr. Spruance, of the Star Electrix Company, Philadelphia, has gone West on a business trip in the interest of his company. Mr. Marshall will be pleased to receive orders in Mr. Spruance's absence. The samples of goods shown at the company's factory ought to please the most particular buyer.

J. Elliott Shaw makes a fine show at 632 Arch street of his Norway iron bells, which are having an excellent sale. He also carries a complete line of everything in the electrical line.

The Cartwright Metal Roofing Co., Broad and Hamilton streets, Philadelphia, are the sole owners and manufacturers of metal tiles and metal slates for siding and roofing. They are waterproof, fireproof and handsome, and builders of electric light stations, etc., should consult this firm as to these goods.

C. F. Langston & Co., the well-known engineers and machinists of 70 N. 4th street, are constantly adding the latest developments in their line to their stock. They are manufacturing the latest improved fan outfits, to be run either with or without belting, besides a large variety of electric motors, steam and gas engines.

Vallee & Brothers, 17 North Sixth street, the selling agents for Paiste switches and other electric light switches, are hustlers; they have a large line of household specialties for which there is a great demand.

OPENING OF A NEW ELECTRIC RAILWAY.

Mr. Atkinson, J. L. Barclay, H. McL. Harding and Mr. Schmidt, of the railway department of the Westinghouse Electric Co.; Mr. England, of the Electric Merchandise Co., of Chicago; Mr. Andrews, of J. G. Brill & Co., car builders, Philadelphia; and Mr. Littlefield, of the Johnson Co., car builders, Johnstown, Pa., left Chicago on a special car on the North Western Railway, Tuesday June 9, to attend the opening of the Riverside Park Railway, at Sioux City, Iowa, Wednesday June 10.

A PHOTOGRAPHIC STUDY OF THE ELECTRIC ARC.*

BASED UPON EXPERIMENTS MADE BY MR. J. C. MC MYNN.

BY EDWARD L. NICHOLS.

The alternating current arc and the continuous current arc afford two entirely distinct fields of investigation. Candle-power, distribution of light, quality of light, temperature, efficiency, resistance, electromotive force necessary to maintain the arc, performance of the carbons under varying conditions; all of these are questions concerning which we have abundance of experimental data, so far as the continuous current arc is concerned.

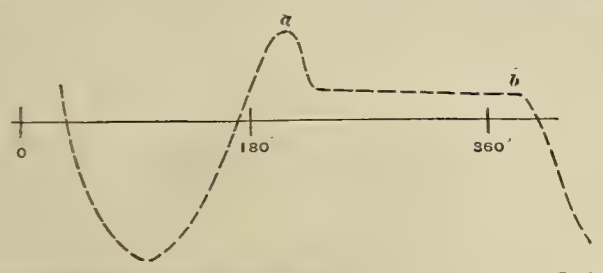


FIG. 1.—From Archbold and Teeple's thesis on the "Ball and Point" effec

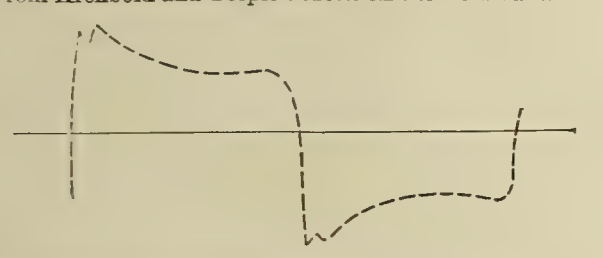


FIG. 2.—From Tobey & Walbridge's paper on the Stanley Arc Lighting Machine

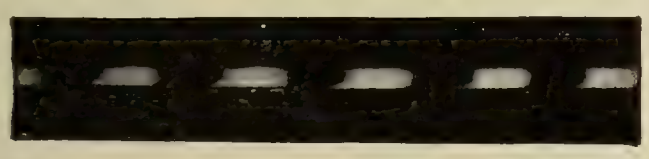


FIG. 3.—Alternating Arc. [Movement of plate horizontal.]



FIG. 4.—Alternating arc. *a.* Long arc (58 volts). *b.* Short arc (43 volts) [Movement of plate horizontal.]



FIG. 5.—Alternating arc. [Movement of plate horizontal.]

In the case of the alternating arc, however, these and many other points are still to be determined.

The arc lamp, fed by alternating currents, invariably hums and sings. The note, which is not to be mistaken for the hissing which we hear from continuous current lamps that are burning under improper conditions, possesses a definite pitch, determined by the rate of alternation of the dynamo. That the note is not due to the mechanism of the lamp itself is readily shown. The Jablochkoff candle, which is devoid of all mechanism, sings as merrily as the lamp with solenoid regulator; any form of hand lamp will do the same. I do not remember having seen any definite statement concerning the source of this humming noise, nor any satisfactory discussion of the question. My attention was first brought to the very obvious explanation of the phenomenon by the study of certain curves of electromotive force, obtained by Messrs. Archbold and Teeple, in the course of an investigation of the alternating discharge between a ball and point*. These curves have recently been published. I reproduce one of them for the purpose of elucidation†. This curve was obtained by the well-known method of instantaneous contacts. The circuit under investigation was the high tension secondary of an induction coil, actuated by an alternating current dynamo, the E. M. F. of which followed the law of sines closely. In the circuit were placed a ball and point, the air space between them being such that the discharge would take place in one direction only, from ball to point. It was established, by the use of a revolving mirror, that an arc existed only during that part of each cycle represented by the horizontal portion of the curve. [*a*—*b*, figure 1.] Shortly after this curve had been obtained, the curves of Messrs. Tobey and Walbridge‡ illustrating the performance of the Stanley arc lighting dynamo, appeared. It will be remembered by those who heard their paper read before the Institute, that this machine, which gave very nearly the sine curve of E. M. F. when working through non-inductive resistance, showed curves very widely removed from that form when arc lamps were in the outer circuit.

Figure 2 contains the curve of the arc-lighting machine when five lamps were in circuit. The relation of this curve to those obtained with the ball and point is evident. Here, also, the variation of the curve from sinusoidal form is to be ascribed to the periodic formation and breaking down of the arc, happens twice in every complete cycle, instead of once, as in the case of the "one way" discharge of the ball and point phenomenon.

After studying these curves it seemed to me unquestionable that the humming of the alternating arc is due to the rapid periodic extinction and re-establishment of the discharge, the effect being similar to that observed in singing flames. When, some months later, opportunity was found of viewing the image of the arc of an alternating current lamp in the revolving mirror, I was prepared to witness the extinction of the arc during a definite part of each alternation. I do not know whether any member of the Institute has tried this simple experiment. I have seen no description of it anywhere, although Wiedemann mentions the application of the revolving mirror to the study of the continuous current arc*, and Joubert† (1880) makes brief mention of a very ingenious application of the plenakistiscope to the study of the changes to which the alternating arc is subject, during each period. When such a mirror, mounted upon a vertical axis, is set up at a convenient distance from the lamp, the images of the white-hot tips of the upper and lower carbons are drawn out by the revolution of the mirror into uniform, parallel bands, extending quite across the field of view. The intervening narrow strip, much darker, is the image of the arc itself. This region, however, is not uniform. It consists of alternate patches of purple and black, which mark the intervals during which the arc exists and is extinct.

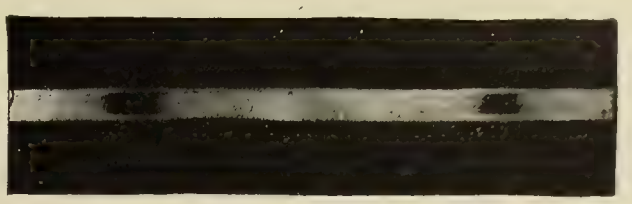


FIG. 6.—Alternating arc. [Movement of plate horizontal.] High speed.

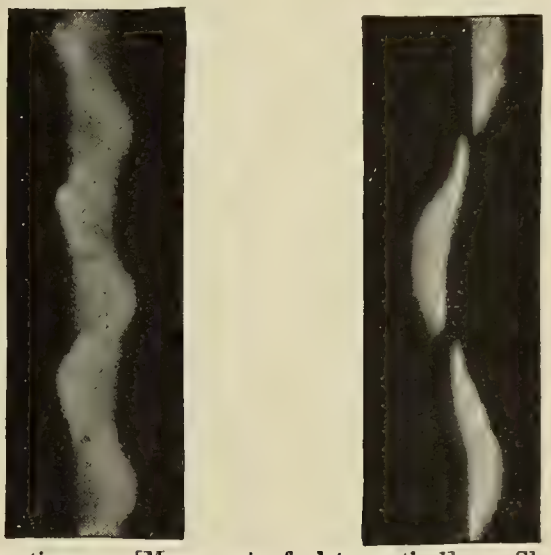


FIG. 7.—Alternating arc. [Movement of plate vertical]. *a.* Showing oscillations due to earth's field. *b.* Showing oscillations in a stronger field.

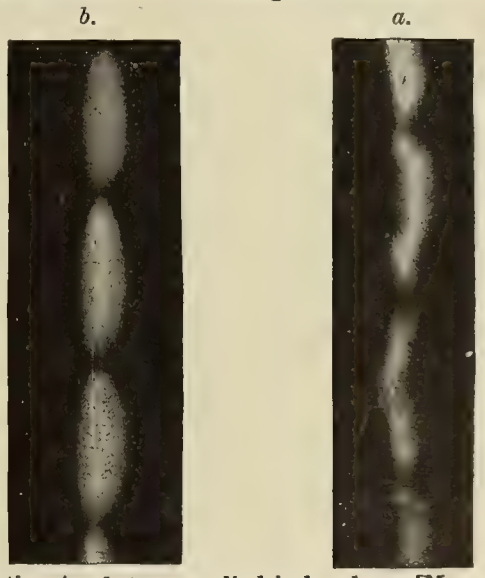


FIG. 8.—Alternating Arc between cylindrical carbons. [Movement of plate vertical.] *a.* Arc viewed from North showing oscillations due to earth's field. *b.* Arc viewed from West.

*Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, New York, May 20, 1891.

*See Archbold and Teeple; Thesis in MS., Library of Cornell University, 1889.

†See "The Alternating Electric Arc between a Ball and Point." *American Journal of Science*, Vol. 41, p. 1.

‡Tobey and Walbridge; TRANSACTIONS, Vol. 7, p. 367.

*Wiedemann; *Elektricitaet* 4, p. 855.

†Joubert, *Journal de Physique*, Vol. 9, p. 300.

(*To be Continued.*)

LETTERS TO THE EDITOR.

NEW NAME FOR ALUMINUM.

NUEVO LAREDO, Mex., June 1.

DEAR SIR:—During the meeting of the American Institute of Electrical Engineers, a new name for aluminum, the metal of the future, was suggested. Why not call it "Almin," which is euphonious, quickly pronounced and distinguished?

Yours very truly,

DR. CHAS. W. ZAREMBA.

TUNNEL LIGHTING BY ELECTRICITY.

The State Board of Railway Commissioners held a meeting on June 3d at the Chamber of Commerce in this city, and obtained many suggestions from different persons as to the best method of ventilating the Fourth Avenue tunnel of the New York Central and Hudson River Railroad.

Dr. Graham Scott, President of the Scott Electrical Manufacturing Company, said that by means of the Huntington search light, which is virtually an electrical arc light, the tunnel could be illuminated so that the light would not interfere with the engineers. Attention was called to the fact that the tunnel very often is filled with smoke and fog, but that did not make Dr. Scott lose any of his enthusiasm. The search light, he said, could penetrate all sorts of fog, smoke and steam.

Mr. William J. Hammer, the well-known consulting and supervising electrician and electrical expert of this city, advocated the placing of incandescent electric lights along the ground of the tunnel. "That's the way the Hoosac Tunnel is lighted," Mr. Hammer said.

CATALOGUES, ETC.

We have just received the first number of "Pantobiblion," an international bibliographical review of the world's scientific literature, published monthly in St. Petersburg, Russia. It is divided into three divisions, the first covering the book publications of the month, the second reviews of books, and the third the contents of scientific periodicals. Each book notice and review is in the original language of the publication, making it a polyglot work useful to every learned man, whatever may be his nationality. The paper has established agencies in all the principal cities of the world, D. Appleton & Co., of New York, acting in that capacity for America.

Hainski & Tucker, the well-known dealers in electrical, mechanical and hardware supplies of all kinds, 921 Broad Street, Newark, N. J., have just issued a neat 50-page catalogue of goods in their electrical department. This firm are manufacturers and dealers in everything in the electrical line, besides contracting for electric light, bell and alarm plants. They have a staff of skilled electricians ready to wire houses quickly and thoroughly.

The Atlantic Avenue Railroad Company of Brooklyn, are distributing a pamphlet among the property owners along that line that will no doubt convince them that they are fighting their own interests by opposing the street railway's adoption of electrical propulsion of their cars. The pamphlet is entitled: "What is the Truth about the Trolley Electric System for the Propulsion of Cars in City Streets?' It contains a brief history of the electric roads of Boston, articles from the public press and many letters from those posted on the subject. There is nothing but common sense between the covers and if it fails to convince those it is meant to reach, it will be because they do not desire to be convinced.

MEETINGS, ETC.

FRANKLIN EXPERIMENTAL CLUB.

At the thirty-third regular meeting of the Franklin Experimental Club, held at the club laboratory in Newark on the 2d inst., two papers were read.

One was presented by Wm. J. Hammer and was entitled "Some Facts and Phenomena about Incandescent Lamps."

Some of the facts and phenomena presented were as follows:

Filaments of carbon are preferable to metals, as carbon is far more refractory and is of higher resistance. A vegetable or structural carbon is preferable to a homogeneous carbon as it is first, mechanically stronger. Then the walls of vegetable cells are very thin and give a high resistance with a shorter length of carbon than is possible with a homogeneous one. This is why nearly all homogeneous carbon filaments are either curled, twisted, or if straight, compel the use of exceptionally long globes.

Carbons after being placed in the globes are always "tempered" or "flashed," commencing with a small current and finally running up to several times the candle power at which the lamps will run normally. This weeds out the poor filaments, and drives out the occluded gases in the carbon, clamp, and platinum wires in the lamps.

The vacuum in an incandescent lamp varies from one one-hundred-thousandth of an atmosphere to one-half a millionth of an atmosphere. Generally it is even less than the former. Formerly it was supposed that too high a vacuum could not be attained, but it is now known that there is less strain and disintegration of the carbon and less blackening of the glass at lower vacuums.

Some times one sees a lamp which burns much more dimly than others upon the same circuit and of the same rated candle-power. This is probably due to a crack in the glass globe and the gradual admission of oxygen which is causing the carbon to be consumed. An evidence of this will be found in the exceedingly hot globe; also in the spotting of the carbon, which will become bright in spots and gradually waste away until it suddenly breaks at one of the bright spots. An incandescent lamp will last longer in a thin globe than in a thick one, as the heat rays pass through the thin glass and escape while the thick one holds them and so lessens the life of the lamp. Incandescent lamps are longer lived on continuous than on alternating currents. The rapid reversals of the current shortening the life of the filaments. About 45 per cent. of lamps in central stations are replaced before breaking, owing to blackening of the globes or to the carbons becoming too thin, thus giving less light.

Carbons will eventually be placed inside dishes, cups, etc., electrically connected so as to keep their contents warmed.

A paper was presented by Earl Atkinson entitled "Electric Motors." Mr. Atkinson first took up the subject in a general way, describing the more recent achievements, and the present state of the art. He said that while the tendency was toward larger motors in some cases, in others it was toward large numbers of small motors, as, for instance, in certain lines of manufactures where each machine was provided with its own separate motor. He then took up the questions more particularly involved in the design and construction of street car motors. These involve the questions of ability to endure without injury the great and sudden changes of load at starting, as well as to be run in either direction. Mr. Atkinson stated it as his opinion that when it becomes possible to provide street cars with satisfactory storage batteries connected to slow speed motors attached directly to the car axle, the resulting service will be all that can be desired.

EASTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL AGE,
620 ATLANTIC AVENUE, ROOM 73,
BOSTON, MASS., June 5, 1891.

The Salem Board of Aldermen has refused to permit the Essex Electric Co. to extend its tracks to the "Willows."

The directors of the Biddeford and Saco horse railroad met last Tuesday and voted to equip the road with electricity this summer.

The first fatal accident on the Newton street Railway occurred on the afternoon of June 1, when a child was struck and instantly killed. No one blames the motor man.

Negotiations are now pending between the Malden Board of Trade and the W. S. Hill Electric Co. It is likely that this company will locate in that city if a proper site can be secured.

Col. L. W. Burnham, of the Electric Gas Lighting Company, has returned from his western trip. He reports business as brisk, and he has taken many large orders for his specialties.

The name of the company carrying on the experiments in lighting railway cars by electricity derived from primary batteries, which system was described and illustrated in the ELECTRICAL AGE of last week, is the Safety Electric Company, and not the Simplex Electric Company, as published.

At the State House last Tuesday the bill to authorize the Interstate Street Railway Company to extend its tracks into Attleboro, North Attleboro and Seekonk was passed to be engrossed with an amendment that it shall not cross the tracks of a steam road without the consent of the Railroad Commissioners.

Gov. Russell has signed the Municipal Lighting Act. After a persistent and heated agitation of over two years, the principle that cities and towns of Massachusetts can supply gas and electricity to their inhabitants has been recognized as a legitimate and constitutional function, and become incorporated in the statute laws of the commonwealth.

The Armington & Sims Engine Company, of Providence, are sending out neat invitations to all interested to visit their works during the June meeting of the American Society of Mechanical Engineers and also of the Master Car Builders' Association, to be held in Providence. They will have running different types of their High Speed Engines.

The Bell Rock Electrical Conductor Co. gave another exhibition of the working of their machine for covering wire with lead at their factory in Maplewood last Wednesday. Some seventy-five gentlemen were present, many of them of the electrical fraternity. The exhibition was an entire success in all its details. Some two hundred feet of wire were covered in about five minutes.

The statement of the assets and liabilities of the Tropical American Telephone Company, issued last January, shows the total assets to be $53,631.50 and the liabilities $2,505.39, leaving a balance of $51,126.11. The assets equal $1.25 per share on 40,000 shares without any account of patents, franchises, contracts and an established business which is said to earn 15 per cent. net on $100,000 yearly and is gradually growing.

The Pettingell-Andrews Company, 192 to 202 Summer street, has purchased the entire business of the Standard Electric Supply Company of 180 Summer street. Their facilities for filling orders were always complete, but with the addition of the various specialties handled by the Standard Company, their prompt service, low prices and

courteous treatment, it will be strange if they do not get a large share of the patronage formerly enjoyed by the Standard Company.

Prof. Elihu Thomson is in receipt of a cable despatch from Mr. Ernst Thurnauer, the Paris representative of the Thomson-Houston International Electric Co., stating that the first prize of 100,000 francs in the competitive electric meter test, instituted and carried on under the auspices of the Paris municipal council, has been divided between his meter and that of Aaron. The Aaron meter is a clockwork meter, requiring to be wound up at intervals, and is also of a very large size, while that of Prof. Thomson is simpler in mechanical construction, requires no winding mechanism, and requires but a fractional part of the space needed for the Aaron meter.

MONTREAL NOTES.

The council of the Board of Trade of this city will shortly interview the Goverment with the object of securing a water-power on the north side of Black's bridge, so as to secure sufficient power to light the north side of the Lachine canal to Cote St. Paul, a distance of about four miles, and also to continue the present wharf system as far as Maisonneuve. This will make a continuous stretch of electric light along the north side of the canal and the city's frontage on the river St. Lawrence for a distance of about seven miles.

MINNEAPOLIS NOTES.

Among the features at the State University the past year was a course of lectures in Histology by Dean Sudduth, of the Medical Department, in which a stereopticon was used. An incandescent light was used instead of the usual oxyhydrogen flame, thus enabling the professor to turn on the lights in the room and further illustrate by diagrams on the blackboard, and return to the lantern views at will.

The Western Union Telegraph Company now has in this city about 130 of their clocks, and in St. Paul about 90. These clocks are all on one circuit, and are synchronized hourly, the master clock being located in St. Paul. The whole system is in charge of Mr. W. H. Kemper. Mr. Kemper was recently called on to repair the elegant clock located in the New York Life Building. This job was one that had baffled the skill of the local clockmakers, but was successfully done by Mr. Kemper, mainly owing to his skill as an electrician.

The Brush Electric Company will begin to receive bids this week for completing its underground wire system in Minneapolis. Two of the bidders are already on the ground and others will follow. A short time ago the Brush people prepared to receive bids, and had the agents of the various electric construction companies here to look over the specifications. The contract was a larger one than they thought it would be, and the visitors asked for time to go to the home offices for instructions. Having received these instructions, they are on the field again. The contract will be worth about $180,000 and will require three months to complete.

The electric cars will be speeding along the Hennepin boulevard within two weeks. Vice-President Goodrich says that a large force of men will begin work on the new line at once and that it would be opened in two weeks. The tracks will only have to be laid from Douglass avenue to 31st street, so the work could be completed within a week, if necessary. After the line has been opened for a few weeks the management expects to be able to make the trip from Washington avenue to Lake Harriet in 25 minutes. Two motors will be placed in service, each carrying a trailer and two during certain hours, the speed being slightly in excess of 10 miles an hour.

The Bloomington and Fourth Street electric line is now running. The cars run seven minutes apart, eight of them keeping the line covered. The run is made in about 25 minutes from Bloomington avenue and 32d street, to 1st avenue South and Washington. The line is well patronized, every car being accompanied by a trailer. The line is regarded as a boon by the southsiders, as it brings them to town about ten minutes earlier than the old horse cars. Additional cars will shortly be put on the Bloomington avenue line, running every five minutes. The loop running on First avenue south, High street, and Hennepin avenue to Washington, is now in use. So far it is used only for the inter-urban cars, but will eventually be used for cars of other lines.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOMS 7-12, "WORLD" BUILDING,
NEW YORK, June 6, 1891.

John Beatty of the Thomson-Houston Electric Company, Boston, was in town last week.

Mr. C. J. Hirlimann, of 91 Greene St., is about completing his new dry battery. Tests so far made indicate that each cell will have an exceedingly long life.

Mr. Benjamin R. Western, of the Manufacturers' Advertising Bureau, of this city, has our congratulations on the marriage of his daughter, Belle Clarke, to Mr. Charles W. Smith, on June 4.

Mr. C. A. Benton, W. C. Bryant, of the Bryant Electric Company, Bridgeport, Conn., and Mr. Marshall of the Star Electrix Company, of Philadelphia, were in town last week.

Mr. Louis Walsh, of the battery department of Alexander, Barney & Chapin, reports more orders on hand for their new dry battery than they can fill, which accounts for their patrons not receiving them more promptly.

Colonel Gouraud, agent for Mr. Edison in London, Eng., who has been in this country for some time in the interest of the phonograph, left for home last Wednesday on the steamer "Umbria." Mr. Gouraud took over with him several improved phonographs.

Mr. C. A. Hussey, the well-known battery expert of this city, is opening an office in the Electrical Exchange Building. He will soon be ready to place on the market his new aluminum storage battery plate, the weight of which will only be one-twentieth that of the present batteries now in use.

The New York Electric Construction Company, general electric contractors, Electrical Exchange Building, 136 Liberty street, have installed numerous light and power plants recently. They are sole agents for the Daimler Gas and Petroleum Motor, the Colburn dynamos and the New York storage batteries.

The Electric Railway Specialty Company have removed from 50 Broadway to 29 Broadway. Their new offices are larger, handsomer and more fully equipped with samples of street railway supplies. As the firm are manufacturers, agents and brokers they can supply anything in the electric street railway line from a spike to a power generator. Their success in manufacturing and pushing meritorious inventions is well-known.

On June 1, Mr. W. D. F. Crane, M. E., became associated with the Engineering Equipment Company, of 143 Liberty street, New York. Mr. Crane will give his time principally to the continued development of the company's growing business in the Anderson trolleys, line materials, etc., the Kellogg, combination steel centre and side poles, and other equipment materials for electric railways, and engineering works in general.

F. A. Magee, M. E., is located at 126 Pearl St., Boston, as the representative of the Engineering Equipment Company, of New York, the well-known contractors for steam and electric equipment materials, and eastern selling agents for the Underwood Manufacturing Company. Mr. Magee will keep a full stock of the Underwood Patent cotton-leather belts and the Dodge "Independence" wood pulleys at his offices and salesrooms.

The Elektron Company have just equipped the B. H. Douglass & Sons candy factory at New Haven, Conn., with five Perret motors, to run elevators, candy machines, etc., in various parts of the building. The motors are supplied with current from a 25 horse-power Perret generator run by a 25 horse-power engine. George G. Grover, the expert electrician of the Ansonia Brass and Copper Company, supervised the installation.

The S. & S. Battery manufactured and sold by the S. & S. Electric Co., 156 West 43d street, New York, is meeting with a ready sale. It is now being bought for use in connection with the phonograph as well as to run motors and sewing machines. So well does it perform its work that twenty families on the one block on which the office is situated use the S. & S. battery for sewing machine purposes.

The Hunt Engineering Company, 238 Washington street Brooklyn, N. Y., have acquired the agency of the Buckeye Electric Company, Cleveland, O., manufacturers of incandescent lamps. They have also secured the services of Mr. E. W. Hickox, formerly the Buckeye's eastern agent, with offices at 120 Liberty street, this city. Both offices will now be used in the Hunt Engineering Company's interest. The company is to be congratulated in securing this agency as the Buckeye lamp is certainly among the best in the market.

Messrs. Truex & Vail, Electrical Exchange, 136 Liberty street, this city, have secured the sole agency of the Swinging Ball Lightning Arrester, which is said to be the most efficient device of this class on the market. It offers the quickest and surest path to the earth for all static discharges, and renders it impossible for the dynamo current to follow. It requires very little attention, and it arrests the lightning discharge before it enters the station. The firm are convinced that this arrester will fully satisfy every one using it. In our next issue we will describe this apparatus more fully.

Many of our readers will be interested to know that the first firm of promoters and financial agents whose names appeared in a New York directory was that of Smith & Ellery. This firm was located in the Trinity Building in 1871. Mr. George B. Ellery has followed that business to this day, recently opening offices under the name of George B. Ellery & Company at 245 Broadway, for the negotiation of all classes of electrical patents, plants, bonds and shares. The firm is ready to introduce patents, organize and incorporate companies, and act as general agents for corporations, and with Mr. Ellery's twenty years' experience, they will no doubt prosper in his hands.

The McLean Engineering Company, consulting and contracting engineers, room 601 Electrical Exchange Building, 136 Liberty street, New York, are prepared to undertake anything in the line of mechanical engineering. Steam plants, millwright work or steam fitting placed in their hands receive the benefit of their knowledge. Several factories in the East were equipped by them lately, includ-

ing a large silk factory in Brooklyn, in which they installed the looms, Greene engines, Phœnix boilers and the other power machinery used. This firm contracts for electric light plants and for either electric or steam power plants. They will also take care of isolated plants of all kinds under contract and furnish materials used for operating the same.

C. L. Eidlitz, of 10 West 23d street, has secured a big contract for a complete electric light and steam power plant for the Cumberland Gap Park Company's Four Season's Hotel, Cumberland Gap, Tenn. The installation will consist of four dynamos and wiring for 3,000 16-candle-power lamps at the hotel; dynamos, motors and wiring for nearly 1,000 16-candle-power lamps at the Cumberland Gap Sanitarium and a large arc light plant for the hotel and Sanitarium Park. Mr. Eidlitz has also secured a contract for a complete electric light plant for the new building of Schumann, the jeweler, located on 22d street and Broadway. From the number of contracts recently made by this gentleman, it is natural to infer that the "Economic" lamp, for which he is agent, is doing well in his hands.

Mr. Joseph Harris, the contracting agent of the Shaver Corporation, has just completed another telephone line at the Morris Park Race Course. The line runs from the judge's stand to the centre of the betting ring. The seven telephone lines, and the water indicators on the water tanks at the grand stand and at the water tower, are reported as giving excellent satisfaction. The indicators are connected directly to the pump house by a metallic circuit, which, with the telephone lines, were erected last year. Negotiations are being made to change part of the telephone system from the grand stand to the club house. Mr. Harris has also closed a contract to erect another telephone line for the D. L. & W. Railroad at their coal docks, Hoboken, N. J. This company has fifteen Shaver Molecular telephones at their docks at present which are giving satisfactory results.

Mr. R. H. Sherwood, who recently opened offices in the Boreel Building, 115 Broadway, New York, for the purpose of furnishing estimates and data for, and equipping and installing electric light and power plants, reports business as being good. Mr. Sherwood first became interested in electrical circles eight years ago, when he became general manager of the Seven States Improvement and Construction Company, with headquarters at Philadelphia. Two and a half years later when this company became absorbed by the Excelsior Company he accepted the Philadelphia agency of the new corporation, becoming assistant manager of the home office in New York four years ago. Two years later, he accepted the New York agency for the electric railway department of the Thomson-Houston Company, remaining with them until he went into business for himself at his present address, May 2, last. Every business in which he has been engaged has been successful under his management. Mr. Sherwood has closed the largest contracts for light and power plants in the United States, among them being the large Thomson-Houston railway plant of Newark, N. J., and the big contract with the Brooklyn City Railway Company. W. T. H.

FINANCIAL.

A decision of considerable importance to the shareholders in electric railroads, as well as those interested in telephone securities, was rendered by the Supreme Court of Ohio, on the 2d inst. The case at issue was the Cincinnati Inclined Plane Railroad Company against the City and Suburban Telegraph Company, on appeal. Action was originally brought by the Telegraph and Telephone Companies to enjoin the Electric Railroad Company from constructing and operating its line by the Sprague or single trolley system, claiming the electric current rendered the low tension circuits practically useless. The Telephone Company claimed the prior use of the earth as a means of securing a return circuit and on this point the Court seems to have based its decision in favor of the Railroad Company, on the theory that the street is intended for the general public to use for the purpose of travel and conveyance of merchandise or other property and the fact of a motive power which facilitates this object being changed to something which might interfere with a subordinate use of the public streets, ought not to make any difference in that regard. This will tend to enhance the value of all electric power conveying systems, whose stockholders are far more numerous than the telegraphs and telephones combined.

The Secretary of the Treasury has issued the following circular which speaks volumes for the present credit of the nation:

WASHINGTON, June 2, 1891.

By virtue of the authority conferred by law upon the Secretary of the Treasury, notice is hereby given that the principal and accrued interest of such of the 4½ per cent. bonds, issued under the acts of July 14, 1870 and Jan. 20, 1871, as may be outstanding on the 2d day of September, 1891, will be paid at the Treasury of the United States, in the city of Washington, D. C., on that day and that the interest on said bonds will then cease.

Suggestions have been made on the part of the holders of some of these bonds of a desire to extend the payment thereof, at the option of the United States, at the rate of 1 or 1½ per cent. per annum, and the Secretary of the Treasury will hereafter consider whether the acceptance of such offers or any of them will be profitable to the Government, and in that event reserves the right to except such bonds from this call.

CHARLES FOSTER, *Secretary.*

That the majority of the bonds will be exchanged for those bearing a less rate of interest is certain, also that the Secretary of the Treasury will accept the issue with good grace. How much better this is than the Canadian loan which failed in France this year.

The Brush Electric Light Company, secured a decision in the United States Circuit Court against the North American Electric Arc Light Company on the 3d inst, restraining the latter company from using more than one carbon, Judge Shipman holding that arc lamps using carbons adjusted to ac independently so as to burn successively were infringements on the plaintiff's patents. Minority stock in this company although freely offered in this market lately, found sale in Cleveland instead of New York.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	3 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 50
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	115 00
Averell Insulating Conduit	3,000,000	100 00	4 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	198 00
Bell Telephone 7's	2,000,000		*112 00
Birmingham Ry & Elec. Co., 6's	1,500,000		par
Boston Electric Light.	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5's	6,000,000		par
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Illuminating (N. Y.)	1 000,000	100 00	60 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	10 00
City Electric St. Ry. Co., 6's (Ark.)	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	106 00
Complete Elec. Con. Co, N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co. (N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80,000		par
Cons. Gas Co. Batavia	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Daft	1,000,000	50 00	
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's		25 00	25 00
Detroit Electrical Works	1,000,000	10 00	10 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison General	14,000,000	100 00	100 00
Edison Elec. Light (N. J.)	1,600,000	100 00	
Elec. Sup. & Con. Co. (N. Y.)	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Empire City Subway Co. (N. Y.)		100 00	
Eric Telephone	4,800,000	100 00	49 00
Essick Printing Tel.	5,000,000	100 00	45 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's	100,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	11 75
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	70 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	par
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1 000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co.. 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7 500,000	100 00	15 25
Laclede Gas, pref	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*74
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	80 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	101 50
Nat'l Cordage, pref.	5,000,000	100 00	105 00
Nat'l Lead Trust	9,000,000	100 00	18 25
New England Butt Co.	100,000	1,000 00	1,000 00
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	90 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. Storage Baty. Co.	100,000	100 00	55 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,600,000	100 00	
North New York, Lighting	150,000	100 00	20 00
Northwest Elec. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
Pittsburg Reduct. Co. (Aluminum)	1 000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	75 00
Rockaway Elec. Lt. Co. 6's	75,000		par
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s	300,000		*86
Saratoga Gas and Elec. Light	325,000		
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
San Diego Gas & Elec. Co. 6's	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation. N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000 000	100 00	95 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	41 25
Thomson-Houston Pref.	4,000,000	25 00	25 50
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100,000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine street Motor Co. 6's	100,000		par
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	80 50
Westinghouse Electric Co.	7,000,000	50 00	13 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			20 00
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent.

A SUCCESSFUL CONSTRUCTION COMPANY.

One of the largest electrical concerns in the new Electrical Exchange Building, 136 Liberty street, this city, is the Thomas Murray Company. This company has an excellent reputation in the trade as engineers, contractors and builders of electrical, steam, and cable railway plants. They make a specialty of the complete construction of electric railway plants, and provide the entire equipment for the same, so that all that is necessary is to give them the entire contract and they will build the road, furnish the rolling stock, install the steam and electric plants complete, and turn the road over complete in every detail and in successful working order to the operating company. They thus possess great advantage over most all other concerns of like character.

They have at their command some of the most expert electrical and mechanical engineers in the country, who are familiar through their long experience, with every detail in their respective departments. In addition to this the company undertake overhead electrical construction, conduit work, and track laying, to all of which they give the best attention and use the best material obtainable. Owing to their large resources they are able to carry on and complete large contracts in very short order, and they point to the fact that they have not once failed to complete their contracts within the specified time. On May 20 last the Grand View Beach Railroad, running between Charlotte and Manitou Beach, N. Y., a distance of eight miles, was completed and put into operation. They had but sixty days in which to build this road, and it was completed in time according to contract. They built the track, graded the road, built bridges, erected the overhead lines, supplied the cars, motors, generators and built and installed the power house—in short they provided and constructed everything that was needed, from beginning to end.

They are now engaged on various contracts, notably the building and complete equipment of a 15 mile electric road in Lawrence, Mass., and 15 miles of railway in Fall River, Mass. Both these roads are to be completed in the shortest time possible, and the company will carry out their part of the contract without fail.

The officers of the company are: Thomas Murray, president; J. D. Murray, vice-president and J. A. McLure, secretary. All these gentlemen are well-known in the trade and through their long and successful experience in electrical matters are in every way qualified to carry on the large undertakings for which the company is justly renowned.

BUSINESS NOTES.

Mr. J. H. Mason, of 118 and 120 Park avenue, Brooklyn, N. Y., has been elected superintendent and electrician of the Mason Battery and Electrical Company, which concern is also sole eastern agents for the Hay-Horn Manufacturing Company of Chicago. Mr. Mason now has his factory in such excellent shape through enlarged facilities that he is able to fill orders more promptly than ever before.

A new book on Telephones, their Construction and Fitting, will shortly be issued by E. & F. N. Spon, 12 Cortlandt street, N. Y. It will be a Practical Treatise on the Fitting up and Maintenance of Telephones and the auxiliary apparatus, by F. C. Allsop. Illustrated by numerous engravings, all of which are fully described in the text. The price will be $2.00, postage prepaid.

The Seymour Electric Light Company of Seymour, Conn., is enlarging its plant by an addition to its buildings, and by an increase of 105 horsepower to its power.

The Edison General Electric Company of New York has closed a contract for an electrical power plant for the Citizens' Street Railway Company of Memphis, Tenn.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued Tuesday, June 2d, 1891.

453,190. Advertising Device. Sidney D. L. Jackson, Youngstown, O. Filed Oct. 23, 1890.

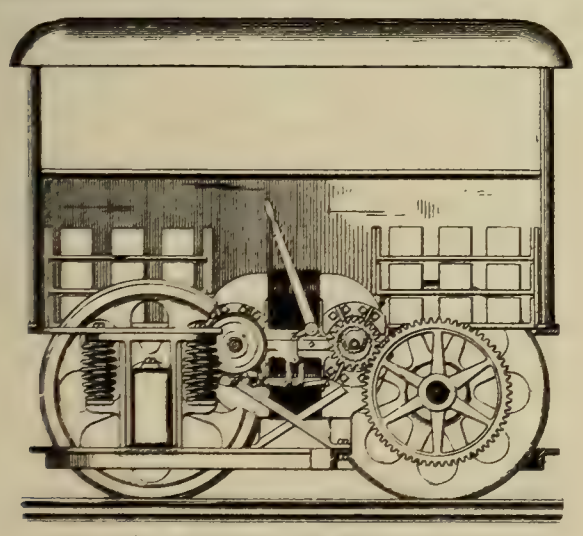
An electric signal device and source of electricity for operating the same located within a frame having a cover with display characters thereon, and a circuit-closer under control of the carrier of the frame.

453,216. Electric Street Car Motor. Jabea F. Shawhan, Dayton, O., assignor by mesne assignments to Freeman B. Dickerson, Detroit, Mich. Filed Sept. 9, 1889.

A motor-car having a rigid truck frame connecting rigidly the two axles, and a second frame supported by spring bearings upon the truck-frame and connected with the body, in combination with an electromotor arranged upon the truck-frame, with independent connections between the motor and the different wheels and batteries mounted upon the spring supported frame.

453,225. Electric Connector. Frank Wheeler, Meriden, Conn. Filed Dec. 30, 1890.

An electric connector consisting of a pair of duplicate parts, each having a semi-tubular projection and a semi-annular recess, and a flat contact of spring material rigidly secured at one end to the terminal of the conductor.



453,216—ELECTRIC STREET CAR MOTOR.

453,242. Magneto Electric Machine. William Humans, Cambridge, Mass., assignor to the American Magnetic Electric Company, Jersey City, N. J. Filed July 23, 1885.

453,248. Bracket for Electric Lamps. Thomas C. Smith, Philadelphia, Pa. Filed May 19, 1890.

A bracket provided with two pairs of arms, each at right angles to the other, one pair angular and adapted to receive the conductor-insulators, the other pair provided with screw-hooks adapted to receive the insulators upon which a shunt-box is fastened.

453,260. Electro-Magnetic Engine. Charles E. Kells, Jr., New Orleans, La. Filed Feb. 24, 1891.

The combination of an electric motor, a driving wheel or pulley and an electro-magnetic clutch in series with the field coils of the motor and with a circuit breaker, whereby the stopping and starting of the motor and the release or engagement of the clutch coincide.

453,261. Telegraph Receiver. Charles Langdon Davies, London, Eng., assignor to the Phonopore Syndicate, Limited, same place. Filed Nov. 18, 1890.

A coil receiving vibratory impulses from a line-wire and thereby varying the magnetism of a permanently magnetized core and causing the same intermittently to attract an armature on a strained metallic ribbon, in combination with re-enforcing coils, the circuit of which is opened as the ribbon oscillates and which also effects the magnetization of the permanently magnetized core.

453,281. Safety Device For Dynamos. Charles G. Young, New York, N. Y. Filed March 31, 1890.

A cut out in circuit with the generator and controlled by a device in continuous circuit with the main line and the ground.

453,286. Pole or Electric Wires. Charles A. Lieb, New York, N. Y. Filed Nov. 3, 1890.

A pole composed of metal strips or wire wound in a tapering spiral, the convolutions being united together and a filling material within the pole to re-enforce it.

453,287. Automatic Switch for Electric Motors. Roderick Macrae, Baltimore, Md., assignor to the Donaldson-Macrae Electric Company, same place. Filed Aug. 27, 1890.

453,318. Switch for Electric Motors. Ferdinand A. Wessel, Brooklyn, assignor to the Excelsior Electric Company, New York, N. Y. Filed Jan. 9, 1891.

The combination with an electric motor, of an armature normally out of central or neutral position in the magnetic field and a rheostatic switch placed in the armature circuit and operated or controlled by the end movement of the armature-shaft, due to the centering tendency of the field magnet when the motor is thrown into operation.

453,319. Automatic Starting-Switch for Electric Motors. Ferdinand A. Wessel, Brooklyn, assignor to the Excelsior Electric Company, New York, N. Y. Filed Jan. 9, 1891.

453,320. Automatic Starting-Switch for Electric Motors. Ferdinand A. Wessel, Brooklyn, assignor to the Excelsior Electric Company, New York, N. Y. Filed Jan. 9, 1891.

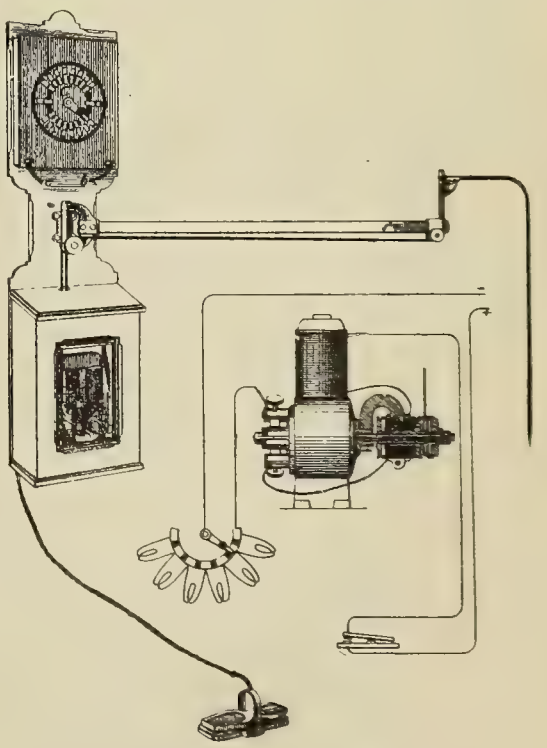
The combination with an electric motor fed from constant potential mains, of a rheostatic switch the whole or greater part of whose resistance is included in the armature-circuit when the motor is at rest and running at slow speed, the resistance being independent of the field-magnet and in a separate branch with the armature of the motor, an armature or keeper placed within the influence of the field magnet and connected to the rheostatic switch and a retarding device.

453,323. Electric Current Tester. William H. Ebert, New York, N. Y., assignor of one-half to John C. Beekman, same place. Filed Feb. 20, 1891.

A testing device, comprising a voltaic pair permanently connected by a yoke and a pair of flexible conductors, one for each member of the pair, fixed in electric contact therewith.

453,326. Insulating Cover for Trolley or Conducting Wires for Electric Railways. Albert L. Ide, Springfield, Ill. Filed Dec. 31, 1890.

A trolley or conducting wire partially enveloped in a non-conducting insulating covering thickest in cross section at its central portion.



453,260—ELECTRO-MAGNETIC ENGINE.

453,349. Switch Board for Electric Arc Light Stations. Robert F. Sawyer, Chicago, Ill. Filed Oct 23, 1890.

453,355. Process of Coating Metals with Oxides. Alexander E. Haswell and Arthur G. Haswell, Vienna, Austria-Hungary. Filed Nov. 3, 1890. Patented in Austria-Hungary.

The process of electro-depositing binoxide of lead on iron and steel, consisting in immersing the article to be coated in

ELECTRICAL PATENTS—Continued.

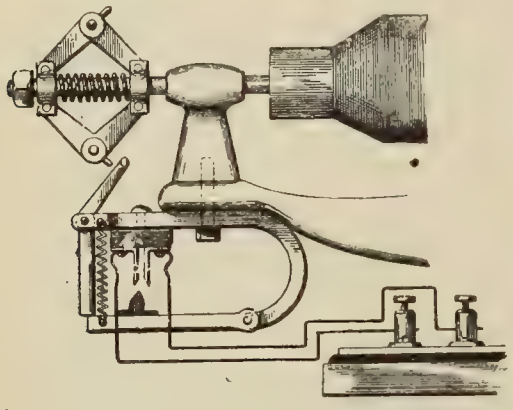
a bath containing nitrate of lead and nitrate of ammonia in solution and in depositing binoxide of lead from the bath by passing an electric current through it.

453,367. Starting Switch for Electric Motors. Clark C. Haskins, Chicago, Ill. Filed Oct. 24, 1890.

In combination with a rheostat switch, a pivotal switch-finger controlled by a spring to return automatically to the off point from any contact to which it is turned therefrom, a bridge yieldingly supported to extend over the contacts and normally obstructing the return upon the contacts of the finger and a catch for retaining the finger in opposition to its spring at the terminal contact.

453,416. Electric Annunciator System. Louis M. Pinolet, Brooklyn, N. Y. Filed Sept. 25, 1890.

The combination of rotating concentric indicating discs rotating together but independently movable, circuit-closers at different points, as in the rooms of a hotel, an electro-magnet in circuit with each push-button and provided with an armature and two projections upon each of the discs at different distances from the centre, the armature being so located that any attracted armature lies tn the path of one of the pro jections, and an electric generator in circuit with the magnets and push buttons.



453,287—AUTOMATIC SWITCH FOR ELECTRIC MOTORS.

453,430. Electrical Typewriting Machine. James F. McLaughlin, Philadelphia, Pa. Filed Aug. 18, 1887.

453,433. Holder for Telephone Receivers. Frank T. Tinning and William K. S. Tinning, Toronto, Ontario, Canada, assignors of one-fifth to Charles Warren Irwin, same place.

453,447. Railway Signaling Device. William A. Luby, Kalamazoo, Mich. Filed Nov. 26, 1890.

453,455. Electric Lamp Socket. LeRoy S. White. Waterbury, Conn., assignor to the Electrical Appliance Manufacturing Company, same place, Filed April 1, 1891.

453,466. Circuit Closer for Burglar Alarms. Edwin A. Darling, Hopedale, Mass., assignor of one-half to William F. Draper, same place. Filed Jan. 10, 1888.

A circuit-closer composed of two thin flat elastic strips of conducting material and a number of thin pads of insulating material interposed between the conducting-strips at short distances from one another along the conductors, and a tubular covering inclosing the springs.

453,476. Electrical Apparatus for Surgical Purposes. Cornelius B. Harness, London, Eng. Filed Jan. 26, 1891.

453,483. Telephone Circuit. William W. Jacques, Newton, assignor to the American Bell Telephone Company, Boston, Mass. Filed March 7, 1891.

The combination, with two metallic circuits, of two pairs of condensers, one pair for each circuit and one plate of a separate condenser being in contact with each line wire, while the opposite or free plates of the pair of condensers of each circuit are connected by a metallic loop and the two loops thus formed are connected by a third.

453,484. Electrical Register for Measuring Pumps. Robert Jewell, London, Eng. Filed June 20, 1890. Patented in England, France, Germany and Italy.

453,572. Automatic Electric Switch. Robert Baumann, St. Louis, Mo., assignor to the Electric Alarm Lock Company, same place. Filed Nov. 7, 1890.

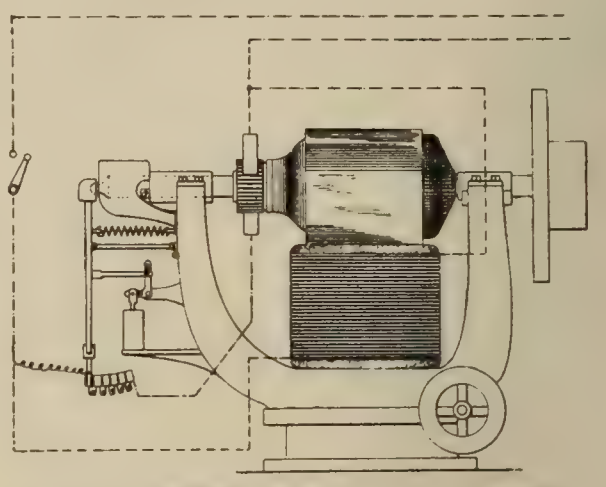
The combination with a rocking disc of a conducting strip having its central portion secured to its periphery and having ends bent outward and contact plates adapted to be connected to the opposite poles of the electric circuit and to make simultaneous contact with the outwardly extending ends of the strip.

453,578. Electric Railroad Signal Alarm. Newton S. Chapman, Kansas City, Mo., assignor of one-half to Frank Hagerman, same place Filed Feb. 18, 1891.

A series of locomotive engines, each provided with an electric generator, alarm, insulated metallic brushes and testing brushes suspended from the yoke of the engine, which are operated by suitable arms and levers.

453,581. Telephone Transmitter. Philip Fitzsimons, Birmingham, Ala., assignor of one-half to Frederick Hardy, same place. Filed Sept. 9, 1890.

453,583. Electric Arc Lamp. William Hochhausen, Brooklyn, assignor to the Excelsior Electric Company, New York, N. Y. Filed May 28, 1890.



453,318—SWITCH FOR ELECTRIC MOTORS.

The combination in an electric arc lamp, of a perforated plate of iron constituting the armature of a magnet and mounted and sustained upon fixed pivotal bearings to one side of the vertical line in which the carbon feeds, a ring clutch sustained loosely on the armature and having an opening coincident with the perforation in the armature, and an electro magnet beneath the armature for drawing it down to effect a release of the clutch.

453,597. System of Electrical Distribution. Fredrick A. La Roche, Philadelphia, Pa., assignor to the La Roche Electric Works. Filed May 17, 1890.

453,601. Sextuplex Telegraph. Thomas A. Edison, Menlo Park, N. J., assignor to the Western Union Telegraph Company, New York, N. Y. Filed June 2, 1887.

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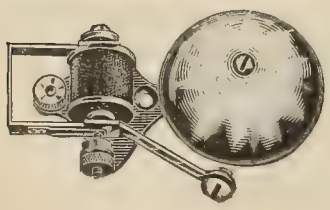
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WEEKLY.

Vol. IX NEW YORK, JUNE 20, 1891. No. 25.

A PROMINENT ELECTRICAL CONCERN.

In these days of competition and struggle for supremacy in the mercantile fields every manufacturer endeavors to secure every possible advantage to make them the fittest to survive. In the struggle the best machinery, the most accurate workmanship, and the greatest facilities to turn out the articles desired by the public, adapted alike to the use for which they were designed and to the pocketbook of the purchaser, secure an advantage against which it is hard to prevail. It is an uphill fight for newcomers to gain a footing against old established firms backed by large capital and years of experience; and even if they have plenty of funds a large portion of it must be devoted to simply extolling their wares, taking chances against its being placed on the "loss" side of the balance sheet.

There is competition in every trade—in some sharper than in others—but everywhere one can recognize the efforts made to display the goods to the best advantage, and see in the goods themselves the desire to manufacture a better grade than competitors. In new fields of manufacture this competition is felt as soon as the new products find a market. This has been the case in the many branches of electrical goods, and firms for the manufacture of specialties for this class have become so numerous that it is difficult to realize that the present electrical industries are but the growth of a few years—very few when compared with the time taken to develop other trades.



SALESROOM OF THE NOVELTY ELECTRIC COMPANY.

Among the numerous manufacturers of electrical goods who have created a reputation for the quality and workmanship of their productions, and who have permanently established themselves in this field is the Novelty Electric Company, 50 to 54 North Fourth street, Philadelphia. Ever since the establishment of this company in 1883 they have endeavored to deserve the patronage of electrical buyers by giving them goods equal to any on the market, and by their courtesy and attention to those with whom they deal have built up a trade that an older house might envy.

As one enters the salesrooms, shown in our first illustration, he is met by salesmen as courteous as clerks in the drygoods stores when waiting upon ladies, and any embarassment that may be felt in asking for a three cent binding post is quickly allayed by the suave clerk who sells the smallest article as pleasantly as the largest order. Everywhere the customer turns he sees neatly arranged electrical specialties; some of new design, some of familiar form. Everything known to the trade is grouped in the large salesrooms to the best advantage, and all kinds of mechanisms, from a push button to a dynamo, are to be seen.

The factory where the firm turns out its enormous quantity of goods is shown in the next two illustrations. It is completely equipped with the latest improved machinery, and all the workmen are first-class machinists.

A 50 horse-power Green-Corliss engine, shown in our fourth cut, and two 50 horse-power steel boilers, furnish power for the factory and the incandescent arc and dynamos, with which the entire building is lighted.

One of the Ball arc dynamos is shown in the fourth illustration.

Everything has an orderly appearance seldom seen in a large manufacturing establishment, which speaks well for those having charge of the factory.



A PART OF THE NOVELTY ELECTRIC COMPANY'S FACTORY.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

DATE OF MONTREAL MEETING CHANGED.

A meeting of the Executive Committee of the National Electric Light Association was held at the Windsor Hotel, Montreal, Quebec, on June 8 and 9, at which business of considerable importance and interest was transacted.



A PART OF THE NOVELTY ELECTRIC COMPANY'S FACTORY.

It was decided to change the dates of the Montreal Convention from August to September 8, 9 and 10, and it was further resolved, according to our advices, that the electrical exhibition in connection with the convention, be opened on September 7, and remain open until September 16, both dates inclusive.

Mayor McShane of Montreal, and several prominent citizens were present, and expressed the assurance of a hearty welcome by the citizens to those in attendance at the convention.

A communication was read from Lord Stanley, Governor-General of Canada, in which that official stated that in all probability he would be present in Montreal, during the convention.

In the afternoon of the 8th, the members of the committee visited the McGill University, and were much pleased with the reception they received. In the evening of the same day an impromptu dinner was tendered to the visiting Americans, by the Citizen's Committee, in the Windsor Hotel. Toasts were drunk and an extremely enjoyable time was had by all.

The following named gentlemen were present at the business meetings of the Executive Committee: J. J. Gulick, of New York; C. R. Huntley, president of the National Electric Light Association; F. R. Redpath, Prof. Bovey, Prof. Cox, M. D. Barr, of the Edison Company in Toronto; W. J. Morrison, Fort Wayne Electric Company; Fred. Nicholls, of Toronto; H. H. Fairbanks, Worcester, Mass.; E. H. Peck, of Brooklyn, N. Y., J. W. Beane, secretary-treasurer National Electric Light Association; S. C. Stevenson, A. J. Corriveau and Jno. Carroll.

Mr. A. J. Corriveau of Montreal, is putting forth all of his energy towards making the meeting and exhibition a grand success, and results so far show that his energy is well directed. He has succeeded in creating a great deal of interest among Canadians, the citizens of Montreal in particular, over the coming convention, and there is no doubt that it will be the most successful ever held by the Association.

Jackson, Tenn., is to have an electric light plant.

THE VALUE OF OIL AS AN INSULATOR FOR HIGH VOLTAGE CURRENTS.*

BY DAVID BROOKS.

Even as late as 1884, in the electrical works, oils were placed among conductors. For instance, James T. Sprague, in the second edition of his book, places them among conductors "in the order of their specific gravity." His first patent for the use of oil as an insulator was taken out in 1878, and now the matter is receiving great attention among the electricians of Europe. In the London *Electrical Review* there is an account of tests by Siemens and Halske, of Berlin, in which they state that an ordinary Siemens' electric light cable was inserted, and broke down at a pressure of some 15,000 volts, but when oil was used, it perfectly withstood the pressure as high as 20,000 volts.

Oil has been used in Switzerland with complete success, not only for insulating wires but also for transformers.

The writer has made the following experiment to show how much better oil is than the air for insulation. A large Holtz machine that sparked 7.5 inches through the air was unable to puncture the insulation of a cable of twisted wires separated one-fourth of an inch, when immersed in oil.

The ends of the twisted wires were spliced to rubber-covered wires, and these we attached to the poles of the Holtz machine after glass tubes had been drawn over them. The twisted wires were then placed in a jar containing oil with a layer of water floating on it, the oil being heavier than the water.

The spark broke through the tubes from wire to wire above the oil; in the part of the jar containing the water the tubes were broken opposite the splice, while the twisted wires in the oil stood the entire pressure of the machine, 7.5 inches spark. Such a spark would be equivalent to 175,000 volts, as defined by Warren De La Rue, between a point and a disc, but this spark of 7.5 inches was between two spheres which requires a much higher voltage.

When no glass tubes were used to protect the conductors, the voltage or tension was much reduced by silent or brush discharge, blue sparks passing through the rubber covering. When bare wires were used to connect the two poles of the Holtz machine, still less tension was produced on account of leakage through the air.

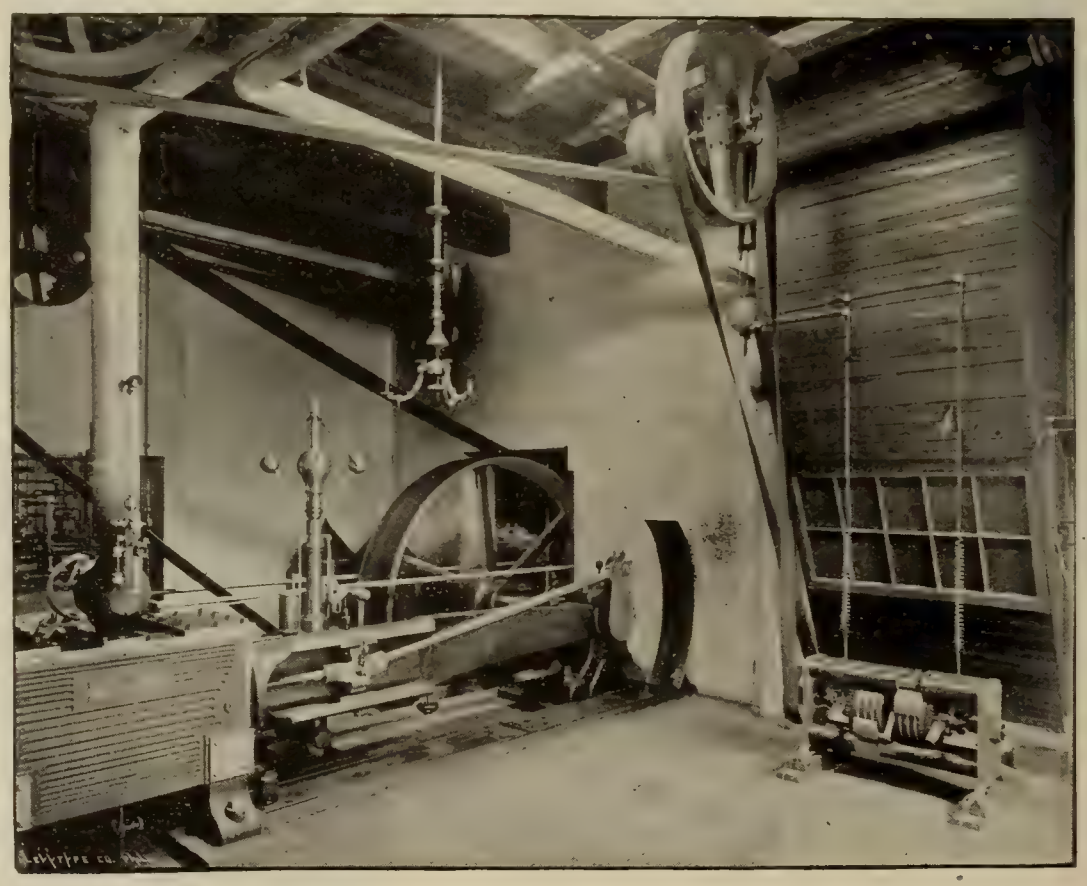
The experiment tends to show that the air is not a good insulator for very high voltages, and also to confirm the experiments made in Switzerland as to the value of oil for insulating transformers, and protecting them from destruction by lightning.

Experiments have also been made with heavily insulated electric light cables for conveying high voltages. None of them stood a tension above 12,000 volts, and most of them broke down by the use of less than 10,000 volts.

* Paper read before the Electrical Section of the Franklin Institute, May 5, 1891.

LEGAL NOTES.

The State Supreme Court, at Columbus, Ohio, on June 2, rendered a decision reversing the decision of the Superior Court of Hamliton county in the case of the Cincinnati Inclined Plane Railway Company against the Telephone Company, who sought to enjoin the Inclined Plane Railway Company from constructing and running their electric railway by the single trolley system because, so it was alleged, the same interfered with the use of the telephone and rendered it almost worthless. The Superior Court decided in favor of the Telephone Company, but the Supreme Court reverses that decision. The decision rendered by this court is final.



ENGINE ROOM OF THE NOVELTY ELECTRIC COMPANY.

A STUDY OF AN OPEN COIL ARC DYNAMO.*

BY MILTON E. THOMPSON.

Of all the dynamo machines in use at the present day, perhaps the internal action of none is so little understood as that of the arc lighting machines of the open coil armature class. Much concerning the regulation and general behavior of these machines seems utterly at variance with what one would naturally expect, from a superficial examination of the design and construction, and it was with the idea of throwing some light

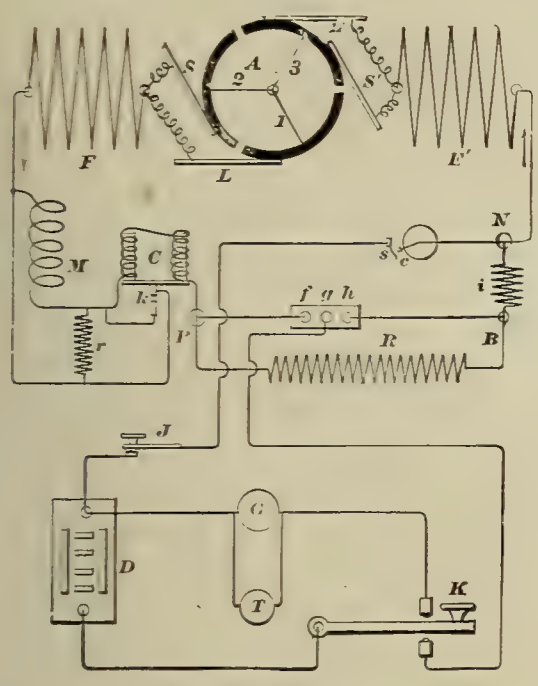


Fig. 1.

on this seeming mystery that the investigation to be described was undertaken. In carrying out this work no attempt has been made to determine the efficiency of the dynamo, or to determine an answer to the question—is the machine well suited for arc lighting? The vast numbers of these dynamos in daily use in all parts of the world is a practical answer which must carry more weight than any which might be suggested by a theoretical study of the machine. The experimental

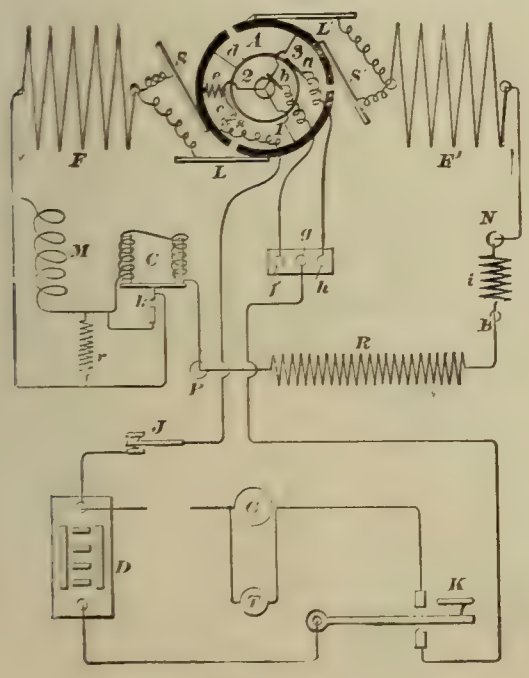


Fig. 2.

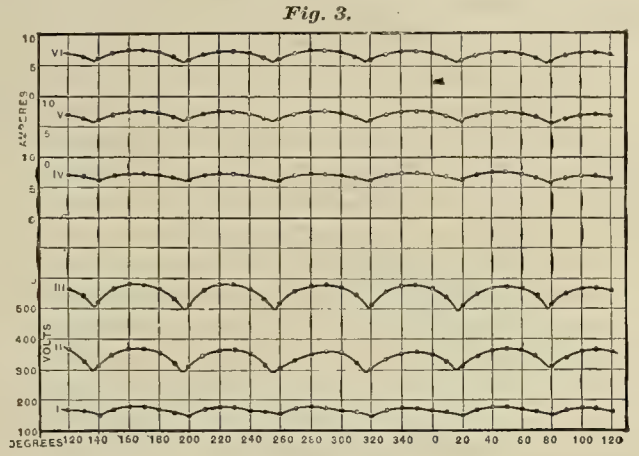
work of this investigation was carried out under the direction of Professor Nichols in the laboratories of Cornell University, during the past winter, by the writer, with the assistance of Mr. H. J. Hotchkiss and Mr. E. L. Morley, and due credit must be given to these gentlemen for any points of interest which may have been brought out by the investigation.

The object in view was to determine accurately, by taking instantaneous values throughout the revolution, the character of the external and internal currents and electromotive forces.

The capacity of the dynamo in question was about ten arc lamps of 1,200 c. p.

In order to carry out this work it was necessary to build a special commutating device of a character somewhat similar to a number of others before used in the Cornell laboratories for taking instantaneous values of current and potential. Professor Ryan was the first to introduce this method at Cornell, which is a modification of that described by Joubert in 1881,* and the device he used was described at length in a paper read before the Institute† on the 17th of December, 1889. The device consisted essentially of a metal tongue mounted upon the shaft of the dynamo and re-

Fig. 3.



volving with it, and making contact once each revolution with a small metal spring mounted upon an arm which was so arranged that it could be revolved about an axis coincident with that of the armature of the dynamo and secured in any desired position. By properly adjusting the position of the arm carrying this spring, contact could be made to take place between the spring and the tongue at any desired point of the entire revolution of the armature.

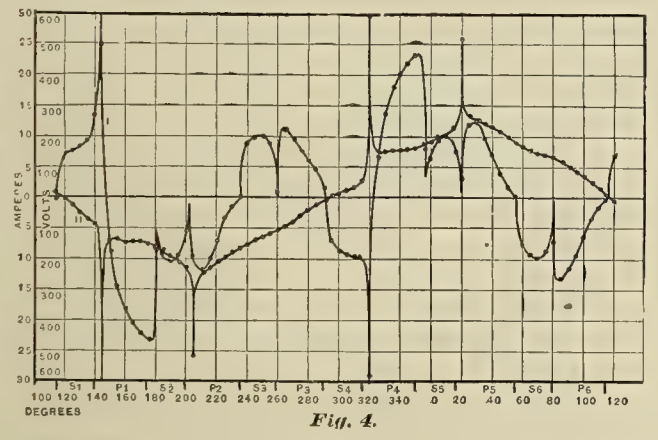


Fig. 4.

Three sets of curves of exterior current and potential were taken with three different loads upon the machine, and three sets of curves of current and potential through a single coil were taken with the same loads. In order to keep the electromotive force as nearly constant as possible, and prevent variations while a set of observations were being taken, the machine was loaded with a german silver resistance. The loads consisted of about 20, 50, and 80 ohms respectively, and were equivalent to about three, six and ten arc lamps.

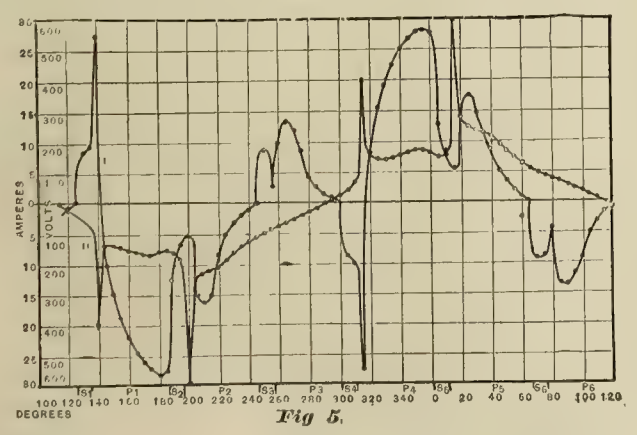
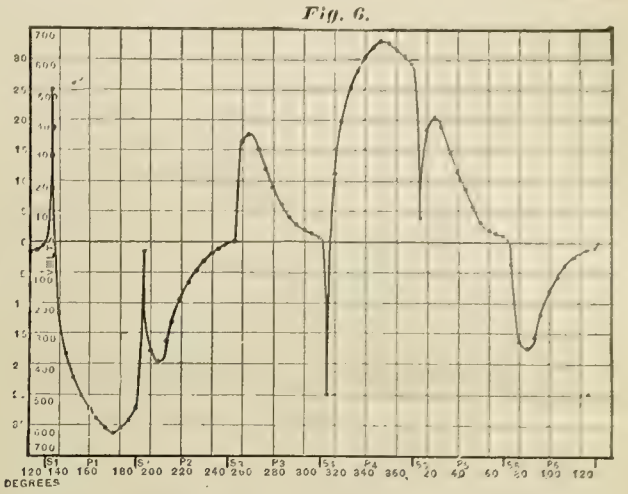


Fig 5.

The current for all loads was supposed to be practically constant, and an ammeter placed in the circuit showed but little variation from the normal current of 6.8 amperes. A condenser and ballistic galvanometer were used for making the measurements, and Fig. 1 shows a diagram of the connection of the dynamo and also of the measuring apparatus. Referring to the diagram, A is the armature, FF the field coils, M the regulator magnet, C the controller magnet, and *r* the carbon resistance used to prevent excessive sparking at the contacts *k*; P is the positive terminal of the machine and N the negative, R is the german silver resistance which constituted the load for the dynamo, and *i* is a resistance of about one ohm placed in the circuit to serve as a basis for the current measure-

Fig. 6.



ments. LL and SS are the brushes of the dynamo, which bear against the three segments of the commutator, as shown in the diagram; D is a condenser, K a discharging key, and J a small spring switch; G is a ballistic galvanometer, through which the condenser was discharged, and T is a shunt box for regulating the throw of the galvanometer and bringing it within proper limits. From the negative terminal of the machine, N, runs a wire to the commutating device, *c s*, and from that to the switch, J. From the positive terminal, P, and the

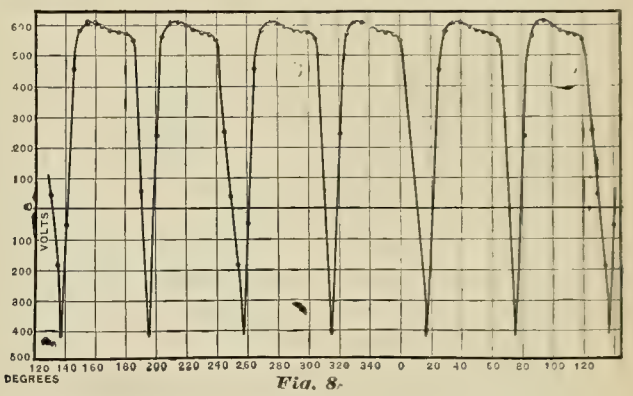
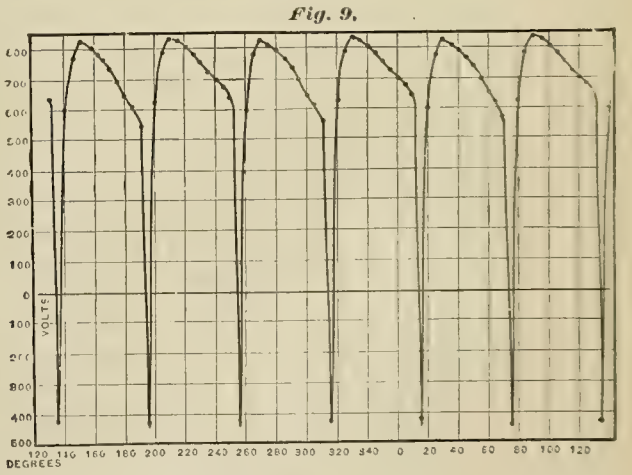


Fig. 8.

binding post, B, run wires to *f* and *g* of the switch, *fgh*, as shown. From *g* of this switch runs a wire to the discharging key, K.

During these experiments the regulator was allowed to act just as in ordinary practice, but each load was constant and practically non-inductive. Three sets of curves of external current and potential were taken, and the measurements were made in the following manner: The commutating device *c s*, being secured in a fixed position, *f* and *g* were connected. The discharging key, K, being then depressed, switch J was then closed,

Fig. 9.



and in a few seconds, the condenser became charged with the difference of potential existing between the terminals of the dynamo at the particular point of the revolution of the armature represented by the position of the commutating device. Switch J being then opened, the discharging key, K, was allowed to rise, and the condenser was thus discharged through the galvanometer, G, causing a deflection which was duly noted. The connections of the switch, *fgh*, were then charged so that *g* and *h* were joined, and in this way the condenser was charged with the difference of potential existing between the points B

Continued on page 375.

*Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, New York, May 21st, 1891.

*Joubert; Etudes sur les Machines Magneto-Electriques; *Annales de l'Ecole Normale-Superieur*, 10, 46 pp., 1881.

† TRANSACTIONS, vol. vii, p. 3.

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NOTES.

THE action of the executive committee of the National Electric Light Association, at its meeting in Montreal on the 8th inst., in changing the date of the convention to September 8, 9 and 10, will, no doubt, meet with the hearty approval of all interested. September is unquestionably a better time to hold a convention than August, as was intended. August is a hot month, and while September is, too, the heat during that month in the latitude of Montreal is not so intense, and it will be more comfortable to move about than it would be in August. It is evident that our Canadian friends are taking extraordinary interest in the coming convention, and it was a graceful act on the part of the executive committee to yield to the suggestion of the citizens of Montreal to hold the convention later. In September everything would be more favorable for having a successful meeting and a social time. As one of the Canadian gentlemen present at the executive committee meeting remarked, the city "would then be looking at its best," and the summer tourists will then have returned home. The fact that these arguments were put forth by our Canadian friends is unquestionable evidence of their desire to accord the members of the association and others interested a hearty welcome. That all Canada is interested in the forthcoming meeting is evident from all reports. The Governor General, Lord Stanley, will be in Montreal at the time, in order to honor the occasion of the convention by his presence, and the mayor and citizens of the Canadian metropolis are vieing with each other in their efforts to provide the best entertainment possible for their American visitors. Everything points to an extremely successful meeting, and the fact that the electrical exhibition is to be kept open for 10 days shows that our enterprising neighbors are in perfect harmony with the spirit of the convention, and are taking a lively interest in its affairs. Even an ultra-conservative must be forced to admit that much good will result on both sides of the border as a consequence of the Montreal convention.

It is always the case that when any public enterprise is projected it is sure to meet with opposition from some quarter, and the extent and activity of the opposition is, to a great degree, a measure of the importance of the enterprise so attacked. This proposition is applicable to electric roads in cities. In Brooklyn, for instance, there is great need for rapid transit, and electricity is much favored, yet a formidable opposition against the use of electric overhead wires for such purposes is set up by certain parties. We find the same state of affairs in Baltimore. There is in that city a lively and growing demand for rapid transit and, of course, electricity comes to the front as the most reliable and satisfactory system that can be adopted. But here, as well as in Brooklyn, there exists some opposition, based upon imaginary reasons. But no doubt electricity will triumph in the end. When its opponents will listen to reason and are made to understand that electric railway currents are not so "deadly" as they are said to be, the electric street car will come down the home stretch in double quick time, with cables, horses and mules "distanced."

There are some people who imagine that an underground electric road in New York, as has been proposed, would be objectionable in many respects. They argue that the air in the tunnel would become foul and unfit for breathing purposes, and that travelers would not relish riding through a stuffy and dimly lighted tunnel. This view of the subject is rather pessimistic and contrary to facts. With electricity as the motive power, there is no vitiation of the air as there is where steam locomotives are used. Electric power gives off no gases, and with the cars brilliantly lighted by electricity underground travel can be rendered as comfortable as on any of the surface lines. The London underground electric road is an example of this. Prof. George Forbes, the well-known English electrical engineer, spoke particularly of the absence of all the unpleasant features attending ordinary underground travel, in some remarks before the general meeting of the American Institute of Electrical Engineers, on May 21. We publish Prof. Forbes' remarks on another page in this issue. They will be read with much interest at this time, when the rapid transit question is the most important one before the public.

United States Consul Mason, at Frankfort-on-the-Main, has sent a report to Washington of the electro-technical exposition in the first-named city. In the order of number and importance of exhibits the United States is fourth. "The American exhibit is important," says the report, "in that every article is unique and represents a new idea, the phonograph and the long-distance telephone receiving especial attention." One important feature of the exposition will be a determination by a competent jury of the relative merits and efficiency of the different systems of electric car propulsion, including overhead and underground wires and storage batteries.

Probably the last public communication of the late David Brooks, of Philadelphia, is that on the subject of oil as an insulator for high voltage currents, read before the electrical section of the Franklin Institute on May 5, and which we publish elsewhere in this issue. The subject is an interesting one at any and all times, but as it is treated in this instance it is of extraordinary interest for the reason that it adds something to the fund of knowledge on the subject, besides probably being the last service to the electrical fraternity of one who has accomplished more in the investigation of this particular subject than any other person.

The casual observer is no doubt puzzled over the difficulties that beset the path of those who are trying to solve the problem of lighting the Fourth avenue tunnels of the New York Central Railroad in this city. The difficulty is not in providing light—plenty of that can be easily had and put into the tunnel—the trouble lies in arranging the light in such a manner that the train engineers will not be blinded by its brilliancy and thus be prevented from seeing the signals as the train advances. It is well known that if a light from any source be placed near the eye, the ability of the eye to distinguish objects and colors beyond the light, is rendered null so long as the eye is so affected. If ordinary electric lights were placed in a tunnel it would be impossible for engineers to see track signals beyond the light or lights nearest to them. For this reason some special arrangement of the lights must be made, but as yet just what plan is the best for accomplishing this has not been determined. Several electricians and electrical concerns have made suggestions in this direction and claim to be able to overcome all of the difficulties met with, but for some reason the railroad companies do not seem to place as much confidence in the plans as do those who propose them.

This week the association of Railway Telegraph Superintendents holds its annual convention at the Grand Hotel in Cincinnati. To operate a railroad successfully these days the telegraph is indispensible, and to carry on the railroad telegraph service successfully it is necessary to place at the head of it a man who is skilled and qualified in every way to fill an office of such importance. The office of railway telegraph superintendent is a very important one, inasmuch as much depends upon the efficiency of the telegraph service. Poor telegraph service means poor railroad service, and if we would have a railroad run on sound business principles a skilled and reliable telegraph corps is an indispensable part of the system. Therefore, much depends upon the skill of the railway telegraph superintendent. The Association of Railway Telegraph Superintendents is growing in importance and power every year. The papers read at the meetings are of great practical value to railroad managers, and much benefit results from these annual meetings. New ideas are exchanged and discussed, as are also improvements in the lines along which the members are actively identified. All railway telegraph superintendents should be members of this worthy organization, and attend its meetings with religious regularity. There is no man so well versed in railroad practice that he can afford to remain on the outside of this association. Every member is sure to learn something at the meetings that will be valuable to him in his own sphere of activity. There will be exhibits in connection with the convention of railroad signaling apparatus of various kinds, and as these devices are of the utmost importance to successful railroad operation they will, no doubt, receive full measure of consideration.

The hot weather the past week should create a demand for electric fans.

Continued from page 373.

and N of the external circuit, at the same point of the revolution as the first reading. The condenser was then discharged through the galvanometer and the deflection noted as before.

After moving the contact spring, *s*, forward ten degrees, the measurements just described were repeated, and so on until the contact had been moved entirely around the circle.

The condenser and galvanometer being properly calibrated, it was an easy matter to calculate from the data obtained as above the difference of potential between the terminals P and N, and between B and N, at 36 points of the revolution of the armature. The resistance between B and N being known, the current was readily determined from the fall of potential. The results of these measurements are shown graphically in Fig. 3, and will be referred to later.

After taking curves of the exterior potential and current, the apparatus was arranged for measuring the potential and current in a single coil of the armature. Coil number 2 was selected as likely to present results nearest the average of all three of the coils, and the apparatus was arranged as shown in Fig. 2. The circuit of the dynamo and its loads were exactly as for the first measurements, and the connections of the measuring instruments were as shown in the diagram. Referring to Fig. 2, *a* is a small brush which bears against a ring *d* secured to the commutator but carefully insulated from it. This ring is connected to the commutator bar of coil number 2, and thus gives metallic connection with this bar at all points of the revolution. A small brush, *b*, bears against a similar ring wound round the armature shaft but insulated from it. This last ring is connected to the three inner ends of the three coils, and thus a continuous contact is made with these ends. The outer end of coil number 2 was disconnected from the commutator bar and a small non-inductive resistance, *e*, was inserted between the end of the coil and the bar. The junction of the coil and the resistance *e* was connected to the tongue *c*, which revolved with the armature shaft. Once during each revolution the tongue *c* made contact with the small spring *s*, from which a wire ran to the switch J, and thence to one terminal of the condenser D. Wires ran from brushes *a* and *b* to the switch *fgh*, and from this switch a wire ran to the discharging key K, as shown on the diagram. When *g* and *h* were connected, and keys J and K depressed, the condenser was charged with the difference of potential existing between the ends of the coil 2 at the particular point of the revolution represented by the position of the contact spring *s*. The condenser being then discharged through the galvanometer, a measure of this difference of potential was thus obtained. Switch *fgh* was then changed so that *g* and *h* were connected, and measurements then taken with the condenser and galvanometer gave the difference of potential between the ends of the non-inductive resistance *e*, and from this the current in coil 2 was calculated. Readings were taken in this way at distances of five degrees apart all around the revolution and the results are shown plotted out in Figs. 4, 5, and 6, three curves at three different loads being taken as before. It is not the purpose of the writer to go into the theories of cause and effect as exemplified in these curves, but to simply present them, calling attention briefly to some few of the more noticeable and interesting features connected with them.

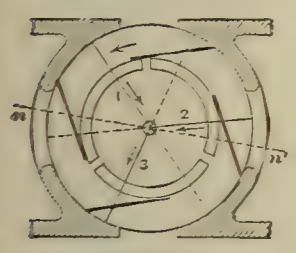
Turning now to the results obtained, in Fig. 3, curve I represents the difference of potential at the terminals of the dynamo throughout the revolution under a light load, and curve IV is the corresponding current. Curve II is the potential for medium load and curve V the corresponding current, while curves III and VI represent the potential and current at full load. It will be noticed that the curves for medium and full load are practically alike, while the curve for light load differs slightly in its character and is less symmetrical, and its minimum points occur slightly later than in the other curves. The curves of current and potential are practically alike, as might be expected since the self-induction of the external circuit was little or nothing. The curves are all of them about such as would result from a closed coil armature with a six part commutator. It may be well to remark that in taking the observations for these curves, closer readings than are shown were taken near the minimum points, so as to be sure these points were correctly placed.

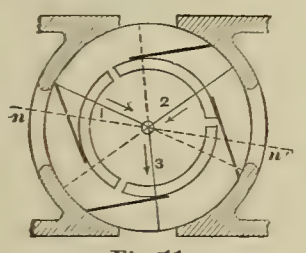
These curves show that the external current is continuous and much steadier and more uniform than is usually supposed.

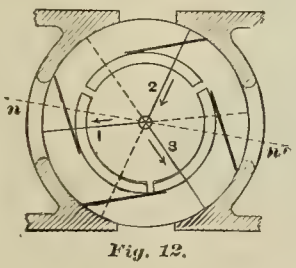
Referring to Fig. 4, we find that the state of affairs in a single coil is quite different from that at the terminals of the dynamo. Curve I represents the difference of potential at the ends of the coil throughout the revolution, and curve II is the current in the same coil during the revolution. The curves shown in Fig. 4, were taken with a light load. Figs. 5 and 6 show curves taken with medium and with full loads. For some unknown reason it was found impossible to get accurate readings for the current at full load, and so no current curve is given in Fig. 6. It is probable though, from the similarity of the current curves at light load and at medium load, that the current for full load differed very little from the other two.

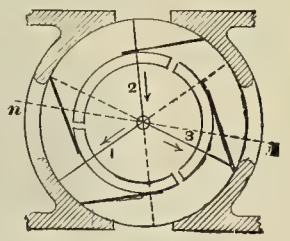
It will be noticed that at all loads the potential changes sign no less than six times during the revolution and falls to zero, or almost to it, as often as twelve times, while the current reverses but twice during the revolution and for the most part goes through very gradual changes. At the bottoms of the figures are lines of spaces showing the positions of the armature during the part of the revolution represented by the curves above them. s_1, s_2, s_3, etc., are the periods of short circuit and p_1, p_2, p_3, etc., are the periods during which two coils are usually supposed to be in parallel with each other and in series with the third coil. There are six periods of each kind in the course of each revolution. Figs. 10, 14 and 18 represent the relative positions of commutator and brushes at the three different loads during the parts of revolution shown at s_1. For the light load this period is about 25°; for the medium load about 10°, and for full load not more than 1°. The periods shown are not the *actual*, but the *apparent* periods of short circuit as it would seem to be from the positions of the commutator and brushes. The *actual* periods of short circuit are somewhat longer, owing to the conductivity of the spark, and last until the spark is blown out. The exact point of the revolution represented by Figs. 10, 14 and 18, is the point 130°, as marked below the curves. Figs. 11, 15 and 19 represent the positions of the brushes and commutator for the parallel periods p_1, or, to give the exact position shown, 160°. Figs. 12, 16 and 20 represent the second short circuit period, s_2, or 190°, and Figs. 13, 17 and 21 show the second periods of parallelism, p_2, or 220°. In all of these figures the relative positions of the coils and poles of the dynamo are also shown, the coils being numbered 1, 2, 3, just as they are on the dynamo. During the entire period represented by each four figures as above, the armature has turned through 120°, or one-third of the revolution, and if we now consider the position of coil 2 changed to that of coil 1 in each figure, our figures will then represent the next third of the revolution. If coil 3 is supposed to occupy the position of coil 1, we shall then have the remaining third of the revolution.

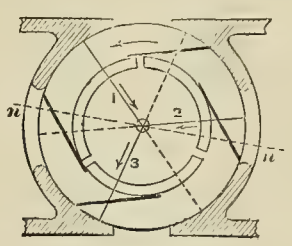
It will be noticed that the more sudden and violent changes of potential occur just as the spark is forming and being broken at the front end of the commutator bar.

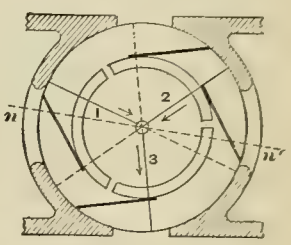

Fig. 10.

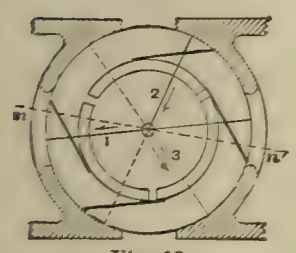

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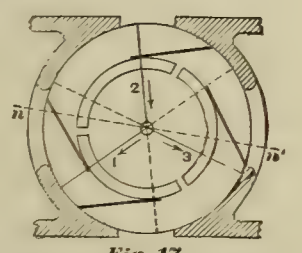

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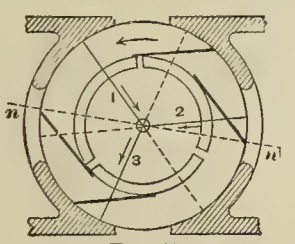

Fig. 13.

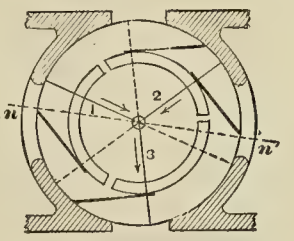

Fig. 14.

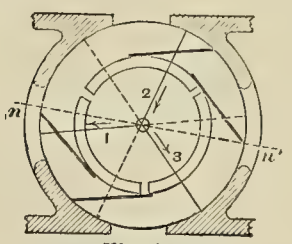

Fig. 15.

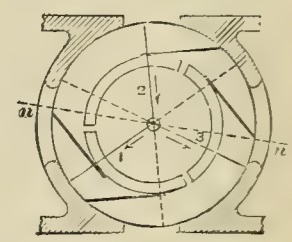

Fig. 16.


Fig. 17.


Fig. 18.


Fig. 19.


Fig. 20.


Fig. 21.

ST. LOUIS NOTES.

The Columbia Incandescent Lamp Company report business very brisk, and though working up to their full capacity, they are away behind on orders.

The Union Depot and Mound City electric lines now leave the current on all night and run the owl cars with it, instead of by mule power as heretofore. The improvement is greatly appreciated by patrons of the roads.

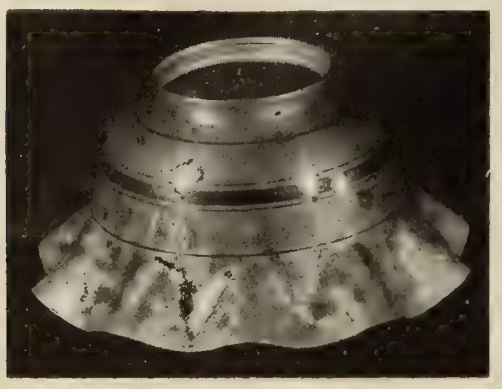
The Lindell Street Railway Company are preparing for the heavy travel to the Fair Grounds during the approaching racing season. Two more dynamos have been ordered and will be in readiness for use before the races open.

The East St. Louis Electric Railway Company has ordered a number of new cars, which will be longer than those now in use. The wires will be strung immediately on the Tudor Iron Works extension, and the company expect to have the branch line running in a few days.

The Wagner Electric Company are turning out a specialty in the shape of a new motor. The merits claimed for it are great compactness of structure and efficiency. Only ⅛ and ¼-horse power sizes are made at present, and the demand for these for fan work, in anticipation of hot weather, is very heavy.

ALUMINUM LAMP SHADE.

Considerable discussion has been indulged in at various times lately as to whether aluminum is a suitable metal for the manufacture of articles for useful purposes. While others were talking the matter over, the Electrical Supply Company, of 171 Randolph street, Chicago, went to work to demonstrate the value of this metal, for the manufacture of certain lines of goods at least. They have recently brought out an aluminum shade for



LAMP SHADE.

incandescent lamps, an illustration of which we give herewith. The shade is very handsome in appearance, being of a beautiful silvery white color and extremely light. The interior of the shade has a frosted surface, which has the effect of casting a strong and soft light upon the desk. The light is of such a character as to be very restful to the eye and there is no strain whatever imposed upon the organ of sight.

This new shade, no doubt, will be much appreciated by those who are desirous of securing a soft, diffused light to work or read by and the Electrical Supply Company have shown considerable enterprise in putting it upon the market at this time, when aluminum is so much talked of and the practical value of which few people know little about.

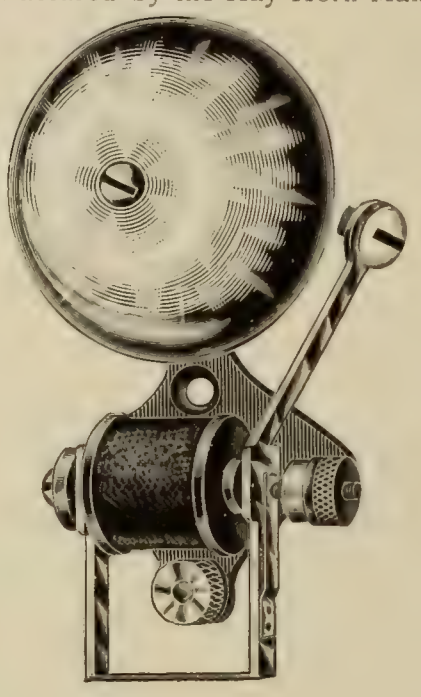
CORNELL'S DYNAMO LABORATORY.

The dynamo laboratory at Cornell University, Ithaca, N. Y., of which a view is shown herewith, is believed to be the largest college dynamo room in this country, if not in the world. It contains no machines that are used in regular lighting service, but is devoted entirely to the experimental study of dynamos and motors. The floor space is 40x70 feet; there are three lines of main shafting overhead that are driven by steam and water power. The collection of dynamos includes nearly all the well-known commercial types, together with many machines of unusual form, constructed especially for experimental purposes. These machines are of various sizes, from 20-horse power down, and they are arranged with special reference to the requirements of experimental work.

An important part of the work in applied electricity, the measurement of currents and electromotive forces, together with a detailed study of storage batteries, arc lamps, voltameters and electric meters, is carried on in the annex to Franklin Hall, which is a substantial one-story building, 100x37 feet. Operations of extreme precision are conducted in the magnetic observatory, an isolated building entirely free from iron, which contains the great galvanometer and other standard instruments for measuring current and potential, and the magnetic elements. Professor G. S. Moler is in charge of this laboratory.

SIMPLE ELECTRIC BELL.

The accompanying illustration represents a new bell manufactured by the Hay-Horn Manufacturing Co., of 63 South Canal street, Chicago, that is attracting attention wherever samples have been tested in this and foreign countries.



ELECTRIC BELL.

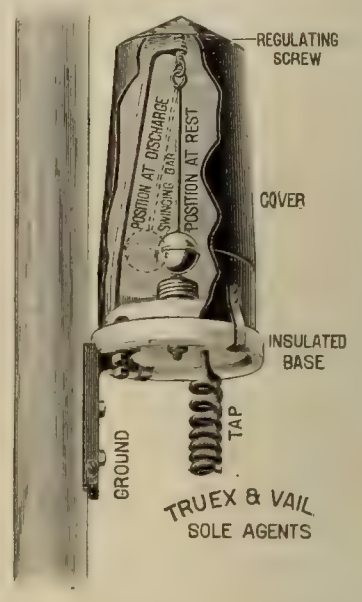
The company's object in making the bell in this style was to reduce the cost as much as possible, and it was found that they had not only succeeded in doing this but that they had also made a bell of loud tone using less than the usual quantity of current. To overcome the difficulty of adjustment met in many forms of bells the manufacturers have introduced an adjustable hammer enabling it to be set very accurately and quickly. The contact points are made of platinum.

The bell is neatly finished and well made.

Eastern customers can have the advantage of low express rates and quick shipments by ordering of James H. Mason, eastern agent, 118 Park avenue, Brooklyn, N. Y.

SWINGING BALL LIGHTNING ARRESTER.

We give below an illustration of the Swinging Ball Lightning Arrester, for which device Messrs. Truex & Vail, Electrical Exchange Building, 136

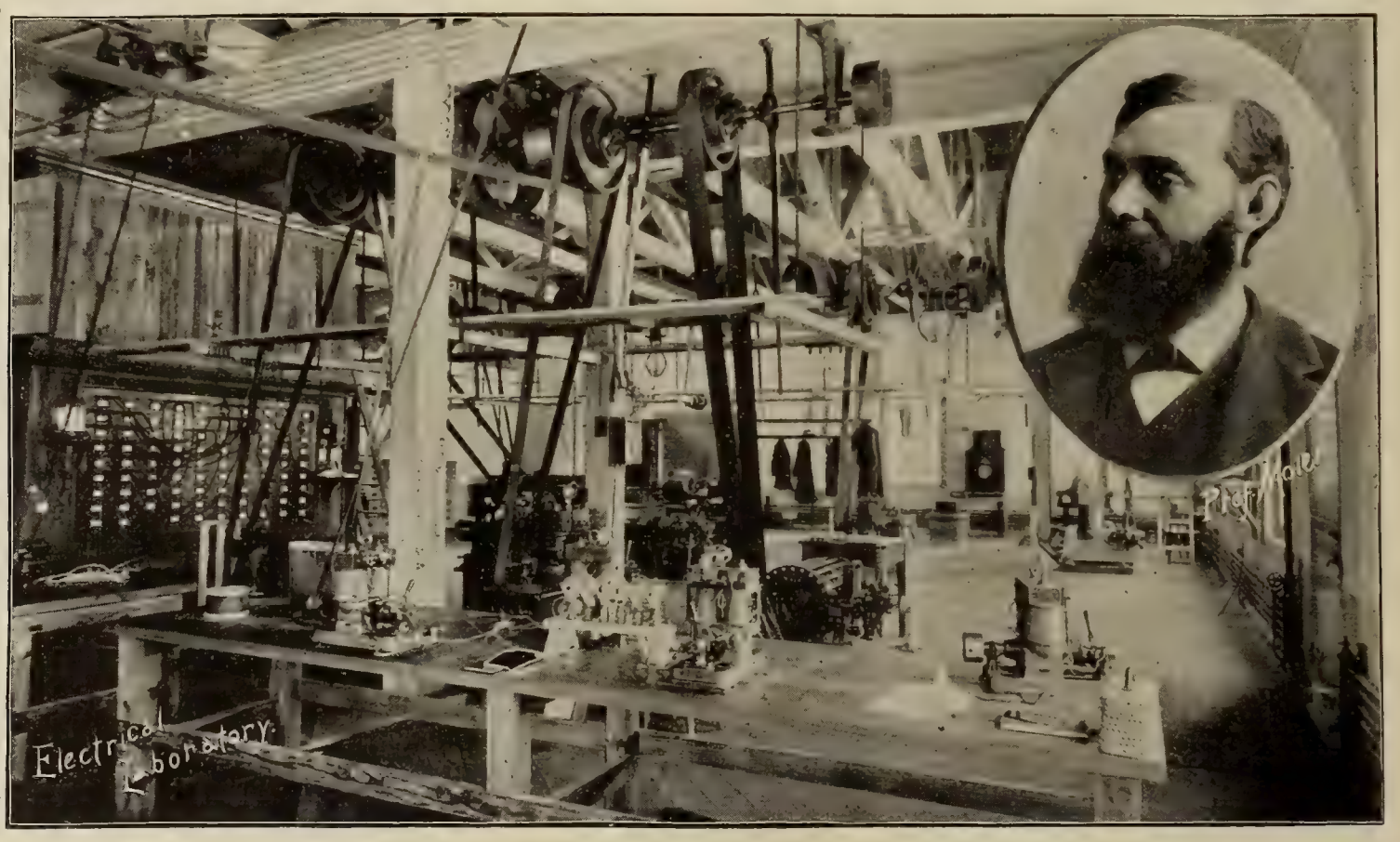


NOVEL LIGHTNING ARRESTER.

Liberty street, New York, are the sole agents.

This arrester is very simple in construction and has no fuses to replace and bother with. It offers the quickest and surest path to the earth for all static discharges and renders it impossible for dynamo currents to follow. The arrester is protected from moisture, there is no complicated mechanism to get out of order, and it requires scarcely any attention. It is perfectly adapted to electric lighting circuits and is said to be the best for all practical purposes. It is also claimed to be an absolute protection against the damaging effects of lightning on railway trolley lines. A special design for this class of work is necessary.

The accompanying cut shows in a very clear manner the principle of operation and the various parts of the arrester. It is so simple in construction that any extended description of the same



ELECTRICAL LABORATORY AT CORNELL UNIVERSITY.

would seem unnecessary here. It certainly has the appearance of being as efficient as the firm claim it to be.

Truex & Vail possess many testimonial letters as to the general efficiency of the arrester, and they all go to show that the device is perfectly reliable in its action and protection.

NEW WESTINGHOUSE COMPOUND ENGINE GOVERNOR.

In the matter of regulation of speed, manufacturers become more exacting with the introduction of improved and sensitive machinery. Most particular in this respect are the electric industries, which highly appreciate in a governor an ability to handle great and instantaneous changes of load.

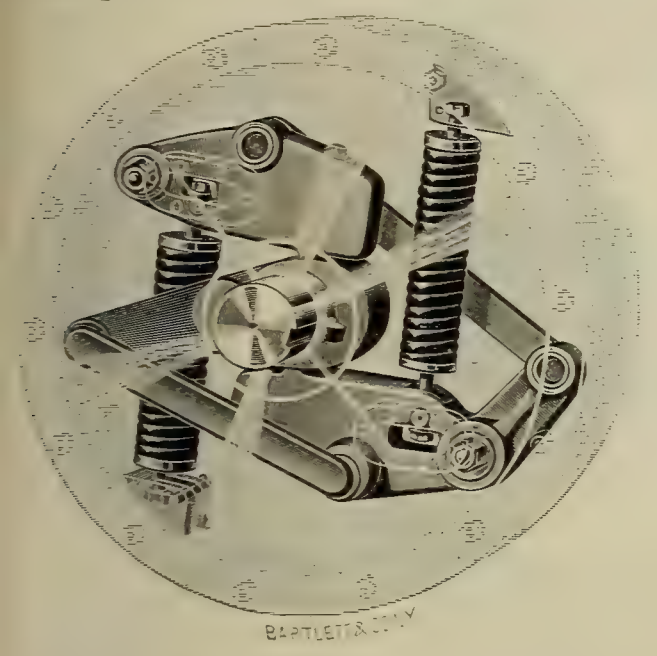


FIG. 1.
Showing Enclosed Governor Case to be filled with Oil.

After two years of invention and experiment, the Westinghouse Machine Company, of Pittsburg, Pa., have designed a governor for use with their high duty compound engine, whose efficiency they

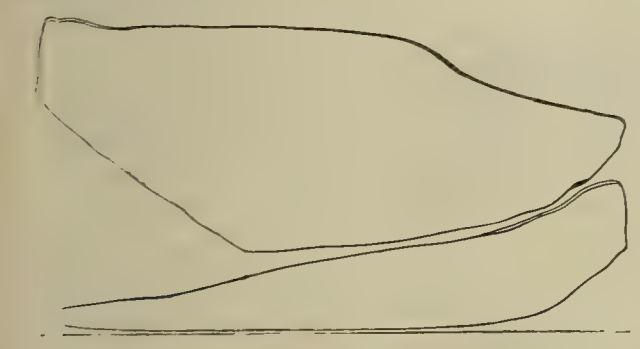


FIG. 2.
A specimen Indicator Card for one revolution, shown for comparison.

claim has never been equalled. With their accustomed disregard of established practice, this company have had the same marked success with their governor as with their engine.

The governor is so compact, that it is placed in a heavy closed case which is completely filled with



FIG. 3.
Specimen Indicator Card, continuous throughout a partial change of Load.

oil to insure the same certain and copious lubrication that obtains in all Westinghouse engines.

While the governor, as a whole, is very heavy and perfectly free to move, even through its whole range if necessary, its strength is a variable quantity and its leverage increases so as to meet and resist the greater strains of longer cut-offs. The crowning excellence of the governor, however, is its ability to utilize its inertia for the necessarily rapid adjustment to meet instantaneous changes of load. The mere tendency of the engine to change its speed to the degree demanded by the regulation on account of change of load, throws the governor to the new position to suit such new load, and the force that changes the adjustment of the governor is inertia.

A test, so severe that it would be but seldom met with in practice, was made on an 18 inch and 30x16 inch Westinghouse engine with this form of governor at the station of the Federal Street and Pleasant Valley Electric Railway Company, in Allegheny City, Pa., and fac-similes of the indi-



FIG. 4.
Specimen Indicator Card, continuous throughout an extreme change of Load.

cator cards are submitted as evidence of the rapidity of the governor's action.

Card No. 2, taken under constant load and for one revolution, is given for comparison only.

Four circuits are driven by this engine, and in Card No. 3 one of these was broken, while a continuous card was taken from the high-pressure cylinder. The card for one revolution from the low-pressure cylinder was taken after the change in the load, and has no connection with the test.

Card No. 4 was similarly taken while three of the four circuits were broken at the same time, and shows an average change of 87 horse-power per second. It also shows that the governor was perfectly stable in its new position. At this rate the governor would travel over its entire range corresponding to a change of its listed capacity of 250 horse-power in less than three seconds, which is about the time necessary to increase the speed of the engine the amount demanded by the regulation, and with a lighter fly-wheel this change would be made in proportionately less time.

It is evident, therefore, that with this governor, the fly wheel becomes simply a balance wheel. It is no longer required in storing energy to delay the change of speed and thus give centrifugal force time to act on the governor.

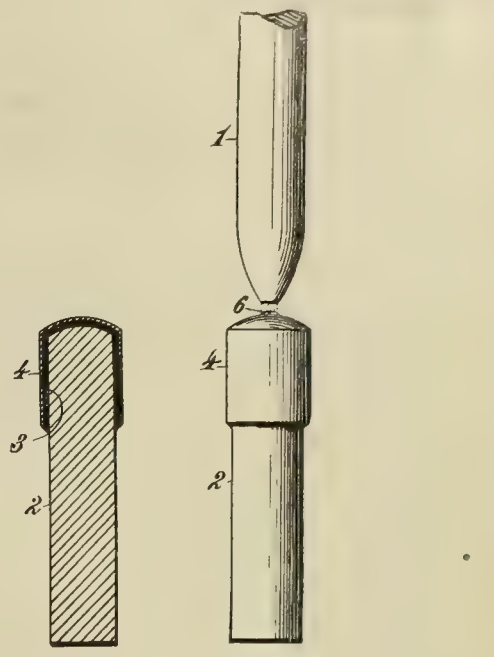
ELECTRODES AND ELECTRODE HOLDERS FOR ARC LAMPS.

We illustrate herewith two ingenious inventions of Mr. A. C. Siebold, of Mount Vernon, N. Y., that will be of interest to electric light men. Anything that will effect a saving in material is not likely to wait long for a market, be the saving ever so small.

The object of the invention shown in Figs. 1 and 2 is to provide a particularly indestructible negative electrode, capable of being used in any arc lamp without regard to the particular construction of the lamp or the system or circuit upon which it is used. Fig. 1 shows a sectional view of the negative carbon and Fig. 2, the negative and positive carbons as arranged in the lamp.

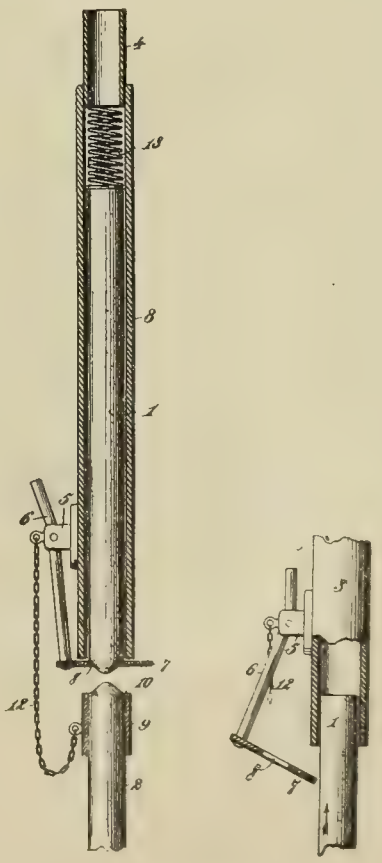
The reference numeral, 1, denotes the positive electrode, ordinarily used in arc lamps. The numeral 2 denotes the negative electrode, consisting of a rod or bar of metal, preferably of the shape illustrated, but not limited to any particular form.

About one inch in length of the end of the bar 2 is coated with a layer of carbon, 3, having a thickness of about one thirty-second of an inch. This coated extremity is then introduced within an electroplating bath of copper, a very thin coating of which is deposited upon the carbon layer, completing the negative electrode in the form shown in Fig. 1. When placed in the lamp in position for use, the point of the positive electrode rests upon the end of the negative electrode; but when the current is switched on the feed mechanism of the lamp raises the carbon a little distance above the end of the negative electrode, and the arc is formed. Upon the formation of the arc a circular opening having a diameter of about one-eighth of an inch, is burned through the coating of copper on the end of the carbon and copper-coated negative electrode, and as soon as this occurs the arc makes contact with the layer of carbon, the exposed portion of which is coated



FIGS. 1 AND 2.
SECTIONAL VIEW OF NEGATIVE CARBON AND CARBONS AS ARRANGED IN LAMPS.

with a crust, 6, consisting of small particles of carbon deposited from the point of the positive electrode by the action of the electric current. As long as the current is maintained, the deposition of these carbon particles continues, and at the same time their consumption gradually goes on, the crust being constantly consumed and constantly renewed.



FIGS. 3 AND 4.
HOLDER FOR POSITIVE CARBON AND METHOD OF OPERATION.

The metallic rod or bar, 2, forms a conductor for the electric current, while the layer of carbon acts as a carbon electrode when the electric arc is formed. The coating of copper excludes air from the carbon layer to effectually prevent its combustion should it become heated to redness by the heat of the arc.

The durability of the negative electrode will be understood when it is remembered that the carbon deposit is constantly maintained during the flow of the current, whereby that portion of the carbon layer which is exposed by the opening in the copper covering is constantly protected from the heat of the arc, while the copper coating excludes the air and prevents combustion of the carbon layer, which it is claimed cannot be consumed even if heated to redness, while at the same time the metal rod keeps the carbon layer cool and acts as a conductor for the current, thus avoiding heating by resistance.

Figs. 3 and 4 show a holder or casing for the positive carbon electrode. It consists of a metallic tube having an interior diameter into which the carbon is easily admitted.

The carbon holder or case, 3, is placed in the lamp by inserting the tube, 4, in the upper-carbon clamp, and the positive carbon electrode is inserted in the holder or case by operating the lever 6, in such a manner as to swing the plate, 7, away from the lower end. The positive carbon, 1, is then introduced and pushed up until its point only projects beyond the open lower end of the casing, when the lever is restored to its original position, whereupon the plate, 7, will support the carbon with its end projecting through the opening, 8. A spiral spring, 13, is arranged above the carbon and between it and the tube, 4, to press the end of the carbon through the opening. The negative electrode, 2, is placed in the lower-carbon clamp of the lamp, and the cap or shield, 9, is placed thereon. Both the attachments for the chain or other fastening, 12, are insulated from the holder or casing and from the shield or cap. Both the carbon points, being in contact with the arc, become intensely heated; but those portions which are inclosed by the metal holder or casing and by the cap or shield are necessarily kept at a low temperature as compared with the exposed ends, and the rapidity of consumption of the carbons is thereby largely decreased. As the consumption proceeds, the positive carbon is lowered in the holder or casing by the tension of the spring, 13, and as the negative carbon burns away, the feeding mechanism of the lamp lowers the holder so that the arc is constantly maintained. As the negative carbon is consumed, the tubular cap or shield, 9, gradually descends by gravity, so that a portion or point of the carbon always projects above the surrounding metal.

It is claimed that these inventions not only effect a great economy in the consumption of carbons, but the use of the holder or casing for the positive carbon permits the use of short pieces of carbons, several of which may be arranged therein at once. Those pieces which are now thrown away as useless may thus be used, with a considerable resulting economy.

A YACHT PROPELLED BY ELECTRIC POWER.

On the afternoon of June 11 a strange-looking craft made an exhibition trip up the Hudson River and attracted much attention from river pilots and the people along the docks. What attracted their attention was not the shape of the boat—for that was not unlike that of any other of its size—but the fact that she was passing through the water at a rapid rate, while the familiar accessories of a steam craft were missing. There was no smoke funnel, nor escaping steam; in fact there was no external evidence of the power that propelled the boat. She had two sail spars, but the sails were furled; what power, then, was used to drive her? was the question asked by those on shore. Electric power was suspected, and such it was.

The name of this unique craft unlocks the secret of her power; it was the electric propeller "Electron." On the date mentioned a trip was made up the river a short distance in order to demonstrate to a few invited persons, including a representative of the ELECTRICAL AGE, the practicability of propelling a boat by electricity.

The "Electron" is a trim craft with an iron hull, 75 feet long and 13 feet beam, and is of the screw propeller type. She was built by James Bigler, the well-known steamboat builder, Newburgh, N. Y., who was on board during the trip.

Her power plant consists of 376 accumulator cells made by the Electrical Accumulator Company, of Philadelphia, and a motor made by the Electro-Dynamic Company of Philadelphia.

The motor is of 15 horse power, shunt wound, and runs at three speeds, viz.: low, 400 to 500 revolutions a minute; intermediate, 700 revolutions, and high, at 1,300 revolutions. Carbon brushes are used, and the armature is of the Gramme ring type.

The motor is placed in the bottom of the yacht, and is coupled directly to the propeller shaft, but electrically insulated therefrom. In fact the entire motor is insulated from the boat.

The captain, or pilot, has full control of the power apparatus, all of the switches and controlling devices being placed in the pilot house. This contains a reversing switch, which is connected with the armature, for the purpose of reversing the direction of the revolutions of the shaft; a 9-point rheostat switch, by the operation of which resistance is thrown in and out of circuit as desired; a double pole motor and charging switch on a common base, and a cell switch which effects the different combinations of cells. On the first point of the latter switch all of the cells are in series; on the second point they are divided into groups of 2 in multiple and 2 in series, and on the third point all of the groups are in multiple. There is also in the pilot house a voltmeter and an ammeter, both of the Electro-Dynamic Company's make, the latter being always in circuit. The voltmeter is so connected that the voltage can be taken across the cells and also across the charging circuit. A 4-point lamp switch is also placed within easy reach of the pilot. By means of this switch the lamps can be cut in on any one of the groups of cells, in this way equalizing the discharge of the cells.

An automatic break switch is to be put in later, for the purpose of automatically breaking the charging circuit when the line pressure falls below a predetermined point.

The accumulators are arranged in 4 tiers on each side of the boat, with ample space between to enable easy examination of the cells. This arrangement is an extremely convenient one, admitting of easy examination of each cell. The batteries are placed below the floor, along the bilge of the boat, thus being out of the way and yet convenient to get at. Besides, it brings the weight below the water line, where it is most needed. As a result of this the boat is, in the language of the sailor, quite "stiff," and possesses good heavy weather qualities for so small a craft.

The motor is placed in the after cabin, underneath the floor in the manner already described. At full speed the motor takes 376 volts; at the medium speed 188 volts, and at the slow speed 94 volts. Okonite wire is used throughout.

The propeller is 26 inches in diameter, with a lead of 15 inches. It is intended, however, to replace this with one of 27 inches in diameter and 12 inch lead, which will increase the speed of the boat with the same power. When this change is made it is calculated that the yacht will make from 9 to 10 miles an hour on the medium speed of the motor and from 12 to 13 miles with the motor going at the top speed.

The propeller is made of phosphor bronze, which metal is used almost altogether for propellers, an account of its great strength.

The "Electron" is to be used as an excursion yacht this season at Atlantic City, N. J., and will sail about the inlet. On pleasant days she will make ocean trips. She is to be run by the Atlantic City Steamboat Company. Mr. James M. Bigler is at present in command of the "Electron," and handles the boat from the pilot house with great facility. The electric plant is in the charge of Mr. W. E. Harrington, superintendent and managing electrician of the Atlantic City Electric Railway.

The charging current will be taken from the wires of the Atlantic City Electric Railway. On the trip the entire absence of jarring and grinding of machinery was very noticeable and the boat forced her way through the water as quietly and easily as a sail boat. There was none of the shaking so common on steam vessels and as far as this trip goes to show, the "Electron" is a triumph in navigation by electric power.

The promotors of this enterprise are to be congratulated on their success and, no doubt, the performance of the "Electron" this summer will be watched with a great deal of interest by electrical engineers. It is an experiment, of course, but there is no gainsaying the fact that so far success has attended the performance of the vessel and its power plant.

At normal consumption of current the accumulators will give sufficient power to run the yacht from 10 to 12 hours on one charge.

CINCINNATI NOTES.

The Cincinnati Electrical Subway Company, a concern proposing to construct a subway into which all electric wires may be placed, are seeking the necessary privilege from the city.

Taken altogether, Cincinnati is the worst lighted city in the United States, but there seems to be a sudden awakening to the fact, and movements are on foot to substitute, to some extent at least, electricity for the poor lights of the gas company.

During a heavy storm on June 2, a $6,000 dynamo of the Cincinnati Electric Light Company, at Front and Race streets, was ruined by lightning, which in some manner jumped the arrester. The dynamo was almost completely destroyed. At the same time the telephone service of the city was badly crippled, the arrester on 1,200 lines being burned out, and many routes badly mixed up by heavy wind.

The Cincinnati Edison Electric Company are building a large plant on Eighth street, between Elm and Plum streets. It will, when finished, be one of the largest and best equipped plants in the West. This company is also building conduits in in the streets and propose laying all their wires under ground. Permission was granted by the late Board of City Affairs to tear up the streets for conduit purposes, but that board being legislated out of office by the legislature, and a new one (Board of Administration) created, the latter body immediately revoked the permit. The Edison Company, however, also holding a permit from the Probate Court of Hamilton County, continued the work after giving the bond under injunction proceedings. The Edison Company operate the only independent system in the city, all the others being under the control of the gas monopoly. The city solicitor, who has always opposed the gas company, has, under instructions from the new board, instituted further legal proceedings against the Electric Light Company. Although the matter is in court, the work of laying the conduits goes steadily on.

Vandalia, Ill., is to have an electric light plant.

The Crescent Electric Light Company, has been incorporated at Long Island City, with a capital of $25,000.

A PHOTOGRAPHIC STUDY OF THE ELECTRIC ARC.

BASED UPON EXPERIMENTS MADE BY MR. J. C. MC MYNN.

BY EDWARD L. NICHOLS.

(*Continued from page* 365).

Mr. McMynn's first step in the investigation which it is my purpose to discuss in this paper, was to photograph the arc under conditions which would bring out this phenomenon. A camera with long bellows was set up near the lamp, the



FIG. 9.—Alternating arc. [Movement of plate vertical; arc in strong magnetic field.]

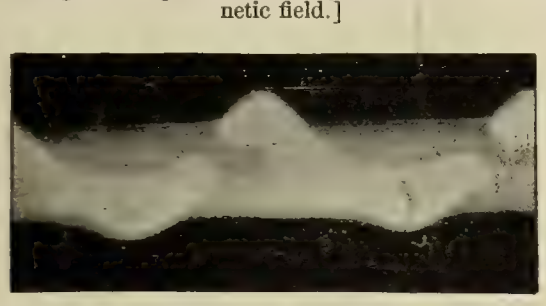


FIG. 10.—Alternating arc. [Movement of plate vertical; arc in strong magnetic field.]

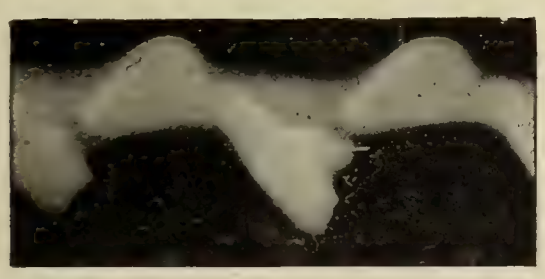


FIG. 11.—Alternating arc. [Movement of plate vertical; arc in a strong magnetic field.]

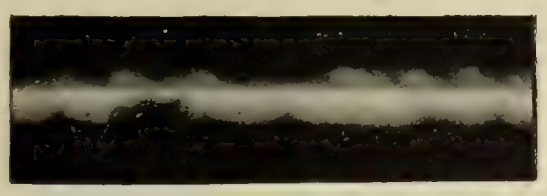


FIG. 12.—Continuous current arc. [Movement of plate vertical; arc in strong magnetic field; arc flaming.]

distances from plate to lens and from lens to lamp being such as to give a somewhat enlarged image of the arc. In the focal plane an opaque screen was mounted, which contained an opening just large enough to receive the image of the carbon points. The apparatus having been adjusted, a sensitive plate was driven past the aperture at high speed. The photographic image differed from that observed in the revolving mirror chiefly in the relative brightness of the arc proper, and of the incandescent carbon of the points. To the eye, the latter is the dominant feature; whereas the *actinic* image of the arc far exceeded in intensity that of the carbons.

These photographs establish the intermittent character of the alternating arc beyond question. They also exhibit in a new light many interesting properties of the arc, some of which are already well-known, while others have not been noted. Of the many negatives already obtained, a few characteristic forms are given in the accompanying plates.

The South Chicago Street Railway has been authorized to build and equip an electric railroad. The ordinance provides for the working of the line by electricity by either overhead or underground wires, and by either primary or storage batteries. The ordinance gives the company authority to operate a number of other tracks, granted under old village trustee franchises, by electricity instead of by horse-power.

THE RAPID TRANSIT PROBLEM IN NEW YORK.

During the discussion which followed the reading of Mr. Frank J. Sprague's paper, entitled "Considerations Which Should Govern the Selection of the Rapid Transit System," read before the general meeting of the American Institute of Electrical Engineers, on May 21 last, Professor George Forbes, the eminent English electrician, made some interesting remarks. He said:

"I know that there is always a general feeling over here that progress in electrical invention is retarded by the conservative spirit in Europe, and that we are slow in taking up things, and that you are very much further ahead than we in all electrical development. I think there is no one who is more ready in many cases to acknowledge that than myself, and frequently after my visits to this country when I have gone back I have been looked upon as a renegade for turning against our English modes of doing business, and for not supporting them, and for saying that you had been doing better in America than we are doing there. England has not in the past taken quite the position with electricity that she did with steam. She has not gone ahead and taken the lead in the world as she did with steam; neither in electric lighting nor in street railways. The reasons, however, for both these are perfectly definite. Electric lighting was retarded in England owing to the defective legislation which was introduced and street railways would be working under different conditions in England from what they are here, if it were possible to permit the overhead wires which we see in Boston and other cities of this country. If they could be permitted in London or other towns, we would be, I venture to say, not far behind you in the progress of street railways in England. But there are such objections to it that that is impossible, and if you, on the other hand, were deprived of the advantages of the overhead wire system for street railways you would be, I venture to say, as far back as we are at the present moment. Now, however, we are coming to a new stage of electrical progress and that is not of street railways but of real rapid transit railways, and there, I venture to say, that we have made a start ahead of the United States; that in the development of the South London Railway we have made a step of very considerable magnitude—not a step of considerable engineering magnitude, but a step of considerable magnitude in overcoming the inertia of the rest of the world; in leading capitalists, municipal authorities and the public generally to recognize that traction on a large scale is an accomplished problem. The development that has already proceeded since the completion of the South London Railway in bringing before Parliament the West Railway, which Mr. Sprague has alluded to, and the other electric railway down the length of Oxford street and Holburn, many miles in length, is an indication that it has been realized by all those interested on the other side that this is an accomplished problem. I have not the slightest doubt that the progress here will be very great indeed. But I did just wish to say a word or two in favor of what we are doing on the other side. So that, although I have always been ready to speak highly of the progress you are making here, I am not going to go back on my own country and say that we do not do good things when we are really doing them. I think every one who has listened to his paper, in all probability thinks that electricity is the only means which will be adopted. I will now say, however, a few words as to my own experience of the South London Railway so far as they seem to bear upon the problem here. The system is working with absolute perfection at the present moment. At the beginning of its running there were some little troubles, chiefly mechanical. There were no electrical troubles connected with the railway after they once got the proper engine down to work. At first an engine not quite powerful enough for all they wished to accomplish was put down, but that was soon replaced by a more powerful one. The only troubles which were shown at first were due to want of bells in the cars and occasional derailing. That has been completely obviated and now its service is as perfect as could be wished. The comfort of traveling on this line is worth speaking about. I have noticed in talking with New York men that their idea is that an underground railway is necessarily objectionable. If those persons speak from experience of the underground railway—the District and Metropolitan railways—I must say it is the most perfect good sense. Traveling on that system is simply atrocious, especially in warm weather. But on the South London Railway the comfort is perfect, the temperature is uniform, summer and winter. There are not the fumes that are in the underground railway in London. No sewerage could possibly filtrate into it. It is at a distance below all sewers and sewer contamination, and the ventilation secured by having two tunnels, the one for going and the other for returning, is absolutely perfect. The arrangements for large elevators—hydraulic elevators at the stations for carrying people to the surface of the ground are also perfect. The only point which strikes one as a little curious is that besides the electric system for propulsion and the hydraulic system for the elevators we also have the compressed air system for the brake; bottles of compressed air being carried on the cars. It may be that an electric system of brakes might be harmonious with the other parts of the system, but I may assure you here, that the comfort of traveling on that railway is perfect, and could not be improved upon. The little noise there is is not in the least objectionable. Nor would it be in a town like this, where we are accustomed to considerable noises without raising objection to them.

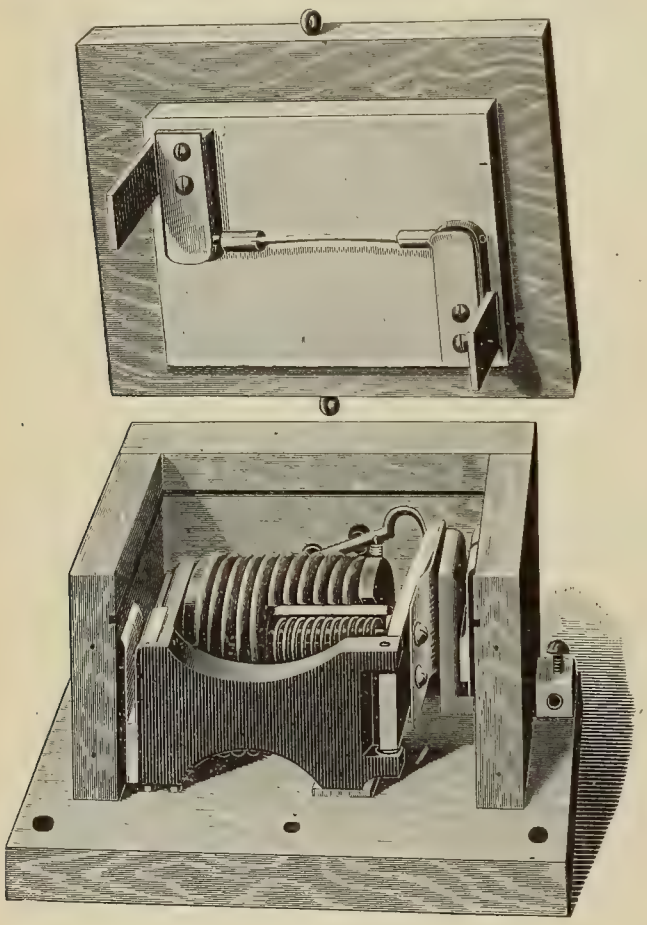
My own opinion is certainly in support of the view which Mr. Sprague has initiated, that the

solution for rapid transit in New York is by tunnelling and electric traction. As to the particular method of electric traction, I will not say anything about that at present. It is a mistake to suppose that there is only one system of electric traction which could be put on—that heavy locomotives pulling the train is the only way by which the problem could be solved. But out of the many ways which may be proposed, I feel sure that from the engineering ability which will be called in to discuss the question and to arrange the plans, the outcome will be satisfactory. I have very great confidence that if these causes to which Mr. Sprague has alluded, outside the engineering, be properly dealt with, that the problem of rapid transit in New York will before many years be solved in the way which electrical engineers wish it to be solved."

CUTTER'S MAGNETIC CUT-OUT.

Where the trolley system is introduced rather quickly, as is generally the case, the ordinary horse-car driver is immediately put in charge of the motor-car and left to learn much from experience. Of course this is at the risk of the electrical apparatus, and accounts in part for the frequent burning out of armatures or field coils.

To guard against this expensive ruining of the motor coils, it is merely necessary to introduce some safeguard which will positively open the circuit when the current becomes too large. The fuses commonly used for this purpose cannot always be relied on in practice. This is partly because the fuses are not always well gauged, and more so because the continued passage of a current not much below the limit of safety is apt to



MAGNETIC CUT-OUT.

change the capacity of the fuse. In either case the fuse may not blow at all or may yield so slowly as to allow the motor coils to burn out first.

The new magnetic cut-out designed by Mr. W. E. Harrington, and made by George Cutter, avoids this risk by letting a small fuse carry the whole current when this exceeds a certain strength. For this purpose the electro-magnet shown in the cut is put in the shunt with the fuse which can carry but a small fraction of the current required by the motor. When the current becomes too great, the magnet attracts its armature and thereby cuts itself out, the armature being locked in this position by a spring catch.

The fuse can be quickly and cheaply replaced and the catch released so as to make the cut-out again ready for action. A thick sheet of asbestos protects the magnet from the fused metal, and all the parts are built of ample size for good wear. This device has been perfected by George Cutter of Chicago, who is putting it on the market.

A THERMO-ELECTRIC METHOD OF STUDYING CYLINDER CONDENSATION IN STEAM ENGINE CYLINDERS.*

BY PROF. EDWIN H. HALL.

The subject of cylinder condensation is one that possibly would come more aptly before the mechanical engineers than before the electrical engineers, and yet most electrical engineers are to a greater or less extent mechanical engineers, and the time seems not yet to be near when we can dispense with the steam engine in the practical applications of electricity.

A little more than two years ago (Jan. 17, 1889), Mr. Dickerson of New York gave an address before the Electric Club of that city, I think, in which he advanced the proposition that the peculiar character of the indicator card of a steam engine which was supposed to show cylinder condensation and re-evaporation was due to leakage by the valves—leakage in by the valves at one part of the stroke, leakage out by the valves at another part of the stroke. He made the statement that the steamers in the waters about New York City, would travel four or five miles an hour with the valve between the boiler and the cylinder closed. I do not know how accurate that statement was. I have never seen any statement in contradiction of it. Mr. Dickerson's paper excited my interest—perhaps more than it would have excited my interest if I had been a trained steam engineer. I knew that this was a matter in controversy between steam engineers—that they were by no means at one as to the amount of cylinder condensation, and by no means in agreement as to what caused the cylinder condensation, some believing that the steam coming in here at A (Fig. 1,) was cooled by contact with a layer of water remaining over from the previous stroke—the layer of water upon the inside of the cylinder. They thought that you could hardly account by the action of the iron alone for the very sudden condensation of the large amount of steam that is condensed. Mr. Dickerson's paper, then, stimulated me to undertake an investigation of this matter in a

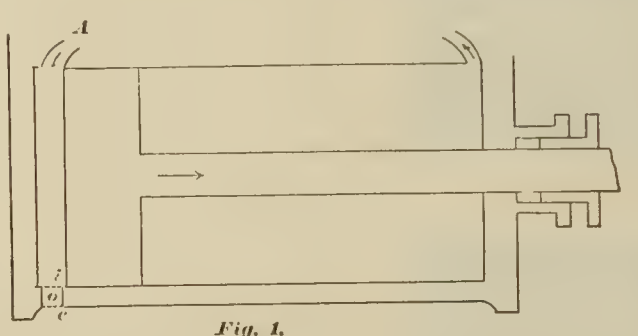


Fig. 1.

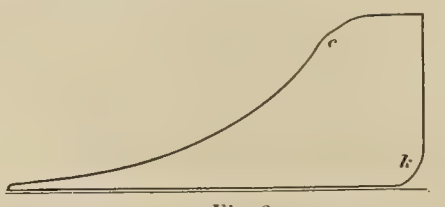


Fig. 2.

direction in which it had not been approached before, so far as I know. Steam engineers have invariably, so far as I know, examined this question by study of the indicator card, examining the pressure at different parts of the stroke—the pressure and volume, and finding out how much steam they indicate. Knowing the pressure at this part of the stroke, C (Fig. 2), and the volume occupied by the steam, we can tell what weight of steam there is in the cylinder as *steam*. It is found frequently that there is more steam in the cylinder at the end of the stroke, than at the beginning of the expansion. According to Mr. Dickerson, that was due to the

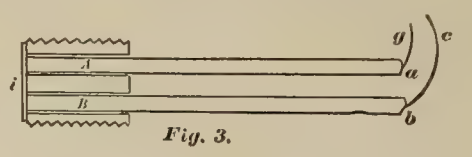


Fig. 3.

leakage by the valves by which steam was admitted, when the pressure in the cylinder fell low. It seemed to me that we might test the question, how much heat enters the cylinder wall by a thermo-electric method. Let this, *i. e.* (Fig. 1) (making a sketch) represent the thickness of the cylinder wall. Now this, O, is a hole which, in the engine which I have used, is bored for attaching the indicator. It is a hole about three-quarters of an inch in diameter. The thickness of the wall is about three-quarters of an inch—a little more than that. I screwed into that hole a plug (Fig 3) having at this end *i*, a slice of iron —I had steel at first—of known thickness. Here is a hole going through the plug to that slice. Here is another. Into that hole I put a bar of antimony, A; into this hole a bar of bismuth, B. The two were insulated from the plug. It is known to all of you that bismuth and antimony make an excellent thermo-electric pair—the best that is in practical use. If I connect the antimony with the copper wire, *g*, the bismuth with the copper wire, *c*, and lead those wires to a galvanometer, I shall get a current through that galvanometer whenever the two junctions here *a* and *b*, are at a different temperature from the section where the antimony and the bismuth strike this slice of iron. If I put the ends of these rods of bismuth and antimony into a pot of paraffine and heat that paraffine, when I get the temperature of these two junctions *a* and *b*, where the copper joins the bismuth and antimony, the same as the temperature where the antimony and bismuth strikes the iron, the current will cease. If the temperature here is below the temperature there, I get the current in one direction. If the tem-

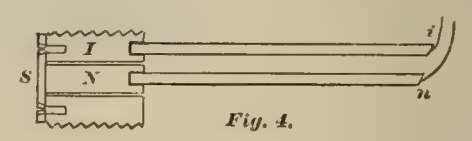


Fig. 4.

perature here is higher than the temperature there, I get a current in the opposite direction. That was the beginning of the method. But it presently occurred to me that it would not do to use bismuth and antimony, for the reason that the heat conductivity of those substances is too different from that of iron. My purpose was to find what the temperature was at a certain thickness in the cylinder wall at a certain part of the stroke. (I close this circuit *g*, *c*, at a particular part of the stroke by means of a cam upon the crank. I can close the circuit at any part of the stroke for a short time.)*

It being my purpose, I say, to find what the temperature is at a particular depth in the iron, I wished to have that temperature as exactly as possible what it would be if this iron were in a normal condition; that is, if this were in a solid cylinder instead of being in a prepared plug. To get that, I found it necessary to have for these bars, A and B (Fig. 3), a heat conductivity which was more nearly like that of iron than the heat conductivity of antimony and bismuth is. So I cast about for some metal which would with iron itself make a good thermo-electric couple, and of which the heat conductivity would be very like that of iron. Nickel suggested itself. Nickel and iron make

* Abstract of a paper read at the General Meeting of the American Institute of Electrical Engineers, New York, May 20. 1891.

* In my latest experiments, the fly-wheel has made about 60 revolutions per minute, and contact has lasted about one-sixtieth part of a revolution. The cam pushes two pieces of brass together without touching either of them directly. Springs hold the two slips of brass apart when the cam is not acting.

a very good thermo-electric pair. I determined to make my plug in this way. Here (Fig. 4) is a plug with a hole bored completely through it. Here is a slice of cast-iron, S, ground to a particular thickness, which is screwed on at the end of the plug, making a steam-tight joint made—at least I meant it to be steam-tight.*

Into this hole I put a core of nickel insulated from the iron except here, where it strikes the slice. The nickel is soldered to the iron in this way. The slice is tinned very thinly; the end of the nickel core is also tinned. The two are heated very hot, and then in a vise they are held together until they are cooled, so that the thickness of the solder there is not more than a thousandth of an inch. The soldering was done with the slice and the nickel core in place, the slice being screwed to the plug, and the core being surrounded with a single layer of paper to keep it free from the iron, except at the bottom of the hole. Slice and core were removed from the plug after soldering, and the solder which had been squeezed out from the joint by the action of the vise was carefully turned off in a lathe. The distance from the outer end of the core to the farther surface of the slice was measured carefully before soldering and after soldering. In no case did these measurements show the thickness of the solder to be as much as .02 mm.

I know very definitely, then, the depth at which the contact takes place. Now, as to the heat conductivity of nickel, I can find no data in the books. I believe no information in regard to it turned up in my studies. But I knew from the relation of its electric conductivity to that of iron that the heat conductivity ought to be nearly like that of iron, for usually heat conductivity and electric conductivity go hand in hand. I had to have a bar of nickel made to make the determination. I had a bar of nickel made about a yard long and about one square inch in cross section, and I had considerable trouble to get it. I determined the heat conductivity of that by comparison with a similar bar of cast iron. I found that the heat conductivity of nickel is rather less than that of cast-iron, perhaps 15 or 20 per cent. less†, but still nearer the heat conductivity of cast-iron, than any other metal that I could get that would make with iron a good thermo-electric junction. The specific heat of nickel is near that of iron, which again is as important, perhaps, as the matter of the thermal conductivity. Now from the nickel core I lead a nickel wire, both being made from the same bar of which I had determined the conductivity; from the iron, an iron wire. This and the one of nickel were slender bars about 15 cm. long, rather than wires proper. These are not drawn to scale. These junctions *i* and *n* (Fig. 4), are put in a pot of paraffine, and I go through the processes which I have indicated already.

I had three plugs like this made. With one the slice of iron was half a millimeter thick (.051 cm.), with the other a millimeter thick (0.101 cm.), with the other two millimeters thick (0.203 cm.). Let this, Fig. 2, be the indicator card from the engine with which we are making this test. I used first the plug with the thinnest slice, and I found the temperature at this depth of iron, half a millimeter at that part of the stroke, *k* (Fig. 2), just before steam is admitted. I did the same with the millimeter slice, and with the two millimeter slice. Let this line D (Fig. 5) represent 4 mm. of the thickness of the cylinder wall, points at depths of one-half mm., one mm. and two mm., being marked upon it. Now I plot a curve. (Let me say that a part of this is prophetic; this curve I haven't been able to plot perfectly). Suppose that distances out here to the left from the line D, represent excesses above 109 degrees—109 degrees centigrade being the temperature of the outer surface of the cylinder wall. With the half millimeter slice at this part of the stroke, *k* (Fig. 2), I find an excess above 109 degrees of eight or nine, which I will represent by the distance *a*. With the millimeter slice I find the temperature to be greater at this part of the stroke, and I will represent the excess above 109° by the distance *b*. With the two millimeter slice the temperature was not very different from what it was with the one millimeter. Through the tops of the lines *a*, *b* and *c*, I draw a curve. (What I wish to do sometime is to be able to plot a curve like that giving the temperature all the way down here inside the wall of the cylinder at this particular part of the stroke).

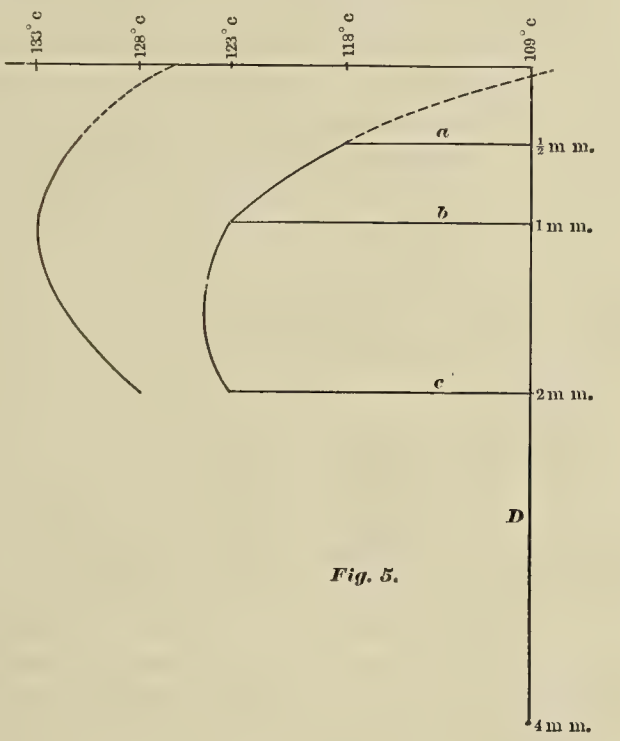


Fig. 5.

I make similar determinations for that part of the stroke, *c* (Fig. 2). I find the temperature at half a millimeter depth has risen to 131° more or less. The temperature at a depth of a millimeter is a little higher. This point ½ mm. deep, has already begun to cool. The fact is, that in my engine the cut-off is like that (Fig. 2)—pretty gradual, so that re-evaporation very likely begins before cut-off is complete. I suspect, however, that 131° is too low for the temperature at a depth of ½ mm. At the depth of two millimeters the temperature is not as high as it is at a depth of 1 mm. At the depth of two millimeters in the iron, there is, however, a jump of some four or five degrees centigrade.

One of these curves (Fig. 5) represents the condition of things at this part of the stroke, *k*. The other curve represents the condition of things at that part of the stroke *c*. The curves are by no means accurate, and they are very incomplete, but supposing them made perfect, I have merely to put on here a planimeter to measure the area between those two curves, and it is then easy to determine how much the heat in the cylinder at this part, *c*, of the stroke exceeds the heat in the cylinder at that part, *k*, of the stroke, and this excess of heat, is the heat which has been given up by the steam to the cylinder-wall, which has been done during the admission. Allowance should be made, of course, for the loss through the wall meanwhile. Then I compare that with the indicator card, and see whether the two are in agreement.

The Grosse Berliner Tramway Company, of Berlin, are considering the advisability of adopting on their lines the electric system used in Budapest, Hungary.

* In some of the experiments this joint was not perfectly tight, for water was sometimes seen to come out by the core N before the plug became hot. Generally upon such occasions the leaking appeared to cease when the plug became hot. The fact probably is that the joint continued to leak slightly, but leaked dry steam, the temperature at the outer end of the plug being about 100° C, and at the inner end considerably higher. Both experiment and reason indicate that the effect of such leakage upon the temperature found was slight.

† The nickel used was of fair commercial quality. I am not yet prepared to publish details of the measurement of its conductivity.

PHILADELPHIA NOTES.

Mr. M. M. Garver is in Philadelphia and will shortly let his friends hear from him on a new specialty which is now in preparation.

J. D. Goodfellow, the popular engineer of Huntington, Pa., and 93 Grace Church, London, E. C. Eng., was in Philadelphia the past week.

G. W. Pierce, 510 Arch street, is bringing out some electrical specialties that will interest the readers of our paper very much.

Mr. D. F. Evarts, of the Simplex Electric Company, 620 Atlantic avenue, Boston, Mass., manufacturers of the well known Simplex wires, was in Philadelphia the past week and he will return home with his books full of orders.

Otto Fleming, 1009 Arch street, is said to be the oldest manufacturer of electro-medical apparatus in Philadelphia and carries the largest line of these goods in that section. Send for circulars and catalogues, which he will be pleased to send to any address.

All suits having been settled, the Wells Electric Construction Company, of Milton, Pa., has been re-organized with the following incorporators: B. N. Carpenter, A. C. Robertson, E. N. Carpenter, H. M. McClure, F. Dansmore, F. Laker, all of Wilkesbarre, and E. F. Colbein of Milton, Pa.

Mr. D. C. Spruance, of the Star Electrix Company, has sold to the Illinois Material Company, 15,000 keyless sockets, 50,000 key sockets and 15,000 switches, and the prospects for the future are certainly remarkably good. Their goods are of a kind that are always appreciated.

Mr. John E. Mohan, of St. Louis, Mo., doing business at the Laclede Building, that city, passed through this place a few days ago on his way home. This gentlemen is a thorough electrician and had visited New York and Boston for the purpose of selecting a supply of electrical goods that will astonish the fraternity at St. Louis.

The Reliance Electric Company, 720 Sansom street, Philadelphia, Pa., make a specialty of repairing dynamos and motors, commutators and all parts of electrical apparatus and is doing the work of a number of the principal isolated plants in Philadelphia.

Mr. H. W. Merchant, of Merchant & Co., 517 Arch street, Philadelphia, is now on his way to the Pacific coast, on a combination business and pleasure trip. He will be absent a month or more. This firm are pushing brush, copper and fuse wire. They are also large dealers in copper wire, rod, sheet and tubing, and also in brass.

Edwin Harrington, Son & Co., 15th street and Penn avenue, manufacturers of patent portable hoists, overhead tramway and hand power elevators are doing a good business. The machines made by this firm are giving the best of satisfaction and are used by a large number of electrical people.

The Star Electrix Co. are meeting with excellent success in their incandescent switches, lamp sockets, etc. Mr. Marshall showed the ELECTRICAL AGE representative an order from Mr. D. C. Spruance for over $4,000 worth of sockets, switches and cut-outs received on June 9. Mr. Spruance is still on the road to 'Frisco.

E. F. Houghton & Co., the noted manufacturers of lubricating materials and belt dressing, of Philadelphia, is said to be the most successful house in their line of specialties. Their well known belt dressing is said to preserve the belt and prevent slipping, and is in use by the principal electric light-companies. This company will send samples for trial free to any one mentioning this paper. The office and salesroom is at 211 South Front street, Philadelphia, Pa.

Charles E. Bibber, the hustling manager of the Consolidated Electric Manufacturing Company, 196 Summer street, Boston, Mass, was in Philadelphia the past week, taking orders for his "A jack-knife" switches, also lamp sockets, etc.

National Electric Company, of which Fred. G. Warrell is general manager, are the manufacturers of the Warrell Fuse Block and contractors for arc and incandescent lighting and motor installations and the introduction of all household electrical specialties. Their Warrell Fuse Block is receiving its full share of attention and many large sales are reported. It is well thought of in Philadelphia and vicinity.

J. M. Rhodes, manufacturing electrician of Philadelphia, has brought out a new and simple gas engine which he claims is going to meet a long felt want in the electrical field for light and power and will exhibit the same in a couple of weeks at 23 South Front street, Philadelphia, Pa. He will then be able to take orders up to 7 horse-power. His claims for this engine are simplicity of construction, compactness, durability and simplicity of governing.

The Equitable Electrical Engineering Co., Drexel Building, Philadelphia, are constructing at Athens a five to six mile complete electric railway system, four motor cars. The Richfield and Manchester road put up additional feeder wires and they are also beginning the construction of their Richmond and Highland Park Railway, which will have two cars. They have just been awarded the contract for the Lebanon and Annville road, a five mile electric railway, but they have not decided the number of cars to be run on this route.

Mr. H. T. Paiste, corner of 12th and Market streets, is the youngest looking and oldest manufacturer of switches, sockets, cut-outs, etc. His china switches are made from 5 to 10 ampere capacity for fine residence installations. He has them in variegated colors, also tinted, ivory, blue, yellow, terracotta, gray and some are made with a bright gold, dull or jet black finish. His goods are said to be the cheapest, handsomest and most durable and there is no doubt that he carries the largest stock in Philadelphia. The success which Mr. Paiste has met with in the introduction of his specialties has been most marvelous.

Partrick & Carter, 125 South Second street, under the management of Charles M. Wilkin, are the oldest manufacturers of telegraph, telephone and household electrical materials, as well as all kinds of electric light specialties. This is the oldest house in this country manufacturing electrical specialties. Some of the largest houses in this city owe their education to this old established firm. They are manufacturing for the trade especially, making up goods in quantities, and are always ready to receive an order to be shipped at a moment's notice. Their patent needle annunciator is one of the most popular instruments now in use and there are more of these instruments in use and sold to-day than any other of like nature.

Henry C. Cutter, electrical engineer and constructor, 27 South 11th street, Philadelphia, headquarters of the Spelliar Electric Time Company, Camden Office Lighting and Heating Company. Mr. Cutter will be found under the very significant name—"Electricity"—which is very significantly advertised on the entrance of their handsome room at the above address. He has a number of valuable specialties which will be brought out very shortly, so we call out the watch-dogs in the electrical establishments to keep their eyes on him. He makes specialties of complete plants for electric lighting and gives attention to all kinds of repairing of electrical apparatus. On the back of his business card will be found a number of references throughout Philadelphia and that section of the country.

Mr. Charles Wann, sales agent of the Gamewell Fire Alarm Telegraph Company, 1½ Barclay street, New York, has lately secured a contract for a complete fire alarm system for Gloucester and Woodbury, N. J. Mr Wann also closed a contract lately for a complete fire alarm system for the city of Roanoke, Va., after severe contests with his competitors, one of which has been on the ground exhibiting their apparatus for nearly one year and had every promise of success. All the odds were against him but he triumphed after competitive tests which speaks well for the Gamewell Company's system.

Among the neatest and most valuable novelties that your representative had the pleasure of seeing the past week was the Cope Electrical Pilot Line for laying electrical conductors through conduits. The ingenuity displayed in the planning of this device is most wonderful. It comes nearer to imitating a living object than anything your representative has ever seen. You may insert the pilot into a circular or square tube or conduit and it trails two endless lines. By simply pulling one or the other this mechanical device or pilot line will work its own way through any length of conduit. Other details, dimensions and information will be gladly furnished at the office of the company, Nos. 6 and 8 North Sixth St., Philadelphia, Pa.

Mr. George W. Hutchinson, of the Standard Electric Time Co., 739 Chapel St., New Haven, Conn., was in Philadelphia the past week, and is very sanguine of the success of his system. The Warner system is a success and is now running large plants throughout the East. Many factories are being equipped and others have been using the system for some years. Mr. Hutchinson installed quite a plant in the works of the Wenstrom Dynamo Electric Co., of Baltimore, Md., and is meeting with considerable success in isolated plants. The Warner Electric gauges, which are made in pocket and laboratory sizes for general battery tests, are meeting with their usual sales. Mr. Hutchinson says they have made considerable improvement on this gauge lately which will make it still more valuable to the thousands needing a good electrical gauge.

The Accumulator Co., 224 Chestnut St., Philadelphia, Pa., are meeting with their usual success and a call at the above address brought out the facts that their Dubuque electric cars are running most satisfactorily. The company lately shipped three more cars to that city making nine cars running, six of which have been in use several months, and one of the six has been running over one year under most difficult circumstances, meeting every emergency and overcoming all difficulties. The Eckington and Soldiers' Home Electric Railroad Company, Washington, D. C., have two cars running very successfully. The plant will have six cars sixteen feet long equipped with 132 No. 23 M. cells of accumulators. At the rate of the success these roads are having, there is no doubt they will double their equipment during the summer.

J. J. Murray & Co., of Philadelphia, well-known makers of electric light glassware, were found actively engaged the past week turning out a big line of incandescent shades of the richest and most elegant patterns. This firm is noted for their flint glass ware, and samples of the ingredients used in the manufacture of these goods are found to contain the very best material throughout. The firm guarantee their glass to be the purest flint glass to be found in this country. The furnace is said to be one of the largest used for this purpose and a trip throughout their vast works would very quickly convince the most skeptical mind of the truth of the claim of Mr. Murray, that he has facilities enough to furnish all the arc and incandescent globes and shades for the electric light business of this country. They turned out in one year 240,000 arc light globes; they also turned out in one year incandescent shades in different styles to the number of 800,000. They do all their own etching and finishing in the various styles of shades, which are among the most ornamental that your representative has ever seen. The firm has one of the most complete catalogues illustrating the different styles of shades running up into several hundred. The most exacting buyer can be satisfied by this firm.

While visiting the various supply houses throughout Philadelphia last week, your representative was attracted to the handsome store of J. B. Shannon Sons, 1020 Market St., where they have a considerable display of electrical specialties in their extensive show windows. No doubt the day is coming when all our electrical supply houses will see the necessity of adding a complete line of household hardware specialties needed by the builder because of the convenience of buying all these goods in one house. The hardware dealer as a rule is ignorant of the necessary good qualities of the electrical household specialties; he is more apt to have pounded off upon him a class of electrical goods that a first-class builder or architect would not touch. For this reason electrical men or dealers would find it to their advantage to carry in connection with their electrical lines household hardware to meet the wishes of the various hardware dealers. On the other hand, the leading manufacturers of hardware, such as Sargent & Company of New York, Russell & Erwin and one or two other houses as large could furnish electrical supply houses with their complete catalogues, which to the writer's mind could be utilized by a dealer in furnishing a line of hardware in connection with electrical supplies.

The Hale & Kilburn Manufacturing Company have just completed a large order for their patented seats for thirty cars for Lincoln, Neb., as well as a large contract for the St. Louis Car Company. They also recently completed an order for their patented seats to go to Guatemala. They are hard at work on their new buildings, which are being pushed forward as rapidly as possible, and which, when completed, will give work to about one hundred more men. This company is engaged now in getting samples ready for a fine exhibit at the Master Car Builders' Convention, to be held at Cape May this month.

E. Ward Wilkins and T. L. Townsend, of the Partrick & Carter Co., have returned from their Canadian business trip, and report very satisfactory results. They had a multitude of orders in their pockets for the King annunciators and other electrical specialties. While in Toronto Mr. Wilkins made an arrangement whereby the Toronto Construction and Electrical Supply Company assumed the Canadian agency for the sale of the Partrick & Carter Company's annunciators, bells, batteries and general house goods. This will prove to be a great convenience for the Canadian trade, as a full line of goods will always be carried in stock by the Toronto house, and will save delay and expense of transportation. W.T.H.

Proposals have been invited for the construction of a power house for the Citizens' Electric Company of Pueblo, Col. The building will be 50x140 feet, and will contain three 100 horse-power boilers and necessary engines and generators. A large quantity of crossarms, poles, etc., have been bought and work will commence at once. Mr. J. F. Vail will be the superintendent. Arrangements have been made to extend the electric street railroad on the east side of the Fountain River two and a half miles. Superintendent Downey will also extend the line from the south end of Santa Fe direct to the Philadelphia smelter. The construction work will be pushed as rapidly as possible.

NEW YORK NOTES.

The following named gentlemen were in town last week: J. P. McKinstry, of the Cleveland, Ohio, Telephone Exchange; C. E. Bibber, of Boston; Jose Eligio Mosquera and Manuael A. Vaslier, of the electrical supply firm of Mosquera & Vaslier, Havana, Cuba.

The Electric Club is to give a smoking concert at the club rooms, 17 East Twenty-second street, Thursday evening, June 18, at 8 o'clock. This is the first entertainment of the kind attempted by the club, and every effort is to be made to make it a success.

Tests to demonstrate the efficiency of steam separators were recently made at Sibley College, Cornell University, under the direction of R. C. Carpenter, professor of experimental engineering. The report, with complete drawings, etc., showing the efficiency of the competing separators, will be sent to parties desiring it by the Hine Eliminator Company, 106 Liberty street, New York, if this paper is mentioned.

Messrs. Pierce & Thomas, 42 Cortlandt street, New York, have opened a branch salesroom under the management of S. L. Wilson, at 45 North Seventh street, Philadelphia, where they will carry a full line of engines and boilers of all styles and sizes. They will make a specialty of the McIntosh & Seymour high speed automatic engines for electric light and power plants. Estimates, plans and specifications can be furnished from both the home and branch houses.

W. F. Stark & Company, 303 Broadway, the sole agents for the Porter motors for electric fans, dental lathes, sewing machines, etc., report a large demand for these neat, compact, powerful and efficient machines. Mr. M. D. Porter, the manufacturer, says that Messrs. Stark & Company are exclusive agents for his motors, and that he is ready to prosecute anyone else imitating or dealing in them. Mr. Porter has moved from 177 Broadway to 173 Greenwich street, corner of Cortlandt.

The Board of Railroad Commissioners received a communication a few days ago from the Edison Electric Illuminating Company, suggesting the use of electric lights and fans in the Fourth avenue tunnel, both to be run from the same low tension current, the lights to be shaded so as not to blind the engineers. They suggested the use of 16-candle power lights placed 30 feet apart, instead of the present arrangement of 32-candle power lights placed 120 feet apart. The Edison Company desire to furnish plans and specifications for the lighting and ventilation.

The Eureka Electric Company, 18 Broadway, City, proprietors of the Loomis system of arc and incandescent lighting, are receiving generous orders for plants on their systems, particularly the incandescent. The Loomis system is now in operation in several cities throughout the country between New York and Florida to the south, and San Francisco to the West. Their large 500-light plant at 40 Wall street, this city, is an excellent example of the system in successful operation, and any company, firm or individual desiring a good electric lighting plant are recommended to call upon the Eureka Electric Company.

The Hall Signal Company, 50 Broadway, New York, is managed by several most exemplary young men who are competent to undertake the installation of railway signals or alarm signals for crossings. The Hall system is now in operation on some of the largest railroads in this country, the chief officers of which testify to the perfect operation of the signal. Their exhibition room at 50 Broadway is complete in every detail. The various signal and alarm systems may be seen in operation here, and the company are always ready to give information on the subject, as well as to receive orders for equipments.

Mr. James H. Mason, 120 Park avenue, Brooklyn, is carrying on the electrical supply business on his own account, as well as the installation of electric light and power plants. He is ready to install fans, blowers, all kinds of electrical household fittings, and electric time systems, and will bid for all kinds of supplies. Mr. Mason is also the sole eastern agent for the Hay-Horn Manufacturing Company of 63 South Canal street, Chicago, the well-known makers of electric bells and annunciators. Mr. Mason, who is the inventor of the famous Mason Battery, will be pleased to see his friends at his New York office, Room 109, *World* building, New York.

Several nickel-plated C. & C. fan outfits have recently been installed in the White House at Washington. Large ventilating exhaust fans, with C. & C. motors connected directly to fan shafts, have been running for several months past in the Pennsylvania State Capitol Building at Harrisburg, one in the assemby and one in the Senate Chamber. The members have been most enthusiastic over the success of these machines, and have passed resolutions testifying to the great improvement the outfits have effected in the atmosphere of the rooms. The White Star Steamship "City of New York" has been equipped with C. & C. fan outfits with 18 in. fans. The Edison Electric Illuminating Company of New York bought one hundred C. & C. fan outfits last week. The new operating room in the City Hospital, Rochester, N. Y., is ventilated by a C. & C. Exhaust Electric Fan Combination with fan 36 ins. in diameter.

The Manhattan Electrical Supply Company, 36 Cortlandt street, this city, has among its members two or three old telegraphers who are well remembered by many of the craft. These gentlemen tender fraternal greetings to their old associates, and desire to let their friends know that they are in the electrical supply field. This company is doing a very large business, and those of the tele graphic fraternity desiring to purchase electrical supplies of any kind should remember the members of the craft who are engaged in this line of industry. Telegraph superintendents, train despatchers and others on railroads, will do well to investigate the specialties carried by this house. Their prices cannot be beaten, and they can always be found trustworthy, and in mail orders every satisfaction is given. They have lately added on several new specialties, including the Johnson Dry Battery. They had one of these dry batteries connected to a bell running continuously for 14 days, and at the end of that time it appeared as fresh as at the start. Their bells are manufactured by themselves and the company can give the best prices on these, as well as on annunciators, burglar alarms, acoustic telephones, telegraph instruments of all kinds, wire, and all the paraphernalia needed in a telegraph or telephone office.

W. T. H.

FINANCIAL.

The new member of the Board of Electrical Control, Commissioner Walton Storm, in stirring up the rather monotonous but lively documents to familiarize himself with the condition of things, fails to discover the existence of any provision made by the State to defray the expenses of the board after November. About that time—barring strikes—half the streets and avenues in the thickly settled portion ot the city will be torn up, and if left to his own desires, the bland, innocent appearing engineer, be he subway, aerial or suburban, either in idea or employ, will not forget to advance the interests he represents, and when the Honorable Board return from their holiday without funds, a lot of work will be done that will have to be undone, after the question of possession has been once more legally settled. There is another matter of the utmost financial importance to the business men of New York proceeding at the moment, which is capable of general improvement from every point of view; that is, the cable roads. Why should not the directors be called upon to employ continuous eight hour shifts? The workmen would earn two-thirds more money to be divided among 66 per cent. more families, beside having sixteen hours of practically undisturbed possession of the route. It has been proven time and time again in the western mines that a man will do as much work in eight hours as in twelve. The first and last hour of the day is at present occupied in preparing for the day's work, and rendering the thoroughfare passable at the end of it, which would be obviated if a man stood ready to proceed with the pick and shovel, left by his fellow workmen. Not only would three times as many men be employed, but the work would advance more than three times as rapidly, and all other business be benefited accordingly; the roads would that much sooner earn the increased dividend, thus rendering engineers, directors, laborers, business men, bondholders, shareholders, and even the public correspondingly happy.

The current flow of gold to Europe occupies so many columns of financial statements, that the probability of its ending affords relief to all interested in the situation. Week by week the amounts have been published and the resources explained. It has been followed across the ocean to its destination, and the report flashed back that all was delivered safely. Now comes the denouement. The cause, of course, was the commercial necessity of liquidating the business of Messrs. Baring Bros.; cash money was obligatory to successfully carry out the scheme; it has been completed, and the balance sheet published officially by the bank of England to the guarantors as follows:

ASSETS.

Good securities	£ 2,860,000
Securities valued as per quotation Oct. 31, 1889, excluding South American	11,000,000
Uruguay securities	2,117,000
Argentine securities	5,785,000

LIABILITIES.

Due to Creditors and Depositors	£ 828,000
Advanced by Bank of England	7,508,000

with the governor's opinion that the guarantors will not be called on to pay a single penny. A new cloud dims the azure serenity, which may be called supplementary, in the reported failure of Russell & Company, but it is scarcely possible that any commercial disturbance can now change the programme and nothing short of the breaking out of actual war in Europe can keep the gold over there for any lengthened period.

Dealings in electrical securities during the month of May were quite active but on the whole showed a slight falling off in prices, as will be seen by comparing the quotations in the list. Among the new corporations of the month was the New York Light and Power Company, $50,000 capital and among its incorporators are the names of Martin B. Brown and James A. Flack.

The Western Union has declared the regular dividend of 1¼ per cent. payable July 15, the annual report to June 30 will show, among other things, that a 1¼ per cent. dividend calls for $1,077,400. Interest on bonds, $222,900, which will leave a surplus of $11,328,000 approximate. Commercial Cable Company has declared a quarterly dividend of 1¾ per cent. on the outstanding stock payable July 1. Bell telephone, regular dividend of 3 per cent., and extra one of 6 per cent. National Lead Trust, 50 cents per share, payable July 15.

The Sprague Electric Railway and Motor Company and the Edison General Electric Company each filed bills in the United States District Court, Massachusetts, against the West End Street Rail-

way Company of Boston, on the 8th. inst. for alleged infringement on patents, including certain underground wire connections with the rails for return circuit; to stop use of guard wires, to prevent use of trolley and feed wires, prohibit use of motors in parallel circuit, and to prevent the cutting of different sections of the line. We shall report proceedings as the case advances, a great many stockholders being interested financially in the result.

Judgment for $142,802 was entered on the 11th inst. against the Harlem Lighting Company in favor of the Manhattan Electric Light Company, Limited. Judgment was also entered on the same date against the International Gas Company which was promoted about four years ago by Chas. G. Franklyn, with a capital of $500,000 for $5,295 on a note endorsed for the Metropolitan Gaslight Company of Elizabeth, N. J.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Aluminum Co	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
American Elec. Exercise Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co. (N.Y.)	1,000,000	25 00	3 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co	2,500,000	10 00	
Asbury Park L. & P	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	115 00
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	200 00
Bell Telephone 7's	2,000,000		*112 00
Birmingham Ry & Elec. Co., 6's	1,500,000		par
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5's	6,000,000		par
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1,000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N Y.)	500,000	20 00	10 00
City Electric St. Ry. Co., 6's (Ark.)	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co	7,716,000	100 00	105 00
Complete Elec. Con. Co., N.Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co. (N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co. 6's	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80 000		par
Cons. Gas Co. Batavia	100.000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	10 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600 000		par
East River Electric Light Co	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000 000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison General	14,000,000	100 00	100 00
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co	100,000	10 00	4 00
Empire City Subway Co. (N. Y.)		100 00	
Equitable G. & E. Co. (Utica)	4,000		†
Erie Telephone	4,800,000	100 00	48 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's	100,000		par
Fort Wayne Elec. Co	4,000,000	25 00	12 00
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	par
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1 000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills	50,000		par
Kansas Elec. Co., 6s, Mo	20,000		*96
Laclede Gas Co	7 500,000	100 00	13 25
Laclede Gas, pref	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*73
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,030,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	80 00
Morristown L. H. & P. 5s (N. J.)	25 000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	102 00
Nat'l Lead Trust	9,000,000	100 00	18 25
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500		†
N. E. Tel. and Tel. Co	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	90 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co	20,000		†
N. Y. Storage Baty. Co	100,000	100 00	55 00
Newark L. & P	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,600,000	100 00	
North New York, Lighting	150,000	100 00	20 00
Northwest Elec. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co	8,000		†
Pittsburg Reduct Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	75 00
Rockaway Elec. Lt. Co. 6's	75,000		par
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s	300,000		*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
San Diego Gas & Elec. Co. 6's	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co	16,000		†
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	41 50
Thomson-Houston Pref.	4,000,000	25 00	25 50
T.-H. Electric Co. 5's Boston	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100 000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100 000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000 000	10 00	7 50
U. S. Drug Stores (Ltd.) ord	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine street Motor Co. 6's	100,000		par
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co	7,000,000	50 00	13 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			20 25
Winston-Salem Elec. St. R.R. (N C.)	250,000	100 00	75 00
Yonkers, L. & P	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent. †Registered Stock.

FOREIGN NOTES OF INTEREST.

The telephone trunk line between Paris and Troyes, 110 miles, was opened to the public on May 16.

The representatives of Siemens & Halske in Palermo have secured the contract to light by electricity the exhibition to be held in that city. Five 60-kilowatt machines will be installed for the purpose, and a sixth dynamo will be used for supplying electric power throughout the building.

February last the town council of Port Arthur, B. C., passed a by-law to raise the sum of $75,000 for the purpose of building, equipping, maintaining and operating an electric railway connecting the municipality of Neebing with the centre of Port Arthur, a distance of some four and a half miles, and to authorize the issue of debentures therefor. After contracts had been let and the work gotten under way, an injunction was issued and the town council constrained from proceeding with the work, on the grounds of illegality in the by-law. A few days ago word was received from Toronto that an injunction had been obtained preventing the construction until legislation is obtained to put it aside, which will be in a few months.

BOOK NOTICES.

CENTRAL STATION ELECTRIC LIGHTING, with notes on the methods used for the distribution of electricity, by Killingworth Hedges, illustrated, price, $1.25; and History of the Transformer, by E. Uppenbore; price, 75 cents. Send for latest catalogue of publications. E. & F. N. Spon, 12 Cortlandt street, New York.

THE NEW WORKS AND OFFICES OF THE CROCKER-WHEELER ELECTRIC MOTOR CO.

The establishment of the Crocker-Wheeler Electric Motor Company, West 14th street, New York City, has been enlarged and the alterations which have been going on for some time in the old portion of the works are completed.

A decided change has been made in the apportionment of the interior to the needs of the business and the general appearance is also much improved.

Access to the company's quarters is now furnished by a new entrance on West 14th street. The staircase lands one in the exhibition room, which is well lighted and neatly finished in hard wood. It is full of interest and the many ingenious and useful applications of the celebrated Crocker-Wheeler perfected motors, ranging from $\frac{1}{12}$ to 5 horse-power, are here seen.

A number of motors, ranging from $\frac{1}{12}$ to 5 horse-power, are exhibited in connection with electric disc ventilating fans, electric pumps, etc. An interesting exhibit is a $\frac{1}{6}$ horse-power motor which runs a Wheeler & Wilson sewing machine. Other applications noticed are a ½ horse-power motor driving a 2x1¾ inch triplex pump and a $\frac{1}{6}$ horse-power motor driving a 1¼x2 inch triplex pump (Gould Manufacturing Company pattern). These pumps work very smoothly.

In the exhibition room on a long table is also shown the Crocker-Wheeler motor dismembered, so that the various parts and stages of its construction can be readily understood and appreciated. The high character of the materials employed and the unusual perfection and finish of every part is clearly seen. The company exhibit with pride all these parts, considering that it is the most convincing way of showing the merit of their motor.

To the right of the exhibition room comes first the office of Prof. F. B. Crocker and Dr. S. S. Wheeler—a pleasant, well lighted and cozy room, nicely furnished with polished oak desks, chairs and other necessary office fixtures. It will also be used for board meetings.

Next are the quarters of the able secretary and general sales agent of the company, Mr. Geo. W. LaRue, from which communication is had with the general business office and drawing room, presided over by Mr. W. H. Geers, the assistant secretary.

Every facility is furnished the company officials and clerical force for the rapid and convenient transaction of the immense business done by this enterprising concern.

The shops and testing room are located to the left of the exhibition room and run the entire length of the block between West 14th and West 13th streets, and are fitted throughout with the finest machinery obtainable, necessary for the manufacture of the company's motors.

The Crocker-Wheeler Electric Motor Company employ about 150 hands, both sexes being represented, and hope before long to keep abreast of their orders. They find the new quarters a great convenience and improvement over the old establishment.

Messrs Crocker and Wheeler give the closest attention to the details of the manufacturing work, to maintain perfection of every part, which is the great feature of their motor and for which the machines justly enjoy a universal reputation.

THE BALL & WOOD COMPANY'S NEW PLANT.

The new plant of the Ball & Wood Company, at Elizabethport, promises to be a model in equipment and convenience for building the improved Ball automatic cut-off engines. With a stretch of 900 feet between the main tracks of the Central Railroad of New Jersey and Trumbull street, with

the Singer Park at one end and the railroad station at the other, it is an ideal manufacturing site. Two railroad sidings will serve, one the main machine shop into which it passes, and the other the foundry, which at present is in contemplation.

From the City Hall in New York to the factory station is exactly ten miles, and a long distance telephone will connect the points, placing purchasers of engines in instant communication with the source of supply. In the main machine shop even a wide-awake engineer will be impressed with the mechanical progress made in the last decade. A glance will embrace an enormous room, light and airy, 70 feet high to the roof, and flanked with wide and substantial galleries sustained by iron columns. Overhead a Shaw electric crane will noiselessly raise a completed compound engine of 20 tons from the testing block, carry it the length of the shop, and place it on a car in readiness for shipment. On either hand are new and massive tools, the latest product of shops both East and West, and throughout the entire establishment an air and order of system prevails which, in itself, will guarantee substantial and excellent work. It is the intention of the company to increase its plant by adding in length when it becomes necessary, and this can be done without interrupting the work in progress. A number of orders for the improved Ball engines are already entered, and in another month the factory will be a busy scene, well worth the inspection of engineers as well as purchasers of this well-known engine.

The Sheffield (Ala.) Electric Light Company has been organized with a capital of $50,000.

BUSINESS NOTES.

The "Acme Link" and "Eureka" belts, made by the Page Belting Company, 16 Dey street, New York, are meeting with remarkable success for power transmission in electric lighting and street railway stations. The principle embodied in these belts is said to give greater traction power and strength compared with belts of old style, as heretofore constructed. Among the recent orders filled by this company was one for the Hampton and Old Point Comfort Railroad Company, at Hampton, Va., where two 28-inch wide "Acme Link" and several "Eureka Dynamo' belts are running, the superintendent says, "as nice as anything I've ever seen."

We regret that we shall be unable to insert in this issue the plates we took some days ago of some very handsome models in the office of Wm. Gardam & Son, 98 John street. We hope to be able to present them to our readers in the near future. This firm, so well-known for their excellent work, not only in models, but also in experimental machinery, have as fine a display to prove their claim to fine workmanship as the most fastidious could demand. They number among their patrons such well-known firms as the Johnson Company, the Edison General Electric Company, Milliken Bros., Peckham Car Wheel & Axle Co., Laffin Brake Shoe Company, Riley Railway Construction Company, St. Louis Electric Power Company, and hosts of other equally renowned houses. With such formidable evidence, it hardly is necessary for us to say, that they stand unrivalled in their line, and are well worthy of the confidence reposed in them.

E. T. Copeland & Co., 106 Liberty street, New York; selling agents for the Ball Engine Company, Erie, Pa., and sole agents for the J. T. Case Automatic Electric Light Engines. These portable engines have caused more talk on the subject of steam power than any other engine specialty in the market. Their special features recommend them to all buyers of engines. They may be placed in any position, on the floor, on the side wall, against a post, suspended from the ceiling, and may be placed on the wall in a right or left position, leaving the driving pulley always in the position required. They are great savers of steam, and all its parts are of the finest construction. The finish of the engines is of the very best, and the best recommendation that can be given of them, is the fact that they have been in continuous use for the past two years in electric lighting plants. There is no engine on the market so suitable for this work. For engines of above 50 horse-power, the Ball Engine cannot be more thoroughly recommended than to refer to their successful use in electric light central stations, as well as in numerous electric railways and power plants throughout the country. The Edison Illuminating Company of Brooklyn, have used them successfully for the past few years and on the enlargement of this plant lately, several more of these engines were added, showing that they had given every satisfaction. Mr. E. T. Copeland, the head, and supervisor of this company, will always be found ready to give information concerning power for any purpose, from an electric light plant to a small yacht or steam launch plant.

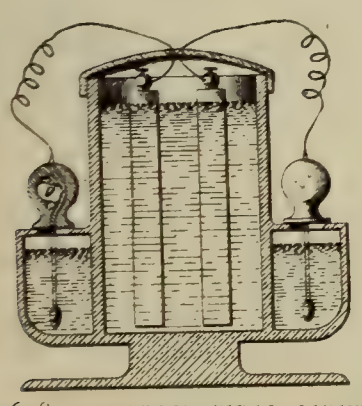
Key West, Fla., is to have an electric light plant.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued Tuesday, June 9th, 1891.

453,618. Electric Cigar-Lighter. Harrison B. Brown, Washington, D. C., assignor of one-half to William W. Dudley and Frank L. Browne, both of same place. Filed Dec. 5, 1890.

An electrical incandescent igniting device consisting of a non-conducting handle with circuit wires leading from a battery and attached to it. One of the wires is divided and its uninsulated ends separated, but juxtaposed, and across the ends a contact-maker temporarily establishes an electrical connection. An incandescing bridge-wire is used to join the uninsulated terminals of circuit wires and complete the external loop. A substance is applied to the bridge-wire capable of absorbing or holding an inflammable liquid.



453,618—ELECTRIC CIGAR LIGHTER.

453,633. Electric Switch. Lawrence F. Furlong and Frederick O. Tucker, Hartford, Conn.; said Furlong assignor to Amos Whitney and Seth W. Bishop, both of same place. Filed Oct. 24, 1890.

453,681. Electrical Measuring Instrument. Frank C. Wagner, Ann Arbor, Mich. Filed Dec. 23, 1890.

Two substantially similar and equal wires fixed at their extremities and mechanically connected transversely, so as to act in opposition to each other, with means for measuring the movement of the wires when only one of them is traversed by an electrical current.

453,693. Electric Arc Lamp. Josiah W. Ells, Pittsburg, Pa., assignor of one-half to Henry B. Smithson, same place, and William S. Boswick, Allegheny, Pa. Filed March 21, 1890.

In an electric-arc lamp, the combination of an electromagnet, lever pivoted to a bearing insulated from but connecting it to the lamp-frame, a shorter lever or clutch underneath and connected to the first lever by means of a link, a movable vertical rod that extends through a hole in the clutch, a hanger attached directly to the lower end of the vertical rod, a transverse shaft in the hanger, a carbon disc supported in the hanger by the transverse shaft, a ratchet wheel rigidly secured to the shaft, a lever pivoted to the same, a pawl connected and adapted to move with the lever and engage the ratchet-wheel to rotate the carbon disc, and an insulating link connecting the long end of the pawl-lever to the frame of the lamp, whereby the carbon disc is adjusted vertically and partially revolved at the same time by action of the electro-magnet.

453,695. Secondary Battery. William W. Griscom, Haverford College, Pa. Filed Dec. 10, 1887.

In secondary batteries, an element containing receptacle with a diaphragm extending across it, and dividing it into compartments. The compartments being closed the gases produced by overcharging are retained.

453,710. Electric Railway. John Jones, New York, N. Y. Filed Jan 15, 1891.

In a crossing-bridge for trolleys, the combination, with the conductor for one line, of two track-arms pivoted thereto, one of the arms having a bifurcated end adapted to receive the end of the other arm, and a link connection between the two arms.

453,722. Attachment for Telephones. Edward E. Baker, Pittsburg, Pa. Filed Feb. 17, 1891.

An attachment for telephone-boxes, consisting of a base-board having a depending flange at one end, and a leaf or table secured to the base-board and arranged to slide in suitable clamps thereon, one of the clamps being provided with a depending flange corresponding to the flange on the base-board.

453,723. Electric Fire-Alarm. Michael M. Braun, Alleghany, Pa. Filed Feb. 17, 1891.

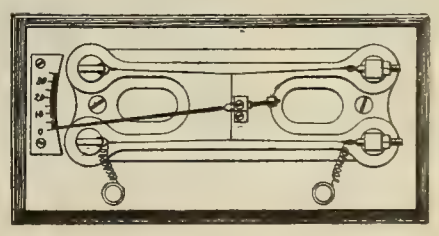
A fire-alarm consisting of a solid base of insulating material, a spring contact arm secured to it and adapted to be connected at its upper end with one pole of a battery, a stationary contact secured to the base beneath the free end of the arm and adapted to be connected with the other pole of the battery, an arm secured to the first contact-plate and projecting at right angles thereto, and a cord having its ends spliced and connected with wax, which joins the free end of the contact arm and the rigid arm, and adapted to hold the spring-arm normally out of contact with the plate beneath it.

453,733. Electric Conduit. John E. Price, Denver, Col. Filed Jan. 7, 1891.

A conduit comprising a body having longitudinal grooves in its lower face, upwardly projecting side walls and intermediate partitions rising from the body, and downwardly curved side flanges projecting from the body and flush with its lower face, and a lid provided with similar grooves and flanges.

453,741. Phonograph. Thomas A. Edison, Llewellyn, Park, N. J. Filed July 30, 1890.

In a phonograph, the combination of a movably supported phonograph diaphragm, an adjusting screw, and means for making a positive engagement between the screw and diaphragm, whereby the diaphragm may be moved to adjust the reproducer.



453,681—ELECTRICAL MEASURING INSTRUMENT.

453,742. Manufacture of Incandescent Electric Lamps. Reginald A. Fessenden, Roseville, N. J. Filed Feb. 18, 1891.

The process of sealing oxidizable leading-in conductors into incandescent electric lamps, which consists of exhausting the air from the bulb and then fusing the glass to the oxidizable conductors.

453,822. Commutator. Elmer A. Sperry. Chicago, Ill. Field Feb. 20, 1891.

A commutator for a dynamo or motor, containing an elastic medium to relieve the insulation from compression strains due to the expansion or contraction of the parts.

453,858. Commutator for Dynamo-Electric Generators and Motors. Henry Davis and Arthur H. Stokes, Derby, England. Filed Dec. 11, 1890.

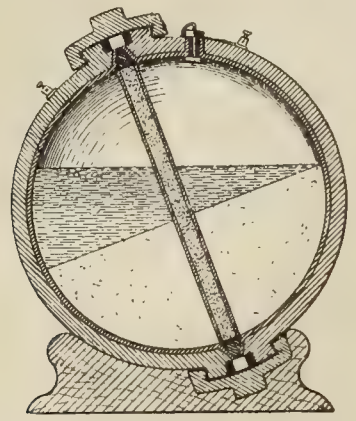
An improved commutator, consisting of a set of insulated commutator bars arranged in the forms of cylindrical ring closed at both ends, and of brushes bearing against the inner surface of the ring and carried by a sleeve projecting through an opening in the plate closing the outer end of the

ELECTRICAL PATENTS—Continued.

ring, the sleeve passing through the outer plate, so that it can be turned in relation thereto and yet form a flame-tight and dust-tight joint at the opening through which it passes.

453,863. Distributing-Frame for Electric Conductors. Angus S. Hibbard, Morristown, N. J., assignor to the American Telephone and Telegraph Company, of New York. Filed Feb. 28, 1891.

453,871. Lighting of Tables and the Like by Electricity. Oscar H. Stovell, Hampstead, England. Filed Feb. 24, 1891.



453,695. SECONDARY BATTERY.

A table having channels in the top and legs, electric conductors carried in the channels, bolts in the legs connected to the conductors for making contact with sockets and connected to the electric house-mains, and blocks placed in the circuits and provided with means for receiving candelabra or lamp fittings.

453,875. Glass-Mold. Thomas B. Atterbury, Alleghany, Pa. Filed Jan. 8, 1887.

A stationary mold for making blown incandescent-lamp bulbs, having a loose sectional ring provided with a name, character, or device, the ring being capable of revolving with the glass as it is turned or revolved in the mold.

453,888. Electric Switch. Willis Mitchell, Malden, assignor of three-fourths to Edward Jewell, Boston, and Levi L. Parsons and Arthur B. Smith, Saugus, Mass. Filed Jan. 8, 1891.

In an electric switch, the combination of a movable circuit-closing bridge with hollow tapering extinguishers thereon and mechanism for directing the ends of the bridge obliquely forward and downward when contact is broken.

453,898. Electric Battery. Jacob O. Brinkerhoff, Hackensack, and Milton E. Smith, Rutherford, N. J. Filed Nov. 26, 1890.

An exciting fluid for electric batteries, consisting of antimonious chloride and an alkaline chloride.

453,950. Secondary Battery Element. John H. Walter, Washington, D. C. Filed Aug. 19, 1890.

A transversely corrugated metal tape wound or bent upon itself in such manner as to present its edges outermost.

453,982. Fire-Alarm Telegraph. George F. Milliken, Boston, Mass., assignor to the Gamewell Auxiliary Fire-Alarm Company, same place. Filed Feb. 24, 1891.

Signal-train may be released by hand or from a distant point by means of an electro magnet whose armature cooperating with an escapement disc, releases a catch in the rod which operates a releasing lever. This occurs only after several makes and breaks (to obviate accidental release), by one of the pins on the disc pushing a dog, arm, and catch into a certain position. The catch is automatically reset at close of signal by pins engaging a lever, thus lifting the catch when a spring restores the arm to its normal position,

453,993. Non-Interference Signal Box. Frederick W. Cole, Newton, Mass., assignor of one-half to Moses G. Crane, same place. Filed Feb. 7, 1891.

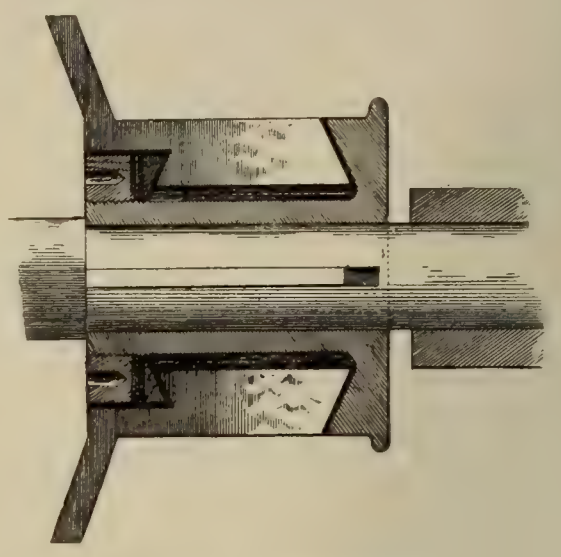
Non-interference is obtained by securing to the armature a signal controlling arm. A guiding flange is fastened to the frame. A signaling lever connected to the pull, has a pivoted extension pressed by a spring toward the back of the box, so that in normal operation it passes up in front of the guide, and at the end of its movement raises a locking-lever and releases the train. Otherwise the extension passes behind and the train is not released. The pull and signaling lever are controlled in their movement by a retarding device, which allows a time longer than the longest closure in any signal to elapse before the locking lever is lifted and the train released.

453,995. Secondary Battery. Stanley C. C. Currie, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed Jan. 31, 1891.

A battery plate or element having a metal core or internal conducting body with an integral spongy or porous metallic surface and inclosed in a casing or covering of woven or braided fibrous material or materials.

454,008. Supporting and Connecting the Driving-Motors of Electric Cars. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Nov. 22, 1890.

The combination, with a car and one or more propelling motors comprising each an armature mounted on and connected directly with a driving axle, and non-rotative field-magnets, of a frame pendulously hung from the car axles and having the field-magnets mounted thereon.



453,822. COMMUTATOR.

454,016. Metallic-Circuit Test and Time-Signal for Telephone Exchanges. Joseph J. O'Connell, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Oct. 4, 1888. Renewed April 18, 1891.

The combination, with the individual annunciator of a metallic multiple switchboard telephone line circuit, of an extra winding on the core of the annunciator in a circuit including a battery and rheotome, a telephone included in a ground circuit having a terminal adapted to be closed to a test-piece of the telephone circuit, and a ground connection for the telephone line circuit at the subscriber's station thereon, whereby on closing the terminal of the ground circuit containing a telephone to the terminal of the line the operator listening at the telephone in the ground circuit may hear the hum caused by the vibratory current induced upon the line.

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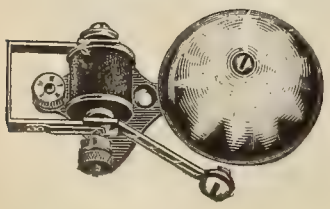
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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

WEEKLY.

Vol. IX. NEW YORK, JUNE 27, 1891. No. 26.

ELECTRIC LIGHT PLANT IN THE CENTRAL BUILDING, NEW YORK CITY.

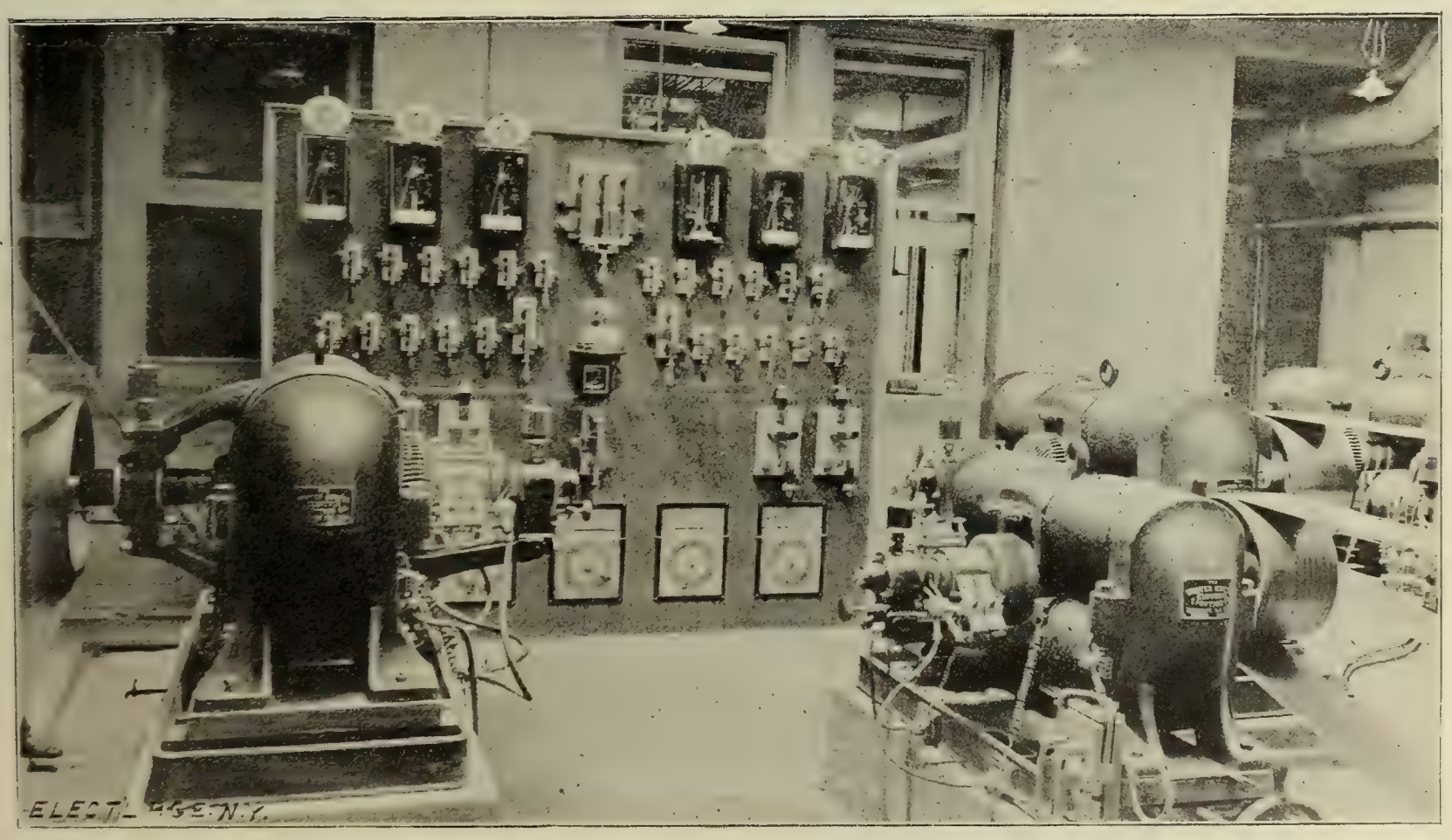
The electric lighting plant installed in the new building of the Central Railroad of New Jersey, at the corner of Liberty and West streets, New York City, presents many features of interest.

A single mass of masonry serves as a foundation for all the engines and dynamos. Layers of felt and sand under the foundation and an air space about it, give such complete isolation of the plant that it can be run under full load without communicating any jar to the building.

pleasure in the orderly arrangement of the numerous wires, of a combined cross section of 8,333,896 circular mils, meeting at the back of the board. It is also interesting to study out the reason of the various connections made here. The three-blade switch at the top of the board will be connected to the three-wire street mains, so that only a few minutes' interruption in the lighting service would follow the complete disablement of the generating plant.

The dynamos are controlled by switches placed on their bases and are connected to a positive distributing bar composed of the positive and negative wires of the three-wire system, united by

the lights on any circuit, with two wires of that circuit entirely disabled, and only half of the lights in any room will be affected if a circuit is rendered entirely useless by an accident. This four-wire system is continued to about seven secondary distributing points on each floor, from which to the fixtures the wiring is on the ordinary multiple arc plan. Nineteen and a half miles of Grimshaw White Core Wire, and nineteen and a half miles of the Interior Conduit and Insulation Company's tubing were furnished of such uniform good quality and were installed with such care, that the plant started up at once without any delay for removing even minor defects in the wiring.



ELECTRIC LIGHT PLANT IN THE CENTRAL BUILDING.

The five dynamos, one 120 ampere compound wound, and four 240 ampere compound wound, are of the latest type manufactured by the U. S. Electric Lighting Company. The low speed obtained by the use of the massive field magnets and the perfection of the mechanical details, promise a very low rate of deterioration and infrequent bills for repairs.

Three Westinghouse Standard engines, one driving a small dynamo and each of the others driving two large dynamos, furnish the necessary power. Shultz leather belts and Underwood cotton leather belts running side by side, give a practical test of the merits of each.

On the front of the switchboard, polished metal and handsomely finished instrument cases contrast pleasantly with the sober tone of the slate background. But the technical eye finds equal

closing the large switch at the centre of the board and to a negative bar used as the neutral bar of the three-wire system. The rest of the switches on the board control the several circuits of the building. The field rheostats for the five dynamos are arranged across the bottom of the board, while the ammeters for the five dynamos and the potential indicator for the system at the top of the board give constant indications of the current furnished.

Each of the 12 circuits consists of four wires arranged for use as two positive and two negative, or as one positive, one negative and two neutral, according as the current is taken from the plant in the building or from the street circuit. Each circuit feeds the bracket lights on one floor and the pendant lights on the floor below. With this arrangement the dynamos can feed half of

A complete system of magnetic circuit breakers and fusible metal safety devices has been installed. These are grouped either at the switchboard or at one of the distributing points, where they are enclosed in neatly finished closets provided with locked doors.

The elegant design and fine workmanship of the fixtures throughout the building reflect great credit upon the Horn, Brannen & Forsyth Mfg. Co., of Philadelphia, Pa., who furnished them.

The tenants' convenience has been consulted by providing a separate gang switch for the control of each fixture of four lights or more.

The contract for the installation of the plant complete, aside from the fixtures, was undertaken by the U. S. Electric Lighting Company, and has been carried out under the careful supervision of their efficient superintendent of construction, Mr.

David E. Drake. Mr. J. P. Hall, of the firm of Tucker and Hall, electrical contractors, 136 Liberty street, New York, had charge of the work, which was done in an excellent manner.

THE COLBURN DYNAMOS AND MOTORS.

We illustrate and describe herewith some of the latest inventions in dynamo-electric machinery of the Colburn Electric Manufacturing Company, of Fitchburg, Mass. These machines are made of the very best material that could be procured and of a design that is pleasing to the eye.



COLBURN INCANDESCENT DYNAMO.

The cores of the field magnets are wrought iron cast solid on one end and on a taper at the other, obtaining a magnetic contact claimed to be perfect. The field wire is wound upon bobbins, which are bolted to the core as shown in the illustrations. The armature is of the drum type, is thoroughly laminated, and is balanced both before and after being wound. There is an automatic oil feed for the bearings, which are made of large size and of the best steel. The commutator is made of tempered copper upon a steel tube, which may be easily removed from the shaft. The brush holders have extra good flexible adjustment. As is readily seen from the illustrations the magnetic field is very short.

ELECTRO-DEPOSITING DYNAMOS.

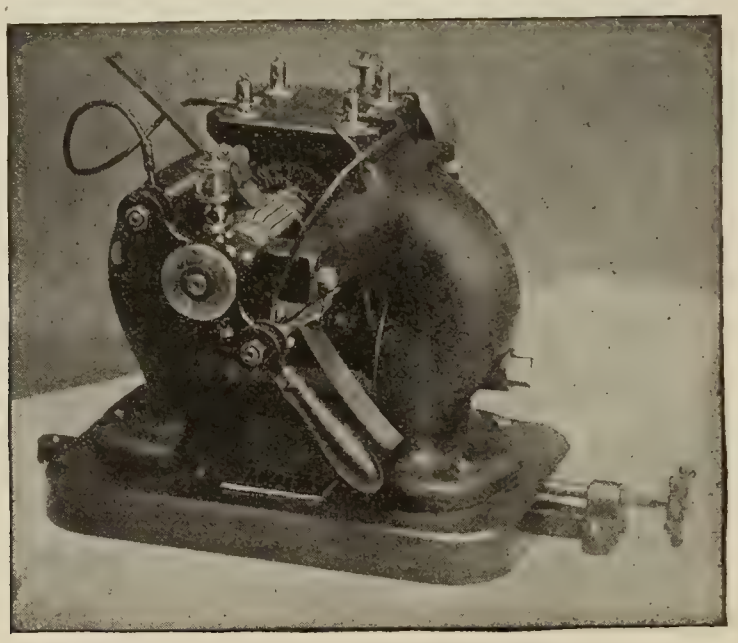
No.	Nickel, Gallons.	Silver, Ounces per Hour.	Copper, Good Shell, 1½ to 2 Hours. Square Feet.	Weight	Speed.	Pulley. Diam.	Pulley. Face.
0	60	4	——	75	2000	3	1
1	200	12	10	125	2000	4	2
2	500	40	30	250	1600	5	2½
3	900	75	50	400	1600	6	3
4	2000	175	100	610	1200	7	4
5	3000	300	150	1040	1100	9	5
6	4000	400	200	1650	1000	12	6

CONSTANT POTENTIAL MOTORS.

Size.	H. P.	Weight.	Pulley. Diam.	Pulley. Face.	Speed.
W	¼	75	3	1	2100
V	½	130	4	2	2100
U	1	200	5	2½	1800
T	2	350	6	3	1650
S	3	500	7	4	1650
R	5	700	8	5	1400

The Colburn dynamos and motors will be just the thing for experimental purposes or for isolated plants. From their high efficiency and their many excellent points they cannot fail to give satisfaction.

We are informed the company are making machines of a larger type than those given in the above tables, a catalogue of which they have in preparation.



COLBURN CONSTANT POTENTIAL MOTOR.

From the mechanical and electrical data given in the following tables it will be seen that these machines are very efficient.

INCANDESCENT LIGHTING MACHINES.

Size.	No. 16 C. P. Lamps.	H. P. Consumed.	Weight.	Pulley. Diam.	Pulley. Face.	Speed.
A	2	¼	75	3	1	2800
B	8	¾	125	4	2	2800
C	15	1¼	175	5	2	2600
D	25	2	250	5	2½	2100
E	40	3½	400	6	3	2100
F	60	5	550	7	4	2000
G	100	8	900	8	5	1600
H	150	12	1200	10	5	1400
I	200	16	1500	10	6	1200
J	300	24	2200	16	8	1200

BIOGRAPHICAL SKETCHES.

R. J. SHEEHY AND HIS INVENTIONS.

Mr. R. J. Sheehy was born in Ireland in 1842, and came to this country with his parents in 1847, and settled in New York. In 1854 he entered the telegraph service as messenger. Finding this employment unprofitable he left the service for something better, but returned to telegraph pursuits in 1862, in the employ of the old American Telegraph Company, as line builder or constructor in New England. About this time Patrick B. Delany was an operator employed by this company at Wooster, Mass., and Mr. Sheehy remembers his progress toward the prominent position he now occupies, as well as many others who have carved a name in the niche of fame. Mr. Sheehy was employed by the American Company in construction work throughout the East, but all his spare time was given to hard study.

In the beginning of 1865, he accepted a position with the Insulated Telegraph Company, and in April of the same year went to Philadelphia for the American Company, returning to the Insulated Company in 1866 as lineman. During the year, the American, Western Union, and the United States telegraph companies were consolidated. During the summer of 1867, Mr. Sheehy sold patent locks in Pennsylvania, Delaware and Maryland, and secured a position as lineman with the Western Union the following winter. In August, 1868, he went with the Franklin Telegraph Company. The lines of this company extended from Boston to Washington. The principal business, of a "broker" nature, was transacted satisfactorily to its customers. Mr. Sheehy was located at Philadelphia, of which office Mr. Sewell Smith was manager, and Patrick B. Delany, assistant manager and chief operator. Mr. Joseph B. Stearns was president of the company, with headquarters in Boston, and James G. Smith superintendent, with offices in New York.

To this company credit is due for the introduction and practical operation of Stearns' duplex telegraph system. The company operated the system between Boston and New York, New York and Philadelphia, and later between Philadelphia and Baltimore. The practical working of the duplex was doubted by the officials of the other companies for some years after it had been put in operation, they claiming it to be—to use a slang



R. J. SHEEHY.

phrase of the present day—"a fake"; that two wires were used in place of one. In a statement made to the directors of the Western Union Telegraph Company at one of their annual meetings, Mr. Orton said the duplex was a matter of no value, his authority, as he stated, being the operators working it on the Franklin lines and afterward employed by the Western Union, who reported it very inefficient.

In the following year, Mr. Stearns while in Washington met one of the attorneys of the Western Union Telegraph Company, and explained to him the principle on which it worked, and during the year a test was made between New York and Philadelphia by the officers of the Western Union. The gentlemen at the Philadelphia end of the circuit were D. H. Bates and James Merrihew, and Mr. Sheehy understands that General Eckert, A. B. Chandler and one other gentleman were at the New York end. At this time there were five wires on the poles of the Franklin Company, one of which was put up for the large drug house of Harrison Brothers, of Philadelphia. This circuit was kept in perfect working order, and as the telegraph company held the right to use it when they needed it, the wire was selected for the test. To satisfy Messrs. Bates and Merrihew that but one wire was used Mr. Sheehy took them to the switchboard, pointed out the various wires and disconnected all but one. He further offered, if they still doubted, to have a lineman cut all the wires but one, on the roof, where they entered the office, but this they considered unnecessary, expressing themselves as being satisfied with the disconnection at the switchboard. The duplex was worked successfully for about one hour. This, Mr. Sheehy thinks, was the starting point of negotiations for the purchase of Mr. Stearns' patents.

At the next annual meeting of the Western Union directors, Mr. Orton stated that the purchase of the Stearns' duplex had been completed, and that he considered it worth at least $1,000,000 to the Western Union Company.

One of the conditions of the sale was that Mr. Stearns should operate his system between New York and Chicago, but when this was attempted he met with difficulties for which he could not account, but concluded them to be due to the length of the line causing a tardiness of discharge and static conditions not previously met with. These troubles were overcome by means of the condenser, making the Stearns duplex practically as it is to-day.

From the Franklin Company Mr. Sheehy went in 1871 to Boston with Sewell Smith for the newly organized Gold and Stock Telegraph Company. Mr. Smith was agent and Mr. Sheehy general utility man, being lineman, builder, inspector, battery man, solicitor and collector. Mr. Sheehy made a success of this company's business in Boston until the latter part of 1875, when he severed his connection and settled down to experimenting and constructing telegraph instruments, motors, and other electrical appliances. Since then he has invented and patented nearly 50 devices in different branches of electrical engineering.

In 1878 he engaged with C. M. Rowley and Thomas J. Montgomery of Boston, agents for the Brush system in New England. About July of that year he installed the first Brush plant in the Mechanic's Charitable Fair, Boston. At the opening of the fair he had two four light dynamos installed which lighted a portion of the building successfully during the fair. The Wallace-Farmer system also lighted a portion of the building. Considerable rivalry existed between the two, but the Brush system met with the most favor.

At the conclusion of the Mechanics' Fair, Mr. Sheehy put a four 3,000 candle-power light arc dynamo in Washburn and Moen's rolling Mills, in Worcester, Mass., the plant working successfully.

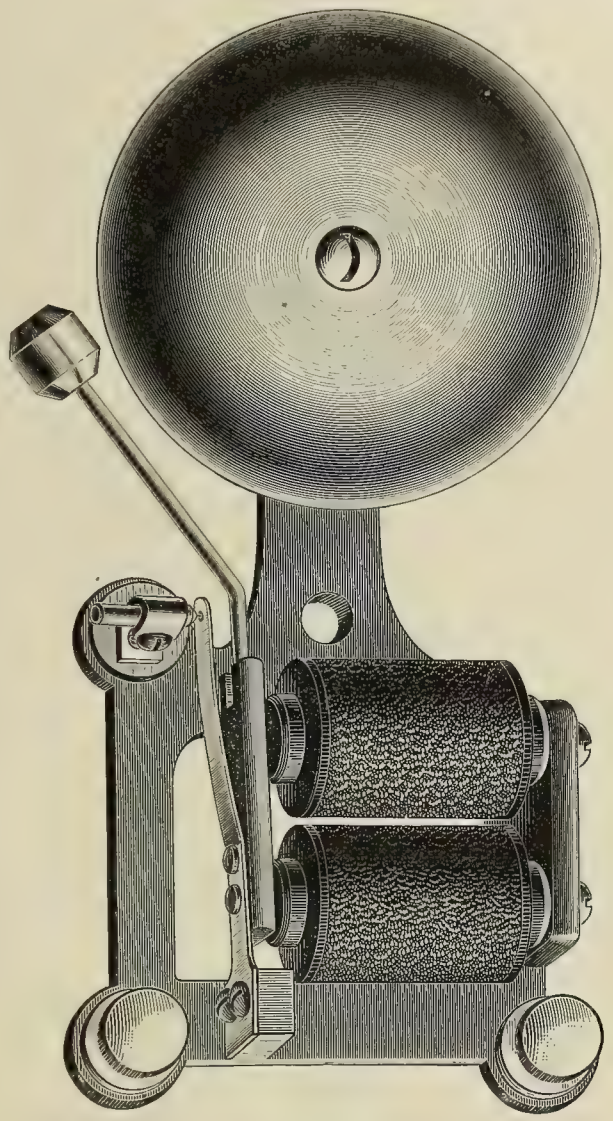
About this time the New England agents thought they would undertake the lighting of the Music Hall, Boston, but Mr. Sheehy advised them not to undertake the problem, as he considered the lights unsuitable for a place of that kind. The dynamos used at the Mechanic's Fair were used but proved unsatisfactory. Mr. C. F. Brush, the inventor, personally examined the place and concluded he could light the place with one of his series machines, and one was placed in the lower part of the building, outside the walls of the portion known as Bumsted Hall. It made so much noise that it materially interfered with the lectures in the hall. To overcome this difficulty a house was built over the machine, lined inside and out, and the walls filled in with sand, but this did not remedy the noise.

(*To be Continued.*)

A NEW ELECTRIC BELL.

E. A. Wildt & Co., of 83 Murray street, New York, has devised an electric bell that has several features not found in any other device on the market.

The bell, which we illustrate, is of the skeleton type and is very compact and simple. The armature consists of a long contact spring to which is fastened a strip of the best Norway iron by two small rivets. The spring at its extreme lower end is fastened to the skeleton frame by means of two counter-bored screws in such a way that the armature cannot shift from the contact point. The device for holding the platinum contact is entirely different from that of any other bell and is something novel in this line. A platinum wire is inserted in a long metal pin forming a core running its entire length. The pin is placed in a small clamp screwed to the base of the bell, and is held firmly in position when the two sides of the clamp are brought nearer together by means of a small screw. The cores of the magnets are large, giving great magnetic strength. There is no possibility of the armature or platinum contact clamp working lose from the base and no danger



NEW ELECTRIC BELL.

of their shifting from their normal position. The bell is tastefully gotten up and has a pleasing appearance.

Messrs. Wildt & Co., have still further decreased the price of their specialties, and are trying to give their patrons the best of everything in the market at the least cost.

SLATE.

If the electrical industry has found new uses for mica, porcelain, lava and other known insulators, it has certainly done wonders for the producers of slate. Formerly this article had its greatest sale for mantels, lamp bases and washtubs, to say nothing of the ordinary school slates, but recent experiments show that a species of slate quarried in Vermont is among the best known insulators, where a large area is to be covered, such as switchboards and the like; it is even displacing the use of hard rubber and fibre for many smaller articles on account of the various finishes that can be given to it, such as imitation of all the different kinds of wood, bloodstone, Tennessee marble, hard rubber, either dull or polished, the slate retaining its moisture, resisting and fireproof properties, for which it is the equal of any other material now in use.

Slate one inch thick weighs about 14 lbs. per square foot, and when it is of the select quality, is easy to drill and tap so that machine screws can be used. Recently a New York construction company drilled 12,000 ¼-inch holes in a piece of slate containing only 22 square feet, ⅝-inch thick. It withstood shop handling, transportation, and considering that the holes were only ¼ of an inch apart, it speaks well for the strength of the slate.

The best slate for electrical purposes is found in Vermont, where, probably owing to the absence of iron ore and other metals, the slate is much purer than that quarried elsewhere. Soft slate has a slight greenish color, although it is frequently found in "purple stock" and other colors.

It is found that "marbleized" slate adds to the moisture resisting qualities of it, besides giving it an artistic effect, which is greatly increased when mouldings are used in connection with it.

It has also been found that Pennsylvania slate, besides containing iron is harder to drill, and there is consequently a more rapid wearing away of the edge of the drill, and careful tests have demonstrated that the selected Vermont slate is the best for electrical purposes. The Manhattan Building on Wall street is equipped with a fine slate switchboard, built by the Eureka Electric Company, who have also furnished one to the Gerlach apartment house, on West Twenty-seventh street. The American Bell Telephone Building in Boston, have recently added a slate switchboard, built by the Western Electric Company, and the Manhattan Electric Company have placed an incandescent switchboard in their Eightieth street and Avenue B station, the board being built by V. Prentis, 303 Kent avenue, Brooklyn. This gentleman formerly used Pennsylvania slate, but found it so expensive on account of the cost of drilling, that he made a change, securing some Vermont slate from T. J. Murphy, 96 Columbus avenue, New York, who has an office at the above address, and finishing shops at Fair Haven, Vt., and found that he could drill the slate in about one-half the time, besides testing up better. Mr. Murphy is now constructing a switchboard 13 feet long, 73 inches high, made in six pieces, for he Electrical Construction and Supply Company, of this city, to be used in a plant now erecting for the H. B. Claflin & Company Building.

Where switchboards are made in sections it is well to make a drawing or give the exact dimensions, and indicate where screw holes are to be, so that the switchboard can be drilled before marbleizing, although it can be drilled afterwards if care is taken to start the drill on the marbleized side, for if drilled in from the back the finish is liable to be cracked off, very much like a veneer.

After slate has been quarried and sawed into marketable thickness, which is usually about one inch, it is "flowed" *i. e.*, a composition paint is poured over the surface. It is then put in a kiln or heating oven and kept for several hours at a temperature of about 150 degrees. If it is to be of a higher finish a second coat is given to it, and it is again baked the same as before. It is then rubbed with fine pumice stone until a smooth surface is made, after which a coat of fine varnish is applied and it is baked once more. In fact, the finishing of it is very much similar to the finish given piano cases, only of course not so highly polished. The slate can be beveled or any of the ordinary forms of mouldings can be given to the edge. Frequently a separate moulding of a different finish is placed around the board to frame it.

In order that those not familiar with the finish, quality and working properties of the slate may be informed, Mr. Murphy will furnish to any of our readers who are interested, a sample of both plain and marbleized slate, and should any special finish be desired, he will furnish a sample of flowed black, polished black, dull black, flowed marbleized, polished marbleized and plain slate, the six pieces of any size under 12 inches square, 1 inch thick, for $1.50; or 50 cents for any one piece. As the slate is used for transformers, fuses, resistance coils, bases for knife switches, rheostat heads, terminal boards, washers, etc., etc., it will be seen that different finishes are very desirable.

Mr. Murphy reports very satisfactory sales and judging from the number of inquiries and the interest taken in his samples, the prospects for a good season are bright.

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ANNOUNCEMENT.

We take great pleasure in announcing that, beginning early in July, we shall commence the publishing of a regular street railway department in the ELECTRICAL AGE. This department, which will be known as "STREET RAILWAY NEWS" will be devoted exclusively to the interests indicated by this title, and it will be of sufficient size to entitle it to the distinction of being the first regular weekly street railway publication ever issued.

Mr. E. V. Cavell, whose many years of journalistic experience in the street railway field has eminently fitted him for such responsibility, will have the entire management of this department.

With regard to "STREET RAILWAY NEWS" we will simply say that nothing will be left undone by us to make it a valuable addition to literature peculiar to that field, and a copy of the paper will be sent regularly each week to every street railway company in the world, the name of which is known to us, thus bringing it no less than 52 times a year before every possible buyer of street railway supplies.

To the end that success may attend our enterprise we ask the favor of your hearty co-operation, assuring you that whatever you may do for us will be duly appreciated and heartily reciprocated when opportunity offers.

ELECTRIC AGE PUBLISHING CO.

Every day, electricity, the latest developed form of energy, is seen adapting itself to new conditions and gradually absorbing to itself the work previously done by other kinds of power. As it becomes better understood the machinery for utilizing its power becomes more simple in construction, and, consequently, better adapted for the work to be done. Electricity, as a source of power, has been constantly encroaching upon the field occupied by other forms of energy, and, although it cannot entirely displace those forms so long as it requires a steam engine to drive the electric generator, it will do so whenever the motor can be fed by a tap from an electric light conductor. The electric motor has long been used for the lighter classes of work, and even some heavy work has succumbed to its potent force, but its greatest triumph is its application to the gigantic crane described on another page. To easily raise and lower, and carry in any desired direction a bridge girder weighing 20,000 pounds with an electric motor occupying less than half the space required by a steam engine of the same power, is a victory that will pave the way for still more extensive use of this wonderful force. Everyone having anything to do with the construction of this powerful machine is to be congratulated upon the success of their work. Showing as it does an increased variety of uses for electricity it but foreshadows the future.

The Association of Railway Telegraph Superintendents met in annual convention in Cincinnati last week, and had a successful meeting. Cincinnati is not the best place in the country in which to hold a convention in the summer time, but one of the objects in going there on this occasion was to get the telegraph superintendents of Southern roads into the association. In this the association was eminently successful, and the roll of membership was very materially enlarged. The society is growing in size and importance every year, and it is national in its character. It does not favor any one section of this broad land, but favors all alike. Railway superintendents are a bright and able set of men, and these qualities were exemplified at the last meeting by the ready response of the members to requests for papers to be read. Considering the short notice which they had, the character of the papers reflected very creditably on those who prepared them. The members of the association possess large resources, and the higher officials of the various roads represented at these meetings should leave nothing undone to make these annual gatherings successful. The officials should encourage the Telegraph Superintendents' Society in every way and help to make it what the members themselves designed it to be—of benefit to themselves and to the railroads they represent. When these superintendents meet annually they read papers on subjects of great value in the practical operation of railroads. Ideas are exchanged and much valuable information and knowledge are acquired. The superintendents in most cases return home with new ideas, which often result in the carrying into execution of plans for the improvement of the service over which they have charge, based upon ideas acquired at these annual meetings. The railroad companies in all cases get the benefit of these ideas, and for that reason should do all in their power to make the meetings successful and helpful in every way. If the railroads were controlled by such spirits as Mr. E. St. John, general manager of the Chicago, Rock Island and Pacific Road, the association would lack nothing necessary to make its conventions entirely successful. Mr. St. John in a letter read before the meeting last week, spoke in a hearty and complimentary manner of the association, in which he thoroughly believes, and stated, that he and the road he represented desired to encourage the efforts of the society. "The world to-day is watching for achievements," says Mr. St. John in this letter, "knowing full well that in the no distant future, the element forced to serve you will be called upon to render far greater service than in the past." . . . "We believe in your organization and its power for good," says Mr. St. John, who, in conclusion, extends generous courtesies of his road to those members and their families who will attend the Denver meeting next June. All presidents and general managers of railroads having telegraph superintendents in their service should recognize and support the efforts of the Association of Railway Telegraph Superintendents to better the service over which they have charge, as that means the betterment of the general service.

The electrical fraternity of New York are to be congratulated on the musical skill among its members as displayed at the smoking concert of the Electric Club the other evening. Although the electrical trades are extremely busy ones, most of those engaged therein manage somehow to find time to cultivate and develop musical and other talents and diversions calculated to rest the mind and body after the wear and tear of business life. On the occasion mentioned the New York electrical raternity banished all care and worry, and gave up the evening to enjoyment and tobacco. These meetings are pleasant and should be repeated at frequent intervals.

EXHIBITS AT THE MONTREAL CONVENTION.

The following circular letter, dated New York, June 15, has just been issued by Mr. James I. Gulick, chairman of the committee on exhibits of the National Electric Light Association, to manufacturers and dealers in electrical apparatus and supplies:

"GENTLEMEN:—The Fourteenth Convention of this Association will be held at Montreal, Canada, September 7th to 11th, 1891.

The large Victoria Skating Rink, having a floor space of some 228 feet by 110 feet, has been rented for the purpose of an electrical exhibition in conjunction with the convention, to extend over a period commencing September 7 and ending September 16.

From present indications, the convention will have an unusually large attendance, and it is proposed to attempt an exhibition on a much larger scale than heretofore, throwing the same open to the general public and under very favorable auspices.

We think you will find it to your interest to lend your most hearty co-operation, and we would be pleased to have you join in this exhibit and place before the many delegates at the convention, as well as the public, some *attractive* and *novel feature* of your business.

The Committee on Exhibits expects to arrange that all goods for the exhibition shall be admitted into Canada in bond, free of duty; duty payable only if sold.

If you will fill out the accompanying application blank, prompt attention will be given to same, and further particulars will be furnished from time to time.

In event of your not being a member of the Association, the secretary will be pleased to forward you membership application.

THE PACKARD VACUUM PUMP.

In the manufacture of bulbs for incandescent lamps the process of exhausting the bulb of air and moisture is one requiring skill and close attention. It is one of the greatest difficulties in the manufacture of incandescent lamps, and the vacuum obtained by the ordinary mechanical pump is far from being perfect. For this reason mercurial pumps are used, but the exhaustion can be materially hastened by employing a good mechanical air pump to exhaust the system as far as possible by mechanical means, the process afterwards being completed with the mercurial pump.

The Packard Vacuum Pump, manufactured by Norman Hubbard, of 93 Pearl St., Brooklyn, N. Y., under the patents of J. W. Packard, has the reputation of being the most efficient of its kind in the market. It is of the mechanical class, and is giving the very best of results wherever used.

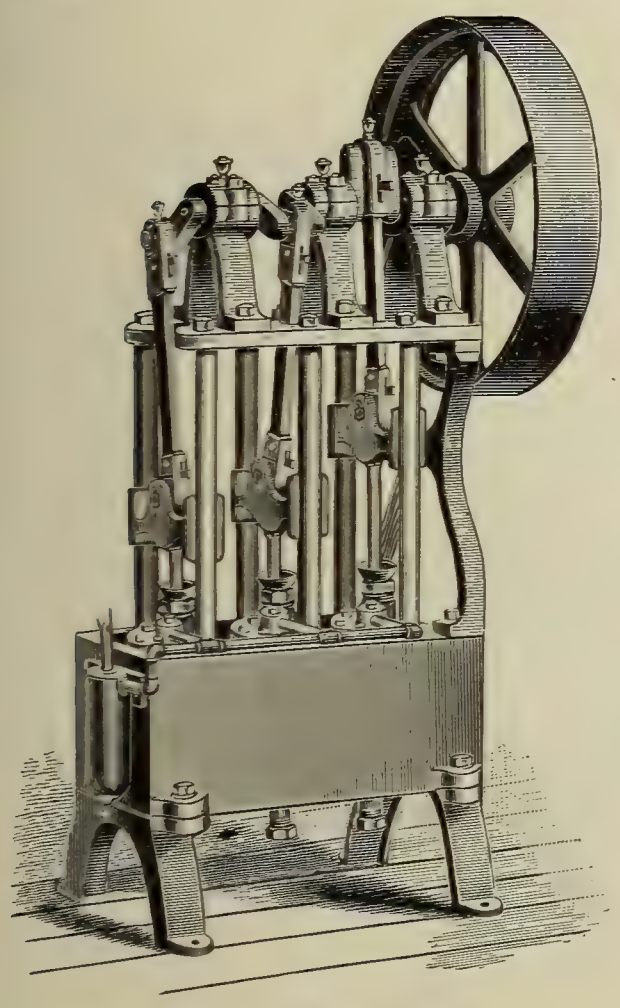


FIG. 1—PACKARD PUMP.

The Packard Vacuum Pump, while adapted to any operation where a high grade of vacuum is required, has been designed especially for use in the manufacture of incandescent lamps, to give the highest attainable vacuum without the use of water in the cylinders, and to be capable of heavy and continuous work. These pumps are made in six sizes, the largest requiring 6 horse power for its operation, and the smallest 1 horse power. In all sizes the cylinders are placed vertically in a cast-iron box, which serves as a bed plate and water jacket, on which the frame and working parts are mounted. The frame is exceedingly rigid, insuring smooth and easy running, and all parts are readily accessible. Each cylinder is entirely independent of the others, and can be used separately or connected up as required. The valve motion is on the principle of the well-known Ritchie valve gear, greatly improved and simplified. All the valves are opened and closed at the proper instant automatically. The materials and workmanship are first class in every respect, and all parts are made to gauge and interchangeable.

The larger sizes of pumps are designed for the operation of the ordinary automatic Geissler pumps.

These pumps have been on the market for over four years and have been adopted by all incandescent lamp manufacturers, save one, in this country. The pump has been perfected in every detail, and is fulfilling every requirement most satisfactorily. The manufacturers guarantee a dry vacuum of 29½ inches.

MOULDED MICA INSULATORS.

We give herewith two illustrations of the well-known moulded mica insulators and the new G. & W. trolley clips, manufactured by the Gould & Watson Company, of Boston.

These mica insulators are moulded when the material of which they are made is in a plastic condition, and through the agency of heat the substance is set. It is claimed for this material that no oxidation is possible; it is not brittle and is practically unbreakable. It is said to possess some very valuable features, and insulators made of it for street railway purposes, are said to give excellent satisfaction.

Fig. 1 of our illustration given below represents the bell form of trolley line insulator, made of moulded mica, and the clip shown is that known as the new G. & W. trolley clip. The special feature of this clip is that no solder is necessary. A firm hold is obtained on the wire by its use, which is maintained by a screw at the base of the insulator pin. The same method of hanging is used to connect the insulator with the support wire.

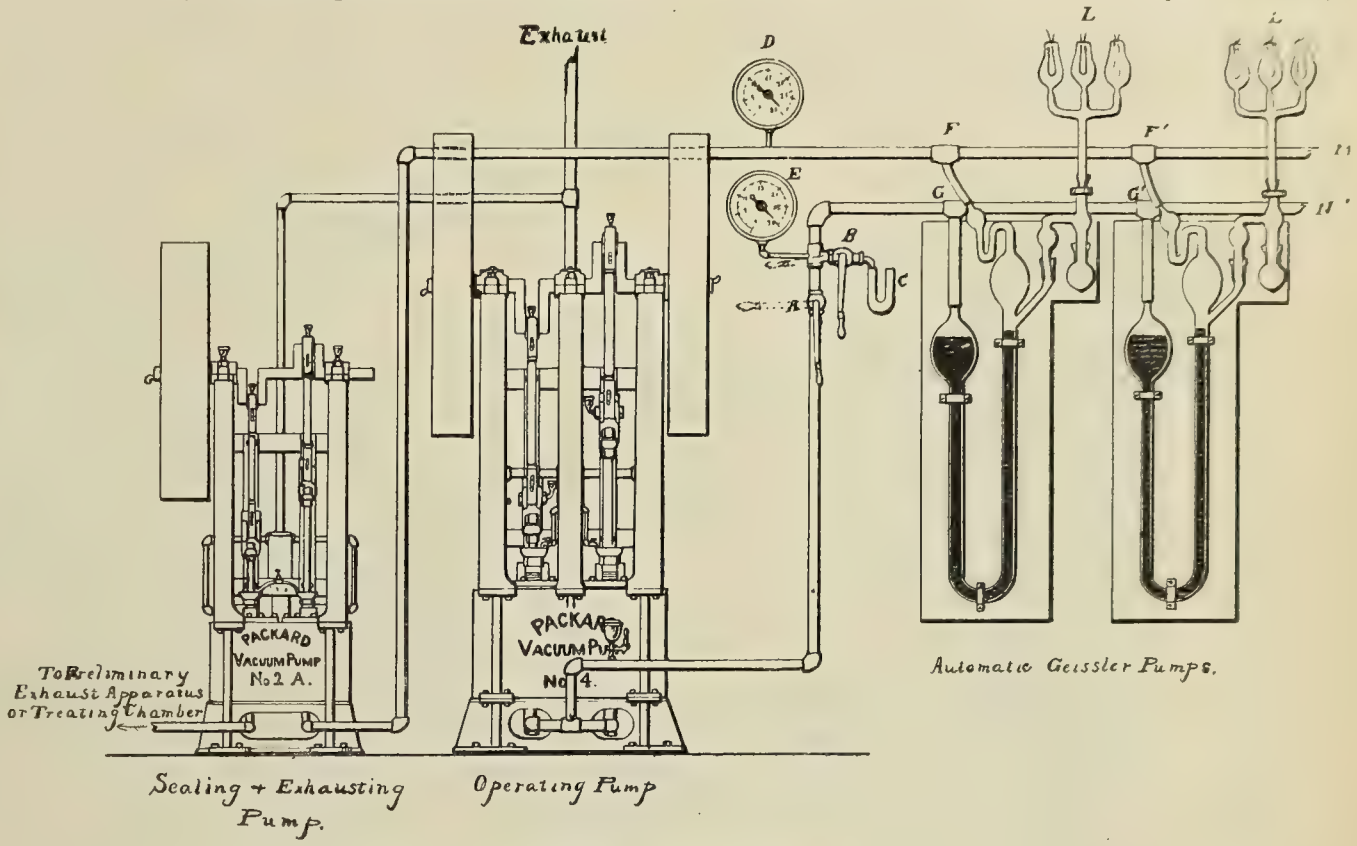


FIG. 2—APPLICATION OF PACKARD PUMPS TO THE OPERATION OF MERCURY PUMPS.

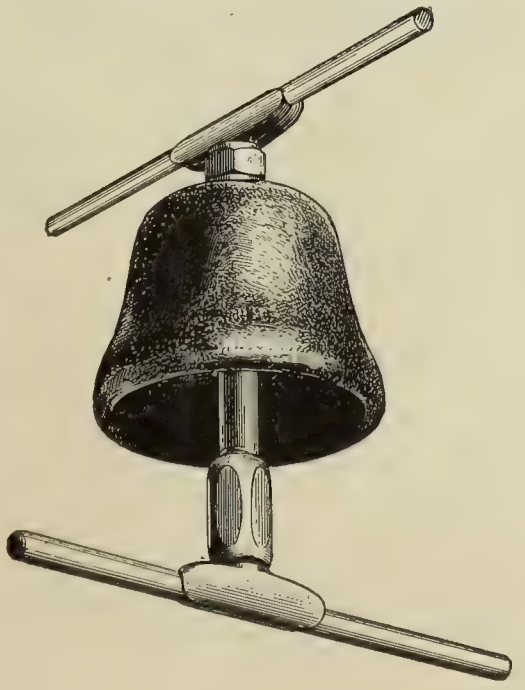


FIG. 1.

G. & W. TROLLEY CLIP AND BELL FORM INSULATOR.

Fig. 2 shows an insulator made of the same material and known as the "petticoat" form. This form is used where a large and powerful insulator is required, and is made with plain or petticoat top. The new G. & W trolley clip is used as on the former insulator, and it is said that these trolley clips are giving excellent satisfaction.

A ROUGH-AND-READY DYNAMOMETER FOR SMALL MOTORS.*

BY JOHN HOSKIN.

I have been requested to bring to your notice this evening a friction-brake dynamometer that is by no means new, but is one that is deserving of being more widely known by electricians than appears to be the case.

Like the well-known Prony brake, it acts as an absorption dynamometer; and without detracting from the acknowledged value of this instrument, especially for testing the value of large prime-movers, yet we need something more portable, more convenient to use, in the very numerous cases where it is desirable to test the efficiency of small motors.

We need a rough-and-ready instrument that is portable, inexpensive, readily used, and at the same time reliable.

This we find in a friction-brake dynamometer, one of the many modifications of those illustrated by Mr. William Worby Beaumont, in his paper on friction-brake dynamometers, read before the Institution of Civil Engineers in London, Nov. 13, 1888, and published in 1889 in the proceedings of the Institution.

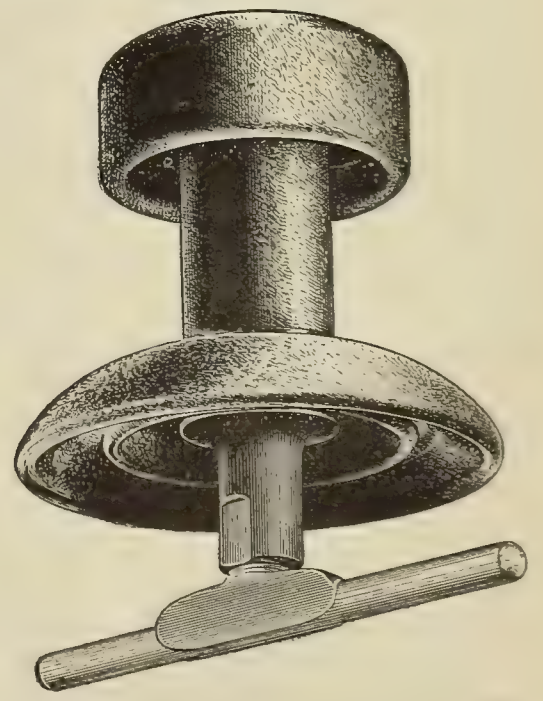


FIG. 2—PETTICOAT FORM OF INSULATOR.

Its construction requires only the use of a leather belt with a spring balance attached to one end, and a suitable weight at the other. The belt is to be thrown over the belt pulley of the motor; the spring balance is fastened to the floor base, or support of the motor to be tested, and the weighted end hangs pendent on the side of the

* Paper read at the meeting of the Electrical Section of the Franklin Institute, May 5, 1891.

pulley which, when in motion, will tend to lift the weight. When the motor is at rest, the strain of the weight should be read off on the spring balance. This reading we will call W. When the current is switched on and the motor runs at speed, the spring balance should again be read off, since the friction of the pulley on the belt will have a tendency to raise the weight; this reading we will call W^1. The difference between W and W^1 in pounds, multiplied by the circumference of the pulley in feet (including one-half the belt thickness on each side), and this by the number of pulley revolutions per minute will give the foot-pounds of mechanical energy, which can be compared with the electrical energy required to produce it, in the usual manner.

Thus, in a few minutes with the aid of a speed counter or tachometer, a voltmeter and an ammeter, the efficiency of a motor can be determined, and its ability to do a desired amount of work ascertained at once, instead of being left to guesswork, as would often be the case if more bulky or elaborate apparatus were needed.

It should not be imagined from these remarks that this form of dynamometer is applicable to small motors only; but it is evident that for testing larger machines where many horse-power have to be measured, the apparatus needs more elaboration, especially in the use of friction blocks under the belt or pulley strap, their lubrication, and the use of a dash-pot to steady the brake when the motive-power is irregular.

But I need not enlarge on this, except to say that in these particulars, whether using steel strap, or leather belt with friction blocks, or rope friction, the same care is needed as in the Prony brake to obtain correct readings.

Before concluding, I submit to your consideration the value of the Waldron rotary pump for use as a dynamometer, although I have never heard that it has been applied to that purpose. In examining one of these engines recently for other purposes, it occurred to me that it would serve as an excellent dynamometer.

This pump is operated by rotary piston blades working in a chamber, without leakage, and with but small friction, the amount of which can be readily ascertained and calculated for use as a "constant."

Its capacity per revolution, and the number of revolutions being known, as also the pressure against which it works, which can be regulated by a pressure gauge, the foot-pounds of work are at once arrived at.

This method of measurement will correctly register the work done, although the speed may be irregular; and its results can be made more accurate than that of the friction dynamometer, because not subject to the irregularities arising from differences in lubricants, temperature, etc., which makes it necessary to use adjusting screws in most forms of friction-brake dynamometers.

ELECTRIC LIGHT PLANT IN THE ST. GEORGE HOTEL, BROOKLYN.

In our issue of February 21 last, we published an illustrated description of a unique electric installation in the St. George Hotel, Brooklyn. The process of washing dishes in that hotel with the aid of electric power, was there fully described.

Naturally a hotel that enlists electric power to perform work of this kind must be an extensive user of electricity in other ways, for lighting purposes for instance.

The electric light plant of the St. George is one of the features of the hotel, and we are now enabled to give our readers a view and description of it.

The electric plant consists of two Edison dynamos with a capacity of 2,500 lights, for which the hotel is wired. The wire connections are such that in case of accident to the plant or a stoppage for any reason, the entire building can, at short notice, be connected with the Edison street mains and lighted from this source. Thus, the hotel is not entirely dependent upon its own plant for light.

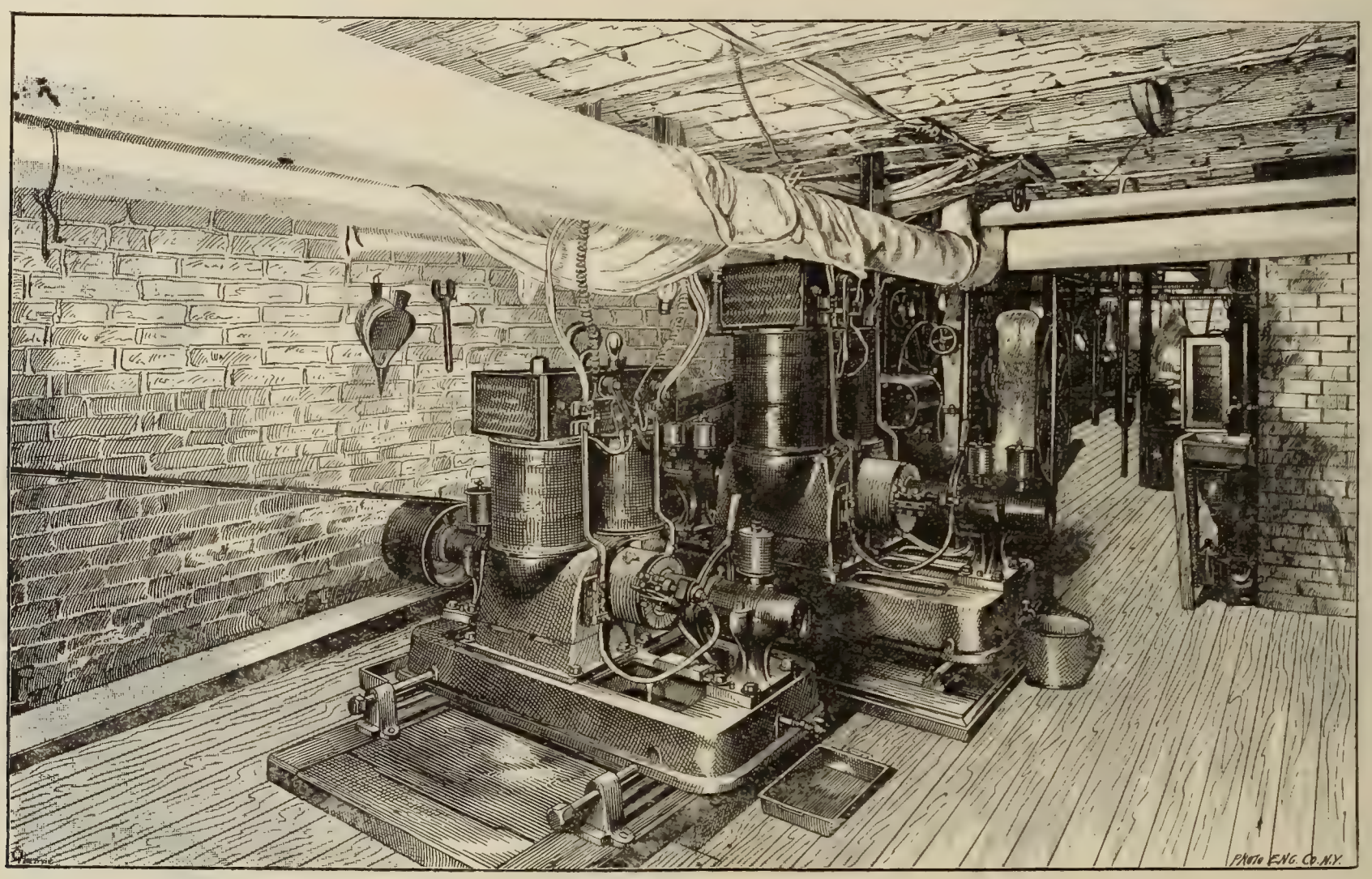
One very interesting feature in connection with the installation, was the extraordinary and successful manner in which the building was wired. The wiring in the main building had been in use for several years, when it was thought advisable to have the building completely rewired. But here a difficulty arose. The lights then in use could not be dispensed with, and it became necessary that the rewiring should be accomplished without disturbing the existing arrangements.

The Edison Electric Illuminating Company, of Brooklyn, was given the contract to do this work, and succeeded in rewiring the building for 1,600 lights without putting out a single lamp depending upon the old circuits for current. When the work was accomplished the Edison Company obtained and presented to the proprietor of the hotel a certificate from the New York Board of Fire Underwriters, certifying that the work had been done in a manner perfectly satisfactory to that Board.

The power plant consists of two New York Safety engines, which are, as is well-known, perfectly noiseless in their operation, and there are two 125, and three 60 horse-power boilers.

A description of the electrical plant of this hotel would be incomplete without a reference to other important uses to which electricity is put.

The annunciator plant is complete, and is in thorough working order, and the fire alarm system, designed by Captain Tumbridge, the proprietor of the hotel, (who also designed the electric dish-washing apparatus referred to), is so perfectly arranged that all danger to the guests from fire is removed. It is said to be perfectly reliable in its operation.



THE ELECTRIC LIGHT PLANT IN THE ST. GEORGE HOTEL, BROOKLYN.

SAN FRANCISCO NOTES.

The electric road is a permanent fixture in this State. In San Jose there are two electric roads run by the overhead trolley system. As they were very successful, running with surprising smoothness and safety, capitalists were induced to construct a third road. In Sacramento, Oakland, Berkeley, Los Angeles and San Diego the electric roads are giving general satisfaction.

The Southern Pacific Railway Company contemplate changing their local steam road in Oakland, connecting with ferry boats to San Francisco, into an electric road.

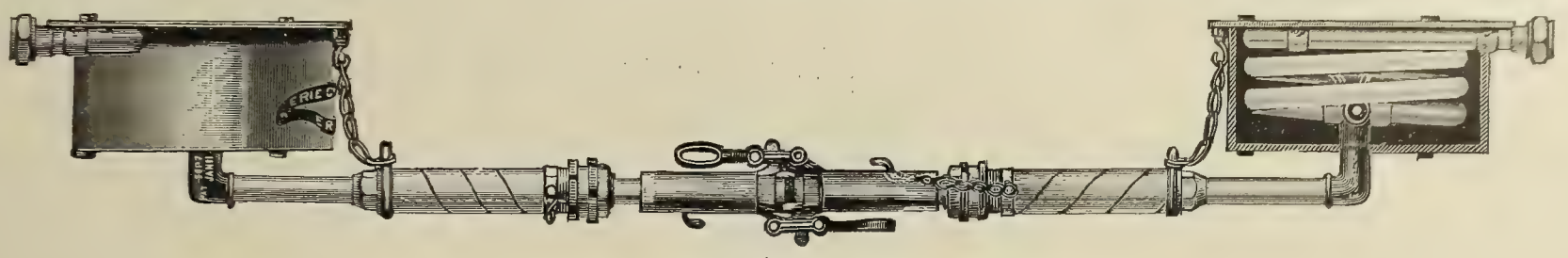
Recently the Board of Supervisors of San Francisco rescinded the ordinance restricting the overhead system for electric roads, since which time overhead trolley roads have been pushing their constructive work.

The Edison Electric Light Company of Cincinnatti, O., is about to build a plant that will cost, with machinery, about $200,000.

CAR HEATING BY STEAM.

One of the greatest objections that has been urged against steam heating for cars, especially on long trains, is that the first coaches are excessively hot and the rear ones too cold, and nothing had been advised to overcome this difficulty until the Erie Car Heating Company, of Erie Pa., invented the apparatus that we illustrate herewith.

It is now made in fewer pieces than the original and is all malleable iron except the coils, which are made of the best one and a half inch seamless brass tubing. Our illustration shows the joints and connections between the cars. The system has been subjected to very severe tests during the past three years, some of the time in temperature 35 degrees below zero, and has never in a single instance, frozen so as to interfere with their working.



ERIE CAR HEATING COMPANY'S CONNECTIONS BETWEEN CARS.

Live steam is taken from the dome of the locomotive, passing it through a reducing valve in the cab, to regulate the amount of steam that leaves the boiler—generally from five to ten pounds, according to the length of the train and the temperature—thence into the main pipe which runs down through the floor of the cab. Here it passes through an S coil and through a slip-joint which readily meets every motion of the engine. No coupling is used between the engine and the tender, as when it is necessary to separate them the plunger of the slip-joint will pull out.

At the rear end of the tender the steam passes through a regular coil, then through the connections to the first car, and into the main piping which passes under the cars, the entire length of the train. A three-way, asbestos lined cock is placed in the main line under the centre of each car, which by means of extension sockets extends to the interior of the car through the floor plate, where it is opened or closed with a wrench. From this cock, pipes pass up through the floor of the car on each side of the aisle, through which steam passes into the radiating pipes on each side of the car. In each of these two pipes which pass up from the main line, a valve is placed under the end of the car seats, by means of which the amount of steam that passes into the radiating pipes is regulated.

All condensation passes off through a trap at the lowest part of the interior piping. All water is blown out of the pipes, leaving them dry and hot so they will not freeze up.

Everything is so simple that it does not require an expert to operate it, and the train men can learn everything necessary in one day.

If for any reason it should become necessary to cut off the supply of steam from any car, by closing the valves in the supply pipes, thus locking the steam in the radiating pipes, the car can be kept comfortable in very cold weather for an hour or more.

ELECTRICAL APPARATUS FOR DENTAL SURGERY.

One of the applications in which electricity has been recognized as the coming "power" is its use in dental surgery. There is no doubt that it will ultimately be applied to every need of dentists so far as they require power. For running dental lathes and mallets, or for giving a powerful light for the mouth lamps, electricity is recognized as the best and cheapest form of energy that can be used. The apparatus occupies very little space, is extremely portable, creates no noise, odor or dirt, and is within the means of every dentist. One of the most important tools used by the dentist is the mallet for filling teeth, one of which, the invention of Drs. Bonwill and Webb, is shown in Fig. 1. This mallet, known as the Bonwill electro-magnetic mallet, has been used by the most skillful dentists in the world and is indorsed by all who use it. With this instrument a blow is delivered upon the packing instrument just when its force is greatest, and the force of the blow is at all times under the control of the operator. Properly used, it condenses the gold thoroughly and evenly throughout the entire filling, and will impact it against thin, frail walls with ease, without fracturing the enamel. The operator is saved considerable time and fatigue by its use, and it is more satisfactory than a hand or foot power mallet.

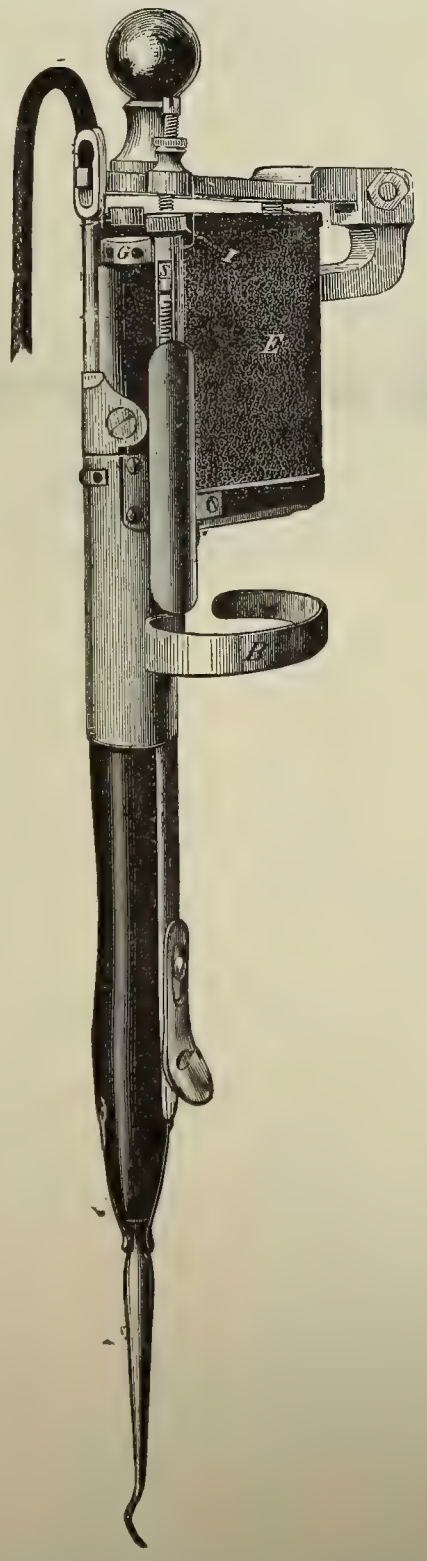


FIG. 1—BONWILL ELECTRO-MAGNETIC MALLET.

In selecting a battery to be used with a dental mallet, the manufacturers, The S. S. White Dental Manufacturing Company, Chestnut street, corner Twelfth, Philadelphia, adopted the Partz acid gravity battery shown in Fig. 2 as the best, because of its long life. Each cell manufactures its own solution as needed. Its construction gives it great constancy and durability, and is such that the solution is always in a nascent condition, constantly developing power, and depolarizing very slowly. Water in which has been dissolved a small quantity of sulphate of magnesia is poured into the cell, and into this is automatically fed "sulpho-chromic salt." When the battery is at work the sulphuric and chromic acids are set free as required; when work ceases the consumption of salt practically stops. One important advantage in the use of this battery is that there is no handling of acids in the fluid form. A cell gives a current of 3 amperes with a voltage of 1.95. The cells do not need to be emptied oftener than once in two or three months.

The S. S. White Company have branches at 1 and 3 Union Square, and at 1260 and 1262 Broadway, corner Thirty-second street, New York, and at 444 Fulton street, Brooklyn; besides in other large cities of the country.



FIG.—PARTZ ACID GRAVITY BATTERY.

BATTERIES FOR ELECTRO-PLATING.

The selection of batteries for the electro-deposition of metals must be carefully made as their construction must vary somewhat with the requirements of the work to be done. This class of work requires a current of large quantity and low potential. To insure this condition we must use large cells, having plates of a large surface. The surface of the plates in a battery should slightly exceed that of the anodes in the depositing solution, and these should have a surface slightly in excess of the surface to be plated. When cells are arranged in series, the current is according to the size of the plates of one cell, and the electromotive force is in proportion to the number of cells. By having large cells and large plates the internal resistance of the battery is lessened, giving a larger amount of current, as the current is equal to the electromotive force of the battery divided by *all* the resistances in the circuit. To insure constancy, both the exciting and the depolarizing liquids must be in a condition to work through the time required. The zinc plates must always be kept well amalgamated with mercury, and the carbons should be of a dense, close composition, because this is a better conductor than soft, spongy carbon. The clamps and binding screws should be massive, and present a clean, broad contact surface to the plates. The connecting wires between the cells should be large because it is useless to connect the battery to the vat by a large conductor if the wires between the cells are small. By lessening the cross-section of these connecting wires the resistance of the battery is increased.

In determining the number of cells to be used in series we must be guided by the total resistance in the whole circuit, employing a sufficient num-

ber of cells to give the electromotive force required to overcome the *sum* of *all* the resistances.

If the E. M. F. is too high to deposit the metal in good condition when the resistance in the circuit is also high, because of too little resistance in the battery cells, the defect may be remedied by giving the battery more work to do. This may be done by dividing the circuit, causing an increased volume of current through the cells which will increase their internal resistance. The circuit can be divided according to the quantity and potential of the current required, the current dividing among the several branches in direct ratio of their resistances.

ON SOME POINTS CONNECTED WITH MAINS FOR ELECTRIC LIGHTING.*

The points that determine the distribution of low pressure are fall of potential, and number of feeding points and distributing stations. We need not consider the heating of conductors. If we take care of the potentials, the waste will take care of itself.

One ton of copper of one square inch sectional area covers a length of 192.3 yards, and its resistance is .0046 ω. Hence, a length of 220 yards weighs 1.13 tons, and its resistance is .00527 ω. A pair of such mains will weigh 2.26 tons, and their resistance will be .01054 ω. 1,000 amperes means, therefore, a loss of 10½ per cent. (and one kilowatt is wasted in every 43.4 yards), 500 amperes means a loss of 5¼ per cent., and 237 amperes means a loss of 2½ per cent. in such a circuit when the full load is supposed to be concentrated at the end. If we take a fall of potential of 2½ per cent. in each main, which is the recognized maximum waste at full load allowed to comply well with Thomson's law, it means 474 amperes delivered at 100 volts, or 1,600 8-candle power lamps served. In fact, we may say that two mains of one square inch copper will serve 1,600 8-candle power lamps at 220 yards distance; and this appears to be the commercial limit of the two-wire low pressure distribution. Of course, if we are content to admit a greater waste, this limit of distance can be extended, and the number of lamps to be served can be increased in the same ratio. The exact waste to be allowed is an economical question governed a good deal by the conditions of the problems, financially as well as engineering. Now, if we add another 100 volts at the point of supply, we can deliver the same energy for the same number of lamps with the same loss, at 880 yards; and for every additional 100 volts delivered, we can extend the distance to which the supply can be driven under similar conditions, as the square of the unit distance, 220 yards, for to maintain the same energy the current is *diminished* in the same ratio. Thus 2,050 volts will drive the energy required for 1,600 8-candle power lamps 50 miles if we use mains of one square inch sectional area, and are satisfied to waste only 5 per cent. of the driving energy. Prof. John Hopkinson, F.R.S., showed how, by the use of an intermediate third wire and two dynamos, we could use 200 volts with our present lamps, and therefore, we could practically diminish for the same distance the weight of copper used by one-half, or we could make the same weight of copper serve double the distance. The third wire, however, diminishes the effective economy of the plan. Its practical commercial limit appears to be about half a mile; and its disadvantages to be more dynamos to work, and considerable complication to adjust and regulate the equilibrium of lamps on the circuit.

The five-wire system, which is in use in Germany, enables us to use 400 volts at the point of delivery; and this, again, enables us to extend our area of supply with the same weight of copper, to one mile, but with more dynamos, and with more regulation and balancing, and therefore with more complication.

There is no practical limit to the high pressure system: 10,000 volts will drive energy from Deptford to London on two mains of one-quarter square inch section to serve 50,000 lamps; and 27,000 volts will drive 300-horse power 112 miles, from Lauffen to Frankfort, on a conductor of .06 square inch sectional area, *i.e.*, a No. 2 copper wire.

* Abstract of paper read by W. H. Preece before the Institution of Electrical Engineers, London, May 7, 1891.

AN ELECTRIC CRANE.

A huge Thomson-Houston Electric Crane has been erected at the works of the New Jersey Steel and Iron Company, Trenton, N. J., and on May 28 it was tested, with results satisfactory to both parties concerned.

The crane is located at the lower part of the works, near the bank of the river, and will be used for the handling of bridge girders, etc. It requires a crane of great power and structural stability to successfully handle such huge pieces of metal as bridge girders, and the introduction of electric power for this purpose is a great triumph for that wonderful force, which is so rapidly adapting itself to every condition where power or work is required.



THOMSON-HOUSTON ELECTRIC CRANE.

The structure consists of two parallel iron tracks 200 feet long, placed 60 feet from the ground, on which the crane proper runs. A bridge reaches from the one to the other of these huge tracks, at one end of which is stationed the cage containing the electric machinery. The bridge, cage, machinery and all travel backward and forward on the tracks at the will of the operator by simply moving a lever.

The mechanical part of the crane was built by the Yale & Town Co., with the exception of the tracks, which was built by the New Jersey Steel and Iron Company. The electric system is that of the Thomson-Houston Company.

This is the first crane of this kind ever constructed in the United States. The generator, a 40-horse-power dynamo, was already owned by the company, and the motor which operates the crane receives its power from this. The motor is of 15 horse-power, and weighs 2,000 pounds.

The raising and lowering, moving backward and forward, and carrying along the bridge of heavy weights are accomplished by directing the power to the different parts of the crane. The traveling machinery of crane weighs all told 37,000 lbs., and the cage where the operator stands and which contains the motor is about 15 ft. long by 20 high by 6 wide. The lifting capacity of the crane is 20,000 lbs., and the speed with which it raises the load is 11 ft. per minute. It travels on the tracks at a rate of 15 feet per minute, but when necessary the vast machine may be operated with twice that speed.

At the test of the crane when its construction was completed a 20,000 pound bridge girder was raised, lowered and carried in every direction with the same ease as a lady uses a fan or a gentleman raises his hat. The New Jersey Steel and Iron Company, which is ever abreast of the times, may feel proud of this new improvement, and the Thomson-Houston Company are to be congratulated on the successful result of their work.

Our illustration gives an excellent view of this crane as it appears in operation. Its mammoth proportions can be readily appreciated by comparison with the figures and objects near by.

SMOKING CONCERT AT THE ELECTRIC CLUB.

The Electric Club held a smoking concert at the club rooms on the evening of June 18, and it was as successful as it was interesting. Mr. T. C. Martin was the manager of the entertainment, and he was very ably assisted in carrying out the programme by the following named gentlemen: George M. Phelps, C. M. L. Paine, R. Varley, Jos. Wetzler, M. C. and M. J. Sullivan, G. H. Guy, F. Z. Maguire and R. F. Outcault. The programme consisted of vocal and instrumental music, and a phonograph recital. Two phonographs were worked together with great effect, and were handled by the Sullivan brothers. Dr. and Master Waldo also participated in the programme, which altogether was of exceedingly high order and the parts were rendered with artistic execution. Smoking was indulged in vigorously all the evening, each smoker using a long clay pipe. There was a plentiful supply of tobacco and the entertainment was a big success in every way.

The Whitney Electrical Investment Company has been incorporatad at Saco, Maine, with a capital stock of $500,000.

The Maine Electrical Improvement Company, the well-known manufacturers of incandescent lamp sockets and shadeholders, intend to increase their output, and are enlarging their plant as a preliminary step in that direction.

CONVENTION OF THE ASSOCIATION OF THE RAILWAY TELEGRAPH SUPERINTENDENTS.

The Annual Convention of the Association of Railway Telegraph Superintendents met in one of the parlors of the Grand Hotel, Cincinnati, O., at 10 A.M., Wednesday, June 17, President G. T. Williams in the chair.

The first business transacted was the election of new members and twenty gentlemen were admitted to membership:

The report of the treasurer was then read and showed the Association to be in a flourishing condition. Letters were read from officials of the Western Union Telegraph and the local telephone companies, placing the wires of those companies at the disposal of the members of the Association during the convention.

After the appointment of a committee to frame suitable resolutions on the death of Mr. W. E. Lewis, late superintendent of telegraph of the Long Island Railroad, the election of officers for the ensuing year was proceeded with. The following gentlemen were named and elected unanimously:

C. S. Jones, of the Illinois Central Railroad, Chicago, president; L. H. Korty, of the Union Pacific, Omaha, Neb., vice-president; Mr. P. W. Drew was re-elected secretary and treasurer.

The next order of business was the selection of place and time for the next meeting. In this connection letters were read from Governor Routt, of Colorado, Mayor Platt Rogers, of Denver and J. J. Burns, superintendent of transportation of the Denver and Rio Grande Railroad, urging that Denver be selected. The letters were of the heartiest and warmest character and the writers promised the members of the association a hearty welcome and an enjoyable time should they decide on Denver.

An interesting letter from Mr. E. St. John, general manager of the Chicago, Rock Island and Pacific road, was read in which that gentleman paid a high compliment to the association and its value. He also favored Denver as the place for the next meeting and offered to provide free transportation over his lines for the members of the association should it be decided to go to Denver.

The motion was then made by Mr. M. B. Leonard and unanimously carried that Denver be the place and the third Wednesday in June, 1892, the time for the next Annual Convention and the secretary was instructed to extend the thanks of the association to the writers of the letters referred to for their kind invitations.

A telegram from Secretary Case, of the Train Despatchers' Association of America, in session in Toledo, O., wishing the superintendents a pleasant and profitable meeting, was read and like greetings were ordered to be extended to that association in return.

A motion was then unanimously carried changing the constitution so as to make the annual dues $5 instead of $3, after which the meeting adjourned until 3 P. M.

At the afternoon session the committee appointed at the morning session reported resolutions on the death of the late W. E. Lewis, and the same were ordered inscribed on the minutes of the association, and a copy sent to the family of the deceased.

W. W. Nichols and N. B. Patterson were elected honorary members.

Some literature bearing on the subject of the World's Fair was received by the association from Mr. Moses P. Handy, chief of the Department of Publicity and Promotion of the World's Columbian Exposition, with a letter from that gentleman, for all of which the secretary was instructed to extend the thanks of the association.

The meeting then at 5 P. M., adjourned until 2 P. M. Thursday, the 18th.

THURSDAY'S PROCEEDINGS.

During the morning, the members spent some time in examining the various apparatus and devices displayed in the exhibition rooms and afterwards, on invitation, witnessed the operation, in the warerooms of the Central Thomson Houston Company, opposite the hotel, the system of the American Auto-Telegraph Company, of New York. By this system autographs and designs of any character are transmitted over a wire and reproduced in perfect fac-simile at the receiving station. The matter to be transmitted is written on a strip of paper, which is passed through the transmitting apparatus and the characters are received at the other end on a chemically prepared strip of paper. The original characters are reproduced on the chemical paper by discoloration through the action of the current.

The operation of this apparatus was watched with intense interest and several of the members had the opportunity for the first time in their lives to see their own signatures and various sentiments and pen drawings transmitted over a wire and reproduced at the opposite end.

At 3:30 P.M. the regular meeting of the Association was called to order, with president Williams in the chair.

Mr. J. W. Dawson, of the K. & M. R. R., Charleston, W. Va., and F. Peters, of the Southern Pacific road, New Orleans, were admitted to membership, after which president Williams yielded the chair to his successor, Mr. C. S. Jones.

Mr. Jones on taking the chair, in a few words thanked the Association for the honor conferred upon him, in electing him their presiding officer for the ensuing year. "This is," he said in conclusion, "a body of ideas in connection with railroad telegraph systems, and we meet only for the interchange of ideas which are for the benefit of all." He promised to carry forward the objects of the association to the best of his ability.

The reading of papers was then proceeded with.

Mr. Geo. L. Lang, of the New York & New England Road, read a short but interesting paper on "The Care and Maintenance of Block Signals." He argued that signals needed care, which they did not always get. The first indications of trouble were when the engineers reported signals set at danger when they should be at safety, and before anything was done all signals were at danger—all through the lack of care and attention. The result of this was that the systems get a bad reputation. The first cost was only the beginning of expense, and unless attention was given to the apparatus general dissatisfaction and annoyance resulted. He maintained that the signals should be in charge of intelligent men, and the batteries should be cleaned often. Every relay should be protected by a lightning arrester and hermetically sealed to prevent the accumulation of dust on the contact points. Another source of trouble lay with the trackmen who are careless and frequently break the wires.

Mr. Lang stated that the cost per signal per annum was about $40 on a double track road. He believed that it was economy to use them provided they were properly cared for. This was especially true on large roads where many trains are handled.

An interesting discussion followed the reading of the paper, after which Mr. M. B. Leonard read a paper on the value of the phonoplex in the railroad service. He mentioned a case where, during the blizzard, the wires on his road were wrecked, but communication was carried on beyond the break by the phonoplex. He was of the opinion that the adjacent wires acted as a condenser and by induction communication was maintained over the break. He thought that the phonoplex was a very good expedient where a railroad company needed extra facilities but did not want to go to the expense of putting up another wire.

An interesting discussion ensued. Mr. Charles Selden explained in a very clear manner the undulatory character of the Morse and Phonoplex currents, and believed also that the phonoplex would work over a break. It was a condenser effect. The phonoplex, he said, was of great help to the Baltimore and Ohio Road, especially in large cities where it was difficult to get overhead wires.

The sensitiveness of the phonoplex and its liability to be affected by other adjacent currents, was thoroughly discussed. Mr. Lang told of a phonoplex circuit on his road between Hartford and Boston being seriously affected by the induction from the Western Union printer wire, which ran parallel to the phonoplex circuit for a short distance.

In answer to a question, Mr. Lang stated that Mr. Edison had told him that two phonoplex circuits could not be worked on the same line of poles on account of the induction. This statement developed the fact that there was considerable difference of opinion among those present as to the truth of this proposition.

Mr. U. J. Fry, of the Chicago, Milwaukee and St. Paul road, then read a paper on the quadruplex which was full of interest. During the reading of the paper, Mr. Fry referred to certain improvements for the purpose of a wider application of the quadruplex and in its general working.

During the discussion that followed Mr. Fry's paper, Mr. Chas. Selden told an interesting story about the quadruplex inventions of Dr. Nicholson, and explained the system invented by that gentleman, which reduced the armature time wonderfully.

The thanks of the association were voted to General Manager St. John, of the Chicago, Rock Island and Pacific road, the Cincinnati Chamber of Commerce, the Cincinnati Electric Light Company, Supt. Miller, of the Western Union Telegraph Company, the proprietors of the Grand Hotel, the Mayor of Denver and others, for courtesies extended to the association, and to the exhibitors for taking the trouble in coming to the convention to exhibit their apparatus and devices.

After the appointment of a committee on Topics for papers for the next meeting, and an outline of the excursions in connection with the Denver meeting next year, by Mr. A. R. Swift, the convention at 6 P. M. adjourned *sine die*.

The following is a full list of those present at the meetings: H. C. Reed, M. L. S. & W. R. R.; J. B. Stewart, West Shore R. R.; J. W. Stacey, Tex. & Pac. R. R.; W. C. Walstrum, N. & W. R. R.; T. W. Parks, I. & G. N. R. R.; S. D. Bogart, honorary member; R. J. M. Dauley, C. S. & H. Ry.; A. Hayward, O. & M. R. R.; F. M. Duncan, D. & R. G. R. R.; K. McKenzie, M. & O. R. R; F. W. Wilson, G. R. & I. R. R.; J. L. Dobison, C. H. & D. R. R.; H. C. Hope, C., St. P., M. & O.; Horace Johnson, B. & O. S. W. R. R.; E. R. Adams, P. & R. R. R.; W. B. McFarlane, F., E. & M. V. R. R.; J. R. Kimball, B. & O. R. R.; W. P. Ward, B. C. R. & N. R. R.; C. Selden, B. & O. R. R.; A. R. Swift, C. R. I. & P. R. R.; C. W. Hammond, Mo. Pac. R. R.; M. B. Leonard, C. & O. R. R.; C. S. Jones, Ill. Cent'l R. R.; C. A. Darlton, R. & D. R. R.; G. L. Lang, N. Y. & N. E. R. R.; G. M. Dugan, Ill. Cent'l R. R.; T. J. Higgins, C., C., C. & St. L. R. R.; H. K. Bullard, M. K. & T. R. R.; H. C. Sprague, K., C., Ft. S. & M. R. R.; U. J. Fry, C., M. & St. P. R. R.; C. H. Smith, I. I. & I. R. R.; A. R. Lingafelt, C., R. I. & P. R. R.; Robt. Stewart, C. R. R, of N. J.; G. T. Williams, president; P. W. Drew, secretary and treasurer; Prof. Gardner, of the United States Naval Observatory, Washington; R. W. Pope, New York; Thos. R. Taltavall, ELECTRICAL AGE, New York.

STREET RAILWAY NOTES.

The street cars of Springfield, Ill., are heated by electricity.

Fire destroyed the plant of the Electric Light Company, at Elizabeth City, N. C. Loss $10,000.

The Consolidated Electric Company has been incorporated at Birmingham, Ala. Capital stock $500,000.

The Rome Gas and Electric Light Company has been organized at Rome, Ga., with a capital of $100,000.

It is rumored that a stock company is to be formed to control the street railway lines of the Twin Cities.

The Mutual Storage Battery and Power Company of New York, has been incorporated with a capital of $200,000.

The East Providence Light and Transportation Company has been incorporated at East Providence, R. I., with a capital of $100,000.

The Rae Motor Works will establish a branch plant in the building formerly occupied by the Franklin Motor Company at Peabody, Mass.

Electric water cars for sprinkling the inter-urban tracks between Minneapolis and St. Paul are being built and will be something of a novelty when put to work.

A storage battery car will be tried on the Peavey system of lines in Sioux City, Ia., shortly, and results of the test will be watched with great interest among electric railway people and others interested.

The Twin City (Minneapolis and St. Paul) Rapid Transit Company, a corporation proposing to deal in street railway stocks and bonds and also to operate street railways in St. Paul and Minneapolis, Minn., has filed articles of incorporation at Elizabeth, N. J.

Superintendent McMichael of the Western Union Telegraph Company, Minneapolis, has petitioned the Council to remove the electric railway feed wires on University avenue, S. E. He claims that they interfere with the operation and maintenance of his company's wires along that street.

We understand that a Mr. Kinsey, of Buffalo, N. Y., has purchased a valuable water-power on Apple river, seven miles from Stillwater, Minn. An electric plant will be put in and will furnish light and power for the electric street railway and other purposes. It is said that 2,000 horse-power will be obtained with the water at its lowest stage.

A company has been organized in Ft Dodge, Kas., for the purpose of building an electric street railway and the City Council will hold a special session to consider the application for a franchise. The road will be built at once if the franchise is granted.

Experiments will be made on the tracks of the North Side Street Railway, Chicago, with an underground electric system. It is claimed by the proprietors of the patents that tests will show their system to be wholly practicable, securing speed equal to that of cable cars and at less expense. Among those interested are John G. Shortall and William Roche. One and one-quarter miles of track will be used in making the trials and the line will be put in operation by August 1.

The effects of competition in inter-urban travel were first made manifest by a reduction by the steam roads in the number of trains run daily between the twin cities. Now the Great Northern road announces a reduction in 50 ride tickets, which brings the price down to 15 cents per ride.

The Joint Council Committee on City Passenger Railways, Baltimore, gave a public hearing on June 3, to the friends and opponents of the ordinance by which it is proposed, to allow the Baltimore City Passenger Railway Company to use the overhead electric trolley system upon its lines. The advocates for the passage of the ordinance stated that the system was safe, rapid and advantageous, and it was not necessary to tear up the streets to instal it. The opponents claimed the trolley wires would be an inconvenience to the fire department, and that was their greatest objection.

The Chicago and South Side Rapid Transit Railroad Company has filed an answer in the Circuit Court to the bill brought by property owners on State street, to restrain it from constructing its elevated railroad in the alley between Wabash and State and Congress and 12th streets. The company says it is constructing its road under and in accordance with the ordinance of March 26, 1888, and an amendment of April 2, 1891, passed on petition of the majority of the frontage owners and the company is in a position to pay at once any judgment rendered against it. It is denied that complainant's property will be damaged by the construction.

In an address recently made before the Dorchester Improvement Union, Dorchester, Mass., President H. M. Whitney of the West End Electric Railway Company, of Boston, gave some interesting facts concerning his own road, calculated to show that the use of electricity was the best way to settle the rapid transit agitation in Dorchester and vicinity. Mr. Whitney said: "We can run the big electric cars for seven cents a mile less than the horse cars, and what does that mean to this community? Why, that simply means that we can furnish you cars seating 34 people instead of cars that seat 22 people, and that in the operating expenses of these cars we can make a saving over horses, and that is the only solution of this problem. You reduce the cost of running the cars, and you increase the size of the cars. That is the solution, and that is the only solution of this question."

The strike of the street railway employés in Grand Rapids, Mich., culminated early in the morning of June 10, when a fight occurred between the police and strikers. The police having learned that there was to be an attempt to blow up the northerly terminal wheel and pit at the Sweet street station of the cable line, Lieutenant Hurley and 20 men repaired to the locality and awaited developments. Soon a crowd of at least 200 men appeared and were charged upon by the police. Thirteen arrests were made and about 30 shots were fired by the mob. Bullets and stones flew thick and fast for several minutes. It was stated that the trouble was caused by sympathizers of the strikers, but Superintendent Eastman thinks the strikers themselves had much to do with the affair. Another disturbance occurred on the west side the same day but nothing serious resulted. Several arrests were made and the men were found to be armed with revolvers.

The Postmaster-General is gathering the best information and opinion regarding methods for facilitating the collection and delivery of mails in large cities. One plan with which he is said to be greatly interested is that devised by Postmaster Harlow, of St. Louis. The plan is to utilize, in the case of St. Louis, the almost perfect street car system of that city, attaching a small postal car to some of the cable trains. This miniature railway postal car, so to speak, could make half a dozen trips a day without the slightest interference with the regular schedule time of the roads. In place of the six large sub-stations, thirty or forty small stations could be conveniently located upon car lines in drug or book stores. The letter-carriers would proceed from these sub-stations directly to their respective routes without the present loss of time. All collections of mail matter would be deposited in sub-stations, and from these points sent directly to the station nearest to the postoffice. The postal cars would run on schedule time so that business men could time their letters very closely.

The Riverside Park electric railway, at Sioux City, was put in operation on June 18; it had been the intention of the company to open the road several days previous, but it was finally decided to leave the opening until the date indicated. A number of Chicago gentlemen, including Messrs. J. Livingston Barclay and James N. Atkinson, of the Westinghouse Company; Mr. A. H. Englund, of the Electric Merchandise Company; Payson K. Andrews, of the J. G. Brill Company; J. F. Slack, of the ELECTRICAL AGE; H. E. Eddy, of the *Street Railway Journal;* N. P. Senat, of the *Street Railway Gazette,* and others. Needless to say that President C. W. Hornick was on hand, as well as Mr. J. F. Peavey. Our correspondent writes:

Mr. Atkinson acted as motorneer on the front car, and the safety with which he landed his guests at the station was heartily commended by his party. The road is very hilly and has a great many very disagreeable and heavy reversed curves, but our little motor car bounded over the hills and around the curves with ease.

During the descent of one of those grades, the car was speeded to its utmost capacity. At North Riverside four pictures were taken of our train. After arriving at the power house, the party partook of the continued hospitality of Mr. C. W. Hornick, and were guided through and around that building. Here they found everything "Westinghouse." The huge boilers, the automatic compound engines, the incandescent dynamos, and all appliances are "Westinghouse." The two engines are complete and compact within themselves and occupy but very little room. The horse-power of each engine is governed by the amount of steam being used; on a basis of 75-horse power for every 100 pounds of steam. The dynamos are wound to 1,000 volts each. Two of these engines and two of these dynamos are on the floor, but only one of each is in use at a time. The line is some eight miles in length, but in three separate sections with am meters at the power house for each section. The sections are divided as follows: Highland Park, Riverside Park and North Riverside; the current for all of which is generated by one dynamo. The patent fuse, switch and cut-out used were duly explained to us. After we had been shown about the power house and car sheds, we again boarded the cars and proceeded to North Riverside with a trailer behind.

After stopping a few seconds at the power house to drop our trailer, we started on our way rejoicing, homeward bound.

The motor cars and coaches were made by the Northern Car Company, of Minneapolis, Minn., and are fine specimens of car building, the cars are 32 feet in length and are of the ordinary vestibuled pattern, with double trucks under each end, the motors being attached to the outside axle of each pair of trucks; each car is provided with two Westinghouse motors, and are arranged inside so that each motor can be cut off separately and only one motor used at a time. The motorneer is not exposed in the least to the weather, and is also secure from the heat of the sun.

The wire for the whole plant was furnished by the Electric Merchandise Company, of Chicago. Each car is finished inside with antique oak and lighted with electricity. The wheels are spoked, with paper filling and steel tired, and of the latest improved pattern.

One of the comparatively new industries in Minneapolis, Minn., is the Northern Car Company, of which C. P. Jones is business manager. The factory is located at Robbinsdale, a suburb of Minneapolis. This company's specialty is street railway cars.

NEW YORK NOTES.

J. H. Rotehamel, of the Columbia Incandescent Lamp Company, St. Louis, Mo., was in town last week.

Capt. Willard L. Candee, of the International Okonite Company (Limited), New York, starts for Europe July 1, on the White Star steamer "Teutonic."

Mr. Frank Kitton, the electrical expert and chief operator of the Western Union Telegraph Company, Buffalo, N. Y., gave us a call last week.

Mr. Franklin S. Carter, of Partrick & Carter Company, has perfected a device which will soon be ready for the market, and when introduced it will surely create a stir in the electric bell trade.

Mr. George T. Shaver has purchased the Closter Dock and 11 acres of land composing the Palisade Gardens and the controlling interest in the Terrace City and Palisade Ferry Company, and has assumed the presidency of the Ferry Company and of the Palisade Garden Company.

Mr. James H. Mason, who has been for a number of years manufacturing batteries and electrical supplies generally at 257 Broadway, New York, will be pleased to receive orders, and give quotations on all kinds of electrical supplies, and solicits estimates from parties contemplating ordering electrical supplies as he feels assured that he can give quotations under the most favorable terms, and at prices unequaled.

Mr. C. C. Foster, secretary and treasurer of the McCreary Electrical Specialty Company, Electrical Exchange Building, 136 Liberty street, city, has just returned from an extended trip throughout the West. He found a glad welcome on his return, his old friends extending congratulations on his improved health and strength. Mr. Foster had passed through a severe sickness and had to combine his extended business trip with the recruiting of his health.

I. George Kaeller, representing the electric light department of the Western Electric Company, New York and Chicago, with headquarters at Rochester, N. Y., is meeting with his usual success in the introduction of the Western Electric system of arc and incandescent lighting. After a hard competition he has secured a contract for lighting the city of Rochester with his popular alternating systems, supplying 50 arc and 600 incandescent lights.

George D. Hall, treasurer and manager of the Wainwright Mfg. Company, Boston, Mass., was in town last week. The Wainwright heaters made by Mr. Hall's company, are having exceedingly good demand at the present time. They have lately installed several thousand horse-power heaters in electric light and power stations, and every steam user not using a feed-water heater would do well to investigate the advantages of this heater in the saving of fuel, steam, and above all, money.

The Mason Battery and Electric Co., 120 Park avenue, Brooklyn, N. Y., of which Mr. James H. Mason is the electrician and engineer, are the manufacturers of the noted Mason batteries, the sales of which are increasing daily. Wherever these batteries have been used they are spoken of in the highest terms, and the company to meet the increasing demand for them, have just completed the installation of a large engine, boiler and steam plant, as well as a large line of machinery for manufacturing the Mason battery, and a new Mason motor which they recently designed.

L. J. Wing & Co., 126 Liberty street, city, are having unusual demand for their Wing disc fans, dynamos and motors, as well as their combined disc fans and motors. Among a few of the orders recently filled by this company, are the following: J. C. Manchester, Ottumwa, Ia., 36-inch fan motor; F. P. Robinson Company, West Roxbury, Mass., two 30-inch fans; Samuel Lee & Sons, Philadelphia, Pa., 30 and 40-inch fans; H. D. Dewee, Boston, Mass., one 1 horse-power motor; *The Sun*, New York, N. Y., 48-inch fan and motor and the Equinox House, Manchester, 18-inch fan and Turk motor.

The following gentlemen connected with electrical industries were in town the past week: Brush, C. R., Cleveland; Carpenter, E. P., Chattanooga; Claflin, A. D., Boston; Clark, E. E. Boston; Cleveland, A. S., Buffalo; Cooke, J. H. Chicago; Engelhardt, E. B., Raleigh; Terry, F. S.; Goodnow, W., Boston; Ide, D. E., Springfield; Kendall, G. G., Boston; Kimball, J., Boston; Lennon, J. M., Minneapolis; Mason, F., McDonald, R. T., Ft. Wayne; Pennock, J. B., Philadelphia; Perry, J. C. Chicago; Plumb, T. W,, Meriden; Pool, G. H., Yokohama; Royce, F. B., Wallace, F. A., Ansonia; Rotehamel, J. H., St. Louis.

The Case High Speed Automatic Engine for which E. T. Copeland & Co., 106 Liberty street, are selling agents, is giving good satisfaction wherever used. There are hundreds of these high grade engines in service at present and every one is giving the best results. The following letter from a user of a Case engine speaks for itself. It is but one of many of the same kind which E. T. Copeland & Co. receive:

"New York, June 17, 1891. Messrs. E. T. Copeland & Company. Gentlemen:—As chief engineer of the steam yacht 'Romola', I fortunately selected a Case engine, size No. 5, for operating our electric lighting plant by direct connection with dynamo. Also two Case engines of the bracket pattern for driving blowers for our furnaces. These three engines have been installed and put in operation, to my entire satisfaction. In fact, I do not think I have ever had experience with anything in the way of small engines of equal merit. Although they run at high speeds, they run without noise and apparently without the least friction. They are in the highest degree satisfactory. I am very glad that I discovered this engine in season to employ it in the above lines of duty. Yours truly, J. F. KENNEDY."

The Hide and Leather National Bank, a new institution lately organized, has elected as vice-president Mr. Charles A. Schieren, the head of the firm of Chas. A. Schieren & Co., the well-known manufacturers of perforated electric leather belting, located at 45 to 51 Ferry street, New York. On June 15 the bank gave itself a handsome and hospitable "send-off," consisting of an inspection of its banking rooms in the Healey Building, corner of Ferry and Gold streets, New York, and a Delmonico lunch to the press, in the rooms of the Hide and Leather Club, corner of Spruce and Gold streets. Directors Edward R. Ladew and Henry C. Howell did the honors of the club rooms, while Vice-President Chas. A. Schieren officiated at the banking house. Mr. Schieren is also one of the directors of the new bank. The capital of $500,000, and surplus of $50,000 has been distributed among the trades represented in the vicinity of the bank, which is the only one in the Fourth Ward, and from the names on the list of shareholders one would judge the success of the bank is assured from the start. The new corporation opened for business on Wednesday, June 17.

The Engineering Equipment Company, 146 Liberty street, Central Building, are having good success with their Underwood Cotton Leather Belting. They have some of the liveliest men acting for them, among them are Mr. C. H. Sewell, a well-known electrician and man-about-town, who is pushing their indurated fibre pipe for conduit use and is also hustling belting and other specialties for the company; Mr. C. S. Merrill, who makes a specialty of the Underwood cotton leather belting with the assistance of Mr. R. R. Cone, and Mr. W. T. D. Crane, M.E., who has general charge of the railway supplies, Dodgewood pulleys, Habirshaw wire, Anderson line materials and trolley systems. The trolley system is receiving a large share of business, some big orders being reported. Mr. F. A. McGee, M.E., is the manager of the Boston office, 126 Pearl street, where this firm carry a large line of electric railway supplies, and where they also make a specialty of the Dodgewood pulleys. They control the Eastern States for this pully and the Underwood cotton leather belting. Good reports of the sale of electric railway supplies, etc., are coming from the Eastern department. The Eastern Office is also doing an increased business in the Underwood belts. Some excellent orders were lately shipped to Cuba and South America.

Parmly, Mitchell & Co., dealers in electric light and railway supplies, 18 Cortland street, have secured the eastern agency of the Columbia Incandescent Lamp Company, of St. Louis, Mo. They also represent prominent manufacturers of switches, lamp sockets, cut-outs, motors, etc. The gentlemen constituting the Parmly-Mitchell Company are practical electricians, having been associated for years with the old Marr Construction Company, of Pittsburg and New York, and are fully able to make a success of the business. Mr. C. F. Parmly was for seven years superintendent of construction for the Marr Company; Mr. P. W. Mitchell was also connected with this Company, but later became connected with the Electrical Supply and Construction Company, of Pittsburg, Pa. Mr. C. D. Doubledoy was manager of the Marr Construction Company and the North American Construction Company, of Pittsburg and New York, for some years. Under his able management electric light and railway plants to the value of nearly half a million dollars were erected by his company in the Eastern and Middle States, Cuba and Brazil. With this solid foundation there is no reason why this firm cannot pull together a most successful business, and manufacturers and others with good specialties they want pushed will do well to call on them at their salesrooms, 18 Cortlandt street, New York.

Theo. Larbig, who was for a number of years representing the house of Holmes, Booth & Haydens, has become associated with the Aluminum Brass & Bronze Co., assuming charge of the new bare and insulated wires of the B. B. brand The insulated wires made by this company are guaranteed to be of the best weather-proof and water-proof materials. A great feature that recommends these wires to the trade is the integrity of the largely experienced gentlemen who have the management of this company, their names alone being sufficient for the standing of their goods. Among them are Mr. Thomas C. Fowler Mr. Frank G. Stone, and Mr. Hawley and with the late addition of Mr. Theo. Larbig, make a big four team whose combined experience thoroughly enables them to produce an article in the above line of unequalled value, and the trade may rest assured that they would not introduce material that had not been thoroughly tried and found equal to the strain that would be put upon it. They have lately brought out a handsome card containing the various sizes from No. 0000 to 16, in interior and exterior electric light wires for general line and house use. The insulation is flexible and of the very highest resistance possible, and it is claimed is not affected by acids or any deteriorating ingredients, solutions, or atmospheric changes. It is highly recommended for telephone, telegraph, fire alarm and other uses, as it will stand the highest abrasion resistance. It is tough and at the same time pliable and becomes tougher with age.

sizes and styles. Another European writes for £300 worth of specialties. They have just brought out a new portable brass incandescent light stand for the desk or table, very handsomely finished and of a very ornamental design. They are just out with a simpler grade of the Bradner Hanger. A cheaper class is also manufactured to meet the long felt want for a hanger for general use. Their Almond Flexible Electric Brackets are wired complete for any current, capacity and any system in 6, 9, 12, 15, 18 and 24-inch lengths. This bracket is made of a very ornamental flexible tube which can be placed in any position. The McCreary Electrical Specialty Company announce that they have just completed arrangements with the following electrical supply houses in Boston, to handle exclusively their well known specialties throughout the New England States: The Pettingell-Andrews Company, 202 Summer street, Holtzer-Cabot Electric Company, 111 Arch street, and the Thomson-Houston Electric Company, 620 Atlantic avenue. They have also secured the Toronto Electric Construction and Supply Company, of Toronto, Ont., as special agents for the Dominion of Canada, where goods can be obtained in any quantity. The McCreary Electrical Specialty Company request that all orders for their goods be sent to these houses, where a complete stock will be found at the lowest prices.

Mr. W. H. Beatty, representing the Novelty Electric Company, 54 North Fourth street, Philadelphia, is in town booming the Novelty Electric Desk Fan and Motor. These fans are furnished with batteries to run them 100 to 200 hours. The Novelty annunciators and the company's new form of Grenet battery are also taking well, not only from their many good qualities, but also by Mr. Beatty's ability to push a good thing. W. T. H.

FINANCIAL.

Hello! Hello!!—Connect me with the long distance.—Hello!—Ellery on Massachusetts Town Clerks, please.—Hello! Hello!! Yes, this is the ELECTRICAL AGE, New York. We have called you up to give you a few points on the illumination of your town. Your illustrious Governor has signed the bill enabling you to own your plant and receive the reward that might accrue to a private local corporation. The first thing for you to do, having concluded you will be up with the times, is to get in contact with those who are lighting the growing towns all over this glorious country, stating that you wish an estimate for not less than a certain number of arc or incandescent lights, with all electrical appliances necessary to operate them, with separate estimate for power if you are not blessed with a water power sufficient for the purpose. Next, having decided on the system or kind of lighting, *i. e.*, Edison, Thomson-Houston, Fort Wayne, Schuyler, Excelsior, or other system adapted to your work, ask for estimates from supply and construction companies for the faithful fulfillment on their part of the whole business, making one bill only to you for the gross amount, payable in instalments as may be provided for; you will by this means have a business idea of each system and the approximate cost of electrical machinery, wire, poles, conduits, lamps, insulators, converters, etc., and also prices for engines, boilers, belting, buildings, etc., with a great deal of specific information regarding each; all of this you can do through the columns of the ELECTRICAL AGE, which is regularly and carefully read each week by every individual you need to reach, and by having a copy in your Council chamber your whole Board will be able to act and vote intelligently when the subject comes up for action. Your advertisement in your local newspaper will not reach the various competitors, as they are located from the Missouri to the sea. If I have not made this plain to you write me and I will be pleased to give you any information I have, at any and all times; I do not recommend any particular system, but shall be willing to pass an opinion on any as to its special economy in your town. I wish you all a grand success in your new departure. Yes, ring me up any time. Good Bye.

There is a rumor floating through the air at many points between London and Butte City, Mont., to the effect that the Messrs. Rothchilds have concluded a negotiation by which they are to obtain possession of the Anaconda copper mines. The figures range all the way from £4,000,000 to £5,000,000. There was a time, and not so long ago, when that house owned or controlled all the quicksilver mines. The extensive demand for the metal by the amalgamating mills of Nevada gave them an immense profit, raised the price and with their usual foresight at the right moment, sold at a very respectable advance all their interests. The late fiasco of the French capitalists in organizing a syndicate to control our copper mines is within the memory of all. There has been very little change in the situation since. Without doubt the figures used at that time would be found in any prospectus issued to-day, and if aluminum enters into competition with copper in the electrical field, as it bids fair to do, the demand for copper will decrease. One thing is certain, and that is, the high price of copper depends entirely on its continued application to electrical purposes; should the production of aluminum reach the expectations of even the conservative promoters this season, it will settle all bull speculation in copper. If the Messrs. Rothschild carry out this purchase, they must have found a value, permanent for some years at least, of which the investing public today are unaware.

Another proprietory patent suit has been instituted in the United States District Court at Pittsburg by the Short Electric Railway Company, of Cleveland, against the Westinghouse Electric Maufacturing Company, of Pittsburg, in which, no doubt, more individual shareholders are pecuniarily interested than in any other electric patent. The issue is, of course, for alleged infringements on patent appliances used on electric railways. Both litigants have motors in working operation on the spot. The Adams Electric Company of St. Louis, will probably be a co-defendant. This bids fair to be a long and hard fought case, and I predict that before its conclusion electric motors entirely different in character will be in possession of the field. Speaking of electric railways, I note the railroad commissioners of Massachussetts have granted the West End Street Railway Company permission to issue $4,500,000 additional stock in the form of 90,000 shares and that the Brooklyn companies are getting nearer their desires. A new point has arisen regarding necessary consents, as concerns church property. If the Brooklyn vestry is at all like their London brothers, it will take just 62 years to gain their consent. In business it is always well to look facts in the face.

Among the statistics emanating from the census bureau, one often is brought into contact with the growth and decay of industries which can only be accounted for by the investment or withdrawal of capital, as demand does not seem to be a factor in the case. One of the latest exhibits showing a decrease, is in the production of manganese, which in 1886 was 34,500 tons and in 1890 only 23,900, valued at $239,000.

The latest and grandest American electrical success abroad is the Sims-Edison Torpedo. As there can be but one customer for the goods, to wit, the Government, it is fair to infer they will be manufactured by a close corporation, if not the Government desiring to have a stock on hand.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
American Elec. Exercise Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	3 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Anglo-Am. Elec. Light Mfg. Co.	2,500,000	10 00	
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln.	2,000,000	100 00	115 00
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	201 25
Bell Telephone 7's	2,000,000		*112 00
Birmingham Ry & Elec. Co., 6's	1,500,000		par
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5's	6,000,000		par
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	*10 00
City Electric St. Ry. Co., 6's (Ark.)	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	105 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80 000		par
Cons. Gas Co. Batavia	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	10 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison General	14,000,000	100 00	101 00
Elec. Sup. & Con. Co. (N. Y.)	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Empire City Subway Co. (N. Y.)		100 00	
Equitable G. & E. Co. (Utica)	4,000		†
Erie Telephone	4,800,000	100 00	48 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's	100,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	12 00
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	par
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7 500,000	100 00	15 00
Laclede Gas. pref.	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*74
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50.000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000 000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	80 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	101 75
Nat'l Cordage, pref.	5,000,000	100 00	103 00
Nat'l Lead Trust	9,000,000	100 00	17 75
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	90 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	55 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,600,000	100 00	
North New York, Lighting	150,000	100 00	20 00
Northwest Elec. Co. 6's	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00

Name of Companies.	Capital.	Par.	Price.
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	75 00
Rockaway Elec. Lt. Co. 6's	75,000		par
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec Light 6s	300,000		*86
Saginaw Elec. Light & Pr. Co. 6's	50,000		par
San Diego Gas & Elec. Co. 6's	750,000		par
Sawyer-Man Electric Light Co(N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co.	16,000		†
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	43 00
Thomson-Houston Pref.	4,000,000	25 00	25 50
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers 6's	100 000		par
T.-H. L. H. & P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction 6s			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine street Motor Co. 6's	100,000		par
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co.	7,000,000	50 00	13 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			20 75
Winston-Salem Elec. St. R.R. (N C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent. †Registered Stock.

CINCINNATI NOTES.

The use of the National Automatic Fire Alarm System is extensive in Cincinnati. To the stranger the alarm boxes attached on the outside of business houses, is somewhat of a novelty, but their value and usefulness are inestimable.

The street car traffic in Cincinnati presents conditions that probably are not found anywhere else in this country or in the world. On some of the streets the tracks are used jointly by horse cars, mule cars, cable cars and electric cars.

Work on the foundation for the new Edison station on 8th street, between Elm and Plum streets, is progressing. Two artesian wells are being driven with the object of obtaining an independent supply of water. A depth of about 1,300 feet has already been reached.

The Triumph Compound Engine Company, 211–217 West 2d street, report an active demand for their engines. The Triumph Compound Engine is at once economical, simple, durable and silent and is claimed to be the most perfect high speed engine built. Fifty per cent. of the engines turned out by this company are for electric light and power work and many are shipped to Mexico and South America for this purpose. The company are now manufacturing and introducing a 2 horse-power engine for electric headlight work and hold an order for 100 of them if the first one is found to work all right. These engines are to be coupled direct to the armature shaft. The company make engines up to 125 horse-power, the lowest being 2 horse-power.

The Card Electric Motor and Dynamo Company, cor. 2d and Plum streets, have no reason to complain in the matter of business. They are very busy and although they occupy two floors of the large brick factory at the address given, they have been compelled to provide for more room; they expect to get possession and occupy the other two floors of the building before the first of the year and they will then have double their present facilities. Their factory is thoroughly equipped with the most improved machinery designed for the manufacture of electrical goods, etc. They have at present about 30 men employed in the factory. The company manufacture incandescent dynamos only. These machines are used very extensively with the Ward low tension current arc lamp and the combination of the two is said to give the best of satisfaction. Ward arc lamps are used with much success in the *Commercial Gazette* building and Duhme & Co's jewelry house. The Card Company make motors from 25 horse-power down. They find the largest sales for 15 horse-power machines. They are now engaged in the manufacture of a 65 horse-power motor for street railway work. The company at the present time are trying hard to keep up with the demand for fan motors, for which there is a great run. Mr. J. E. Hockett, formerly superintendent of the Central Union Telephone Company, at Indianapolis, Ind., is now general manager of the Card Electric Motor and Dynamo Company.

Post & Co., 215–217 West 4th street, manufacturers and dealers in railway and electrical supplies, opened their electrical department about two months ago and the wisdom of this move cannot be questioned. The firm report an active business in electrical goods and they are constantly enlarging their stock and the variety of goods handled. They make a specialty of electrical railway work and handle trolley hangers and gears. The firm have just brought out a little snap switch that is remarkable for its simplicity and it is very durable besides. It has excellent breaking qualities and is neat in appearance, the base being of china. This switch is called the "P.C." and the firm report a very active demand for it. They are selling a great many of them. They are made for 5 and 10 ampere currents. Post & Co. handle the "A.B.C." incandescent lamp exclusively and report that it is giving excellent satisfaction among users. The firm are doing a large trade in the manufacture of electric headlights, both arc and incandescent. These headlights are extensively used on the river steamboats, as well as on locomotives. One of the firm's specialties is an electric portable which is meeting with a large sale. The features of this portable are ease of wiring and low cost and it is very neat in appearance. The firm are agents for the Edison-Lalande battery in Ohio, Indiana and Kentucky and will carry a stock of these celebrated batteries. They are also going to handle Habirshaw wire, also "F.W." line wire. The firm's factory is in Ludlow, Ky., where they employ 250 men. The firm manufacture and sell Miller's excessive current protector, which is a protection against all dangerous currents. It is said of this device that it always operates when you want it to and never when you don't want it to. It is referred to more particularly in our exhibition notes, which will be found on another page in this issue. Mr. O. M. Hubbard, formerly connected with the Thomson-Houston Company, Cincinnati, O., is the manager of the electrical department and he speaks very encouragingly of the business outlook in his line.

The Nowotny Electric Company, No. 30 East Fifth street, is one of those progressive concerns which are constantly bringing out something new and adding to their reputation for enterprise. This company is one of the most enterprising to be found anywhere. They are manufacturers and dealers in general electrical supplies, principally house furnishing goods. They also do a large business in repairing dynamos and motors. They have just brought out a new open circuit battery which possesses great merit. The outer cell forms the carbon element and is so constructed inside as to give an enormous available active surface. By actual measurement the active surface is 196¼ square inches, which far surpasses that of any battery in use. This cell, which is cylindrical in shape, is known as the "Imperial," and is an improved form of the "Multiple" battery, which is used so extensively and successfully and for which the company has earned a well-deserved reputation. The Merchant's Police Company, of Cincinnati, are using over 500 multiple batteries in different branches of the business and in a letter to the Nowotny Electric Company, the captain of police says that he finds this battery to be the best he has ever known and endorses it highly. The multiple cell is square in shape and is sub-divided into two compartments, each being a cell in itself. The new "Imperial" cell has a great future before it and it will likely find extensive use where open circuit batteries are required. Its life is greater than that of any other open circuit battery in the market. The cover is fitted tightly to the cell in such a way that it is impossible for salts to creep. The result is a clean and neat battery at all times. The outside surface of the carbon cell is treated with a vitrified substance to prevent the escape of the fluid. The company have also recently introduced another form of the multiple cell for laboratory work. The zincs are raised and lowered, being set by a screw at any desired height. The exciting fluid is electropoin and the cell gives a current of 8 amperes. The Nowotny Electric Company, in addition to their large trade, do all the electric work for no less than 18 river steamboats and their reputation for enterprise and first class work, grows apace. The company furnish estimates for all kinds of electrical work. The little electric motor and medical battery combination made by this company is a very useful apparatus and is simple and cheap. Mr. John S. Nowotny is the manager of this enterprising concern.

T. R. T.

PHILADELPHIA NOTES.

A. H. Chadbourne, Provident Building, is successfully introducing the Westinghouse system for electric railways.

I hear that Mr. Charles Jackson, an old and experienced electrician in New York, has been appointed agent of the Quaker City Electric Company's dynamos and motors. There is no doubt of his ability to make a success of these goods.

Clay, Pepper & Register, 117 to 121 North Front street, Camden, N. J., office, Provident Building, Chestnut and Fourth street, Philadelphia, is the name of a new firm who is manufacturing electrical engines and are bringing out a fine line of motors and dynamos, switches, etc.

The Whitney Glass Works, 227 South Front street, are meeting with their usual success in glass battery jars. This concern is said to be the largest producer of this line of goods in their section. These goods are a specialty with them, and are found among the leading battery manufactories of the country.

W. J. Buck, Son & Co., 407 North Eighth street, are said to be the largest manufacturers of electric fixtures in this city, and they claim to produce and are placing more goods in this line than any other electric fixture house in their section. The display of goods at their salesroom at the above address is evidence of the fact that they are alive to the wants of the buyers in this line.

To be without a desk motor and fan combined is like going without your dinner in warm weather and every office desk should be supplied with one of the Novelty Electric Company's handsome desk fan motors. They are neat, compact and simple. The motor and fan complete with a No. 9 battery costs only $10, and No. 11 battery $15, and will run constantly for 15 hours on one charge on a No. 9 battery and from 75 to 100 hours on No. 11 battery.

Schleicher, Schumm & Company, Thirty-third and Walnut sts., the noted manufacturers of Otto Gas Engines, are having their usual trade for these machines. The demand is increasing for their large size, single and double cylinder, for light

and power plants. Large numbers of them are now in active use throughout the United States and are meeting with high approval and many testify to their excellent working.

J. W. Queen & Co., 924 Chestnut street, are said to be the largest makers of test instruments in this country. Their goods are of standard make and are used as standards among electric light, power, railway plants and general testing and experimental work. They make special instruments for general telegraph inspection use, as well as instruments for the general testing of incandescent lamps; also test instruments for all classes of electrical work, school outfits being a specialty.

The Novelty Electric Company, 54 North Fourth street, are out with their elegant new catalogue, to attempt to describe which would only be a failure. It has not an equal in this country for variety of illustrations, beauty of finish and for the quantity of goods represented. The typographical part of the work is done in the most tasteful manner and the firm can be congratulated upon the successful issue of such a beautiful catalogue. Every buyer of electric goods should have one of them for constant reference.

Alfred F. Moore, 200 and 202 North Third street, with G. A. Harmount, western agent, 149 Wabash avenue, Chicago, Ill., manufactures insulated electric wire, flexible cords and cables. Mr. Moore is, without a doubt, the oldest manufacturer in this line of goods in this country, and his outfit is said to be equal if not greater than that of any other producer in this line. His flexible cords are of a rich finish and of the best make and quality of goods and they are among the standard in this line. The excellent quality and serviceability of the goods of Mr. Moore's manufacture are well known, and orders for the same are large and satisfactory.

Wright & Starr, 37 South Third street, are experimenting most successfully with the Waddell-Entz Storage Battery System in connection with the Brill car and truck in Philadelphia. Messrs. Wright and Starr are expert electricians and practical engineers and undertaker the calibrating of electrical instruments and the engineering of electric railway, light and power installations.

MINNEAPOLIS NOTES.

The Kent Electric Lighting Company has been incorporated at St. Paul with a capital stock of $500,000.

Few telegraph and electric wires will be left to impede the work of the fire department and cause endless annoyance at the end of the year, as the work of placing them underground is progressing rapidly. As soon as the plans for an underground system are approved by the Western Union directors, that company's wires will go down and the work of putting the North American's out of the way will begin in a few days. The Brush Electric Company will soon let the contract for putting its cables below the surface and the Soo Railway Company has submitted plans for an underground system to the city.

A new electrical corporation has been started in this city during the past two months that bids fair to become the peer of any electrical supply house in the country. The new firm is called the Standard Electrical Corporation and was organized to deal in everything connected with electrical industries, from the ties of an electric street railway to the power generators and cars, and from a push-button to an electric light plant. They will act as manufacturers, agents and electrical commission merchants and are ready to undertake the installation of any kind of electrical plant. Mr. George G. Smith, the son of George Gregory Smith, the president of the Vermont Central Railroad and ex-governor of Vermont, is president of the new corporation; Mr. W. J. Reno, treasurer and Mr. J. M. Lennon, the well-known electrician and mechanical engineer, is the business manager.

EASTERN TRADE NOTE.

The Page Belting Company have assisted in the establishment of mechanical and electric plants by means of furnishing their belting during the past month. The following are among the many parties which they have supplied: Quincy Market Cold Storage Company, Boston; Manufacturing Investment Company, Madison, Me.; including both link and flat belts, among the latter a 3-ply large driving belt; Milton Electric Light Company, Milton, Mass.; Concord Street Railway Company, Concord, N. H.; E. W. Littlefield, East Boston, Mass; The Santley Lumber Company, Wilmington, Ohio, and a large establishment in Virginia. Among the various Acme link belts of their manufacture was a 12-inch belt to Carthage, N. Y., and one to Lynchburg, Va.

EXHIBITS AT THE RAILWAY TELEGRAPH SUPERINTENDENTS' CONVENTION.

Two reception rooms on the ground floor of the Grand Hotel were used for the purpose of displaying various electrical apparatus.

The Edison phonoplex system of telegraphy was shown in practical operation on a circuit over the Chesapeake and Ohio Road to Huntington, W. Va., a distance of 165 miles. Work on the phonoplex instruments was carried on at the same time the wire to which they were connected was being used on Morse in the usual way. The apparatus attracted considerable attention. The phonoplex is now in practical and regular operation between Clifton Forge and Richmond, Va., on the Chesapeake and Ohio Railroad, a distance of 200 miles, and is said to be giving entire satisfaction.

An attractive display of Edison-Lalande batteries was also made on the same table with the phonoplex. There was a sample of every type of cell made by the Edison Manufacturing Company, except the cautery cell. The types shown included the new telephone cell. This cell is square in shape and has a capacity of 40 ampere hours. Both the Edison exhibits were in charge of Mr. W. S. Logue.

The Gill-Alexander Manufacturing Company, of Kansas City, Mo., gave an exhibition of the practical operation of their Individual Telegraph Call Bell system. This exhibit was in charge of Mr. E. R. Gill, general manager and electrician of the company.

One of I. N. Miller's patent electric light protectors was exhibited. This protector is not operated by lightning, and will not open the circuit except when a dangerous current is passed through it. Currents from ½ ampere to 7 amperes operate the heat coil and open the circuit. Arc currents of over 7 amperes burn out the fuse, which is of 25 gauge german silver wire. This device is manufactured and sold by Post & Company, Cincinnati.

An exhibit which attracted attention was that of Chase's automatic electric railway crossing signal. This signal is entirely automatic, self-adjusting, self-regulating and positive in action. It is operated by the wheels of the locomotive or car pressing upon a lever pivoted alongside of the rail, the lever in turn operating, by suitable mechanism, a dynamo, by which a current of electricity is generated and conveyed by wires to the street crossing, causing the clock mechanism to be released, thereby ringing a powerful gong and thus announcing the approach of the train far in advance. The same train upon reaching the crossing runs over another lever, thereby stopping the clock and at the same time winding it up, leaving it in condition to be actuated by the next train. The signal is made by Fred H. Holton & Company, 41 Harvard street, Cambridgeport, Mass., and the exhibit was in charge of Mr. Edward M. Chase, the inventor and superintendent. Semaphores can be operated in the usual way, and the system is said to be entirely reliable in every respect. The apparatus is to be at once put into operation on the New York and New England road at Mattapan, five miles out of Boston.

The Hall Signal Company, of 50 Broadway, New York, was represented by S. Marsh Young, the company's general agent. An electric illuminated semaphore and train order signal was shown.

The new wasteless crow-foot and star-shaped battery zincs, a recent invention of Georges D'Infreville, 110 Liberty street, New York, was shown. Any number of zincs may be used in one cell, thus giving greater surface and consequently greater current.

Mr. T. McCoubray, ex-secretary of the National Electric Light Association, represented the interests of the International Okonite Company. Mr. McCoubray distributed among the members a small, neatly printed circular, setting forth the merits of and giving some interesting facts concerning Okonite wire.

The Union Switch and Signal Company, of Swissdale, Pa., had on exhibition an electro-mechanical semaphore signal similar to those in use at interlocking points, and adapted to be used as an automatic track signal, station block signal, or anywhere where it is desired to display danger or safety signals to approaching trains. This company has recently perfected and introduced a form of relay which effectually prevents the danger of a relay becoming inoperative on account of lightning stroke, or other high tension currents. This apparatus is said to be a great improvement on existing block systems, as it insures absolute protection against the class of currents referred to. The company is taking a large number of orders for the new apparatus. Last February the Cincinnati and Southern Road gave an order for the equipment of a large number of tunnels with the system, and this contract is now being completed. The display was under the charge of Mr. C. W. Scott, the company's electrician.

A display which attracted considerable attention was that of the O'Neill automatic highway crossing alarm, manufactured by the Electric Supply and Manufacturing Company, Cleveland, Ohio. Mr. O'Neil the inventor and A. L. Dunbar the general agent, were present explaining the merits of the system. As the train approaches a crossing the weight of the engine operates a track instrument which closes an electric circuit, and this controls the gong at the crossing. The ringing of the bell is stopped in like manner, and by an ingenious device the length of time during which the bell will sound may be definitely varied at will. The Sampson battery is used exclusively by this company for the operation of their apparatus. They say it is the best battery in the market for this purpose. This system of signals is now in practical operation on the Colorado Midland, Toledo and Ann Arbor, Flint and Pere, Marquette, Chicago and Grand Trunk and the Nickel Plate. On the latter road the system has been in use over two years and has given the best of satisfaction in its operation.

The Thomson-Houston Company secured the contract for the electric plant at Exeter, N. H.

The Stanton Construction Company are to erect an electric light plant at Newport, Ky.

CORRESPONDENCE.

CREEPING SALTS IN BATTERIES.

J. B. TALTAVALL, ELECTRICAL AGE.

Dear Sir: Thinking that perhaps the following may be of interest to some of the readers of the AGE and that perhaps some may be able to explain the phenomenon, I describe a peculiar condition of two cells of No. 1 Samson batteries that recently came to my knowledge. These batteries, which have been in operation about a year, are used to operate two electric bells, acting through a circuit of about one hundred feet of No. 20 copper annunciator wire. Lately the bells worked very feebly and on examining the batteries I found the exterior of the jar completely covered with salts and the zincs were almost completely destroyed by corrosion. In setting up these batteries the best quality of ammonium chloride was used in the usual quantity. The batteries were situated in a chamber which, while kept warm during the winter, was not extremely so. The liquid of the batteries when examined was little lower than when first set up, showing that the trouble was not owing to evaporation.

I have had batteries of this make subjected to much more severe usage, but have never before met with instances where climbing salts were formed, or where zincs were corroded; though I have found both of these actions quite common in "Leclanche Disque" cells.

I have in use at present a cell of No. 1 Samson, which operates a single bell through a circuit of about one hundred feet of No. 20 wire. This battery has been in operation for eighteen months without renewing and still furnishes sufficient current to operate the bell perfectly and there has been no climbing salts formed and no perceptible corrosion of the zinc.

If any of your readers can explain the phenomenon of which I have written, I should be pleased to hear from them.

IPSWICH, Mass. W. H. WILLCOMB.

SPECIAL NOTE.

The National Electrical Manufacturing Company, 20 Vesey street, manufacturers of household, office and hotel electrical supplies, the Porter Electrical Messenger System for hotels, or wherever a large number of room calls are needed, have secured a contract for two room calls on the Porter Electric Messenger System—400 calls in all—several smaller annunciators for the office, sanitarium, etc., of the Cumberland Gap Park Company's Four Season Hotel, Cumberland Gap, Tenn. Also a watchman's clock and burglar alarms for the same hotel. Mr. F. J. Wheeler, of the National Electric Manufacturing Company, has returned to New York safe and well, after a two weeks' tour in Connecticut.

The Merchants' and Miners' Transportation Company intend to light their wharves at Norfolk, Va., by electricity.

THE ELECTRICAL AGE'S ILLUSTRATED ELECTRICAL PATENT RECORD.

Issued Tuesday, June 16th, 1891.

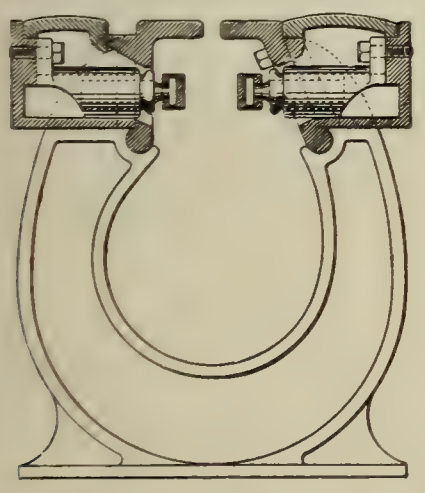
454,018. Electric Signal for Mine Shafts. Frederick W. Bacorn, Marysville, Mont. Filed Sept. 2, 1890.

The combination, with cage chairs and a lever to operate connected by bars, and a fixed electric contact point, of an adjustable electric contact point attached to and actuated by one of the connecting bars, an electric circuit and signaling devices therein.

454,020. Electric Railway Car. Edward M. Bentley, New York, N. Y. Filed March 26, 1887.

The combination of the truck frame mounted upon the axles independently of the car springs, the electric motor supported beneath the car body on the frame, the counter-shaft having substantially rigid bearings on the frame with the motor and driven by the latter, and the car axles having substantially rigid bearings with the counter-shaft, and driven therefrom by means of a connecting rod.

454,021. Electric Motor Car. Edward M. Bentley, New York. N. Y. Filed June 13, 1888.



454,022—CONDUIT FOR ELECTRIC RAILWAYS.

An electric motor journaled on an axle of a truck which it drives and arranged in an upright position, with its pole-pieces and armature uppermost.

454,022. Conduit for Electric Railways. Edward M. Bentley, New York, N. Y. Filed Sept. 8, 1888.

The combination, in a conduit for an electric railway, of a slot rail having a series of supporting yokes, and an exterior box placed outside of the slot rail at a point between two adjacent yokes, the box opening into the conduit and containing a support for the supply conductor.

454,023. Electric Railway. Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Oct. 22, 1890.

The combination in an electric railway, of a supply conductor and rail return with an accessible bare supplementary conductor connected electrically with the rails for increasing the conductivity of the return branch of the circuit and in contact with which the traveling motor also is maintained.

454,024. Electric Motor. Harry H. Blades, Detroit, Mich. Filed May 11, 1889.

In a dynamo electric machine, the combination, with the armature rings, of an internal spider or hub frame engaging therewith, and rings cast on the spider arms and forming an annular support for balancing weights for the armature.

454,031. Electric Switch. Horace T. Clark, Bridgeport, Conn. Filed April 15, 1891.

In an electric switch, the combination, with suitable terminals, of a circuit closing bar pivoted at its heel end, an L-shaped rocking lever having pivoted thereto a swinging actuator, and a spring adapted to engage and move the actuator.

454,038. Incandescent Electric Lamp Controller. John J. Fanning, Chicago, Ill., assignor of one-half to John Bairstow, same place. Filed Nov. 4, 1890.

A rheostat consisting of wire wound upon the cylinder of insulating material, the different convolutions being separated from one another and the wire forming the lower portion or portions of the coil being of less area in cross section than the wire forming the upper portion of the coil, vertical rods or guides with which one end of the circuit is electrically connected, and the brush mounted thereon, the brush upon its inner surface conforming to the shape of the cylinder and being constantly pressed against the same by spring pressure, with means for moving the brush up and down to gradually introduce the resistance of the rheostat into the circuit.

454,057. Galvanic Battery. William MacMillan, New York, N. Y. Filed Oct. 17, 1890.

A porous cell for galvanic batteries, consisting of a perforated cup of stiff fluid-resisting paper and of a covering of fibrous material.

454,060. Insulated Electric Conductor. Edwin D. McCracken, Alpine, N. J., assignor to the Norwich Insulated Wire Company, New York, N. Y. Filed March 5, 1891.

The combination of an electrical conductor and an insulating ribbon of paper folded longitudinally and having therefore multiple layers applied thereto.

454,087. Electric Locked Switch. Francis Teague, London, County of Middlesex, England, assignor to John Abbott Iliffe, same place. Filed Dec. 15, 1890. Patented in England.

A locked electric switch comprising an insulated base carrying contact plates, a metallic base, a spindle having upon it a locking arm engaging at a part of its revolution with a locking spring, a laminated brush, a releasing arm with curved front to depress the locking spring, and stop remotely placed thereon to allow the releasing arm to engage with the brush, cap, turning spring, vertical pressure spring and actuating handle.

454,090. Transformer. Elihu Thomson, Swampscott, Mass. Filed Oct. 11, 1890.

The combination with a rectangular sectional core having two of its sides covered by the primary and secondary coils wound thereon, and its other sides flush with the ends of the coils, of the closed iron frames of the magnetic material surrounding the core and coils and completing the magnetic circuit.

454,091. Secondary Battery. Donato Tommasi, Paris, and Charles Theryc, Marseilles, France. Filed Nov. 10, 1890.

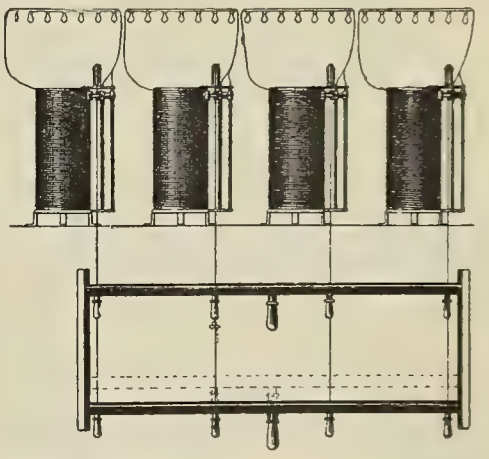
In an electric battery, an electrode made in tubular form and provided at one of its ends with an insulating plate or disc and a suspending and conducting rod secured at one end to the plate.

454,095. Controlling Mechanism for Elevators. William O. Wakefield, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 6, 1890.

The combination of an electric motor with a regulator therefor, a plunger working within a cylinder and connected with the regulator, and a valve mechanism under the control of the attendant for controlling the movement of the plunger.

454,138. Bi-Telephone. Ernest J. P. Mercadier, Paris, France. Filed Feb. 27, 1891.

In a bi-telephone, the combination of two separate tubular casings, each screw-threaded on its outside and having a cap screwed on each end, one of which has a central perforation screw-threaded for the reception of a perforated nipple. One of the casings being mounted by means of a screw-threaded collar on either end of a resilient yoke, serving to press the nipples into the ears of the user to support the apparatus.



454,038—INCANDESCENT ELECTRIC LAMP CONTROLLER

454,155. Subway for Electric Wires. William Readman, Toronto, Canada, assignor to John Culmer Hurst, same place. Filed July 26, 1890. Renewed May 20, 1891.

In a subway for electric wires, the combination of a casing having one of its side pieces cut away at its upper end to form a seat and provided at regular intervals with openings, a series of longitudinal tubes within the casing for the reception of the wires, a removable side piece provided with an inwardly and upwardly extending flange, and a cover for the opening provided with depending flanges adapted to overlap the flanges of the casing and removable side pieces.

454,166. Mast Arm for Electric Lamps. Thomas Dillon, Indianapolis, Ind., assignor of one-half to John Caven, same place. Filed Jan. 19, 1891.

In a mast-arm, the combination of a single bar, a shaft secured to one end of the bar at right angles thereto, a bracket forming a bearing for the shaft and adapted to be secured to a mast, a pair of bars joined at one end and mounted on the shaft and single bar, so as to be longitudinally adjustable thereon, and counter weights mounted on the pair of bars.

ELECTRICAL PATENTS—Continued.

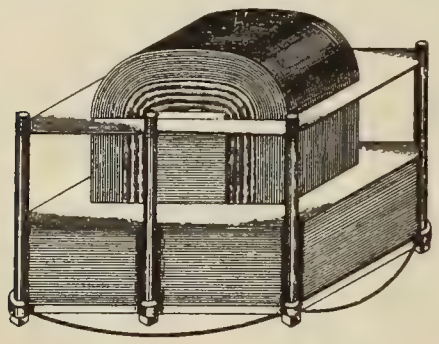
454,177. Conduit for Underground or Subway Electric Systems. John J. Miller, Pittsburg, Pa. Filed Feb. 14, 1891.

In combination with a conduit or subway, the guard rail and the depending hangers arranged between the rail and the adjacent side of the conduit and terminating above the lower edge of the rail, having the trolley wire secured to their lower ends and provided above the same with bell-shaped drip flanges or guards.

454,178. Motor Car for Underground Electric Systems. John J. Miller, Pittsburg, Pa. Filed Feb. 14, 1891.

The combination, with a laterally movable slide, of the trolley arm mounted in the slide and provided with a flat guide plate to operate in the conduit slot.

454,184. Electric Head-Light. Richard Pattison and Dennis G. Desmond, Boston, Mass. Filed Dec. 9, 1890.



454,090—TRANSFORMER.

A lantern for street car head-lights, comprising a body provided with a reflector and having a rotable transparent front bearing signs indicating the car route, and a non-transparent plate or flange on the body overlapping the front and normally concealing determined portions of the signs.

454,187. Secondary Battery. John S. Sellon, London, England, assignor, by mesne assignments, to the Accumulator Company of New Jersey. Original application filed April 26, 1887. Divided and this application filed June 27, 1888. Patented in England.

In a secondary battery, a plate or support containing an alloy of two metals and an amalgam thereof.

454,207. Electric Resistance Box. Rudolph Eickemeyer, Jr., Yonkers, N. Y. Filed Feb. 16, 1891.

The combination of a set of resistance coils in two parallel rows, a rigid flat metallic frame having insulating bars upon it, composed of refractory non-combustible material and maintaining the rows of coilsand the coils in each row in a properly separated condition and thoroughly insulated from the metallic frame.

454,226. Wall Fixture for Electrical Conductors. Oscar H. Pieper and Frank M. Watson, San Jose, Cal. Filed Nov. 5, 1890.

A tube or bushing adapted to be fixed in the wall to form a guide for the wires and having its outer end threaded and projecting beyond the wall, in combination with a cap fitted over the end of the tube and having the push button and contacts within it.

454,238. Electric Pole in Gas or Vapor Explossive Engines. Frank E. Tremper and John W. Eisenhuth, San Francisco, Cal.; said Eisenhuth assignor to the Electric Vapor Engine Company, same place. Filed July 31, 1890.

In an explosive engine, sliding rigid rods projecting into the cylinder in the path of the piston and forming electrodes, and means for controlling the sliding movements of the rods.

454,245. Signal Indicating Apparatus. Jacob O. Ziegler, Boston, Mass. Filed Nov. 28, 1890.

The combination, with a non-magnetic base consisting of a ring provided with a cross-bar, of an electro-magnet having pole pieces of substantially uniform thickness and curved on their inner faces, secured to the base at the extremities of the cross-bar, and an armature pivoted to the cross-bar between the pole-pieces, and having curved extending arms movable between the electro-magnet and the base adjacent to the inner faces of the pole-pieces, a signal indicating device attached to one end of the armature, and a counter-balance secured to the other end of the armature.

454,253. Electric Arc Lamp. Powhatan Clarke, Baltimore, Md., assignor of one-half to Frederick H. Smith, same place. Filed Feb. 13, 1890.

454,262. Incandescent Lamp Filament. Thomas A. Edison, Llewellyn Park, N. J. Filed Oct. 27, 1886.

Carbon filaments for the incandescent conductors of electric lamps, formed from the hard central portions of the roots of plants.

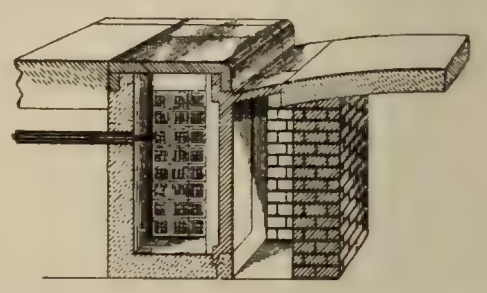
454,270. Electric Current Indicator. Albert T. Herrick, New York. N.Y. Filed Oct. 16, 1890.

In a current indicator, the combination of a solenoid composed of several coils, a commutator to which the coils are connected for joining the coils in series or in other relation at will, an indicating device controlled by the coil, and a scale marked in sections, the divisions of each section indicating one-half the number of units indicated by a like division on the following section.

454,275. Tubular Electric Conduit. Edward H. Johnson, New York, N. Y. Filed Sept. 15, 1890.

The combination, in a compound tube for electrical purposes, of two or more series of lengths of tubing of insulating material of different diameters and of continuous cross section, one series of tubing being slipped within the series next larger in diameter and breaking joints therewith, and a cementing substance between each series of tubing, also of insulating material.

454,294. Electric Arc Lamp. Samuel W. Rushmore, Brooklyn, N. Y. Filed Dec. 10, 1890.



454,155—SUBWAY FOR ELECTRIC WIRES.

454,295. Electric Arc Lamp. Samuel W. Rushmore, Brooklyn, N. Y. Filed Feb. 16, 1891.

454,313. Electric Apparatus for Treating Deafness. George F. Webb, Jefferson, Ohio. Filed April 21, 1891.

An apparatus comprising a battery, a belt, an electrode supported on the belt and contacting with a person, an electrode shaped to fit the ear, and connections between the electrodes and the battery.

454,336. Dynamo Electric Machine. Rudolph Eickemeyer, Yonkers, N. Y. Filed June 15, 1888.

454,338. Electric Telegraphic Apparatus. Samuel V. B. Essick, Brooklyn, N. Y. Filed Jan. 12, 1891.

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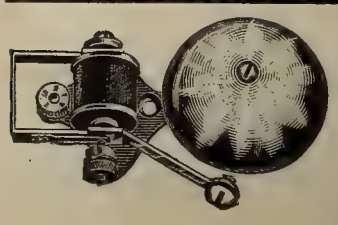
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WEEKLY.

Vol. IX. NEW YORK, JULY 4, 1891. No. 27.

ELECTRIC SECRET SERVICE SYSTEM.

At the convention of the Association of Railway Telegraph Superintendents, held at the Grand Hotel, Cincinnati, O., June 17 and 18, the Electric Secret Service Company, of 45 Broadway, New York, gave a practical exhibition of its system of Automatic Circuit-Locks and Signals, and we give below an illustration of the exhibit, made from a photograph of the same taken on the ground, representing two stations, fully equipped.

The locks shown at the convention were in the main circuit of the Chesapeake & Ohio Railway, thus affording a practical test of the value of the system under ordinary working conditions.

This system is believed by the company to embody all the essential features of a reliable, economical and thoroughly practical individual call and signal system, and it is also believed that none other can be offered to the railroad world which does not infringe the rights secured to the Electric Secret Service Company by the many patents which it controls. The company has withheld the marketing of its apparatus until it was fully protected by patents upon all improvements made, and has incurred still further delay in acquiring other patents which it was deemed advisable to own, but it now considers that it is in a position to protect its customers from all possible annoyance or molestation, and offers all necessary guarantees to that end.

The apparatus furnished by the Electric Secret Service Company consists of a multiple transmitter which can be adapted to any number of stations by extending the number of discs employed, a combination lock, or individual signal, and an automatic answer-back or return signal. These instruments may be inserted in any telegraph line without disturbing the arrangements of an office, and the amount of battery required for them is only one cell in excess of the cells used for the ordinary working of the station. The transmitter may be dispensed with if desired, and the locks worked by ordinary key. The answer-back or automatic return signal is so arranged that the operator who is called sets the signal again on shutting off the gong.

Two forms of instruments are provided, one for use on short lines where the telegraphing is only occasional, and where the variations of resistance are slight; the other for longer lines with a greater range of current variation and where the telegraphing is constant. By observing a reasonable amount of caution in this respect the locks will be found to work satisfactorily, even when a sounder will not take Morse characters.

The application of this system gives a new value to railroad telegraph lines. By its use a train dispatcher can take positive control of all stations on his circuit, when he so desires. He can communicate with any office, or display any signal, without the intervention of other operators; and, at pleasure, can send his message or signal over the line without the knowledge of any other than the operator addressed, by cutting out all intermediate stations. The transmitter or key allows the locks at the several stations to be opened and closed at will, in whatever order selected, and the automatic return-signals announce the performance of the desired work.

The same control can be exercised over signals and semaphores directly. The board or lantern can be handled from the dispatcher's or other central office, and all others than the one immediately affected will necessarily remain passive. The position of the signal will be automatically registered at the office of transmission, and no signal can be registered without having first assumed its intended position. The lock may be readily applied to the operation of a block-system, road and other grade crossings, tunnel signals, sidings, and, in short, any railway service where it is essential or desirable to perform work at a selected point without involving others upon the same circuit. It can be easily and cheaply applied to most of the existing systems of railroad signals.

At one-man stations, or others where the employès are at times called away from the telegraph table, the lock may be attached to a continuous-ringing or other gong, and notice be given whenever the station is called by day or night; thus dispensing, in many cases, with the employment of a special night-operator. As only the "combination" called will respond, no other office would be disturbed by this operation. The alarm bell may also be connected with the station signals when so desired.



EXHIBIT OF THE ELECTRIC SECRET SERVICE COMPANY'S SYSTEM AT CINCINNATI.

In the present form, as illustrated, the system is designed particularly for use as an individual operator's call ; but it can be adapted when required to the company's patented system for cutting out intervening telegraph offices, so that the train dispatcher or superintendent may communicate directly with one office without the intervention or knowledge of others in the same line. It is also the intention of the company to bring out in the course of a few weeks an adaptation of its system to calling train crews, and shortly thereafter to present a complete signaling system, wherein the combination locks are applied to home and distant signals irrespective of distance from the point of operation.

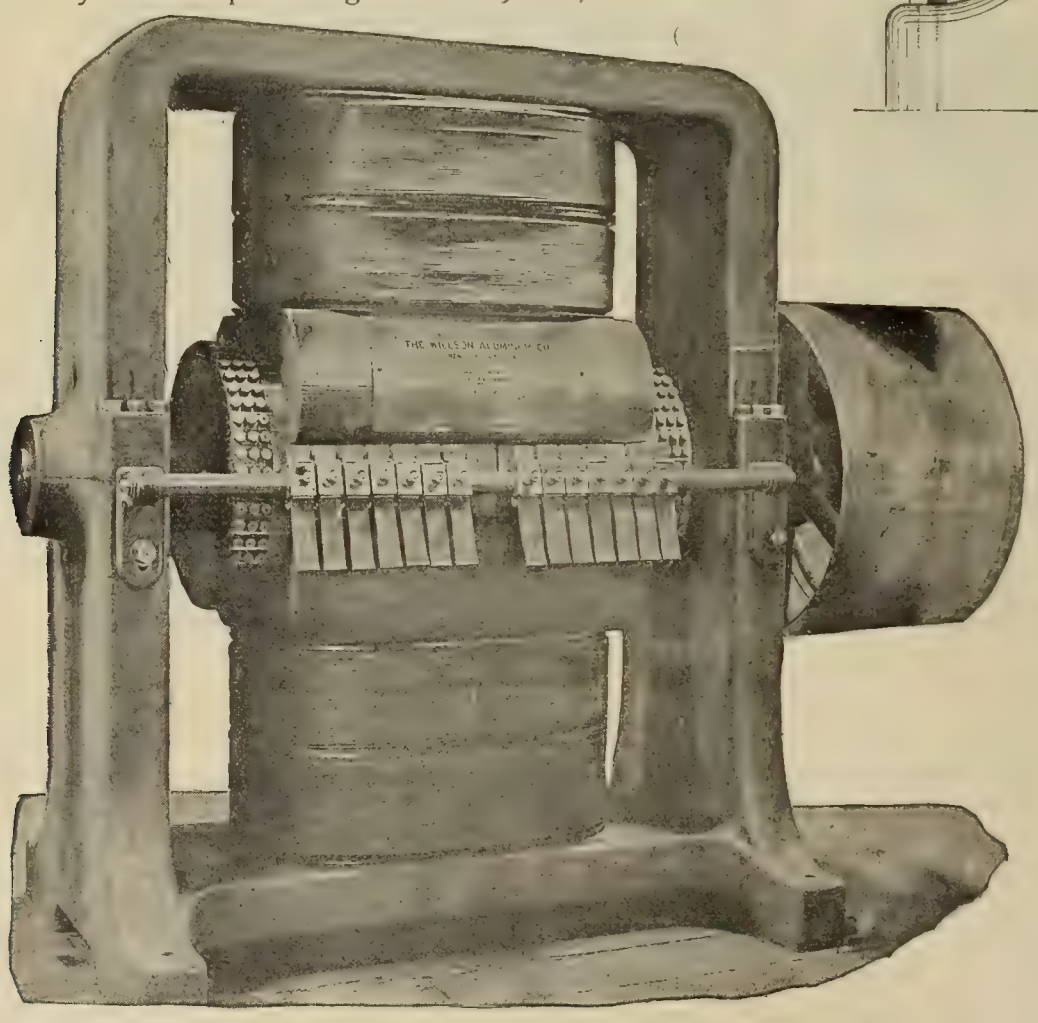
Besides the above, there are several other important uses to which the locks may be put, which will be described at another time.

The instruments now shown are covered by patents granted E. R. Gill, Jr., Adin A. Hatch, Wm. C. Moore, Geo. L. Foote and Charles J. Kintner, all of which are the property of the Electric Secret Service Company. In addition to these, other patents have been applied for covering further details of the company's operations. The company has already brought suit to defend its rights from violation in the State of Missouri and will bring other suits against any and all persons or corporations who may attempt to infringe or violate its rights in any manner elsewhere.

Mr. C. P. Mackie, the general manager of the Electric Secret Service Company, was in attendance, as were also Mr. S. S. Bogart, the general agent, and W. C. Moore, electrician, both of the same company.

A MONSTER GENERATOR OF ELECTRICITY.

In our issue of May 2 last we published an article on the subject of electricity in the production of aluminum, and at the same time gave illustrations of a large dynamo used in the works of the United States Aluminum Company, Boonton, N. J. This dynamo complete weighed over 19 tons,



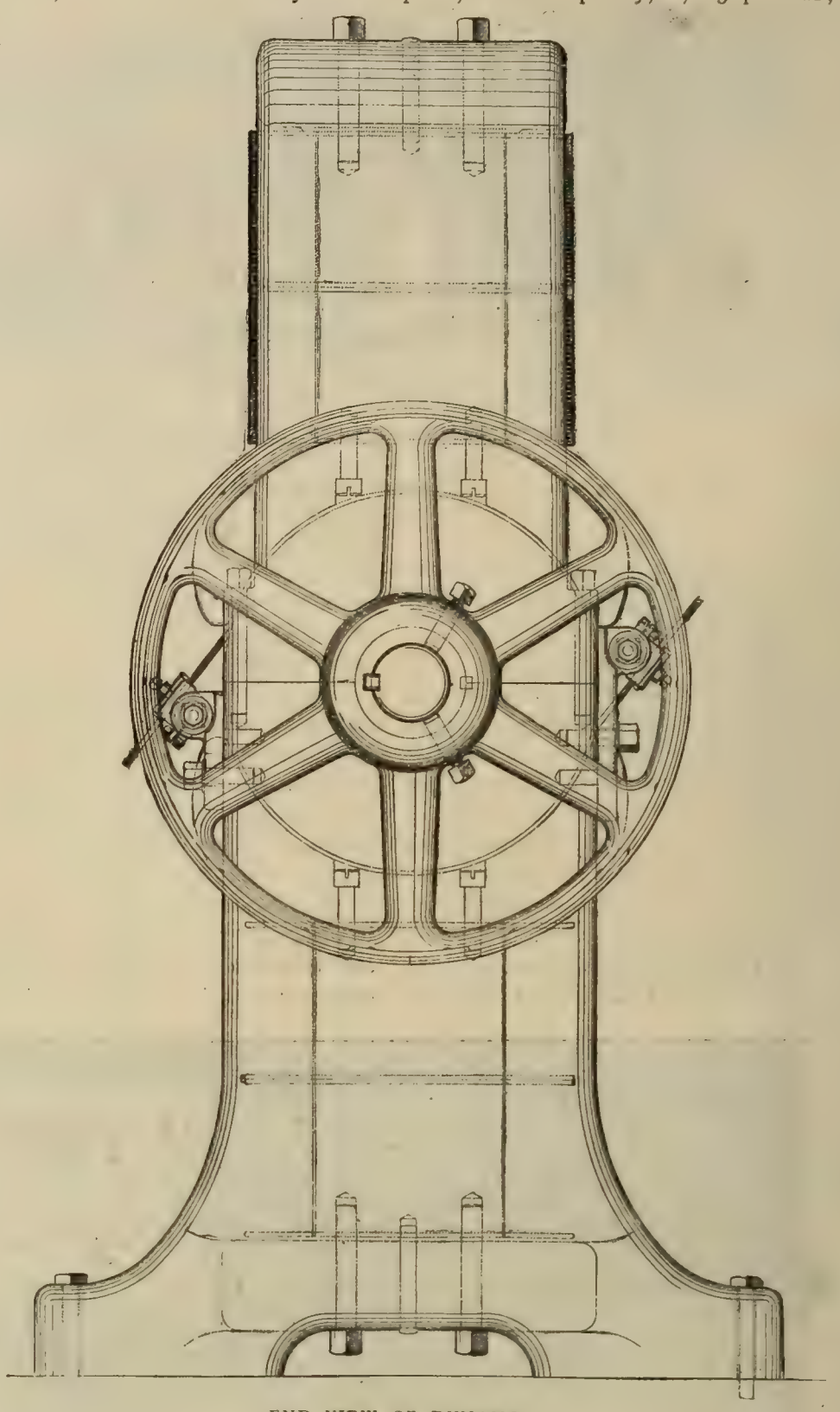
THE WILLSON DYNAMO—THE LARGEST IN THE WORLD.

and generated a current of 3,500 amperes, at 35 volts. In the same article the general details of the machine were described.

In our issue of June 6 we described a dynamo used in the production of aluminum and aluminum-bronze, at Neuhausen, Switzerland, which was said to be the largest dynamo in the world. This machine gives a current of 14,000 amperes at 30 volts.

The claim that the latter machine is the largest in the world, however, will now have to be yielded in favor of a dynamo recently constructed in Brooklyn, N. Y., by the Willson Aluminum Company, for metallurgical work, as far as the output is concerned. This machine, which has a capacity of 750,000 watts, was designed by Mr. Thomas L. Willson, the company's electrical engineer, under a patent granted to him on June 25, 1889.

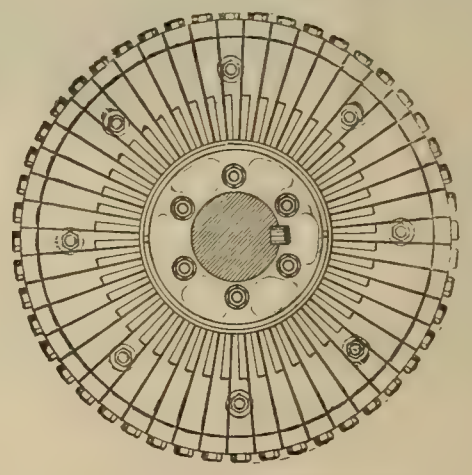
The following data pertaining to this dynamo will be of interest: Weight of armature complete, without pulley, 6,163 pounds; weight of



END VIEW OF DYNAMO.

cast-iron frame, 11,000 lbs.; weight of wrought iron used in the construction of the machine, 7,000 lbs.; weight of wire used for the field magnets, 3,380 lbs.; making the total weight of the machine, including pulley, 29,442 lbs.

One of the peculiar features of this huge dynamo is the absence of a commutator, which is usually an important part of electric machines. The currents are collected by placing the brushes directly

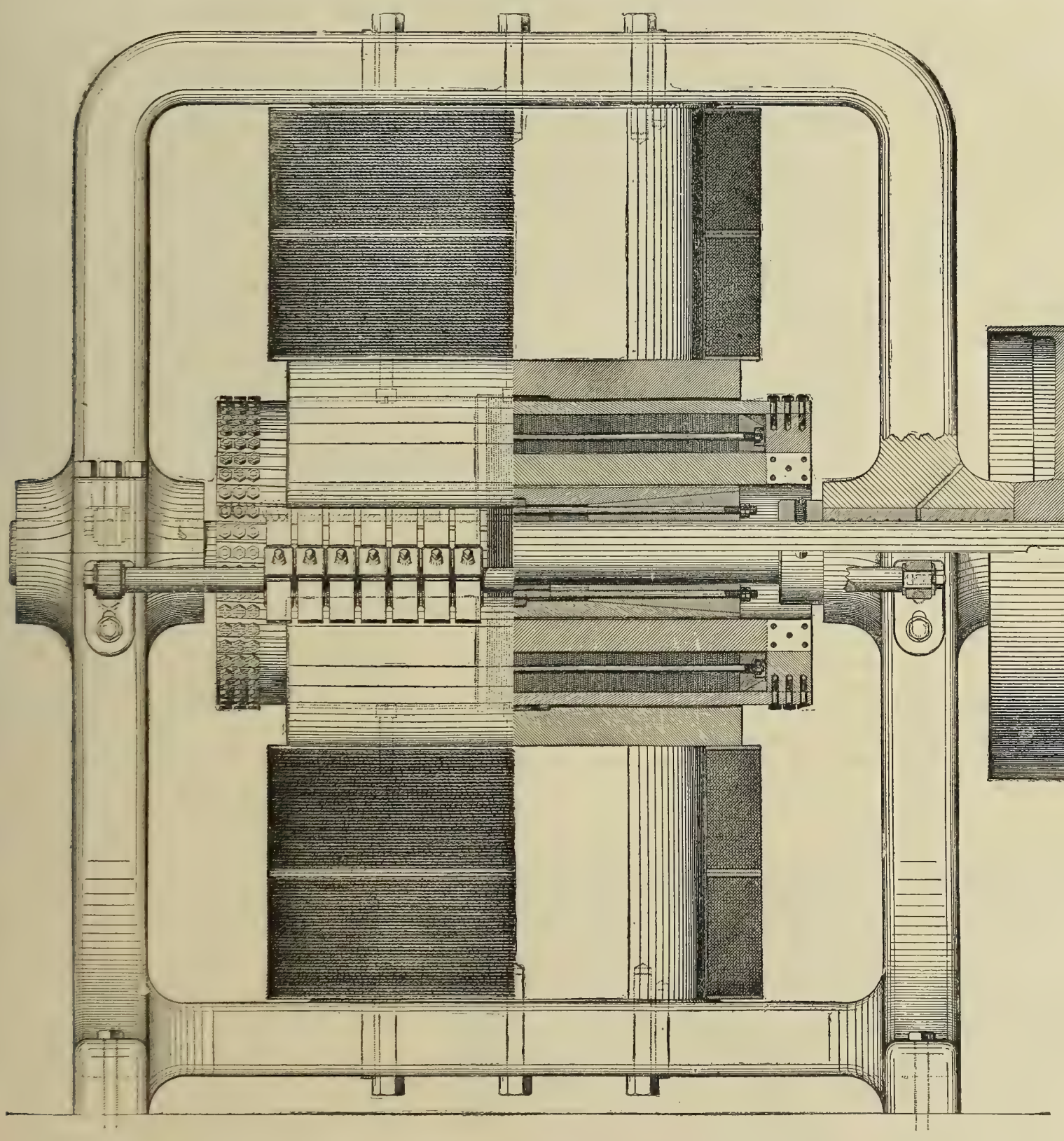


END VIEW OF ARMATURE.

upon the periphery of the armature, which is itself a commutator, being constructed of segmental bars, having an external appearance the same as an ordinary commutator. These bars are placed around a laminated iron core upon the well-known principle of the Gramme ring, to constitute a single spiral around the core. The brushes are placed between the polar gaps upon the bars not under the influence of the field magnets, and there is consequently very little electro-motive

force generated between any two bars so placed; there is also a complete elimination of sparking, which takes place in machines having more than one convolution of wire to a commutator section.

The machine in actual work at the speed of 130 revolutions a minute, generates an electro-motive force of 25 volts, the field being charged with an external current of 76 amperes at a pressure of 38 volts. Under such conditions, after running several hours, the armature did not show any marked rise in temperature due to Foucault currents, which it would naturally be supposed would be produced in bars of such width as those used upon this armature; namely, 1½ inches. The cross-section of the parallel conductors of the armature being three square inches, gives these a capacity for an enormous current. It is estimated that this machine will be run at 10,000 amperes continuously



PLAN AND SECTIONAL VIEW OF DYNAMO.

without undue heating, and at a speed of 530 revolutions a minute. The electro-motive force produced will be 100 volts and a possible total current of 1,000,000 watts. It is not expected, however, that the machine will be worked over 750,000 watts.

In the mechanical construction of this dynamo great care has been exercised in order to get the work as well done as can be performed in an ordinary machine shop not specially fitted for dynamo construction. The special tools used for the construction of the armature. shaft, and for magnet winding, were made by the Brady Manufacturing Company, of Brooklyn, N. Y. The casting of the frame, in which over 11,000 lbs. of cast-iron were used, was done by William Taylor & Sons, also of Brooklyn. This firm did all the machine work upon the frame as well as assemble the dynamo.

The application of this machine will be principally for the production of aluminum. For this purpose precipitated alumina will be used, the electricity generated by the dynamo simply performing the function of producing the decomposition of the alumina. The eliminated oxygen is carried off by reducing gas injected into the crucible at the point of liberation of the oxygen, and for this reason the process might be called an electro-mechanical one.

The officers of the Willson Aluminum Company are George F. Seward, president, 140 Broadway, New York; J. Turner Morehead, Leaksville, N.C., and Thomas L. Willson, of Brooklyn, N. Y., electrical engineer and secretary.

THE WIRE QUESTION IN ROCHESTER.

The electric wire question is receiving the consideration of the Electrical Committee of the Common Council of Rochester, N. Y. The subject of interference with the telephone service by induction from the electric railway wires was considered at the last meeting of the committee, and Mr. Barnes, the City Electrician, recommended that the telephone company construct metallic circuits to avoid the trouble. He also recommended that the telephone wires be provided with the proper fuses or cut-outs in order to prevent the admission of heavy currents into buildings, in case the telephone wires should become crossed with the electric railway or electric light wires. Representatives of the telephone company objected to the establishment of metallic circuits on the ground that the cost would be very great, and that as the dividends have never been greater than six per cent on the stock, it would be almost too great an expense for the company to undertake, without the expectation of increasing their income. The meeting, however, adjourned without taking any definite action in the matter, which, it is expected, will be settled at a subsequent meeting.

OBITUARY.

Professor William Edward Weber, the well-known electro-scientist, died in Göttingen, June 24, at the age of 87. For nearly 70 years, Prof. Weber was an ardent student of the phenomena of electricity and magnetism, and at the early age of 21 years published a work entitled "Theory of the Waves," which was well received and drew attention to him. About 1849 he and Prof. Gauss began a series of researches that resulted in the establishment of magnetic observatories in various parts of the world.

A movement is on foot in several English shipping ports, to establish electrical communication with the principal light houses along the coast.

Bursting balloons in the sky by means of electricity, to produce rain and for destructive purposes in time of war, has proved successful in recent experiments in Washington.

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HEADQUARTERS PITTSBURG CONVENTION.

A suggestion has been made that the headquarters of the delegates and visitors to the Pittsburg Convention of the American Street Railway Association be changed from the Monongahela House to the Seventh Avenue Hotel. The latter named place has a large courtyard, which could be easily roofed over, and which would make a splendid exhibition hall.

The suggestion is, certainly, a timely one, and doubly so in view of the highly unsatisfactory treatment applicants for rooms have received at the hands of the caravansary first mentioned as headquarters.

Our next number will mark a new era in electrical journalism. The first weekly street railway paper ever published will then appear as an integral part of the Electrical Age, under the title of Street Railway News. There is so much going on in the street railway world that nothing short of a regular weekly publication devoted exclusively to these interests can do the subject proper justice, and the Electrical Age with its customary enterprise has, at very great expense, prepared to enter the field and produce a journal for street railway people that will be at once reliable and progressive. We have already received much encouragement in our undertaking from every quarter, and we desire to firmly impress upon the minds of our street railway friends that the Street Railway News will be their paper and will put forth its best energy in their behalf. The Electrical Age will, of course, continue to look after the interests of the electrical fraternity in every direction, and no pains nor expense will be spared to present to our readers the latest and best of everything in every department covered by the Electrical Age and the Street Railway News.

We publish on another page in this issue an interesting article on the blackening of incandescent lamp bulbs. This, with the abstract of a paper read by Mr. Wm. J. Hammer before the Franklin Experimental Club, Newark, N. J., on June 2, published in our issue of June 13, makes interesting reading, and the thought very naturally forces itself upon the reader that there is room for great improvement in the manufacture of incandescent lamps. A poor incandescent light is about as unsatisfactory as a candle light, and yet how many dimmed bulbs are seen everywhere. It is detrimental to electric lighting interests to allow these impaired lamps to be used. Consumers are quick to notice what is usually termed "poor light," and are apt to charge the deficiency to the system in general. The public does not care whether the poor light is caused by a blackened lamp or insufficient current; all that concerns it is that it pays for a certain amount of light and it does not get it; public faith in the efficiency of electric lighting is, therefore, liable to be shaken on account of blackened lamps. As to the cause of the blackening, opinions differ; but all are agreed that it is injurious to the electric light business to use imperfect lamps. On the other hand, lamp renewals is a very large item in the expense account of electric light companies, and how to keep the figures down to the lowest mark is a problem extremely difficult to solve. Improvements are constantly being made in the manufacture of lamps, and they maintain their efficiency a much longer period than formerly. Indeed, there are on the market lamps of certain makes that seem to be entirely free from blackening, and at the same time their rated life is very high. We have seen some of these lamps quite recently that have been in use since the 1st of last February, and their brilliancy was not in the least impaired. Their life has also exceeded that of lamps of more prominent makes, and altogether they are a decided improvement on the average incandescent lamp. Users of these lamps speak of them very favorably, and there is no doubt that if one manufacturing concern can produce lamps that will not blacken, all others will some day solve the problem in their own way.

One of the grandest sights in New York will be witnessed at the *World* Building on the night of July 4. That grand structure, in which the offices of the Electrical Age are located, will be magnificently illuminated on this patriotic occasion, and no less than $50,000 will be spent for this purpose and fireworks. It is a big building to illuminate and it will be a grand sight.

In a little more than two months from this time the next convention of the National Electric Light Association will be held in Montreal, and it is certain to be the most successful meeting ever held by that association. The people of Montreal are stirred up to the very bottom of their hearts with enthusiasm, and the members of the association will receive a welcome that they will never forget. We wonder if the majority of the members appreciate or have any idea of what is being done by the Montreal people with a view to making the meeting a grand success? Representative citizens are putting forth every effort with that end in view, and they are prompted entirely by unselfish motives. Their main object is to give the visitors a rousing welcome and make them feel that Canadians are not foreigners to them. The meetings will likely result in giving a healthy stimulus to the electrical trade between the two countries. The exhibits will surpass everything ever before attempted in that direction, and there naturally will be a great awakening and development of interest on the part of our neighbors in electrical matters. Recent reports from Montreal state that already 14,000 feet of space has been applied for there. This does not, of course, include what is asked for at this end of the line. The exhibition feature of the convention will be a great triumph, and we trust an unlimited amount of good will result to both peoples interested. We refer our readers to a letter on this general subject, which will be found on another page of this paper. Some idea of the importance of the Montreal convention may be gained from this letter.

In this issue we add two or more articles on aluminum to the many published in these columns. The plant of the Pittsburg Reduction Company, which we illustrate and describe will be interesting from several points of view, while the discussion of aluminum from a chemical standpoint will add to the interest. There is considerable dispute as to whether the metal is reduced by electrolytic action or by the intense heat of the electric arc, or both; perhaps a comparison of the two articles will enable our readers to form some idea of the truth. As aluminum and oxygen when separated collect at different odes it looks like electrolytic action, but when it is seen that the metal settles on the electrode beneath it, the laws of gravitation raise doubts. A series of questions arises at once still further puzzling to anyone attempting to solve the question. At a high temperature the attraction of carbon for oxygen is very powerful, but why does not the oxygen collect at the carbon negative pole instead of combining with the carbon that accumulates at the positive pole? Is there any carbon at the positive pole, and if so where does it go after the oxygen combines with it? Carbonic Anhydride (CO_2) is heavier than air and also non-inflammable, whence then can it go? If it is simply intensely heated carbon that separates the oxygen from the alumina, why will not an arc light in close proximity but without immediate contact do the same? Has it ever been tried? As our readers will see, one question leads to another, and in some cases the question will be found very antithetic. We would like to see this solved. Who will do it? The rapid development in the process of reduction has drawn general attention to this metal, and those who can settle the disputed point will know the best method of reduction, possibly a better one than any known now.

The friends of Mr. Theodore Larbig, a well-known New York electrician, will be pained to learn of his sudden death in Brooklyn, June 27. He was shot and killed by D. J. Meserole during an altercation.

The Telegraph Edition of the Electrical Age has received the indorsement of the Train Dispatcher's Association as their official organ, and hereafter a portion of each issue will be devoted to their affairs. This will make the Telegraph Edition very interesting and valuable to train dispatchers, railway superintendents, etc.

BIOGRAPHICAL SKETCHES.

R. J. SHEEHY AND HIS INVENTIONS.

(*Continued from Page 389.*)

Mr. Rowley discovered, very much to his surprise, that he could receive a respectable shock from this machine by touching the brushes while it was running. In the old form of machines he was in the habit of touching the brushes to see how nice they ran. When he tried this with the new machine he was found by Mr. Sheehy sitting on a pile of coal with his friend looking on in wonder.

The five or six lights fed by this dynamo being inadequate, it was decided to use a No. 7 machine having a capacity of 16 arc lamps, but the artists, among whom was Clara Louise Kellogg, protested, saying they would not appear under them.

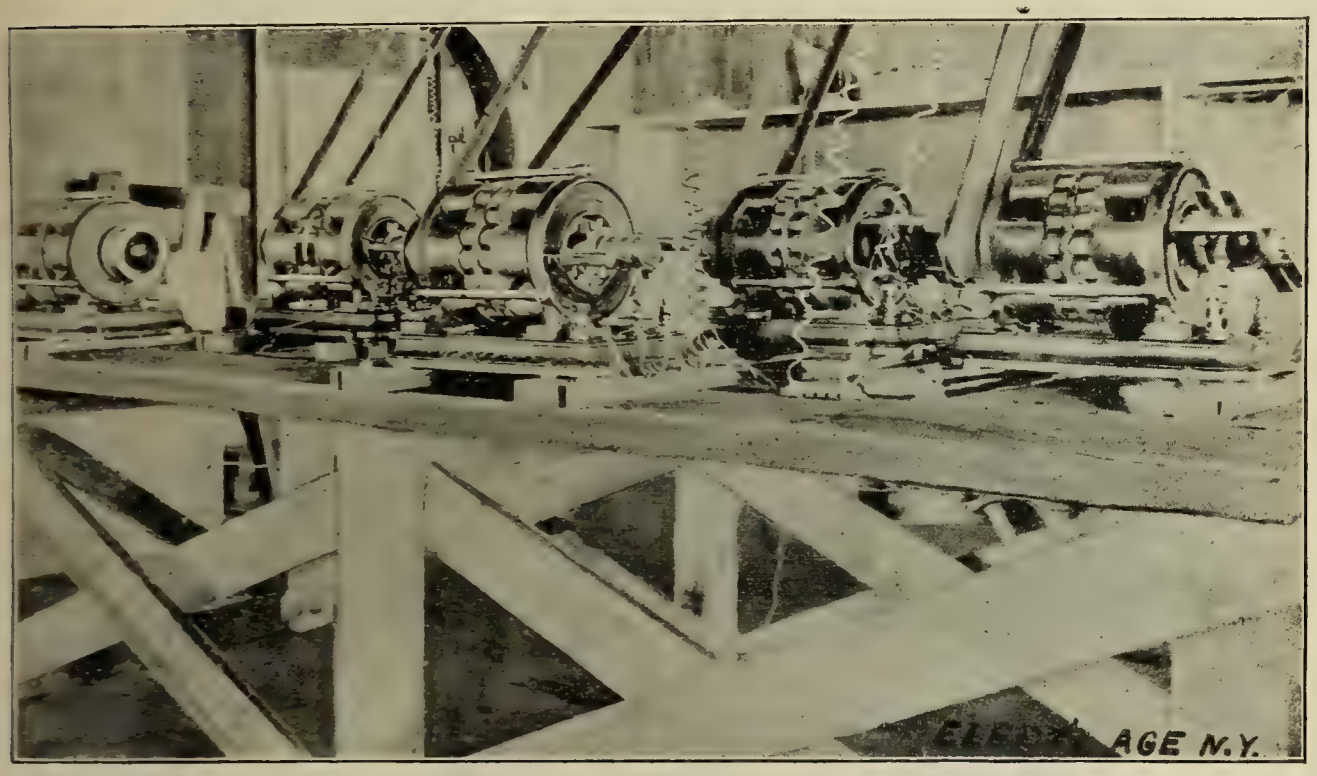
They afterwards lighted the hall satisfactorily during a dog show. The dogs made considerable noise, but the Brush people could never find out if it was as a protest or not.

A six arc light plant placed in the clothing house of Freeland, Loomis & Co., of Boston, proved very satisfactory; but an 18 lamp machine nstalled in the Merrimac Mills, Lowell, Mass., was not accepted, the mill people thinking the outlay would be too much to light the whole establishment by electricity. They then put a plant into the Willimantic Linen Company's mills at Willimantic, Conn., and one in the Conant Thread Company, of Pawtucket, R. I., both giving good satisfaction.

The plant which was most beneficial to the Brush system, establishing its practicability and economy, was that installed in the Riverside Worsted Mills, of Providence, R. I., an establishment making a special grade of cloth of dark colors. The mills ran day and night for several years, with an annual gas bill of $20,000, but the quality of light was such that the goods made at night could not be kept up to the standard of those made during the day. The arc lamps proved so satisfactory that they increased the size of the first installation until they had over 70 arc lamps in the mills. They informed the Brush people that with this system the yearly expense was $6,700, including power, labor and interest, as against $20,000 for gas, and that they turned out 15 per cent. more goods at night with an increase of over 10 per cent. in quality, bringing the work done at night up to the day standard. To the many inquiries concerning the use of the electric light, received from all over the country, this enterprising firm returned prompt answers, giving the system the highest indorsements.

This establishment, as far as Mr. Sheehy could judge, was of all places the very best that could have been selected in this country to demonstrate the practicability of electric arc lighting, and he considers that to it is due much of the rapid success of the Brush company, and the very general recognition by manufacturers throughout the country of the advantages of electric lighting in general.

In the summer of 1879, Mr. Sheehy placed a six light machine at Nantasket Beach to light the grounds of the Nantasket Beach Hotel. To show what the light was capable of doing, he placed a lamp with an ordinary locomotive reflector on the top of the hotel, so arranged as to throw a light in any direction desired. Mr. Sheehy threw the light on a steamer coming through the channel from Boston to the beach, producing such clear, sharp lines that a shadow was reflected on the beach that could be seen by the passengers on the boat. The captain afterwards told Mr. Sheehy that the lamps made it appear as if he was about to run down another steamer, compelling him to stop his boat to investigate. He was somewhat surprised to find it to be the shadow of his own boat. People went to the beach by the thousands to see this sight. The light was death to lovers' retreats along the beach, making public many awkward positions of too demonstrative lovers.



DIRECT AND ALTERNATING CURRENT MACHINES IN LABORATORY OF R. J. SHEEHY FOR EXPERIMENTAL WORK.

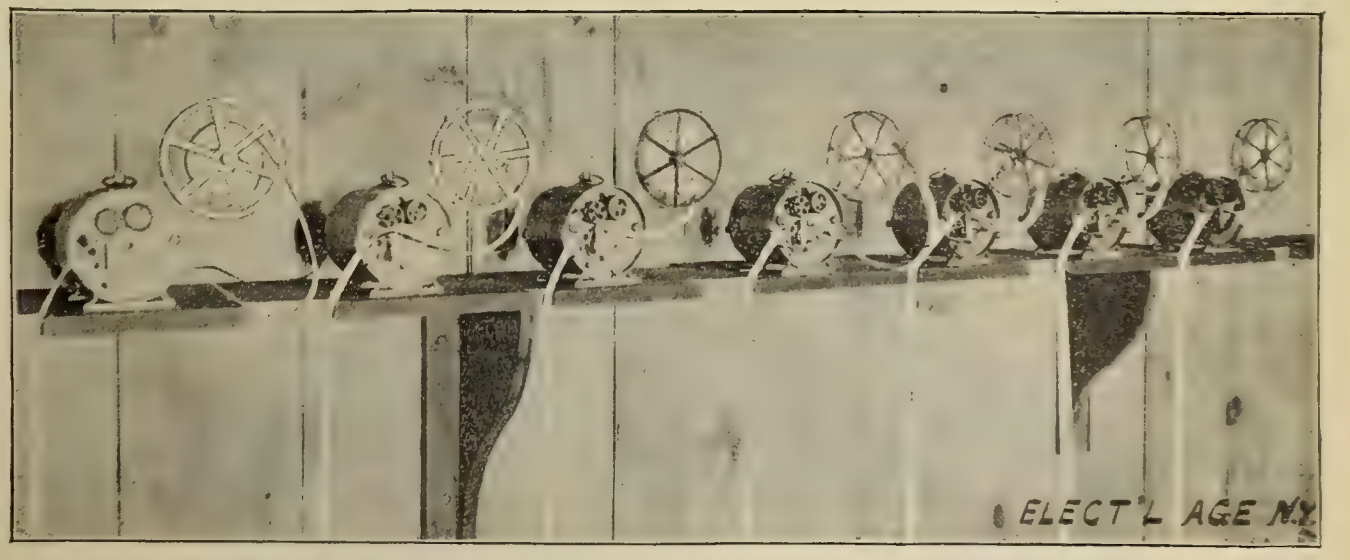
In the spring of 1879, the New England agents formed a company known as the Brush Electric Light Company of New England, and shortly after acquired the agency for the New York and Philadelphia territories. Mr. Montgomery going to Europe as the agent of the Home Company, the New England Company remained under the management of Mr. Rowley.

In the Fall of 1879, an office was established in New York. The first arc plant was placed in Mr. A. D. Julliard's store and afterward with Dunham, Bulkley & Co., and Bates, Reed & Cooley. At this time Mr. Sheehy brought to Mr. Julliard's attention the idea of forming a company in New York, and the latter gentleman thought so well of it that he brought a number of gentlemen together for that purpose, but the scheme fell through.

In April and May, 1880, Mr. Sheehy was engaged in arranging an electrical plant on the steamer "Massachusetts" and in testing electric search lights for sea-going purposes. Various kinds of reflectors were tried, but it was found that the light interfered with the pilots of the boats going in the opposite direction. Buoys and other objects could be easily picked out on dark nights, but it was found fog diffused the light so as to make it useless from the standpoint of a search light. Among the many passengers making numerous trips on the boat while the tests were being made was Mr. Pain, of the house of Harding, Colby & Co., of Boston and New York. This gentleman afterwards joined Mr. Julliard in forming the present Brush Company, of this city.

Mr. Sheehy was the founder of all the companies organized in his territory, with but one or two exceptions, bringing the gentlemen that formed the different companies together. He developed the Brush business in the East.

Mr. Sheehy severed his connection in the East in 1882, taking the agency for the Southern territory. He first established a local company at Norfolk, Va., and then aided Mr. A. A. Hayes in the establishment of the Washington (D. C.) Company. In Washington he made an exhibit of tower lighting, placing lights on the Washington Monument, 555 feet high; around the base of the Goddess of Liberty on the dome of the Capitol, 380 feet above ground, and on the tower of the Smithsonian Institute, 150 feet high. Various kinds of reflectors were tried, and he succeeded in flooding the avenues with light to such an extent that it became trying to the eyes. People living in Alexandria, Va., six miles distant, said they could read papers by the light. As the question for lighting the city was under advisement, Mr. Sheehy suspended operations for a time, but at the request of the government he resumed again. In the meantime the dome of the capitol had been painted white, and when the current was again turned on the intensity of the electric lights reflected from the new paint attracted insects from far and near with detrimental effect upon the neat appearance of the dome. A fresh coat of paint was applied, but the insects stuck to the pigment wherever they came in contact with it, necessitating a third coat



EQUITABLE MANUFACTURING AND ELECTRICAL COMPANY'S PRINTING INSTRUMENTS.

In 1885, Mr. Sheehy returned to the business he had started in Boston in 1876 and 1877, experimenting in telegraphic apparatus. He improved and devised apparatus of various kinds until he successfully invented and patented printing instruments for local and long distance ex-

change purposes; printers for private lines, printers for quotation and general news service, a multiplex system, autograph or copying telegraph instruments; also synchronizing systems for trunk line service between large business centres. The principles employed in these instruments differ from those used heretofore. Alternating current electro motors and others of peculiar construction, invented by Mr. Sheehy, are substituted for the old methods of driving the apparatus; in fact, the motors are in reality the instruments. This feature simplifies the construction and increases the speed of their working very materially. Finally, Mr. Sheehy has combined them all into one general telegraphic system, for both local and long distance purposes.

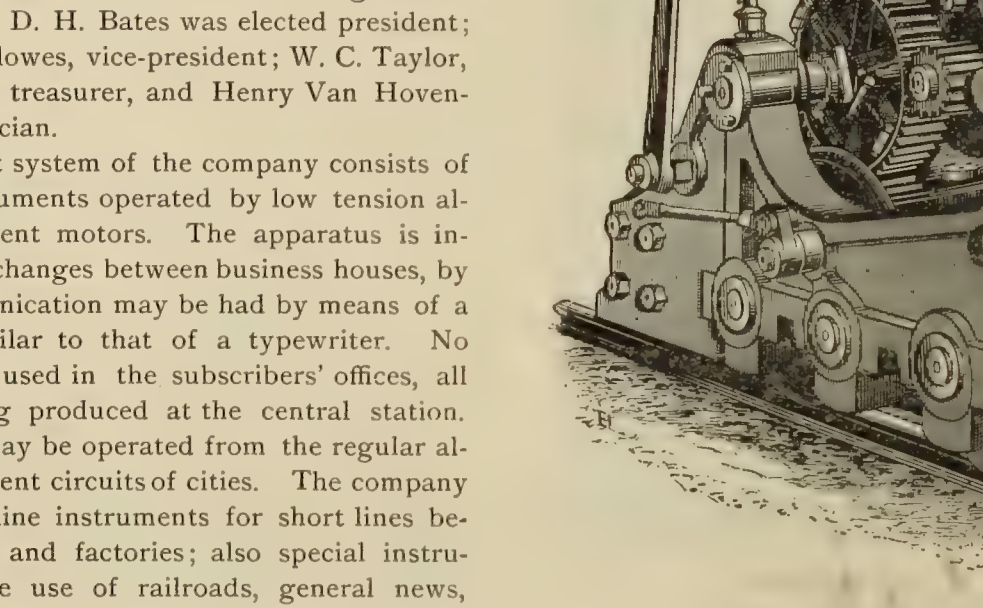
In 1890, he organized the Equitable Manufacturing and Electrical Company, now of 44 Broadway, New York. The original officers were: Mr. Cornelius Fellowes, president; J. H. Bradford, vice-president, and Walter C. Taylor, secretary and treasurer. At the last meeting of the directors, Mr. D. H. Bates was elected president; Cornelius Fellowes, vice-president; W. C. Taylor, secretary and treasurer, and Henry Van Hovenburgh, electrician.

The present system of the company consists of printing instruments operated by low tension alternating current motors. The apparatus is intended for exchanges between business houses, by which communication may be had by means of a keyboard similar to that of a typewriter. No batteries are used in the subscribers' offices, all currents being produced at the central station. The motors may be operated from the regular alternating current circuits of cities. The company have private line instruments for short lines between offices and factories; also special instruments for the use of railroads, general news, stock quotations, and instruments for attachment to telephone lines by which a record is made in the place of the usual verbal message. It is claimed that the long distance telegraph system will double the present capacity of telegraph wires between large business centres.

The Equitable offices at 44 Broadway are now fitted up with a complete outfit.

ELECTRIC LOCOMOTIVES FOR MINES, MILL TRAMWAYS, ETC.

Within the past few years the Edison General Electric Company has so improved its dynamos and mining locomotives, as to reduce the operating expenses to a very low figure compared with the older methods. At first the main items of expense were due to a more or less frequent



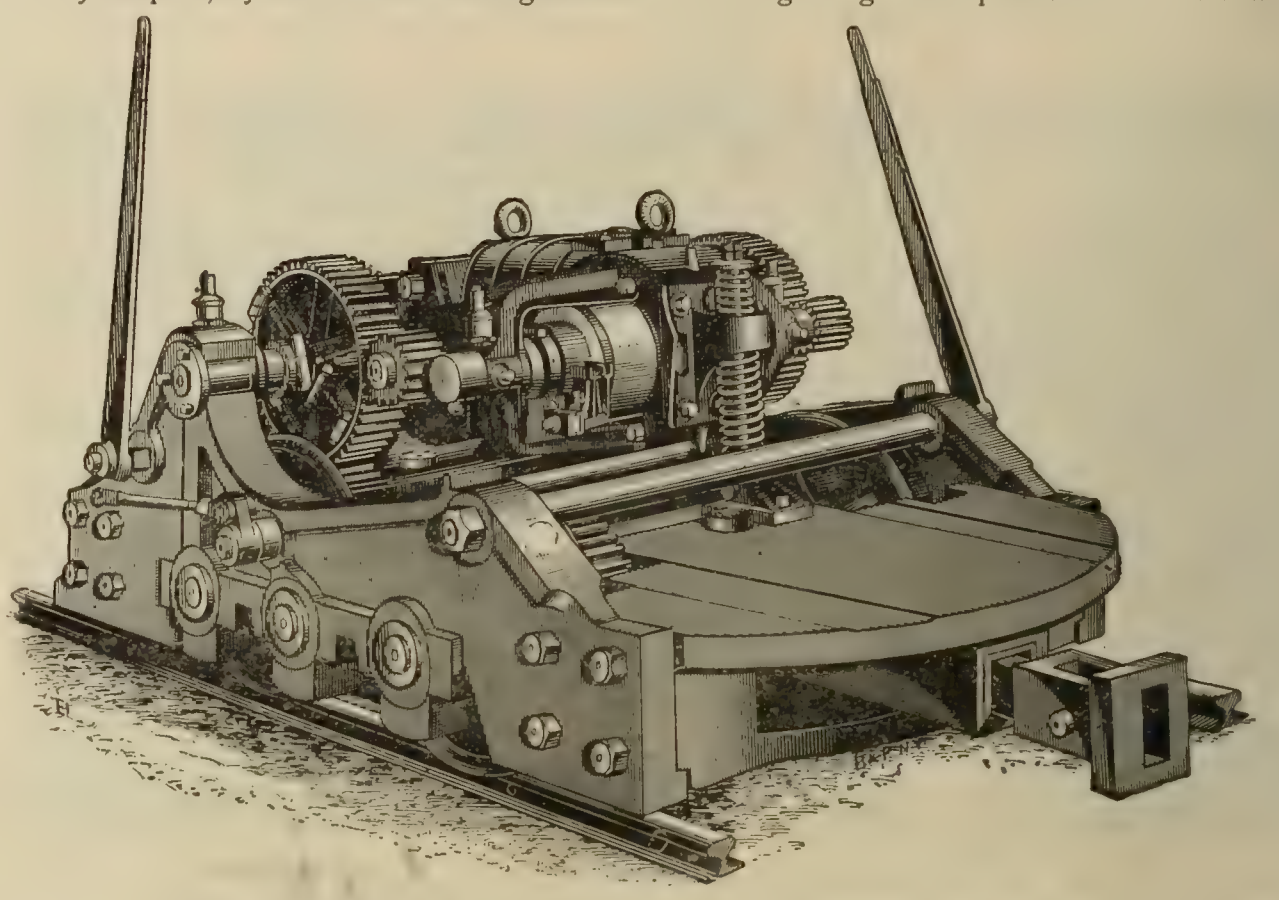
EDISON GENERAL ELECTRIC COMPANY'S 9 KILO-WATTS MINING LOCOMOTIVE.

burning out of the armatures from causes little understood at the time, and the excessive wear on the brushes and commutators, due to the use of copper brushes.

Armatures will still burn out occasionally, though it is now a rare occurrence with the Edison machinery. In fact, a burnout seldom occurs except from carrying excessive loads, or through the grossest carelessness. The danger from these causes is diminished by the use of the improved safety devices furnished by this company.

The second item of expense, viz.: rapid wear of brushes and commutators, has been much reduced by the substitution of carbon brushes, which are much cheaper and last several times as long as those of copper.

For mines in which a large amount of switching has to be done, the Edison Locomotive is peculiarly adapted, by reason of the arrangement



EDISON GENERAL ELECTRIC COMPANY'S 15 H. P. ELECTRIC LOCOMOTIVE.

of the controlling devices placed upon the machine itself, whereby the operator can at all times keep one hand on the regulating lever, which is at the same time the reversing lever, and the other hand on the brake, thus enabling him to do quick work in emergencies, or when switching, or taking a side track.

The Edison General Electric Company make a 9 kilo-watt, 1¾ ton locomotive, especially for use in mills and in mines on very small veins; the dimensions of the locomotive and power developed being such as especially to adapt it to such purposes.

In its construction, care has been taken to distribute the weight so that all four wheels will bear evenly, a feature which insures a maximum traction where both axles are driven from the same motor, and which otherwise contributes to the perfection and economy of the machine.

The motor itself is well protected by a metal housing so arranged as to give ready access to the commutator and brushes by the simple lifting of a slide; and by removing four bolts and raising the main cover, the whole motor is exposed to view and its various parts are thrown open to inspection.

The power is transmitted from the motor to both axles by means of spur gears only, the pinion of the armature shaft gearing with a wheel on a counter shaft, central between the two axles and directly beneath the motor. From another wheel on this counter shaft the power is transmitted direct to the car axles. This simple arrangement permits of the fewest possible moving parts, and insures maximum efficiency in the transmission of the energy of the motor to the car wheels.

All the gearing is well protected from dirt and possible accident by the cast iron frame of the locomotive; and by attaching all the bearings rigidly to the frame, the possibility of the different shafts and axles getting out of true with each other is entirely removed.

The total weight of this compact little locomotive is only 3,500 pounds; and as before stated, although it has a gauge of but 18 inches and stands only 31 inches above the rail, it develops 10 horse-power.

The 11 kilo-watt, 3 ton locomotive, is a somewhat larger and more powerful machine, adapted to cases where there is more room, and where heavier work is required.

Like the first its design is very strong and compact; but the frame, instead of being cast in one piece, consists of several bolted together in a most substantial manner. The housing for the motor and gearing is of wood.

On the smaller machines of this type a 15 horse-power motor is used, one end of which is hung to a support on the frame, and the other flexibly suspended after the regular manner found so efficient in street railway practice. In this, as in the 10 horse-power locomotive, the motor is connected to both axles by direct gearing.

The locomotive has a seat at either end for the engineer, within easy reach of the lever of a powerful hand-brake, and a switch of the regulation street railway type, the latter having one lever by which the motor is brought to a standstill, started up or reversed, and the speed regulated according to requirements.

The cut of this locomotive shows it with the housing removed.

It can be adapted to any gauge greater than 30 inches.

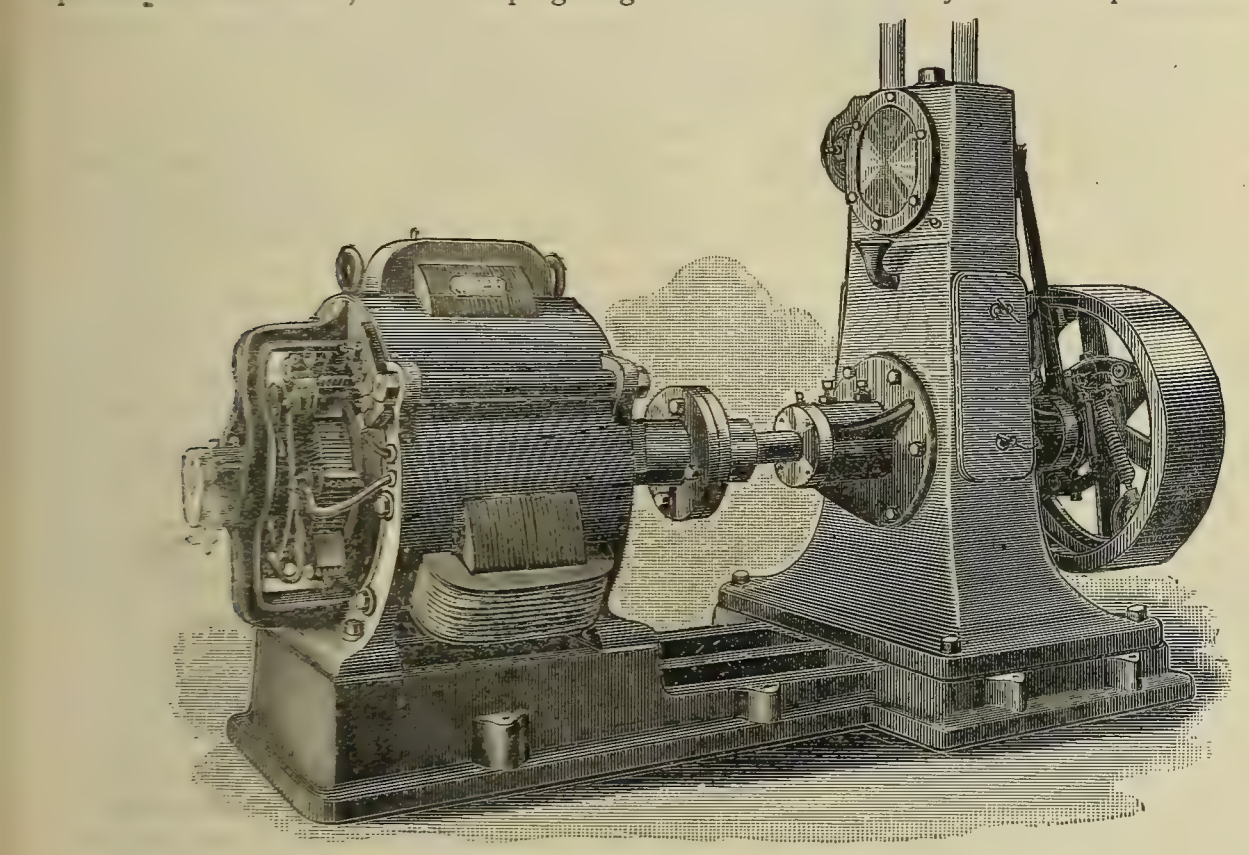
The 30 kilo-watt, 5 ton locomotive is similar to the above in general design, appearance and gauge.

The 70 kilo-watt, 9 ton locomotive has a capacity of 400 mile tons per hour and is by far the

largest mine locomotive at present on the market. It weighs about nine tons complete, and is capable of hauling a train of 120 tons in weight at a speed of eight miles per hour on a level.

LIGHT PLANT ON THE YACHT "ROMOLA."

We illustrated in a recent issue a high speed Case bracket engine, placed on the wall and belted to a low speed Perret dynamo on the floor beneath, the pulleys of engine and dynamo being large and of about the same diameter, showing an admirable way of economizing floor space. In this issue we show a Case pedestal engine coupled to the armature shaft of a Perret 85-light dynamo for use in places where head room as well as floor space is a consideration, such as ship-lighting.



PERRET DYNAMO AND CASE ENGINE ON YACHT "ROMOLA."

The engraving is taken from a photograph of a plant recently placed in the yacht "Romola," belonging to Mr. Pulitzer, proprietor of the New York *World*.

The dynamo and engine are placed on a heavy shelf in one side of the engine-room and supply light throughout the yacht, which is 170 feet long, and also current to a storage battery used for lighting when the engine is not running. The speed of the combination is 585 revolutions per minute and everything is in such perfect balance that there is practically no vibration. The dynamo is, of course, waterproof and has the Perret patent self-adjusting brushes.

The plant was constructed and installed by the Elektron Manufacturing Company, 79 Washington street, Brooklyn, N. Y.

THE BLACKENING OF INCANDESCENT LAMPS.

Probably every lamp manufacturer is familiar, says Leigh S. Powell, in the London *Electrical Review*, with the fact that lamps made with filaments which have been "baked" at a comparatively low temperature, blacken very readily indeed, whilst when made with others which have been raised to a very high temperature, they resist the tendency very much more effectually. Further, that the same results occur in lamps when low or high temperature flashing has been employed. He is also very familiar with the effect of different temperatures on the hardness of the resulting carbon. If then the vaporation of pure carbon be the true explanation of the darkening of lamp bulbs, it follows that the difference in degree must arise solely from the circumstance that a comparatively loose condition of the carbon is especially favorable to the formation of carbon vapor. But the production of carbon at a low temperature would also be especially favorable to blackening, if the hydro-carbon view is the correct one. The writer can well remember when attending Dr. Frankland's lectures on chemistry, being impressed by that gentleman's assertion that to produce pure carbon by any of the usual methods is almost an impossibility, and that to free it from the ever present combined hydrogen it is necessary to heat it in chlorine gas for days. That all hydro-carbon compounds are eliminated from the filaments in ordinary use is, therefore, extremely doubtful. In further support of the view that the presence of hydrogen may exert an influence in the feature of blackening, the fact may be cited that filaments of carbon baked at a low temperature become materially harder in process of running lamps made with them, and yet the rate of blackening, instead of diminishing, seems to proceed at an accelerating rate. It would be most interesting if those who have the opportunity would collect and thoroughly examine the composition of the deposit which collects on lamp bulbs, and thus throw valuable light on this interesting subject, and in addition, direct the steps of the pioneering lamp manufacturer into a track which is likely to lead to a material decrease in this unfortunate property of lamps. To carry out the work satisfactorily, it would be necessary to examine the deposit obtained from lamps from various sources, and then, should it prove to be other than pure carbon, to further ascertain, if possible, the treatment the respective filaments have been subjected to. The latter undertaking would, probably, be the more difficult of the two, considering the commercial interests at stake. It may be mentioned that the obscuring film is readily removed from the glass by means of a little warm caustic soda solution. Also the fact that the film is a sufficiently good conductor of electricity, even when faint, to become coated with copper when a piece of the glass is made the cathode in a copper plating bath. It is possibly due to this fact that an incandescent lamp acts as such an excellent condenser.

It is interesting to speculate as to how the obscuring matter, whatever it may be, finds its way from the filament to the glass. It is conceivable that there may be three methods by which the transfer can be effected: Firstly, by the direct formation of a vapor, as in the case of the vaporation and sublimation of arsenic; secondly, by the solution to saturation of the matter in the residual gas and subsequent precipitation therefrom on the neighboring cold surface, as instanced by the solution of water in warm air and its re-appearance on a window or other cool surface; thirdly, by the mechanical emission of solid particles. From a consideration of specimens of blackened lamps, it is difficult to determine which of these methods is the true one, or whether two or more methods combine to effect the transfer, because, in vacuo the conditions of matter are so materially altered in so many essential details from those with which we are ordinarily familiar that arguing by analogy becomes impossible. But whether the transfer is effected by gaseous or solid particles, we may note certain very significant effects. The sharply defined uninterrupted circular line of slightly tinted glass, so distinctly visible by daylight in every well blackened lamp whose Ω-shaped filament is perfectly symmetrical, tells a peculiarly interesting tale. There can be no doubt that this half-colored line is caused by the limb of the filament nearest the glass acting as a screen to the emissions of the more distant one. In other words, the projected particles of only one of the limbs can strike against the light colored strip, because just there the further one is hidden, whereas in every other part of the bulb they can, and do, strike from both limbs, and consequently at all these other parts the glass is colored to twice the depth of the screened portion. Another notable effect is that of the patchy, unequal blackening which occurs in the bulb of a lamp whose filament develops a bright spot, the glass in the neighborhood of the spot being the darkest part. The same thing happens when the filament is bent so as to stand appreciably out of the centre of the bulb. From these observations it is perfectly clear that the matter, whether in the form of vapor or solid, is in the radiant condition, and that there is no turning of corners for it. The particles fly direct from the filament to the glass and there adhere to it and to one another as firmly as do the particles of copper on the cathode of an electro-plating arrangement; and further, they appear to follow the same law as light, in its property to decrease in intensity with the distance from the issuing point. It naturally follows from this consideration that for a given size of filament the larger the bulb the less the amount of blackening, other considerations remaining the same.

As regards the remarkably coherent black film, it may be remarked that if it is built up by the accumulation of countless *solid particles* it would entail that carbon is possessed of far more of the soft, doughy property of lead or wax than one is apt to attribute to it. The principal causes assisting to bring about the cohesion, assuming this view to be correct, are, no doubt, the probable enormous velocity with which the particles travel, and the freedom from any foreign matter acting to interfere with the intimate contact of such particles as they collect.

Referring to the economic length of run that a lamp should have, it seems to the writer that any particular number of hours arrived at by calculation, can only hold good in a general sense, for the reason that lamps *do not* all blacken equally in the same time. Probably the actual run that lamps will have, in private houses at any rate, will be determined by the inconvenience experienced from an insufficiency of light rather than by any other consideration.

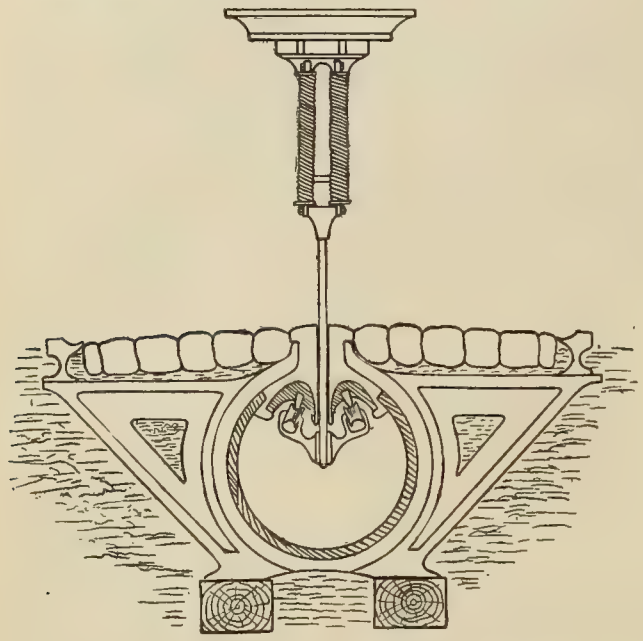
The Minneapolis Electric Light and Power Company, a few days ago filed articles of incorporation. The capital is $750,000 and the incorators are Chas. H. Prior, James W. Griffin, William D. Hale, Edward S. Corser, Moses D. Hayes and Alexander Robertson.

There will probably be an electric light plant at Scotland Neck, N. C., in the near future.

Mr. Fred E. Degenhardt, Western representative of the Standard Underground and Cable Company, Chicago, Ill., was in town this week on a flying business trip.

ERICKSON'S IMPROVED CONDUIT SYSTEM.

Electricity as the motive for street car traffic has been talked about and discussed from every possible standpoint, and it is still the subject of very earnest consideration on the part of capitalists and others interested. There are now many established concerns possessing well-regulated systems of electric propulsion, and these systems are giving much success. They are, moreover,



ERICKSON'S IMPROVED CONDUIT SYSTEM.

all overhead trolley systems, and in all cases the trolley wires are exposed, which fact the public are inclined to regard with many misgivings.

Mr. Erickson, of the Edison Illuminating Company, of New York, has for some time carefully watched progress in this direction and has noted the fact that in many cities the feeling against the erection of overhead trolley wires is great. He came to the conclusion that because one part of the system was inefficient, the whole principle of electric tramways should not be abolished. With a view, therefore, of rendering it possible to operate an electric system on street car lines and at the same time be free from the objections urged against trolley lines, he has invented a system by which both conductors may be underground. He is prepared to meet any argument concerning its perfect safety and cheapness, even to compete with the trolley overhead system in the latter virtue.

The conduit is made of wrought and cast iron, and in such parts that its construction is comparatively simple and the wear or breakage of any one part, does not necessitate the introduction of an entire new section. The conductors are moulded in an improved fire and moisture proof insulating material, which holds them securely on every inch of the conduit. The sides of the aperture for the passage of the trolley arm are extended far down into the conduit, so as to insure freedom from grounds and short circuits of the conductors.

Allowance is made for the proper drainage as in the cable systems. The moisture collecting on the sides of the conduit causes no damage, as it cannot get at the conductors as arranged in the insulation.

No doubt the day is not far distant when street railway committees of municipalities will offer no objections to the introduction of electricity as power on street railways for more rapid transit, and this invention is of the class that will hasten the coming of that day.

The power station and engine room of the Seashore Electric Railroad Company, Asbury Park, N. J., was destroyed by fire, June 18. The station was equipped with sixteen of the latest improved dynamos and eight engines. Efforts will be made to rebuild the plant at once, but it is thought the company will be obliged to operate its road by some other method during the tourist season.

THE FUTURE OF THE ALUMINUM PROBLEM FROM A CHEMICAL STANDPOINT.

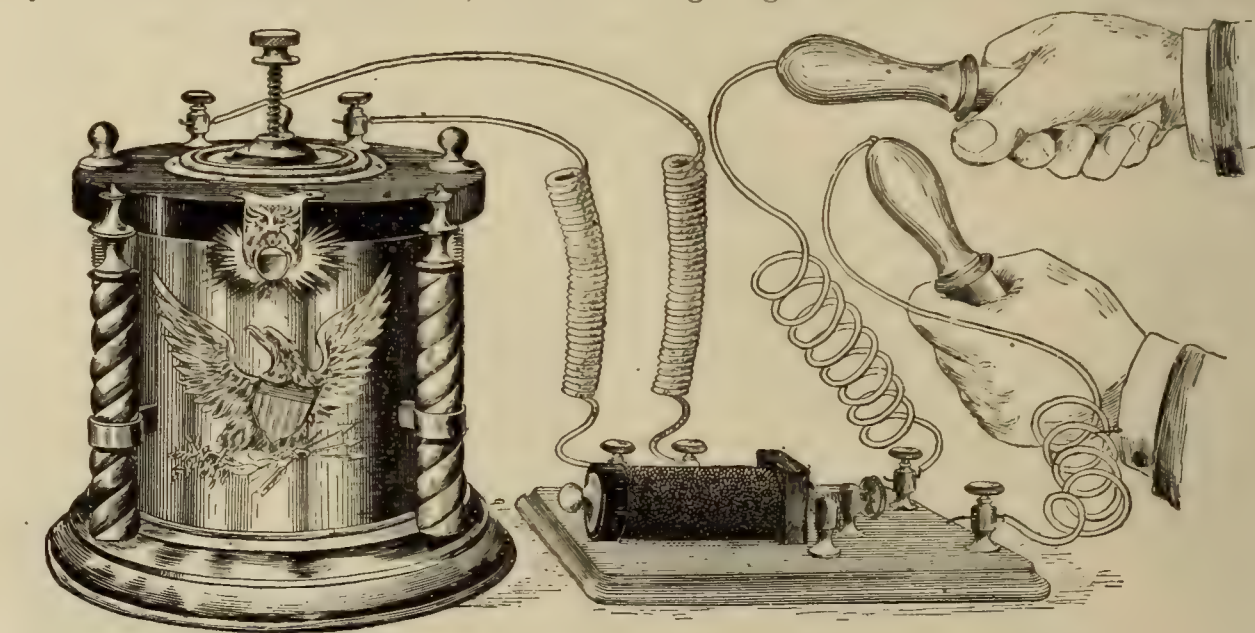
During the discussion which followed the reading of the paper on the subject named in the title of this article, read by Dr. W. H. Wahl before the general meeting of the American Institute of Electrical Engineers, May 21, Prof. Elihu Thomson said: "I have listened with the greatest interest to the statements and arguments put forward, and I do hope indeed that the chemist will come at the top, even at the sacrifice of the electrical part of the question. There is a source of heat, it occurred to me during the reading of the paper, which has been neglected and which might probably be turned to account in this direction, and that is the mere concentration of the sun's heat by large mirrors or lenses. The temperature is, of course, almost that of the sun itself and will certainly fuse aluminum, and we will get it at simply the cost of the use of the apparatus on a sunny day. It is simply an idea which occurs and which may, of course, be shown to be fallacious, but at the same time I can imagine an enormously large lense or mirror which brings its rays to a focus at the bottom, as it were, of a deep crucible, and have our material there subjected to that cheapest heat of the sun from which all our heat is derived through a series of changes which involve great losses."

Prof. F. B. Crocker (the chairman) said: "In connection with that I happen myself to have heard of such a process. A gentleman told me he was building an apparatus. I do not know how far he has got, or whether he has attained any results. There is no doubt about the possibilities of high temperature and there is no doubt about the cheapness. I think myself that there is absolutely no question about the possibility of reducing aluminum by carbon provided you have the temperature. I think the argument that carbon has sufficient chemical affinity to draw oxygen away from the aluminum is fallacious, because in the first place, as Dr. Wahl says, the Cowles process is a proof that sufficient temperature will reduce aluminum, because I do not consider that the action there is electrolytic at all. In the second place, carbon can reduce sodium and potassium, which, if anything, are higher or almost as high in their affinities, as aluminum. It is simply a question of temperature or condition. Carbon has a peculiar property of apparently developing high chemical affinity at high temperatures. The higher the temperature the more it develops a tremendous chemical affinity for oxigen; and it seems to go up directly with the temperature. I do not believe it is unlimited but it will go up sufficiently high, I think, to reduce alumina to a metallic state. If temperature and carbon are all that are needed the sun and ordinary carbonaceous material will make certainly a very cheap process for reducing that metal. But the production of that temperature by anything but electrical methods or the sun's heat seems to me discouraging. No metallurgical temperatures reach at all near that, nor is there any likelihood of their reaching it. Regenerating furnaces produce very high temperatures but not high enough for that purpose. It is not impossible. Of course the principle of regenerating furnaces would apparently allow us to reach very high temperatures, but I doubt if they would work very well, and I should think very high temperatures would possibly be obtained by electrical heating."

Dr. Wahl: "In connection with this portion of the discussion I desire to say simply that while I have no doubt that the reaction in the Cowles furnace is to some extent an electrolytic action, yet I am of the opinion that it is probably what I have described it to be and what I believe it is generally accepted to be—a condition of a reduction by the excessive heat which can be produced in the furnace—purely a chemical reaction affected by the enormous heat of the electric arc—the enormous heat rather caused by the passage of the current through this resisting material. But what actually takes place in the Cowles furnance or in the Heroult furnace is difficult to see. I would not desire to have myself quoted as making any positive statement. Conditions are exceedingly curious. We may possibly interrupt the operation midway and find one state of things and keep on and stop at another stage of the operation and see something else. It is probably partly electrolytic and partly chemical. As to the possibility of obtaining a sufficiently high temperature directly, without the aid of electric heating, I think that it is impossible."

A HANDY BATTERY.

In our issue of May 23 we illustrated and described an electric cigar lighter manufactured by the Barr Electric Manufacturing Company of 17 and 19 Broadway. Besides its usefulness as a cigar lighter it can be used in numerous other directions, in fact, used anywhere that any other battery can be used. The battery material is cheap, and one charge will be sufficient for 30 to 60 days.



BARR ELECTRIC CIGAR LIGHTER AND ELECTRO-MAGNETIC APPARATUS.

Our illustration shows the battery applied to a medical coil, the two making a complete and perfect outfit. It is neat, portable and powerful, and produces an electric current of the finest or greatest intensity. As shown in the illustration, it is ready both for obtaining a light for a cigar or for use as a medical apparatus.

Mr. F. P. Lewis, in charge of the construction of the Raleigh (N. C.) electric street railway, has been ordered to Memphis, Tenn., to construct an electric street railway in that city. His brother, Mr. E. A. Lewis, succeeds him at Raleigh.

Electrical Books at the ELECTRICAL AGE office.

THE PITTSBURG REDUCTION COMPANY'S PLANT.

The rapid development in the processes of reduction of aluminum during the past few years, resulting in making the metal a practical, marketable product, has drawn general attention to the progress it is making in metallurgical science, and a description of the plant and process of the Pittsburg Reduction Company, one of the largest concerns organized for the extraction of this metal in this country and the first to manufacture the pure metal on a commercial scale, will interest our readers.

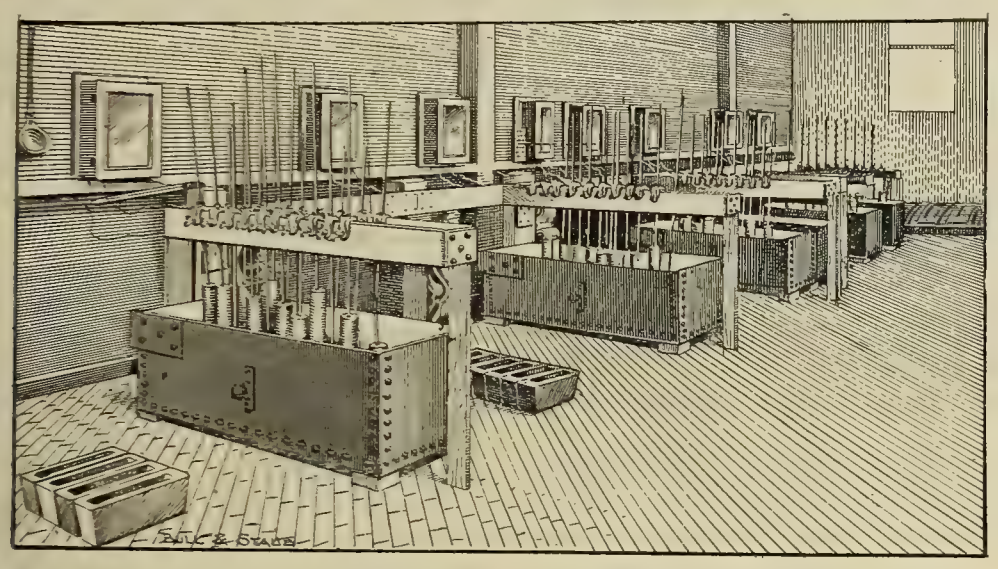


FIG. 1—REDUCING POTS.

What was the result of an expensive laboratory experiment has become, within the last two or three years, a product on a large commercial scale, and one that has set metallurgists, engineers and mechanics wondering as to what extent the new metal would replace those which are familiar to to all. Numbers of articles on the nature of the metal have appeared in our pages from time to time, and our readers are, no doubt, well informed on the subject, so we will proceed with the description of the above named works and their process.

The Pittsburg Reduction Company control the patents of Mr. Charles M. Hall, of Oberlin, O., covering the process of reducing pure aluminum by dissolving the common earth alumina, formed of aluminum and oxygen ($Al_2 O_3$) in a fluid bath composed of aluminum fluoride and sodium fluoride, and then electrolyzing the alumina by means of an electric current. The supply of alumina is now imported from Germany, in the form of a hydrate, and before reduction is calcined in furnaces similar to the reheating furnace used in rolling mills. Gas is used for fuel in these furnaces, and in all other parts of the works excepting the emelting furnaces, where coke is used.

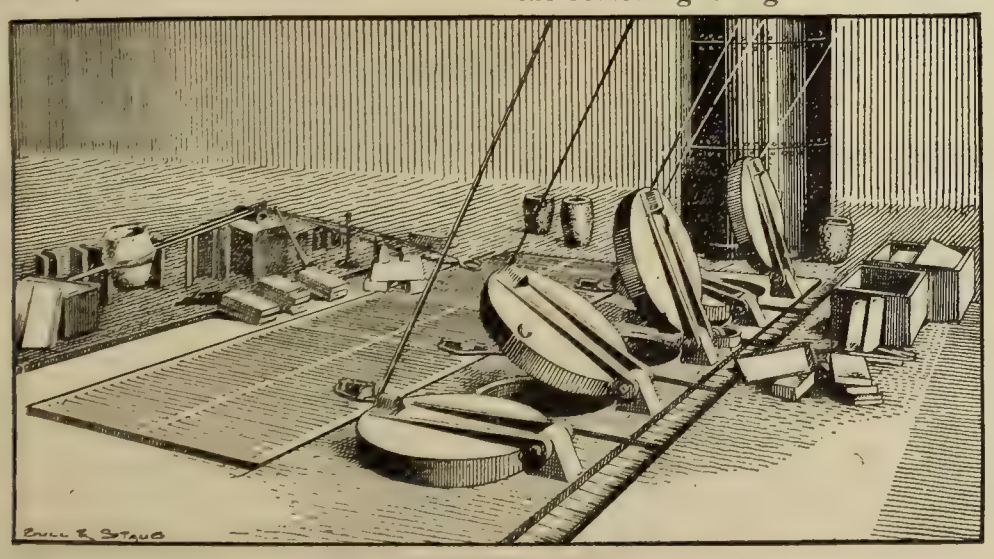


FIG. 2—MELTING HOLES.

The "reducing pots," shown in Fig. 1, are made of iron, lined with carbon, the whole forming the negative electrode in the operation. The positive electrodes are carbon rods suspended from heavy copper conductors by rods of copper. Surrounding the carbon rods is a fluoride bath kept molten by the heat of the electric arc between the rods and the carbon lining of the pot, and in solution in this bath is the aluminum oxide. The process decomposes the alumina by electrolysis, the pure aluminum collecting at the negative electrode and the oxygen combining with the carbon of the positive pole, going off as CO_2. The reduced metal settles to the bottom of the pot and is ladled or tapped off and made into rough ingots. A little less than one pound of carbon is consumed for each pound of aluminum produced. Seven pots in all are used, five large ones connected in series in one circuit with two large dynamos, and two smaller pots connected in the same manner with two smaller dynamos. The positive poles of each of the large pots consists of a double row of large carbons, as shown in Fig. 1.

The rough ingots are remelted in graphite crucibles to rid the metal of any electrolyte that may have come from the reducing pot with it and made into standard ingots weighing five pounds each, the remelting being done in the melting holes or furnaces shown in Fig. 2. The ingots are in dimensions 6x12x¾ inches and the purity of the metal is from 97 to 99.90 per cent., varying according to the grade of ore used. The slight impurities which exist in the metal consist almost entirely of silicon, both in the graphite and combined state. An analysis of a sample of the metal gave 98.52 per cent. of aluminum; 0.42 of silicon, combined; 0.72 of graphitoidal silicon; 0.05 iron; 0.03 copper; 0.01 lead; no arsenic, sulphur, phosphorus or calcium, and but a trace of sodium.

The electric current for this process is generated by four shunt-wound Westinghouse dynamos; two wound for a current of 2,500 amperes each, with a potential of 50 volts, at a speed of 325 revolutions per minute; the other two generate a current of 1,000 amperes each, at 25 volts pressure, running at 1,060 revolutions. There are two circuits, the two large dynamos being connected in parallel in one and the two smaller in the same manner in the other. The conductors for carrying the 5,000 ampere current are two copper bars, six inches by one-half inch and for the 2,000 ampere current similar bars four inches by one-half inch. The power plant for running the dynamos consist of three Babcock and Wilcox boilers each of 208 horse-power, and two ordinary tubular boilers of 60 horse-power each. There are three engines: two of 200 horse-power each, of the Westinghouse compound type and one "automatic" engine by the same builders of 125 horse-power. Each of the compound engines drives one of the large dynamos, to which it is connected by belting as shown in Fig. 3. The small 125 horse-power engine drives the two small dynamos, the dynamos being belted to opposite ends of the engine shaft. Part of the power plant is held in reserve at all times for use in case of accident.

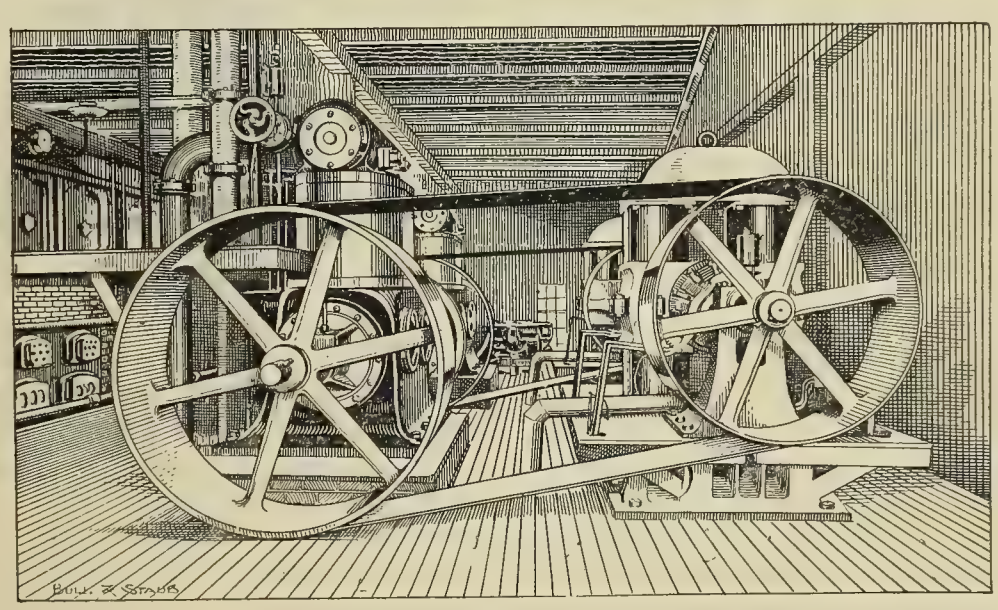


FIG. 3—ENGINES AND DYNAMOS.

NEW CATALOGUES.

One of the neatest catalogues it has been our pleasure to see for some time is that just issued by the Novelty Electric Company, of 52 and 54 North Fourth street, Philadelphia, manufacturers, importers and dealers in everything electrical. This firm, a description and illustration of whose plant we gave in our issue of June 20, have just issued a catalogue differing from the ordinary methods of compiling such works. In this work the illustrations are classified and placed on separate plates, while the descriptions and prices are placed on correspondingly numbered plates in the last half of the book. As the illustrated plates are the full size of the page—14x10½ inches—the catalogue has a very rich effect.

The new catalogue of the Jenney Electric Motor Company just received is neatly gotten up. Besides illustrations and descriptions of their dynamos and motors, it contains considerable information and formulæ for power users.

The Pittsfield Electric Company, of Pittsfield, Mass., has just issued a neat little book of 60 pages, entitled "Plain Talks about Incandescent Electric Lighting," containing a vast amount of information in regard to electricity for light and power, and the instruments used in electrical installations. It also contains the policy pursued by the company and rates for incandescent and arc lighting and electric power plants.

Look out for the STREET RAILWAY NEWS next week.

CORRESPONDENCE.

PRIMARY BATTERIES.

To the Editor of the Electrical Age:

Dear Sir.—In a former communication we said that the instructions found in the "books" as to the best means to suppress polarization were misleading when applied to batteries of strong and constant current. We are told that to diminish internal resistance and suppress polarization, the following means are the ones to be relied upon, and are about the only ones indicated. First, increase the size of the electrodes; this will certainly lessen the *resistance* of the battery, but will not suppress polarization, only to this extent, that it will take a longer time to cover the surface of large plates with hydrogen bubbles than small ones.

Second, we are told to surround the conducting electrode with a mixture or solution composed largely of oxygen, which, as the hydrogen passes from the generating to the conducting electrode, will combine with the oxygen of the mixture or solution, and form water and thus prevent the polarization of the conducting electrode, which is so important to the working of the battery. We admit that these means are more or less efficient, but it will be asked wherein is there anything misleading in these instructions, as we have asserted. They have led us to increase the size of both electrodes indefinitely almost, and to give more square inches of surface to the conducting electrode than to the generating electrode. In a description of a battery before me, it is said that the carbon has 400 square inches of surface exposed to the solution, the zinc in the same cell exposing 325 square inches of surface to the solution.

This seems to be regarded as a meritorious feature, and is so, provided depolarization depended upon the extent of surface of the conducting electrode.

This is what we have been taught to believe, and it requires some courage to say that it is a great mistake, but a perfectly justifiable one I grant, so long as no better means was known to exist for the accomplishment of this indispensable result. Now, without multiplying words, I have to say that I have discovered or devised other means of suppressing polarization in a strong primary battery so that in the battery referred to 70 square inches of carbon surface is all sufficient. I use the term "depolarize" in the sense of disposing of the hydrogen so that none of its bubbles attach themselves to the conducting electrode so as to affect the working of the cell injuriously. What then becomes of the hydrogen? Well, no matter about that now, further than this, it does *not* unite with the oxygen of the solution and form water, nor does it touch, so to speak, the conducting electrode; so that the battery is constant and only weakens by the exhausting of the fluid excitant, which can be replenished at no cost that need be named.

In the inner solution "conductivity" is what is of greatest importance.

We have made a sufficient number of practical tests to justify us in claiming a new means or method of depolarizing a battery which renders it very constant and of very low internal resistance, and greatly cheapens cost of maintenance.

If then a conducting electrode with a comparatively small number of square inches of surface, can be made to do its work better than one with a greatly increased number, and if the hydrogen can be disposed of so as not to in any way injuriously affect the working of the battery with lessened cost, and with other and more convenient means than those named and recommended by the "authorities," we may fairly claim that these instructions have been misleading as we have charged.

We have the highest respect for the authorities in all branches of science and usually rely implicity upon them, and in the present case it can be claimed that they have plainly indicated that the kind of improvement we claim was "possible" and to be expected.

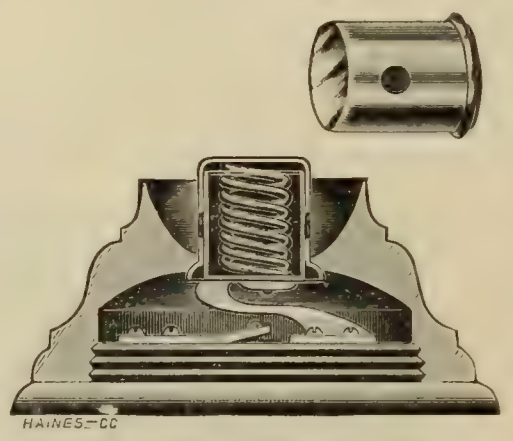
One has well said that the resources of chemical electricity are almost infinite, but at present the fault was in the apparatus, that the present and possible battery were wide apart. We confess that for years we worked upon the line suggested by that remark, and I trust not without results.

New York. B. J. Wheelock.

COMBINATION FIRE ALARM AND PUSH BUTTON.

A very ingenious and valuable device is Ely's improved combination fire alarm and push button, of which we give below an illustration and description.

This button is designed for use in hotels and dwelling houses, and is so constructed that the solder upon each side, holding the cap containing



FIRE ALARM PUSH BUTTON.

the spiral spring (shown in the accompanying illustration), will fuse at a temperature of from 127 to 150 degrees of heat, thereby releasing the enclosed spring, which closes the circuit and causes a continuous alarm in any part of the house desired.

To place this button in practical use, it is only necessary to unscrew the cap of the button already in use, remove the porcelain knob and put this in its place, using it the same as the ordinary button.

In drawings and specifications for hotels and dwellings this new device can be added at a very small extra cost, and as the invention has great usefulness and practicability it is being placed very extensively in the hands of architects, who readily perceive its value.

This device is handled by "The Denio" Auxiliary and Automatic Fire Alarm Company, 377 Brown street, Rochester, N. Y.

THE MONTREAL CONVENTION.

In a letter to the editor of the Electrical Age, Mr. A. J. Corriveau, of Montreal, says:

"We are very much pleased to see that your paper is continuing to take a deep interest in our convention matters. I read with pleasure your editorial in last week's number, but I must make a remark—I think that you have too much stretched a point in mentioning me as having so much credit in our success here in our convention. I must differ with you, and say that most of the credit is due to friends here who are some of our most influential citizens of Montreal, who have so willingly taken hold of the matter with me—especially Prof. Bovey, Mr. Redpath, Mr. Stevenson, Mr. Carroll, and a number of others. I can only tell you that everything is working harmoniously, and every one is doing his best to make this coming event a great success.

"Representatives of the Edison and Thomson-Houston Companies were here at a meeting of the exhibition committee, and they are going into the exhibition matter heartily and regardless of expense, and both companies intend to make the largest exhibits they have ever attempted to make before.

"Quite a large number of exhibitors have already asked for space at this end, and I have no doubt a very large number have also asked for the same at the other end. Already 14,000 feet have been asked for here, so you can see what the thing promises to be."

STREET RAILWAY NOTES.

It is reported that the Adams Electric Company of this city will ask to be made co-defendants with the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa., against whom the Short Electric Railway Company, of Cleveland, O., has brought suit in Pittsburg, for alleged infringement of patents owned by complainants for gearless electric motors. It is also stated that the Adams Electric Company will, at the same time, institute a suit against the Short Electric Railway Company, for infringement of the patent issued to Dr. Wellington Adams, of St. Louis, and covering the gearless motor principle. The officials of the Adams Company allege that the suit between the Short and the Westinghouse systems is in reality a friendly litigation intended to secure adjudication on certain points of their own, which would materially strengthen their position as defendants in the suit that was to have been brought by the Adams Company, following the decision in its present suit against the Sprague system.

President Lewis, of the Brooklyn City Railroad Company, announces that he has secured the consent of a majority of its stockholders for the proposed issue, by his company, of the $6,000,000 mortgage bonds. The company proposes to go right ahead, and will, on July 1, issue $3,000,000 worth of bonds, the issue of the other $3,000,000 being postponed until the company gets permission to use electricity on all of its various lines. Each stockholder is allowed to buy the bonds at par to one-half the amount of his present holdings.

The Corporation Attorney of New York recovered judgment for $114.13 penalties and costs against the Dry Dock, East Broadway and Battery Railroad Company, New York, for not running all-night cars. The company appealed, and the Common Pleas General Term affirmed the judgment, holding that the company had not shown the ordinance to be unreasonable.

Postmaster Hale is considering the advisability of making some arrangement by which the electric inter-urban trains can be turned to account for carrying mail between Minneapolis and St. Paul. Several schemes have been proposed, one of which is to attach a small mail car to certain trains and have a clerk on board to assort mail matter as deposited, thus securing frequent and speedy delivery.

Mr. Frederick Willson, of Chicago, has just been appointed special agent of the Short Electric Railway Company, in Cleveland, O.

Alderman McCarty, of Brooklyn, stated the other day that if the State Railroad Board granted the application of the Atlantic Avenue Railroad Company, of Brooklyn, to use the overhead trolley system on its lines, he would favor action by the Common Council asking the Corporation Counsel to secure an injunction restraining the company from proceeding with the work, in order to test the legal right of the State Railroad Commission to interfere with municipal control of the Brooklyn streets.

On Atlantic avenue, between Third and Fourth avenues, Brooklyn, may be seen three or four electric railway poles. These were erected by Milliken Brothers, as samples, "to demonstrate the principle of carrying electric wires for motive power purposes." The poles were erected on permission of the Common Council, and are to be removed upon notice from the City Works Commissioner whenever, in his judgment, it may become necessary.

The Brooklyn City Railroad Company is extending its Flatbush line to the town of Flatlands. The new extension will be run on the trolley system, and its terminus will be at the Flatbush crossing. The line will ultimately be extended to Canarsie, L. I., and will connect with the Second avenue electric road at some point yet to be designated.

President Lewis, of the Brooklyn City Railroad Company, it is stated, intends to run a small steamer from the foot of Twenty-fifth street, where the Second avenue electric line ends, to Coney Island, and that the company will thus be able to carry passengers to and from Coney Island at a cheaper rate than any other line in the city.

It is reported that the Second Avenue Electric Road in Brooklyn will soon be absorbed by the Brooklyn City Railroad Company, and become a part of that vast system. The officers of the Brooklyn City Railroad Company do not deny that such absorption is highly probable, but refuse to talk on the subject at present. The Second avenue electric road, when finished, will run to Gravesend Bay. The service on this line is improving daily, and it is well nigh perfect now.

The new Montague street cable road in Brooklyn, will probably be opened about July 1.

Geo. W. Mansfield, of the Thomson-Houston Electric Company, Lynn, Mass., was registered at the Imperial Hotel, New York, on Monday.

The County Commissioners, Cincinnati, O., have granted to the Pendleton, Mount Lookout and East Walnut Hills Electric Railway, the right to extend its track from Glenway avenue to the city line, crossing below grade on Observatory avenue. The rate of fare is to be five cents. This road will run through private property, and will be used exclusively by the electric line, the way not being a public thoroughfare.

Mr. W. R. B. Willcox, of Chicago, who is identified with the interests of the Burton Electric Co., manufacturers of the Burton Electric Heater, of which the Electric Merchandise Co., of Chicago, is selling agent, favored the office of the STREET RAILWAY NEWS with a call last week. Mr. Willcox will be East for about a couple of weeks, and during that time will explain the workings and salient points of the heater to street railway officials and others interested in such matters.

The Westchester Electric Railroad Company, Pelham, N. Y., has made application for the privilege of constructing and maintaining an electric railway in and about Pelham. The Town Board will meet on the first of July for the purpose of taking action on this application.

In our last issue we inadvertently omitted reference to the exhibit of the Electric Secret Service Company, of 45 Broadway, New York, at the recent convention, in Cincinnati, of the Association of Railway Telegraph Superintendents. The exhibit was a complete and attractive one, and the operation of the system was very generally and favorably commented on. Elsewhere in this issue we give a full description of this exhibit, also an illustration of the same, both of which will be of extreme interest to our readers.

ELECTRIC AND MAGNETIC THEORIES.*

The medium surrounding a wire that is a part of an electric circuit is the seat of a double set of actions. Its electric potential varies from point to point, the medium being in a state of electrostatic disturbance. It is also in a state of magnetic disturbance, and its magnetic potential varies from point to point, but in a wholly different manner. For the sake of simplicity let us consider an indefinite long straight wire, through which a "current" is passing. For the sake of numerical precision, suppose the wire to have a

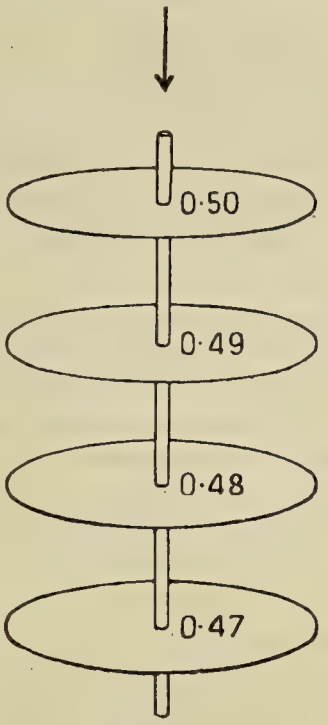


FIG. 1.

resistance of $\frac{1}{100}$ ohm per inch, and a current of 1 ampere to be passing through it. Then points distant an inch apart along the wire will differ by $\frac{1}{100}$ of a volt. Select one of these points where the potential has the value, say, of 0·50 volt. Through this point consider a plane drawn so that the wire is normal to it. All points in this plane

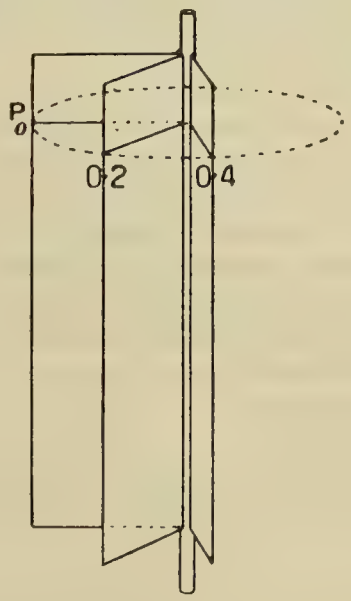


FIG. 2.

will be at the same potential: the plane will be a surface of equipotential. No energy need be spent in moving a unit of electricity from any point in this plane to any other point in it. At other points along the wire let similar equipotential surfaces be drawn, as in Fig. 1. The lines of electrostatic force will be straight lines drawn parallel to the wire, and will cross the equipotential surfaces normally. But surrounding the wire will be another system of lines and surfaces mapping out the magnetic properties. Consider any point P near the wire. On a unit magnetic pole, at a distance of r centimetres, the force due to the one-ampere current will be equal to $0.2 \div r$ dynes, and will tend to move it (as viewed in Fig. 2) clock-wise around the wire. If we push it the opposite way around we shall do work upon the unit, and when we have pushed it once completely round the wire we shall have done $2\pi \times 0.2$ ergs of work; or to move it through an angle of one radian ($= \frac{1}{2}\pi$ of a circumference) will require an expenditure of 0.2 ergs of energy. A plane drawn through P and the wire will be a plane in which all points are at the same magnetic potential. A system of such magnetic equipotential surfaces may be drawn around the wire; they will be set radially, at equal angles apart, reckoning from the zero position. For a current of 1 ampere the angle between surfaces that differ by $\frac{1}{10}$ of a unit of magnetic potential will be equal to $\frac{1}{4}\pi$. Now, imagine these two systems of surfaces to be superposed. The intersections of the electrostatic equipotential surfaces with the magnetic equipotential surfaces will be a set of radial *lines* (Fig. 3). Now consider what would happen if we had to move either a unit of electricity or a unit magnetic pole along one of these lines, such as PQ. Because the line is in a surface of electrostatic equipotential, no work would be done along the line in

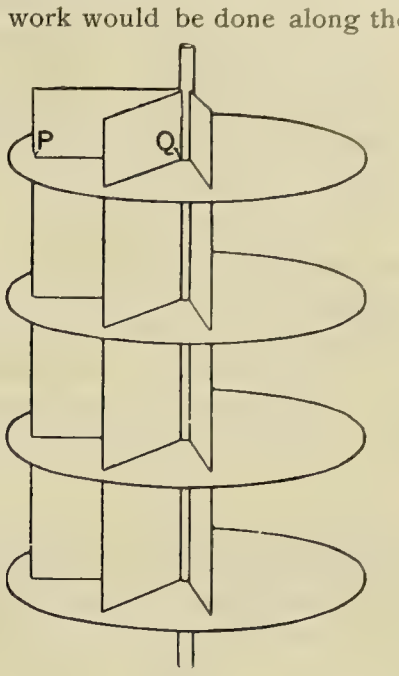


FIG. 3.

question in moving a unit of electricity along it and because it lies in a surface of magnetic potential, no work would be done in moving a magnetic pole along it. Now, according to Poynting's view, it is precisely along such lines as these—the intersection of the static and magnetic equipotential surfaces—that the electro-magnetic energy flows. It is the only path compatible with the condition that the energy in crossing the medium shall not either add anything or take anything away from the energy already existing in the medium. If it were to leave this line and pass either to a point of higher or lower potential in the medium, this would alter the state of the medium and change the configuration of the electrostatic and electromagnetic stresses in it. That is, of course, exactly what happens during the time when an electric current is starting, during the variable period, while energy is being poured out into the medium to throw it into the peculiar state at the beginning. But we have been dealing here with the question of steady flow.

Again, in the case of alternating currents setting up alternating electromotive forces across the medium in another circuit, during part of the oscillation some energy is being thrown outwards into the medium simply to set up stresses and some more energy is actually crossing by the paths so set up into the second circuit and during another part of the oscillation the energy that was momentarily resident in the medium is re-entering the source to be again thrown out. Doubtless the energy paths are of somewhat complex form in all these cases; that is no reason why their real existence should be held doubtful. Take a single case. Consider a system of circuits with two interposed transformers: one transforming from a primary circuit into a secondary, the other transforming from the secondary circuit into a tertiary. How complex must be the paths here along which the energy flows, even if one confines one's attention solely to those parts of the circuits where the transformations are taking place.

*Abstract of a paper read by Silvanus P. Thompson, London.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOM 7–12, "WORLD" BUILDING,
NEW YORK, June 27, 1891.

The Thomas Murray Company, 136 Liberty street, are very busy constructing electric railroads throughout the central and eastern states. The Charlotte and Manitou Beach Electric Railroad is receiving its finishing touches and the cars are all running in a very satisfactory manner. The company has a big gang of men preparing the way for eight miles of electric road in Lawrence, Mass.

E. J. Horton, 45 Broadway, has closed a contract for two electric railroads on the overhead system.

The fan motors of ⅛ H. P. for alternating systems, made by the Excelsior Electric Company, 115 Broadway, are meeting with big success. The demand is so great as to exceed the output. The motors are handsome in design, well constructed and highly efficient.

P. & B. paint is still increasing in favor. The manufacturers of these goods, the Standard Paint Company, moved to 2 Liberty street on May 1, where they have greater facilities to meet the increasing demand for their specialties, which comprise P. & B. insulating compound, paper, tapes and armature varnish—all valuable electrical goods.

The Copenhagen Thermostat, a cut of the actual size of which appears in this paper, will, upon examination, be found to be a most convenient device and it is guaranteed to be most reliable. Its size, as well as its neatness, recommends it for residences. It is very simple and can be tested by any person not having electrical knowledge. The Copenhagen Electric Alarm Company, Cincinnati, Ohio, will send one on receipt of price. Send for circular.

"Ward" Arc Lamps running on incandescent electric light circuits, is the universal idea everywhere now. To not have a Ward Arc Lamp in your store or factory is like bread without butter. These lamps are also valuable for lighting the exteriors of stores, warehouses, etc. Thousands of them are installed weekly. The Electric Supply and Construction Company, 18 Cortlandt street, this city, are alert to the needs of the public for proper illuminators. Their alternating and 500-volt electric railway "Ward" Arc Lamps are growing in favor and there is a big demand for them. Every electric railway company should investigate this lamp. These lamps are made for any voltage and current to suit any system.

W. H. Gordon, of W. H. Gordon & Co., 115 Broadway, agents for Simplex Wires, has just returned home with his book full of orders. The company are still filling orders for their sockets, switches, cut-outs, Ellis oil filters, Sunbeam incandescent lamps and arc lamp hangers. Railway supplies is their hobby, and they are always ready to please a customer in this line, particularly in Simplex feeder wire.

Vulcanized fibre always stays on top, while its competitors are going out of business. Vulcanized fibre is the invention of William Courtenay, an accomplished electrician and mechanic, who succeeded in bringing into the market an article that is now in general use among manufacturers of dynamos, motors and electrical apparatus generally. It is used as well extensively in all the mechanical trades and manufactures.

The Pelton Water Wheel Company, of San Francisco, announce a new departure in the establishment of an Atlantic department of their works, with manufacturing facilities that enable them to fill orders and make prompt shipments from this point to any part of the world. Their New York office is located in the Central building, Liberty and West streets, and is fully equipped for making plans and estimates, as well as affording reliable information in regard to any proposition for the development and utilization of water power.

C. L. Radway, 136 Liberty street, this city, is manufacturer of the Radway Improved Feed Water Heater, which possesses some valuable features. In the manufacture of these feed water heaters, drawn seamless brass tubes are used and there is no danger of leaky joints caused by expansion and contraction of the tubes. The shell is manufactured of cast iron and will not pit nor corrode. The material and workmanship of this apparatus are of the best, and Mr. Radway guarantees that they will heat the feed water to a temperature of 200 to 212 degrees F. with exhaust steam alone, without back pressure on the engine. Mr. Radway gives 30 days' trial for his heaters.

E. T. Copeland & Co., 106–108 Liberty street, are keeping up their record for large orders for the Ball automatic high speed engines and Case automatic engines. Among orders received June 27 are two 80-horse-power Ball engines for Temple Beth-El, N. Y., for the Edison system, one 10 horse-power Case engine for the Municipal Electric Light Company, Brooklyn, one 15 horse-power Case engine for the Edison Company, N. Y.

Pierce & Thomas, 42 Cortlandt street, this city, engineers and contractors for electric railway and electric light steam plants, have lately completed several plants of both classes, among which is one in the Palisade Amusement Company's handsome new exhibition building. Here the firm put in two 80 horse-power McIntosh and Seymour automatic engines, return tubular boilers, pumps, etc., for the Thomson-Houston plant installed by Curtis & Dean, of 115 Broadway. They have also installed half a dozen McIntosh & Seymour compound engine return tubular boilers and accessories in the power house of the Second Avenue Electric Railway in Brooklyn.

R. Kanze, manufacturer and dealer in electrical supplies, bells, burglar alarms, gas lighting supplies, novelties, etc., 103 East 9th street, this city, has brought out a new primary battery of great merit for open and closed circuit work. Mr. Kanze can be complimented for the neatness and compactness of his electrical display; his show window is a veritable electrical exhibition and worthy of attention.

J. C. Gill, 90 East 9th street, this city, has a compact little shop with show window and is doing electrical work of all kinds.

H. C. White, of the Phœnix Iron Works, No. 15 Cortlandt street, this city, has just returned from the West after a two months' trip.

Mr. C. E. Bibber, general manager of the Consolidated Electric Manufacturing Company, 196 Summer street, Boston, was in Philadelphia and New York City recently. Your representative met Mr. Bibber in Philadelphia, and found him scouring the city and getting many scalps in the way of orders for his popular sockets, "Jack Knife" switches, and other specialties, among which may be mentioned his insulating joint. This device is the most simple, compact and perfect in its construction, and can be made very cheaply. The insulating material is placed between two pieces of metal, which are compressed over and around it in such a manner as to make a perfectly gas-tight insulating joint, at the same time preserving strength and durability.

The Edison Manufacturing Company, of Orange, N. J., are busier than ever turning out Edison-Lalande batteries to meet the constantly growing demand. On a recent western trip of one of the representatives of this paper, he found the demand for and use of these batteries very extensive. The Edison-Lalande batteries meet every requirement of general and local use. They are particularly adapted to telephone and telegraph uses and for running small motors for phonographs, sewing machines and dental and jewelers' lathes. This battery seems to be a great favorite everywhere and is doing excellent work.

The Clark Electric Company, Corbin Building, No. 192 Broadway, this city, are doing an excellent business. Their system has the reputation of being a most excellent one. It is claimed to be the best regulated, most economical and safest of any. The automatic safety device controlled by the company absolutely prevents accident from broken wires. As soon as a wire is broken the current is automatically cut off at the dynamo.

The Hunt Engineering Company, general electrical contractors and manufacturers and dealers in electric supplies, No. 238 Washington street, Brooklyn, has just received a contract for the installation of an arc plant for the Weston Furnace Company, of Manistique, Mich. They report excellent business, and have lately closed several contracts.

Mr. P. Claus, the well-known electrician, 352 East 120th street, this city, is now connected with the Germania Electric Company, manufacturers of the Schaefer Incandescent Lamp. The home office of this company is in Boston, and the works are at Cambridgeport, Mass. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAME OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co. (N.Y.)	1,000,000	25 00	3 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Asbury Park L. & P.	50,000	10 00	
Atlantic Ave. Ry. Bkln.	2,000,000	100 00	115 00
Aut. Phon. Exh. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	200 00
Bell Telephone 7's	2,000,000		*112 00
Birmingham Ry & Elec. Co., 6's Ala	1,500,000		par
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	17 00
Brooklyn City R. R. 5's	6,000,000		par
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	10 00
City Electric St. Ry. Co., 6's (Ark.)	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	105 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co. (N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L. Co. of West Co. 6's	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80 000		par
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	10 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison General	14,000,000	100 00	100 75
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Empire City Subway Co. (N. Y.)		100 00	
Equitable G. & E. Co. (Utica)	4,000		†
Erie Telephone	4,800,000	100 00	48 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	12 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00

Name of Companies.	Capital.	Par.	Price.
Hackettstown Elec. Light (N. J.).	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	par
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7,500,000	100 00	14 25
Laclede Gas pref	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*74
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50 000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	80 00
Morristown L. H. & P. 5s (N. J.)	25 000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	96 25
Nat'l Cordage, pref.	5,000,000	100 00	103 00
Nat'l Lead Trust	9,000,000	100 00	17 25
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	93 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,600,000	100 00	
North New York, Lighting	150,000	100 00	20 00
Northwest Elec. Co. 6's Manitoba	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	75 00
Rockaway Elec. Lt. Co. 6's	75,000		par
Russell Electric Co. (Boston)	300 000	5 00	5 00
Saratoga Gas and Elec. Light 6s	300,000		*86
Saginaw E. L. & P. Co. 6's Mich.	50.000		par
San Diego Gas & Elec. Co. 6's Cal.	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	110 00
Shaver Corporation., N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co.	16,000		†
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L. H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	43 50
Thomson-Houston Pref.	4,000,000	25 00	25 75
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers 6's	100,000		par
T.-H. L. H. & P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Union Switch & Signal Co (Pa.)	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000 000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine Street Motor Co. 6's (Colo.)	100,000		par
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co.	7,000,000	50 00	13 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			20 00
Winston-Salem Elec. St. R.R. (N C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent. †Registered Stock.

FINANCIAL.

No investor at this time can afford to ignore rumors affecting the particular security representing the income to which his family expenses draw a line, especially if the rumors predicate the action of either known financiers or those acting for them, and when we hear that Mr. Villard has had numerous and lengthy consultations with his European resources, and is revisiting the scene of action, it is not to be wondered at that considerable excitement is displayed by those who hold either bonds or shares in railways or electric concerns of which he commands the future. Certainly he must have noticed the consolidated interests of electrical corporations abroad, and when we hear that he has succeeded in amalgamating his railway and electrical interests so closely, that a full half of all present and future patents or discoveries of Edison pertaining to railways passes under his control, and further, that he not only proposes to change to electric, the local rail systems of such cities as Cincinnati and Milwaukee, but also to light them, it is full time for permanent investors who may be affected, to decide on their future. As a natural bull my advice is to hold on, and if possible get more.

The crucial test of mind over matter in the interest of health and safety is at last being seriously attempted by capital in the plan approved by the commissioners. It is not our province to impede experiment, and we calmly await the result of the Fourth Avenue Tunnel exhibit. We have every reason to believe that the shareholder's affairs are in competent keeping; that every effort will be made to add to the efficiency of the railway service and its income increased, even if it shall be found necessary to raise the roof of the tunnel to Heaven, or employ electric power to move the trains, which will, no doubt, come in good time. In the interim many other plans will be exhausted. The tests will add materally to the experience of the electrical construction, engineering and supply companies, as well as increase their already large and constantly growing dividends. The stocks of nearly every one of these corporations are above par, their bonds being seldom offered for sale after the first marketing, while several are paying eight per cent. in regular quarterly dividends; small lots of 100 shares or less can be had, but never larger lots except to settle estates. The fundamental principle of light, heat and power and the cost of production, owing to the competition of patentees, is aproximately known. Supplies and construction not only vary with every plant, but the demand is constant and will continue to increase for many years to come. For investment, supply and construction shares occupy the front rank with the greatest possibilities. Electric investors should give this a prominent position in their note books and reap the benefit of these large incomes. Notice especially the Electric Supply and Construction Company on our last inside page and ask some lineman to point out one of their lamps to you. Catch on.

What has Become of the Lamb? is just now the conundrum which occupies the attention of the Stock Exchange and vicinity, quite to the exclusion of all other subjects. The bag is baited with choice reports, rumors of increased dividends, consolidations by which expenses are to be decreased wonderfully, anti-cut-rate contracts signed, depots buried under freight awaiting transportation, magnates wining and dining each other to celebrate the grand condition of affairs, the bag is held out with an alluring grace, equalled if at all, only by an expert angler's fly as it quivers and dallies in mid stream, just on the edge of the water, still the lamb don't materialize. He ain't there; every cosy nook has been prospected, and the conclusion arrived at by a very large majority of the hunters is that Dame Fashion is the party who is responsible for the situation. A few years ago, when half a dozen men met whose checks were negotiable with four figures on them, and conversation became at all general, bond and stock stories predominated. This is no longer *fashionable;* the lamb has found new pasture; soon he will not come below Fourteenth street; he speculates on the yacht, or horse race, the baseball game, steamships' time, athletic contests, and invests his profits in stock exchange securities as he does in broad acres, buildings and other property, to take and hold for a considerable time. The railway boom reached its zenith years ago and has steadily declined from the day when Europe ceased taking American railway securities, and paying for them in iron rails; the *fashion* changed to other classes of investments, and as the Stock Exchange offered none of the new materials, the lamb ambled off into close corporations, local enterprises, municipal bonds, land mortgages, until about ten years ago he got into the field of electric investments. He is there to-day and there to stay; he has invested over $500,000,000, and is increasing the sum every day, scattering in every direction from the amber to the dynamo, and he knows no boundary in space covered by travelers, merchandise, sound or action. It is too late to entice him back; he must be met half way and shown a fold trimmed to his fancy. The only way to do this is to join the electric army, make the change known through the Electrical Age to the lambs of the world, and march on in the midst of commercial success, or continue to connect with the negative electrode and conclude the regulation five years average of Wall street life in disaster.

WESTERN NOTES.

The Central New York Electric Company, 607 Kirk Building, Syracuse, N. Y., reports an increasing business in their various lines of specialties, such as Bishop white core wire, Perkins switches and lamps and the Cutter specialties, consisting of lamp supporting and swivel pole pulleys and main and branch cut-outs. This firm has just closed several large orders for "K.K," line wire for which they are agents. Attention is called to their advertisement on colored pages.

The Aluminum Carbon Company, Buffalo. N. Y., whose factory is located at Lancaster, Pa., is now turning out an excellent quality of carbons for electric lighting and other purposes. The Buffalo office is in the Coal and Iron Exchange.

The Keystone Electric Company, Erie, Pa., report a brisk business. Their extensive new building is already pretty well crowded with work. The power used in the establishment is furnished by a motor of their own make which is said to possess excellent qualities. A reversible elevator motor operates the elevator so satisfactorily that a well-known elevator concern has placed a large order with this house for these motors. Over two dozen orders for motors are on file. The Keystone Electric Company have also contracted to put in an electric light plant.

As to the assertion that the proposed Laclede-Missouri-Municipal Electric Light deal is off, there are many persons in St. Louis who believe that it is not. The situation is a peculiar one. A temporary restraining order was granted which the defendants fought, securing continuance after continuance on one plea or another. On the day the case was to have been argued the State dismissed the injunction on the mere statement of the defendant corporations that there would be no consolidation, the deal having fallen through. Notwithstanding this, it is reported on the street that the State had had the wool pulled over its eyes and that the consolidation was really in force. On the other hand, the officials of the companies concerned declare that the deal is really off.

The Central Electric Company is showing some very handsome samples of lead encased Okonite cable. The demand for this class of cable has increased so lately that the Okonite Company has decided to go into its manufacture on a large scale, and is selling its product in the West through the above company, who are their general western agents. They have already received some flattering contracts and will soon be in the field as active competitors for this class of work. They are also prepared to lay the cable and deliver it connected up, ready for current, having especially good facilities for performing these contracts. Some very large orders for extra sizes

of Okonite wire are being received and the Central Electric Company has recently taken several contracts for this wire running as high as 600,000 circular mils in diameter. As the most of this is for underground and submarine work, it is evident that the large purchasers are beginning to realize that the best is always the cheapest. The excessively hot weather of the past week is what electrical people call "good fan weather," and the Central Electric Company report large sales of motor fans, and keep a variety of electric fans for customers to select from.

Cutter's Lamp-Supporting Pulley has so many good points about it that it is bound to sell itself. It is thoroughly sleet-proof, and will hold the lamp securely even if the hoisting rope should slip, so that it will save the cost of many a lamp in the course of a year. This pulley infringes no patent, and George Cutter, of Chicago, will protect users against any threatened suits

The Detroit Electrical Works have purchased sixteen acres of ground fronting on the Grand Trunk railroad, between 12th street and Wabash avenue, Detroit, and will erect one of the most extensive electrical manufacturing establishments in the country. The cost of the plant will be from $200,000 to $300,000.

The Ball Engine Company Erie Pa., are just putting the finishing touches on a new and commodious extension to their immense works. This company is now enabled to handle much larger engines than heretofore. A large crane with a capacity of 12 tons runs the entire length of the new shop. The large and spacious gallery extending around the entire building, as well as the ground floor, is well lighted and fitted up with the best and latest made tools in the country. The Ball people are now engaged in constructing engines for electric welding purposes for the Johnston Company, of Johnstown, Pa. The extensions to their works will also enable the Ball Company to turn out engines of 500 horse-power, which is just double the capacity of their former product. The three engines, each cross compound special 250 horse-power, for the new power house at Buffalo, are perfect models in their line and probably the best ever turned out by the company. They are especially adapted for heavy railroad work and the trials so far give excellent predictions as to their capabilities.

The Electrical Supply Company, 171 Randolph street, Chicago, are distributing a unique circular, setting forth the advantages of their "Shield Brand" wire. The company will, on July 1, move to 102 and 104 Michigan avenue, corner of Randolph street.

The Fisher Electric Company, Detroit, Mich., is putting a number of lighting plants on lake steamers. This company puts in a high grade of work and the results are highly satisfactory to all concerned.

Mr. David H. Darrin, of Buffalo, has put in several light plants on lake steamers, as well as several isolated plants. He is now engaged in placing a 200-light plant in a boarding house, which is to be furnished power from an Otto gas engine.

F. P. Little & Co., Buffalo, N. Y., has just closed a contract for some electrical work at the State Capitol at Albany. Mr. Beals, formerly of the Wenstrom Company, has entered their employ and is a valuable acquisition to the excellent force of Little & Co.

F. P. Jones & Co., 301 Main street, Buffalo, N. Y., has exceptionally good facilities for the introduction of electrical devices in and around Buffalo and Niagara Falls. This firm recently put in a Regan Vapor engine, four cells of Sampson battery furnishing the spark. This unique plant runs a large number of sewing machines.

EASTERN NOTES.

Fred H. Angell is selling a large number of the specialties of the Electrical Specialty Company of Pawtucket, R. I. Among them is the Thomas Mast Arm, which receives a large amount of attention in every city visited by Mr. Angell. The new iron box cut-out switch for arc light circuits made by this company is also having an enormous sale among electric light companies who testify to its merits by duplicating their orders.

Mr. Elliott Otis Johnson, the popular salesman for the Redding Electric Company, of Boston, was married June 24 to Miss Alice Bartlett, the daughter of Mr. and Mrs. Charles Bartlett Clough, of Lynn, Mass. The ceremony was performed at St. Stephen's Memorial Church in that city. Mr. Johnson was for some time with the Standard Electric Company of Vermont, and later with the Standard Electric Supply Company of Boston, severing his connection with that company to accept his present position with the Redding Company.

The Electrical Specialty Company of Pawtucket, R. I., have sent us an "Official Souvenir" of the Cotton Centenary of the City of Pawtucket. The souvenir is a copper medal, on the face of which is a fac-simile, in relief, of the old Slater Mill, which was the first cotton mill built in the United States. This old mill is now occupied by the Electrical Specialty Company as their offices and factory. The medal hangs from a short piece of silk ribbon of red, white and blue, and is very handsome in appearance.

One day last week a practical test was made at the power house of the Suburban Electric Light Company in Boston, of a device for rendering harmless dangling ends of broken wires conveying electric currents. The invention is purely automatic in its action, and is an effective safeguard from the danger of shocks, and fires from the breakage of wires. It is a cheap arrangement. and is equally applicable to electric light, railroad trolley and telephone wires. Mr Max Kerstein is the inventor, and it is proposed to develop the patents as fast as possible. The use of this device will be of great assistance to promoters of electric railways, light and power companies in obtaining charters, etc.

AN EXTENSIVE CONCERN IN BROOKLYN.

The representative and best known house in Brooklyn actively engaged in the manufacture of gas and combination fixtures and electroliers, is that known as the W. C. Vosburgh Manufacturing Company, Limited, whose office and store are located at 418 and 420 Fulton street. Its factory is at 273 to 281 State street, and it also has a branch at 184 and 186 Wabash avenue, Chicago, Ill. This extensive business was established in 1865 by Messrs. W. C. Vosburgh & Co., by whom it was conducted until 1881, when it was duly incorporated under the laws of New York with the firm name of W. C. Vosburgh Manufacturing Company, Limited.

The following gentlemen, who are widely and favorably known in trade circles for their enterprise, business ability and integrity, are the officers, *viz.:* H. C. Beck, president, John Nix, vice-president, C. H. Littlefield, secretary and Francis L, Strickland, cashier and treasurer.

This company manufactures largely the finest work in brass or bronze as yet produced in gas and electric fixtures, and is constantly advancing in this important and artistic industry. Its specialties for the drawing room and all parts of a mansion, also its fixtures for churches, theatres, public buildings, etc., are absolutely unrivalled in this or any other country for elegance, design, fine finish, quality and workmanship. The company promptly fills orders at the lowest possible prices and its trade, which is steadily increasing, now extends throughout all sections of the United States and Canada and is beginning to gain a foothold in South America.

Among some of the large public buildings recently furnished with fixtures by this company are the following: Vanderburgh County Court House, Evansville, Ind.; Douglass County Hospital, Omaha, Neb.; New United States Court House and Post Office, Williamsport, Pa.; Chicago Railroad Building, Chicago, Ill.

The company is making great strides in new and desirable designs for both public and private buildings, as the awarding to them of many contracts locally as well as throughout the country will testify.

In conclusion we would observe that a visit to the company's warerooms will fully satisfy purchasers and their friends that the fixtures manufactured by this popular concern justly merit the praise bestowed upon them by a critical and observing public.

GENERAL NOTES.

A press dispatch from Chicago states that a test of the writing telegraph between New York and Chicago was made on June 21 and, allowing for atmospheric conditions, was fairly successful. A message of 60 words was transmitted without a break, and was recorded automatically by a pen attached to the transmitting instrument.

A London exchange reports the extraordinary run of one of the dynamos at the West Brompton electric light station of the House-to-House Company, London. A generating plant was started on the 28th of November last, at 3:45 P.M., and ran night and day until 9:30 A.M., on the 29th of December, making a total run of 665¾ hours. During that time the fly-wheel of the engine made 3,595,050 revolutions, the pulley of the dynamo, 15,938,055 revolutions, and the field magnets traveled a distance of 46,787 miles.

There are to be two large manufacturing firms started soon that will need the best kind of light, and electrical men will do well to get in their bids for light installations. One of these firms is John Sullivan & Sons, who are to erect a textile mill plant at Philadelphia, Pa., consisting of two five-story buildings, 200x40 feet, costing over $150,000. The firm will need electric light to make the various fabrics made at night equal to the day work. The other is a paper and pulp manufacturing plant, to be erected at Suspension Bridge, N. Y., at a cost of about $500,000. The plant will be the largest in the world John L. Newton, of Chicago, Ill., is at the head of the syndicate and the contract for designing the buildings has been awarded to Gen. Sooy Smith of Chicago.

The Edison General Electric Company has just issued a pamphlet describing the Edison system of electric railways. It describes all parts of the system and contains cuts of the Edison electric railway machinery and a number of photographs of street railways in operation in different cities.

An electric railway is to be built between Asheville and Rutherfordton, N. C.

The Germania Electric Company of Cambridgeport, Mass., is to erect a large plant at Woonsocket, R. I.

BUSINESS NOTES.

Electric lighting plants and power stations require protection against fire, more than almost any other manufacturing industry, and yet how often do we see such appliances about? Buckets are the best general protection against fire and the "Indurated Fibre" buckets for which Cordley & Hayes, 173 and 175 Duane street, New York, are sole agents, are the best. Write for their catalogue if you want to fit up with fire apparatus.

The Electrical Specialty Company of Pawtucket, R. I., has been incorporated with E. B. Crocker, president and A. D. Ross, treasurer, for the purpose of manufacturing arc light appliances under patents of Van A. Thomas, superintendent of the Narragansett Electric Lighting Company, of Providence, R. I., as well as inventions by other practical electricians. They have secured as their factory the renowned old Slater mill, the first cotton mill in the United States, the centennial of which was celebrated last fall. The catalogue just issued by them shows a very extended line of practical devices; among them we observe the Thomas mast arm for street lighting, which is rapidly coming into general use where safety and economy are desired, and which all practical electrical engineers acknowledge to be the proper method for lighting highways. The company has secured the services of F. H. Angell as traveling salesman.

Mr. Edgar Peckham is filling large orders for various street railroads. Among these are 30 trucks for the street railway company of Syracuse, N. Y. A large order has been received from Denver, Col., for non-oscillating trucks, which are spoken well of wherever used. Helena, Mont., also sends a large order.

The Minneapolis Brass and Iron Manufacturing Company, located at 116 First avenue, North, make a specialty of all kinds of electrical street railway appliances and brass work. They report a large business.

If you want a Water Cooler these hot days, ask for an Indurated Fibre Cooler. Tin and galvanized iron coolers are slightly cheaper in first cost, but one season is about all they will stand. You will find the "Indurated Fibre" Cooler as good as new five years hence. If your dealer hasn't these goods, write to the general agents, Cordley & Hayes, 173 and 175 Duane street, New York, and they will tell you where you can get your wants in this line supplied.

Otto Flemming of 1009 Arch street, Philadelphia, the well-known manufacturer of standard apparatus used in electro-therapeutics and surgery, has added to his variety of beautiful instruments a very practical graphite rheostat, called the Massey Current Controller, for which letters patent have been granted him.

To keep cool this hot season in your office, store, etc., write for one of the Novelty Electric Company's desk fan motors, 54 North Fourth street, Philadelphia, Pa.

Elements of Construction for Electro-Magnets, by Count Th. du Moncel. Translated by C. T. Wharton. Price 75cts. Electro-magnets constructed and used in accordance with his formulæ are employed in the most advantageous manner possible. Sent postpaid on receipt of price. E. & F. N. Spon, 12 Cortlandt street, New York.

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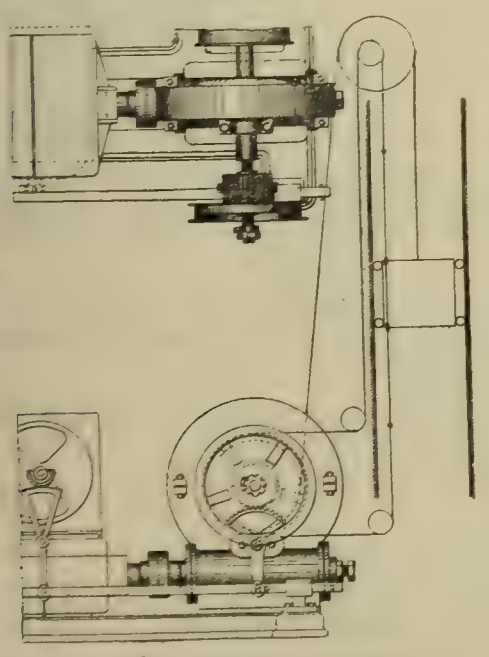
Issued Tuesday, June 23d, 1891.

454,462. Electric Elevator. Rudolph Eickemeyer, Yonkers, N. Y. Filed May 14, 1890.

An electric motor adapted to both hoist and lower the car with a movable switching device adapted, according to its position, to open and close the motor circuit and to admit current in respectively opposite directions through the armature circuit, and means for mechanically varying the current in that circuit.

454,467. Belt Controller for Dynamos. William A. Foote, Battle Creek, Mich. Filed July 31, 1890.

In a belt controller for dynamo machines, the combination, with the base having an inclined upper face and an upper frame having an oppositely inclined lower face slidingly secured on the base of a cylinder secured on the base parallel to the incline of its upper face, with a piston having a rod with its opposite end secured to the upper sliding frame, and means for supplying and exhausting liquid in the cylinder back of the piston.



454,462—ELECTRIC ELEVATOR.

454,470. Signal Device for Telephone Pay Stations. William Gray, Hartford, Conn. Filed April 19, 1890.

A coin channel to which is attached a tilting tumbler having one end arranged in the path of movement of a coin in the channel, and a sliding dog bearing a coin separator that is projected into the channel by the movement of the dog.

454,475. Electric Regulator for Constant Potential. Carl Hering, Philadelphia, Pa., assignor of one-half to John Hoskin, same place. Filed Dec. 16, 1887.

In a regulator for maintaining constant the potential of a shunt wound dynamo, the combination of a direct acting electro-magnetic device whose current is derived from the points at which the potential is to be kept constant, and an adjustable resistance in series with the shunt-magnet coils, which is increased by greater current in the electro-magnetic device and decreased by smaller current in the electro-magnetic device, the resistance being a carbon pile consisting of plates or discs of carbon the axis of which pile is inclined between the horizontal and the perpendicular.

454,476. Electric Regulator for Constant Potential. Carl Hering, Philadelphia, Pa., assignor of one-half to John Hoskin, same place. Filed May 24, 1889. Renewed May 23, 1891.

In combination with an electric regulator for constant potential, having an electro-magnet and having a resistance adapted to be diminished in conductivity by increase of current through its electro-magnet, a relay having an electro-magnet and having a resistance adapted to be increased in conductivity by increase of current through its electro-magnet, the first-named electro-magnet and the last-named resistance being in the same circuit.

454,485. Electric Arc Lamp. Hermann Lemp and Merle J. Wightman, Hartford, Conn., assignor to the Schuyler Electric Company, of Connecticut. Filed Oct. 26, 1886.

454,486. Overhead Electric System. Charles A. Lieb, New York, N. Y. Filed Nov. 6, 1890.

An insulating turn-buckle for electric wires, having a body part made of a single piece of insulating material recessed from the ends inwardly and threaded metallic end pieces.

454,487. Car-House Hanger. Charles A. Lieb, New York, N. Y. Filed Nov. 18, 1890.

A hanger for the support of overhead wires, consisting of a wooden body piece with a bolt running through it provided with means at both ends of the bar for the attachment of electric wires.

454,488. Commutator for Dynamos or Motor. Charles A. Lieb, New York, N. Y. Filed Dec. 12, 1890.

A commutator brush having a fixed frame, and a series of contact points placed in holes therein diagonally across the commutator bars and pressed against the commutator bars by separate springs, which press upon but are independent of the contact points.

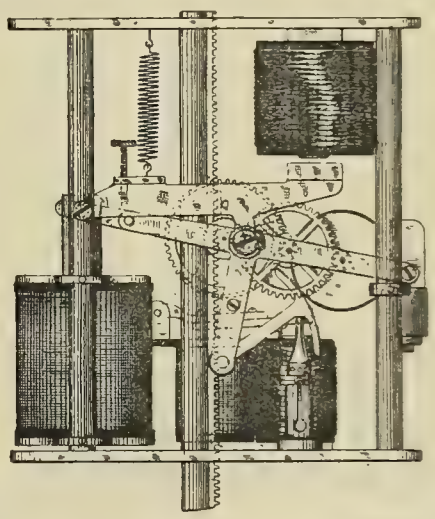
454,496. Limit-Switch. Frank B. Rae, Detroit, Mich., assignor to the Detroit Electrical Works, same place. Filed Jan. 14, 1890.

In a limit-switch, the combination, with the poles of a magnet included in the circuit, of a circuit breaker normally in electric contact with the poles within their field of force, mechanism controlling the movement of the circuit breaker, the arrangements being such that when the circuit is broken the field of force is at its maximum.

454,503. Signal Attachment for Telephone. Alfred D. Sundeen, Swan B. Molander and Gustaf W. Anderson, Mora and Andrew M. Carlsen, St. Paul, Minn. Filed June 23, 1890.

454,504. Signal Attachment for Telephone. Alfred D. Sundeen, Swan B. Molander and Gustaf W. Anderson, Mora and Andrew M. Carlsen, St. Paul, Minn. Filed June 23, 1890.

454,522. Trolley Pole Mechanism. George H. Larkin and James Tomkins, St. Paul, Minn. Filed Feb. 17, 1891.



454,485—ELECTRIC ARC LAMP.

In a trolley pole mechanism for electric cars, a stationary base frame upon the deck of the car having a flat upper surface, a trolley pole base frame pivoted centrally to the base frame and with bearing wheels in its free outer end, the trolley pole having the trolley wheel and pivoted by its lower end in the trolley pole base frame contiguous to its pivotal point, and springs connecting the trolley pole and trolley pole base frame.

454,532. Trolley for Railway Cars. Edmond Verstraete, St. Louis, Mo., assignor of one-half to Peter M. Kling, same place. Filed July 26, 1890.

A trolley regulated by a piston rod fitting within a cylinder.

454,536. Electric Car Trolley. William Duncan, Allegheny, Pa. Filed June 25, 1890. Renewed May 20, 1891.

454,541. Speed Regulator for Dynamo-Electric Machines. Erastus E. Winkley, Lynn, Mass. Filed April 15, 1890.

454,546. Electric Conductor. Alfred W. Sperry, Hartford, Conn., assignor to himself and G. Wells Root, same place. Filed Oct. 27 1890.

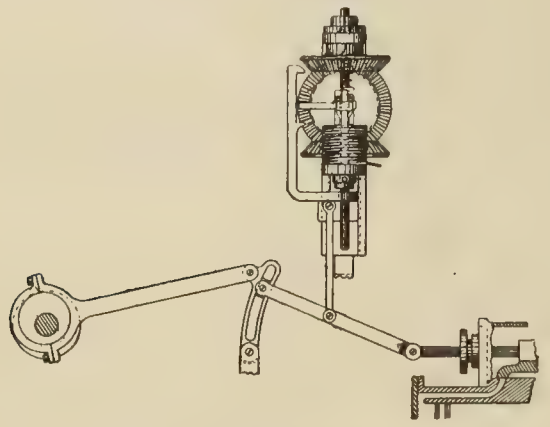
Metallic electric conductors having tubular ends and plugs to unite one length to the next and a fire and waterproof covering around them.

454,558. Incandescent Electric Lamp. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Aug. 7, 1882.

The combination of an inclosing globe, a continuous integral loop-shaped carbon filament therein, conducting wires attached to the ends of the filament and extending outside the globe for electrical connection with an external circuit, and a third conducting wire connected with the middle point of the filamentary loop and also extending outside the globe for electrical connection.

454,573. Electrical Pessary. Walter N. Sherman, Merced, Cal. Filed Feb. 18, 1891.

A pessary consisting of a disc or diaphragm of soft rubber formed with a stiffening centre perforated to receive an electric generator.



454,541—SPEED REGULATOR FOR DYNAMOS.

454,584. Switch-board for Telegraph Lines. Frank T. Viles, Hyde Park, and Nicholas Young, Boston, Mass. Filed Jan. 13, 1891.

A detachable switch-hook for a switchboard, consisting of an insulated handle, two bars of uniform length extending therefrom and adapted to straddle a wire of one set, both bars being provided with springs and with hooks at their outer ends adapted to engage a wire of the other set.

454,598. Galvanic Battery. Philip Hathaway, New York, N. Y. Filed Sept. 18, 1890.

In a chloride of silver battery, the combination of a zinc vessel containing the negative element and the exciting medium, and also forming the positive element, with a negative element composed of chloride of silver cast in the form of a rod having an indented or corrugated surface.

454,604. Electric Search-light. Gaston Sautter, Paris, France, assignor to Sautter, Harle & Co., same place. Filed Feb. 27, 1891. Patented in France.

454,622. System of Electric Lighting. Nicola Tesla, New York, N. Y. Filed April 25, 1891.

A method of generating or producing for the operation of the lighting devices currents of enormous frequency and excessively high potential.

454,625. Electric Signals for Railway Trains. Francis P. Lenahan, Wilkesbarre, assignor of one-third to Paul A. Oliver, Oliver's Mills, Pa. Filed Feb. 28, 1891.

454,626. Electric Motor. Frank B. Rae, Detroit, Mich., assignor to the Detroit Electrical Works, same place. Filed Sept. 5, 1890.

The combination, with a spring-actuated break-switch in the main line, the switch being provided with extensions, of a shunt field-magnet circuit included in series with the coils of an electro-magnet, a pivoted spring-actuated switch arm in the armature circuit which has a series of resistances, and a spring-actuated locking lever for the arm controlled by the electro-magnet in the shunt field circuit, the arm being provided with an insulated extension arranged to engage the extensions on the break switch to operate the latter.

454,627. Electric Motor. Alexander B. Rodney, Chicago, Ill. Filed Jan. 3, 1891.

The combination, with the main shaft, of two or more radial arms, each provided with an auxiliary motor connected therewith, the auxiliary motors being provided with wheels adapted to travel about the face of the main field-magnet, the auxiliary motors being adjustable outwardly and inwardly upon the radial arm.

454,630. Telegraphy. Benjamin B. Toye, Toronto, Can. Filed Sept. 25, 1890.

In a main line circuit, one pole charger arranged to reverse the currents in the usual way, in combination with one continuity-preserving transmitter and one break-before-make transmitter arranged to send currents of different intensities in the same direction.

454,643. Electric Signal Receiving Instrument. George L. Foote, Brooklyn, N.Y., and William C. Moore, Kansas City, Mo., assignors to the Electric Secret Service Company, New York, N. Y. Filed April 14, 1891.

454,650. Regulating Electric Lights and Power. Isaac Herzberg and Abram Herzberg, Philadelphia, Pa. Filed December 10, 1890.

A controlling device for electric circuits comprising an adjustable dial with mechanism for rotating it, an electric switch and a staff having two arms projecting therefrom, one of which is connected to the switch and the other controlled by the dial.

454,669. Electric Hose Coupling. Joseph B. Strauss, Cincinnati, Ohio. Filed March 19, 1891.

454,671. Lightning Arrester. Elihu Thomson, Swampscott, Mass. Filed Oct. 30, 1890.

454,672. Lightning-Arrester. Elihu Thomson, Lynn, Mass. Filed Nov. 5, 1890.

A lightning arrester comprising a pair of discharge-plates in series with a number of sets of polarizing cells, and a plurality of discharge-plates with jumping-spaces in shunt with the sets of polarizing-cells.

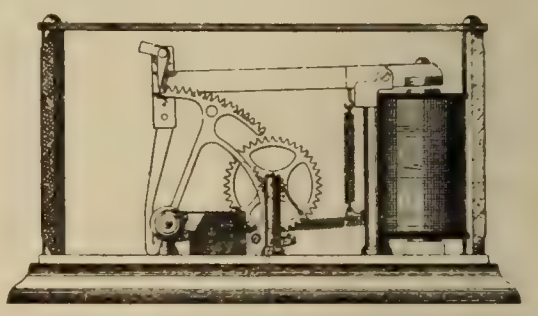
454,673. Lightning-Arrester. Elihu Thomson, Swampscott, Mass. Filed Jan. 31, 1891.

454,698. Method of and Apparatus for Heating Bars by Electricity. Edwin E. Angell, Somerville, Mass., assignor to the Electrical Forging Company, of Maine. Filed March 16, 1891.

The method of heating metallic bars or blanks, which consists in inserting a bar or blank in an electric circuit, then inserting another bar or blank in parallel in the same circuit side by side with the first blank, and then withdrawing one of the bars or blanks from the circuit, the other bar or blank remaining in the circuit during such withdrawal.

454,724. Galvanic Battery. Julius Emmner, Jr., Washington, D. C., assignor, by direct and mesne assignments, to Philip T. Dodge, trustee, same place. Filed Dec. 15, 1890.

454,746. Electrical Fire Alarm. Brunswick W. Leonard, Saybrook, assignor of one-half to John C. Nichols, New London, Conn. Filed March 24, 1891.



454,643—ELECTRIC SIGNALING RECEIVING INSTRUMENT.

454,782. Lamp Cut-Out and System. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 20, 1886.

454,794. Electric Connection. John H. Bickford, Salem, Mass., assignor to Joseph F. Porter, New York, N. Y. Filed March 6, 1891.

454,815. Electric Light Hanger. George W. Smith, Union City, Ind. Filed Jan. 22, 1891.

454,816. Electric Circuit Closer. John H. R. Ward, New York, N. Y. Filed Jan. 8, 1891.

454,818. Electrode for Secondary Batteries. Boyd Anderson, Texarkana, Tex. Filed Sept. 29, 1890.

454,832. Electro-Magnet Clutch. Erastus S. Bennett, Denver, Col., and Horace F. Parshall, Baltimore, Md. Filed July 29, 1890.

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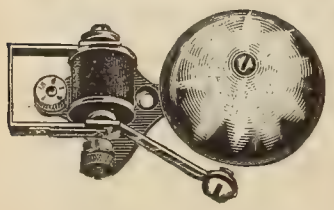
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WEEKLY.

Vol. IX. NEW YORK, JULY 11, 1891. No. 28.

EXPERIMENTS WITH ALTERNATE CURRENTS OF VERY HIGH FREQUENCY AND THEIR APPLICATION TO METHODS OF ARTIFICIAL ILLUMINATION.*

BY NIKOLA TESLA.

There is no subject more captivating, more worthy of study, than nature. To understand this great mechanism, to discover the forces which are active, and the laws which govern them, is the highest aim of the intellect of man.

Nature has stirred up in the universe infinite energy. The eternal recipient and transmitter of this infinite energy is the ether. The recognition of the existence of ether, and of the functions it performs, is one of the most important results of modern scientific research. The mere abandoning of the idea of action at a distance, the assumption of a medium pervading all space and connecting all gross matter, has freed the minds of thinkers of an ever-present doubt, and, by opening a new horizon—new and unforseen possibilities—has given fresh interest to phenomena with which we are familiar of old. It has been a great step toward the understanding of the forces of nature and their multifold manifestations to our senses. It has been for the enlightened student of physics what the understanding of the mechanism of the firearm or of the steam engine was for the barbarian. Phenomena upon which we used to look as wonders baffling explanation, we now see in a different light. The spark of an induction coil, the glow of an incandescent lamp, the manifestations of the mechanical forces of currents and magnets are no longer beyond our grasp; instead of the incomprehensible, as before, their observation suggests now in our minds a simple mechanism, and although as to its precise nature all is still conjecture, yet we know that the truth cannot be much longer hidden, and instinctively we feel that the understanding is dawning upon us. We still admire these beautiful phenomena, these strange forces, but we are helpless no longer; we can in a certain measure explain them, account for them, and we are hopeful of finally succeeding in unraveling the mystery which surrounds them.

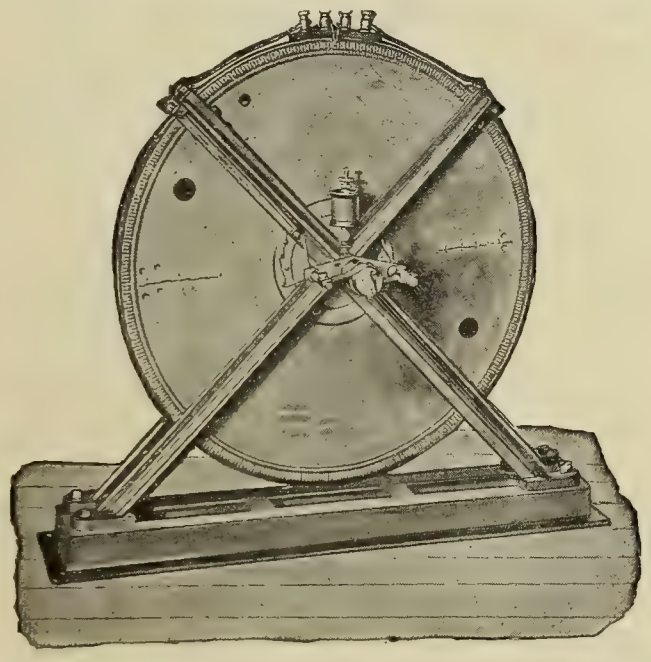


FIG. 1.—HIGH FREQUENCY ALTERNATOR WITH DRUM ARMATURE.

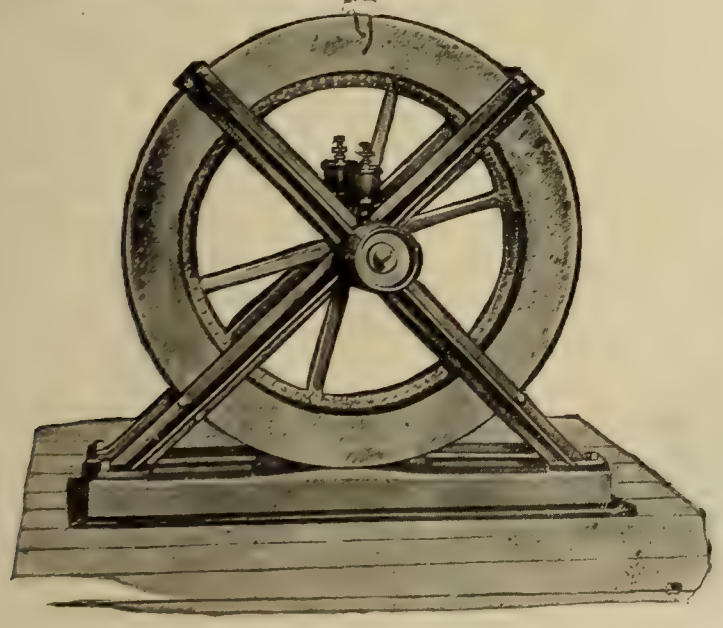


FIG. 2.—HIGH FREQUENCY ALTERNATOR WITH REVOLVING DISC ARMATURE.

In how far we can understand the world around us is the ultimate thought of every student of nature. The coarseness of our senses prevents us from recognizing the ulterior construction of matter, and astronomy, this grandest and most positive of natural sciences, can only teach us something that happens, as it were, in our immediate neighborhood; of the remoter portions of the boundless universe, with its numberless stars and suns, we know nothing. But far beyond the limit of perception of our senses the spirit still can guide us, and so we may hope that even these unknown worlds—infinitely small and great—may in a measure become known to us. Still even if this knowledge should reach us, the searching mind will find a barrier, perhaps forever unsurpassable, to the *true* recognition of that which *seems* to be, the mere *appearance* of which is the only and slender basis of all our philosophy.

Of all the forms of nature's immeasurable, all-pervading energy, which, ever and ever changing and moving, like a soul animates the inert universe, those of electricity and magnetism are perhaps the most fascinating. The effects of gravitation, of heat and light we observe daily, and soon we get accustomed to them, and soon they lose for us the character of the marvelous and wonderful; but electricity and magnetism, with their singular relationship, with their seemingly dual character unique among the forces in nature, with their phenomena of attractions, repulsions and rotations, strange manifestations of mysterious agents, stimulate and excite the mind to thought and research. What is electricity, and what is magnetism? These questions have been asked again and again. The most able intellects have ceaselessly wrestled with the problem; still the question has not as yet been fully answered. But while we cannot even to-day state what these singular forces are, yet we have made good headway toward the solution of the problem. We are now confident that electric and magnetic phenomena are attributable to ether, and we are perhaps justified in saying, that the effects of static electricity are effects of ether under strain and those of dynamic electricity and electro-magnetism effects of ether in motion. But this still leaves the question as to what electricity and magnetism are, unanswered.

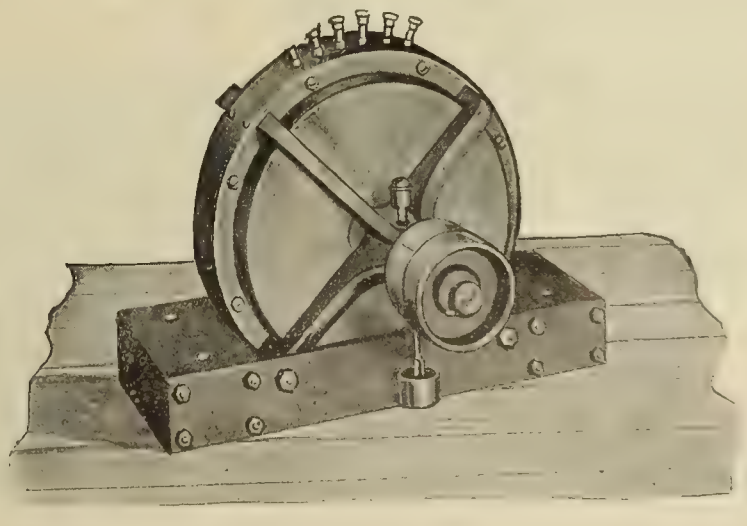


FIG. 3.—HIGH FREQUENCY ALTERNATOR WITH STATIONARY DISC ARMATURE AND STATIONARY EXCITING COIL.

* A lecture delivered before the American Institute of Electrical Engineers, at Columbia College, May 20, 1891.

First, we naturally inquire, What is electricity, and is there such a thing as electricity? In interpreting electric phenomena, we may speak of electricity or of an electric condition state or effect. If we speak of electric effects, we must distinguish two such effects opposite in character and neutralizing each other, as observation shows that two such opposite effects exist. This is unavoidable, for in a medium of the properties of ether, we cannot possibly exert a strain, or produce a displacement or motion of any kind, without causing in the surrounding medium an equivalent and opposite effect. But if we speak of electricity, meaning a *thing*, we must, I think, abandon the idea of two electricities, as the existence of two such things is highly improbable. For how can we imagine that there should be two things, equivalent in amount, alike in their properties, but of opposite character, both clinging to matter, both attracting and completely neutralizing each other? Such an assumption, though suggested by many phenomena, though most convenient for explaining them, has little to commend it. If there *is* such a thing as electricity, there can be only *one* such thing, and, excess and want of that one thing, possibly, but more probably its condition determines the positive and negative character. The old theory of Franklin, though falling short in some respects, is, from a certain point of view, after all, the most plausible one. Still, in spite of this, the theory of the two electricities is generally accepted, as it apparently explains electric phenomena in a more satisfactory manner. But a theory which explains better the facts is not necessarily true. Ingenious minds will invent theories to suit observation, and almost every independent thinker has his own views on the subject.

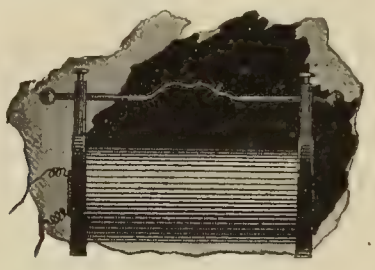


Fig. 4.—Sensitive Thread Discharge.

It is not with the object of advancing an opinion, but with the desire of acquainting you better with some of the results, which I will describe, to show you the reasoning I have followed, the departures I have made—that I venture to express, in a few words, the views and convictions which have led me to these results.

I adhere to the idea that there is a thing which we have been in the habit of calling electricity. The question is, what is that thing? or, What of all things, the existence of which we know, have we the best reason to call electricity? We know that it acts like an incompressible fluid; that there must be a constant quantity of it in nature; that it can be neither produced nor destroyed; and, what is more important, the electro-magnetic theory of light and all facts observed teach us that electric and ether phenomena are identical. The idea at once suggests itself, therefore, that electricity might be called ether. In fact, this view has in a certain sense been advanced by Dr. Lodge. His interesting work has been read by everyone and many have been convinced by his arguments. His great ability, and the interesting nature of the subject, keep the reader spellbound; but when the impressions fade one realizes that he has to deal only with ingenious explanations. I must confess, that I cannot believe in two electricities, much less in a doubly constituted ether. The puzzling behavior of the ether as a solid to waves of light and heat, and as a fluid to the motion of bodies through it, is certainly explained in the most natural and satisfactory manner by assuming it to be in motion, as Sir William Thomson has suggested; but regardless of this, there is nothing which would enable us to conclude with certainty that, while a fluid is not capable of transmitting transverse vibrations of a few hundred or thousand per second, it might not be capable of transmitting such vibrations when they range into hundreds of millions per second. Nor can anyone prove that there are transverse ether waves emitted from an alternate current machine, giving a small number of alternations per second; to such slow disturbances, the ether, if at rest, may behave as a true fluid.

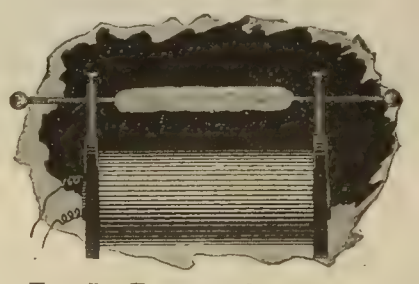


Fig. 5.—Flaming Discharge.

Returning to the subject, and bearing in mind that the existence of two electricities is, to say the least, highly improbable, we must remember, that we have no evidence of electricity, nor can we hope to get it, unless gross matter is present. Electricity, therefore, cannot be called ether in the broad sense of the term; but nothing would seem to stand in the way of calling electricity ether associated with matter, or bound ether; or, in other words, that the so-called static charge of the molecule is ether associated in some way with the molecule. Looking at it in that light, we would be justified in saying that electricity is concerned in all molecular actions.

Now, precisely what the ether surrounding the molecules is, wherein it differs from the ether in general, can only be conjectured. It cannot differ in density, ether being incompressible; it must, therefore, be under some strain or in motion, and the latter is the most probable. To understand its functions, it would be necessary to have an exact idea of the physical construction of matter, of which, of course, we can only form a mental picture.

But of all the views on nature, the one which assumes one matter and one force, and a perfect uniformity throughout, is the most scientific and most likely to be true. An infinitesimal world, with the molecules and their atoms spinning and moving in orbits, in much the same manner as celestial bodies, carrying with them and probably spinning with them ether, or in other words, carrying with them static charges, seems to my mind the most probable view, and one which, in a plausible manner, accounts for most of the phenomena observed. The spinning of the molecules and their ether sets up ether tensions or electrostatic strains; the equalization of ether tensions sets up ether motions or electric currents, and the orbital movements produce the effects of electro and permanent magnetism.

About fifteen years ago, Prof. Rowland demonstrated a most interesting and important fact, namely, that a static charge carried around produces the effects of an electric current. Leaving

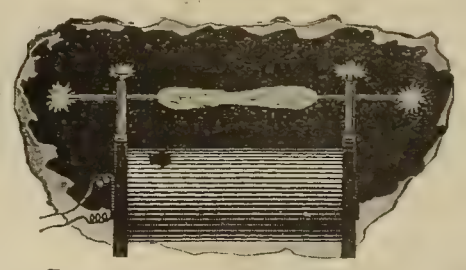


Fig. 6.—Streaming Discharge.

out of consideration the precise nature of the mechanism, which produces the attraction and repulsion of currents, and conceiving the electrostatically charged molecules in motion, this experimental fact gives us a fair idea of magnetism. We can conceive lines or tubes of force which physically exist, being formed of rows of directed moving molecules; we can see that these lines must be closed; that they must tend to shorten and expand, etc. It likewise explains in a reasonable way, the most puzzling phenomenon of all, permanent magnetism, and, in general, has all the beauties of the Ampere theory without possessing the vital defect of the same, namely, the assumption of molecular currents. Without enlarging further upon the subject, I would say, that I look upon all electrostatic, current and magnetic phenomena as being due to electrostatic molecular forces.

The preceding remarks I have deemed necessary to a full understanding of the subject as it presents itself to my mind.

Of all these phenomena the most important to study are the current phenomena, on account of the already extensive and evergrowing use of currents for industrial purposes. It is now a century since the first practical source of current has been produced, and ever since the phenomena which accompany the flow of currents have been diligently studied and through the untiring efforts of scientific men the simple laws which govern them have been discovered. But these laws were found to hold good only when the currents are of a steady character; when the currents are rapidly varying in strength quite different phenomena, often unexpected, present themselves and quite different laws hold good, which even now have not been determined as fully as is desirable, though through the work, principally of English scientists, enough knowledge has been gained on the subject to enable us to treat simple cases which now present themselves in daily practice.

The phenomena which are peculiar to the changing character of the currents are greatly exalted when the rate of change is increased, hence the study of these currents is considerably facilitated by the employment of properly constructed

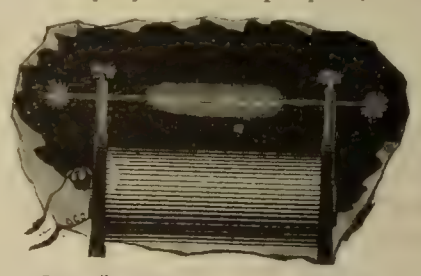


Fig. 7.—Brush and Spray Discharge.

apparatus. It was with this and other objects in view that I constructed alternate current machines capable of giving more than two million reversals of current per minute, and to this circumstance it is principally due that I am able to bring to your attention some of the results thus far reached, which I hope will prove to be a step in advance on account of their direct bearing upon one of the most important problems, namely, the production of a practical and efficient source of light.

The study of such rapidly alternating currents is very interesting. Nearly every experiment discloses something new. Many results may, of course, be predicted, but many more are unforeseen. The experimenter makes many interesting observations. For instance, we take a piece of iron and hold it against a magnet. Starting from low alternations and running up higher and higher we feel the impulses succeed each other faster and faster, get weaker and weaker, and finally disappear. We then observe a continuous pull; the pull, of course, is not continuous; it only appears so to us; our sense of touch is imperfect.

We may next establish an arc between the electrodes and observe, as the alternations rise, that the note which accompanies alternating arcs gets shriller and shriller, gradually weakens, and finally ceases. The air vibrations, of course, continue, but they are too weak to be perceived; our sense of hearing fails us.

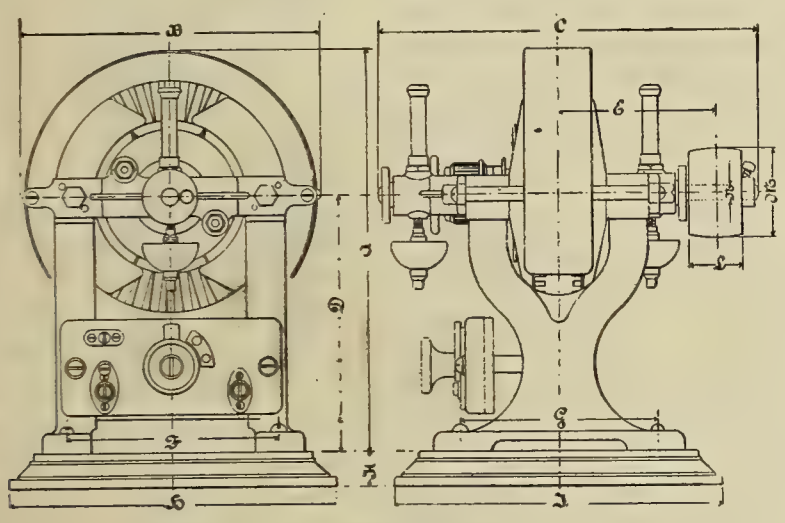
We observe the small physiological effects, the rapid heating of the iron cores and conductors, curious inductive effects, interesting condenser phenomena, and still more interesting light phenomena with a high tension induction coil.

(*To be continued.*)

SMALL EDISON ELECTRIC MOTORS.

Uses for small electric motors from $\frac{1}{16}$ H.P. to ½ H.P. are numerous and the application of these machines for the performance of work of all kinds is extending daily. Much work which was formerly done by hand and which could not be performed in any other way, is now accomplished by electric power. The flexibility of the electric system of transmission is one of its great features, and, owing to this property power can be taken to and used at any point at which it would be impossible to apply power in any other form.

In our issue of May 30, we published a description and illustrations of a small slow speed motor designed by the Edison General Electric Company, of New York. This motor is known as the 1891 type and was designed by Mr. Edison with special reference to its use in small sizes. It embodies to the highest degree all the essential features of a perfect small electric motor, namely: 1, minimum of attention and repair; 2, high efficiency; 3, small first cost; 4, slow speed; 5, perfection of mechanical detail.



SMALL SLOW SPEED EDISON MOTORS.

In addition to the cuts already given in the issue mentioned, the one given herewith will be interesting, showing as it does a sectional and end view of the motor.

We are also enabled to give below some additional and interesting data of these motors:

Volts.	Guaranteed h. p. at full load.	Winding.	Revolutions per minute. Light load.	Revolutions per minute. Full load	Weight in pounds. Gross weight.	Weight in pounds. Net weight.
120	$\frac{1}{12}$	Series.	4400	2000	....	14.75
120	⅛	Series.	2900	1675	....	20.25
120	⅓	Series.	2500	1100	....	28.50
120	½	Shunt	1710	1300	....	37.60

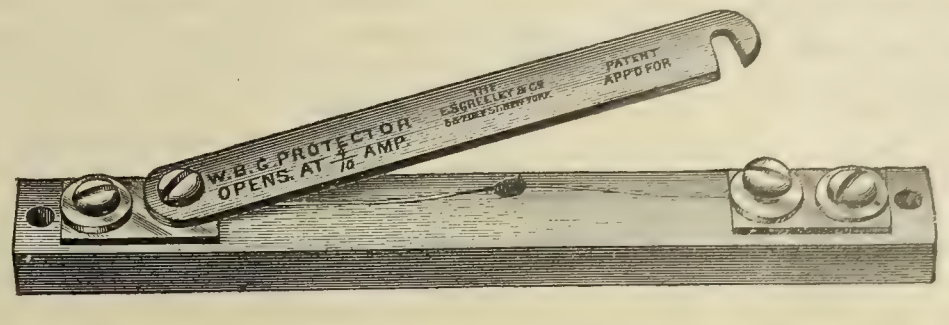
The study of this table in connection with the facts already given, seems to warrant the claim that the motor is an highly efficient one.

THE "W. B. G." PROTECTOR.

The need for protecting telephone, telegraph and other electrical instruments, including bells, switchboards and cables, from danger by heavy or abnormal currents is now very generally felt and admitted especially in telegraph and telephone circles.

What is needed for telephone use is a protector that will protect a station or central office against dangerous currents of all kinds, including the "sneak" variety. On this page we publish cuts of the "W. B. G." Protector.

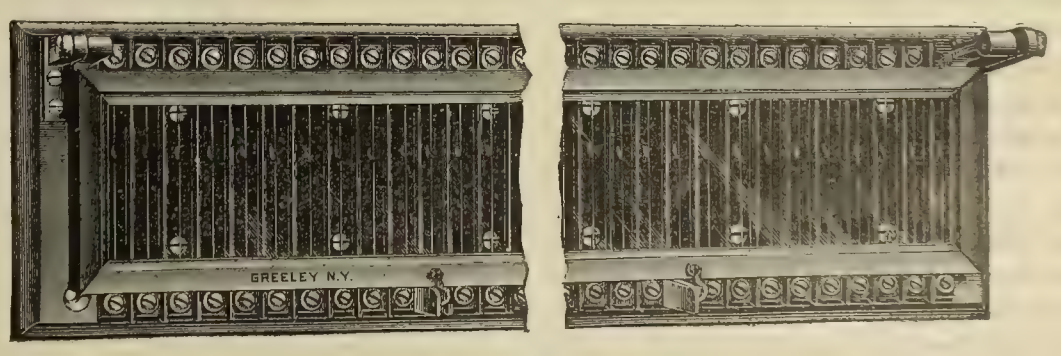
The inventors of this device are practical telegraph and telephone men and understand fully the necessity of a thoroughly reliable protector for telephone and telegraph stations and instruments. Of course any device that would be efficient in these two lines of electrical business would be equally so in others, such as burglar alarms, messenger and clock service, and in all cases where apparatus is exposed to damage from heavy or abnormal currents. The protectors are mounted 1, 2 and 3 on a base, (which is of vulcanized fibre) and in sections of fifty, handsomely finished, as shown in the cuts.



1 WIRE W. B. G. FUSE PROTECTOR.

The single, double and triple protectors are intended for use at telephone subscribers' stations and are mounted to accommodate "single," "metallic" and "Law system wiring." The sections of fifty are intended for use at central offices or any place where a large number of wires enter. They are also mounted to order.

The main feature of the invention is the manner in which the fuse is melted by the generation of heat in the small coil of comparatively high resistance wire, which is wound upon one end of the fuse, and which is part of the circuit. The coil is formed of German silver wire of size and length necessary to produce heat enough to melt the fuse upon the passage of any current at the point where it may be deemed desirable to have the line "open." For ordinary use at subcribers' stations they are wound to open the line at about $\frac{4}{10}$ ampere, and for use at other places, such as central offices, where more delicate apparatus may need protection, they are wound accordingly.



50 WIRE W. B. G. PROTECTOR BOARD.

It is also used in cable boxes, and by a very simple arrangement forms good protection against lightning, as well as strong currents.

These devices are already manufactured and on sale by the supply house of The E. S. Greeley & Company, of New York, which is the headquarters for the goods.

The Hubbell Portable Electric Lamp and Power Company, of New York, has been incorporated with a capital of $1,000,000, with offices in New York City.

AN ELECTRICAL SUPPLY HOUSE IN DIFFICULTY.

On June 30, the Empire City Electric Company, 15-17 Dey street, New York, made application before Judge Beach, of the Supreme Court, for the appointment of a receiver in proceedings for a voluntary dissolution. In the application, Mr. Charles S. Beardsley, of Yonkers, N. Y., was named in connection with the receivership. The application was granted, and Mr. Beardsley appointed, his bond being fixed at $25,000.

This action of the Empire City Electric Company was a great surprise to the trade.

The company's capital stock is $100,000, and in its application for a receiver it declared that it will doubtless be able to settle in full with its creditors if time be given and its assets be not sacrificed. It is claimed that if time is granted the company will not only be able to settle in full with its creditors, but that its stockholders will also receive a surplus.

BUFFALO NOTES.

Mr. Charles R. Huntley, president of the National Electric Light Association, has just returned from Montreal, where he has been in consultation with the local committee of the Association and prominent citizens looking to the welfare of the next Association meeting, which will take place in September. The demand for space is far beyond all expectation, and from the present outlook the meeting will eclipse all previous ones. Mr. Huntley is an exceedingly happy man, and he is to be congratulated on the success so far achieved. Much praise is also due Mr. A. J. Corriveau, of Montreal, who is using every effort to have affairs pass off smoothly. The hard work he is doing, is attracting widespread and favorable attention.

Mr. Frank Kitton, chief operator of the Western Union Telegraph Company and electrical expert for the Board of Underwriters of Buffalo, has returned from a two week's vacation much recuperated in health. No man in Buffalo is better or more favorably known among the electrical trade, and the work he has performed redounds to his credit as an expert.

The power station of the Buffalo Street Railway Company is nearing completion. The work is being done by the Field Engineering Company of New York, and no expense is being spared to make it the most complete electric street railway plant in the country.

The first transformer was constructed by Faraday in 1831.

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NEW YORK, JULY 11, 1891.

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GIVE THE LITTLE FELLOWS A CHANCE.

There is a class of tradesmen that should be under the fostering care of large electrical supply houses and encouraged rather than discouraged in the prosecution of their trade. We refer to the small dealers in electrical supplies. In all other lines of trade the small dealers are protected in the matter of prices by the wholesale houses but this rule does not seem to be recognized to any great extent in the electrical trade. It is possible for an individual outside of the trade to go to most of the large houses and purchase goods on precisely the same terms that are given to the person who buys goods to be retailed to the consumer. In other words, any one can go and buy electrical goods of large houses in small quantities at wholesale prices. Such being the case it is no wonder that the small dealer is feeling the effect of such unbusiness-like methods and many of them are being driven to the wall by their more formidable competitors. There is no alternative for these small tradesmen. They try to maintain the list price on their goods but are seriously handicapped by the practice of the large houses in allowing discounts without proper discrimination. It is to the positive advantage of the manufacturers and supply houses to afford the small dealers all the encouragement and protection possible. The more of these dealers, or outlets, so to speak, the faster will the goods reach the public. They may be likened to the branch circuits on an incandescent system. The large supply houses represent the feeders. These feed the smaller circuits and the larger the number of taps the greater will be the flow through the feeders. The small dealer represents an outlet for the goods of the wholesale house, and while the laws governing the incandescent circuit may not be perfectly applicable to trade in every particular, yet there is an accordance between the two which is well worth the attention of the trade. Give the little fellows a chance and they will increase your trade. By discouraging them you rob your own pocket.

NOTES.

President Harrison, on July 2, appointed William E. Simonds, of Connecticut, Commissioner of Patents vice Charles E. Mitchell, resigned.

The progressive Japanese are rapidly adopting modern conveniences and appliances, particularly in the electrical line. Our Tokio correspondent states that a fire and police telegraph system, with 370 boxes or stations has been established in that city. The electric light is already a permanent fixture, and the telegraph and telephone are so familiar to the people that they have long ceased to be regarded with wonder and curiosity. Electricity is the greatest of all civilizing influences, and where it is not found it is safe to assume that darkness and ignorance reign supreme.

The lecture delivered by Nikola Tesla before the American Institute of Electrical Engineers, at Columbia College, May 20, last, was one of the most important contributions in recent times to electrical knowledge. As Mr. Tesla spoke extemporaneously only fragments of his lecture found their way into print. Owing to the importance of the subject, however, the lecture has since been written out in full by Mr. Tesla, and we are enabled to begin, in this issue, its publication. Owing to its extraordinary length however, we shall publish it in parts in successive issues, so that our readers may be able to read the paper in full. In this issue we give the first portion of Mr. Tesla's interesting lecture, and as it has already created much general interest, its publication in full will be welcomed and appreciated by all interested in electricity.

The Mayor of New Orleans and the Postal Telegraph Company are at loggerheads, with the result that that company's wires were cut down in the streets and all telegraphic communication by its lines was cut off. The Postal Company had strung its wires on poles contrary to orders from the city council. After the damage was done an agreement was reached between a committee of the council and the Postal Company that the latter's wires might be strung on poles. In New Orleans there is a company which erects "towers," 150 feet high, on street corners for carrying electric wires and the council had ordered the Postal Company to string its wires on these "towers." This it refused to do, and asked permission to lay its wires underground. This request was not granted with the result as above stated. The city council is opposed to underground conduits on the ground that they are not practicable in the permanently moist soil of New Orleans, and the "towers" have been declared unsafe.

The article on the subject of electric light and wires in Paris, printed elsewhere in this issue, will be read with interest and profit. Everything the French people undertake is done in a scientific manner; even electric lighting, about which there is much to learn, has been established on a firm and sound basis. Here in America much work of this class has been of the most temporary character, but in France such work is not permitted. The electric lighting of Paris has been accomplished in a skilful and scientific manner, and no doubt many American engineers and contractors could learn a great deal to their advantage by a thorough study of the methods employed in installation work in the French capital. It is refreshing to New Yorkers to read that the disposition of wires in Paris is a problem of easy and satisfactory solution. The Parisian officials do not indulge in the incipient riots when they have electric wires under consideration the way the authorities in New York do. Of course, Paris and New York are totally different places, but the fact stands that electric lighting anywhere can be done in a scientific and entirely satisfactory manner.

THE STREET RAILWAY DEPARTMENT OF THE ELECTRICAL AGE —WHAT IS THOUGHT OF IT.

Chicago, Ill., July 2d, 1891.

Mr. J. B. Taltavall, Pres. Electric Age Pub. Co., New York:

Dear Sir:—Your favor of the 25th ult., announcing the new departure in which my friend, Mr. Cavell, is to take a prominent part, has been received. I beg to offer congratulations and to wish for your success in this department.

I have admired the business enterprise shown by your paper during the last few months, and trust that you will be favored with the prosperity which you certainly deserve. It seems to me that equal congratulations are due to your company and to Mr. Cavell. His long and practical experience in the street railway field, and his deserved popularity with all classes will be an aid to him and an advantage to you in the new departure.

Wishing you continued success and with kindest regards to Mr. Cavell, believe me,

Sincerely yours,
W. R. Mason.

NOTES FROM JAPAN.

In a communication from our Tokio correspondent we glean the following interesting facts concerning electrical affairs in Japan.

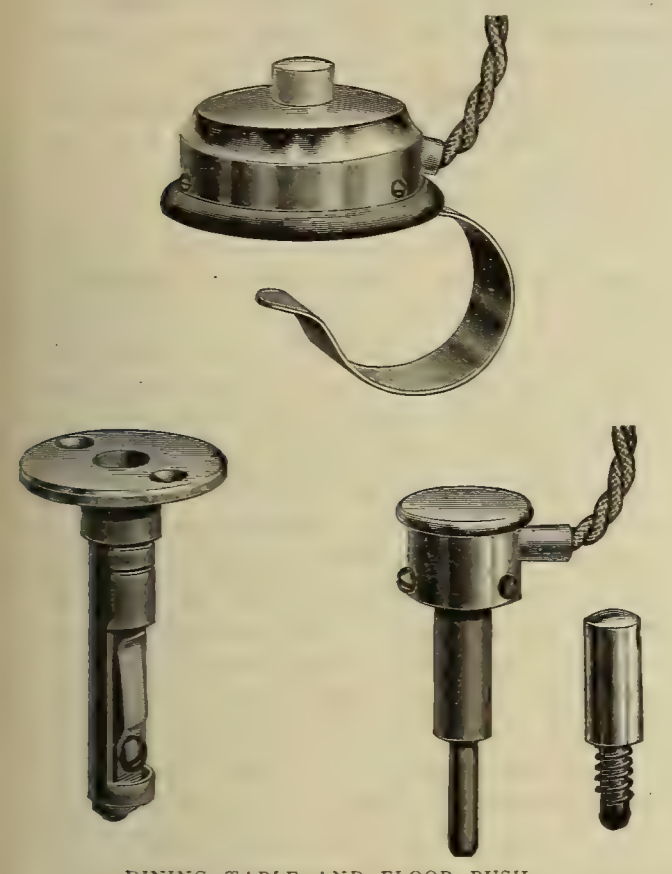
A fire and police telegraph system has been established in Tokio, and the construction of the same is about complete. There are 370 boxes scattered throughout the city, and they are placed in a small house or sentry box for the policemen. They are not exposed on the streets as they are in this country. Fifteen instruments are placed in each circuit. The self-starting Morse ink register with relays will be used, and all of the circuits will be of the "closed" class. These are the first closed circuits used in Japan, all telegraph circuits being worked on the open circuit method.

Mr. S. Katogi and some of his associates in Tokio made some remarks, on June 18, before the Electrical Society of that city on the new fire alarm system. Mr. Katogi will later on give a lantern exhibition before the same society illustrating American progress in electrical matters. Among the pictures he will show will be the new *World* Building in New York City; a view of the maze of wires Broadway and Wall street, New York and a view of the switchboard of the Cortlandt street Telephone Exchange, New York.

Mr. Katogi has introduced into the Japanese theatres arc and incandescent lamps for the purpose of producing effects simulating the rising sun, rainbows and lightning, and he has met with great success.

COMBINATION PUSH BUTTON.

We present to our readers herewith an illustration of the "E.S." combination dining table and floor push, which is somewhat different in construction to other devices of this kind, particularly in the method of fastening the cord. The cord, which is silk-covered, enters the push at the side, and is fastened so that it cannot become broken or abraided by pushing the plug in place with the



DINING TABLE AND FLOOR PUSH.

hand or foot. Tinsel cord is not used as it is of too high a resistance, requiring more battery to ring the bell.

The floor plate is constructed to exclude dust or dirt so that the workings of the push cannot become obstructed from this cause.

Bell-fitters should find the combination push very saleable. It is manufactured by the Electrical Supply Company, 171 Randolph street, Chicago.

THE MASSEY CURRENT CONTROLLER.

We illustrate herewith a valuable little adjunct of every electrical medical apparatus, that is interesting for its usefulness, for the principle involved in its design, and the simplicity of its construction. Medical men know the value of a controller to regulate the amount of electrical current used, and the unpleasant sensation caused by too



RHEOSTAT OR CURRENT CONTROLLER.

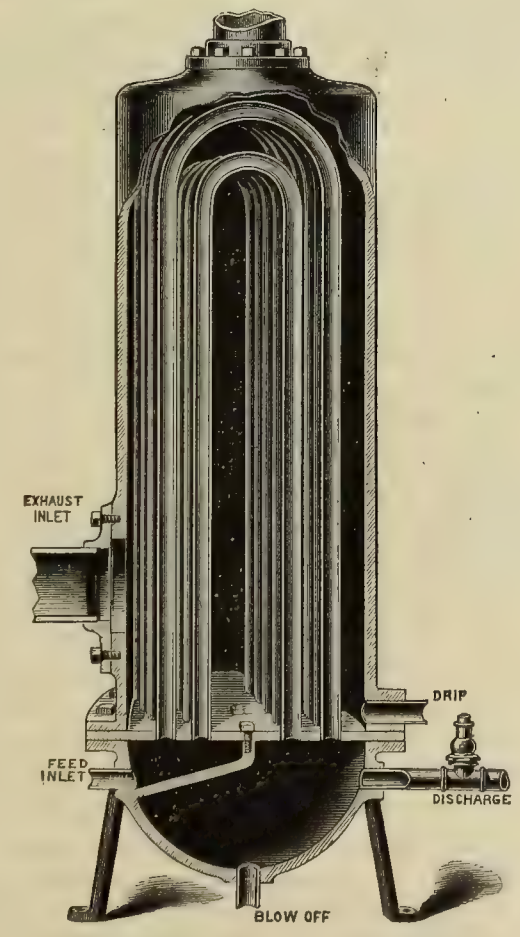
rapid changes in such adjustment of current. Water rheostats have been usually used for this purpose as the changes made are very gradual, but Otto Fleming, the manufacturing electrician of 1009 Arch street, Philadelphia, has succeeded in producing in the Massey current controller, a device fully the equal of a water rheostat, occupying one-fifth of the space, and at a much smaller cost.

It consists of a porcelain plate, provided with a sickle-shaped conducting area of graphite broadening and thickening up to the terminal, where the graphite unites with a metallic surface, which is in direct contact with the battery without any material resistance. When the crank is placed to the right of the hard rubber bridge, the contact comb of the crank rests entirely on the porcelain and the circuit is broken; moving it slightly forward, it soon touches the sickle point and the graphite mark permits the least amount of current to pass through, since the current must pass over the whole area of graphite. By turning the crank slowly and steadily onward, there is a gradual increase of current without shock, until finally the metallic surface is reached, when the whole power of the battery is turned on. A reversed action turns the current off. If the motion is made slowly, the increase and decrease is exceedingly gradual. By its use, a more economical wear of the cells results, as all cells are worked alike. It may be used with a small or large number of voltaic cells, or in connection with an incandescent light circuit for medical galvanic work.

RADWAY'S IMPROVED FEED-WATER HEATER.

We illustrate herewith a feed-water heater that is the result of considerable experience in this line.

Drawn seamless brass bent tube is used, both ends being secured into the one head or tube plate (as shown in the cut), by means of a roller tube expander; there exists, therefore, no danger of leaky joints, caused by expansion or contraction of tubes. The shell being manufactured of cast iron will not pit or corrode.



FEED WATER HEATER FOR BOILERS.

The water being divided into many small columns, by means of the tubes, a much greater heating surface is in consequence obtained, therefore, coming, as it does, into almost immediate contact with the exhaust steam, it becomes heated in a very short time to from 200 degrees to 212 degrees without back pressure.

The settling chamber is divided into two compartments.

As the water enters the heater, it passes up through the tubes and down into the settling chamber, then out of the top of same to the boiler.

The chamber and the tubes are from twelve to twenty times larger than the inlet and outlet of the feed, thereby allowing a slow and free passage of the water, as well as plenty of time for the sediment to settle at the bottom, where it can be blown off.

The area for the exhaust to pass around the tubes is from four to six times the size of the exhaust pipe, therefore there can be no back pressure.

Mr. G. L. Radway, of 136 Liberty street, New York, the manufacturer, guarantees that they will heat the feed water to a temperature of 200 to 212 degrees Fahrenheit with exhaust steam alone, without back pressure on engine, when not worked above their rated capacity.

EASTERN NOTES.

The well-known Holtzer-Cabot Electric Co., Boston, Mass., has taken the agency of the Norwich Insulated Wire Company and will carry a full line of its goods in stock. The Norwich company is to be congratulated on having such an able agency in the New England States, as the H.-C. Co. are noted for their hustling qualities.

The Electric Gas lighting Company, 195 Devonshire street, Boston, reports an active business. The general business has doubled within four years. The Samson battery business has also increased very rapidly throughout the whole country, and the same may be said of the company's general merchandising. The company employs at its factory between 35 and 40 men, who are kept at work the year round.

The N. E. Fire and Heat Regulator Company, 70 Pearl street, Boston, have just issued a pamphlet illustrating and describing their devices for regulating the temperature in dry-rooms, rubber vulcanizers, etc. The apparatus consists of a thermostat by means of which an electrical contact is made when the temperature rises or falls one degree more or less than it is desired to maintain. This company are the manufacturers of a large variety of indicating and controlling devices, for which there is a large demand.

The Denison Electrical Engineering Company, agents and builders of dynamos and electric motors, designers and constructors of special electrical work, elevators, ventilating apparatus and storage batteries, 87 Lake Place, New Haven, Conn., are doing a thriving business. In the Fall, the company expects to get out an electric motor specially designed for elevator work. Mr. J. F. Denison, lately with the Audubon Machine Works, severed his connection with that concern on June 1, and is now electrician and general manager of the Denison Electrical Engineering Company.

The National Electric Company, 19 Congress street, Boston, manufactures a patent shielded anti-induction telephone wire, which is said to give excellent results in practice. It makes a complete metallic circuit in one wire, which may be put on the same poles and cross arms with electric light or electric railway trolley wires, all heavily charged. Under these conditions there are no inductive disturbances noticeable on the telephone circuit. It is also said to be the best preventive of abrasion yet devised, and for electric light wires it prevents any grounding of the current when the wires run through trees, or are in any position where abrasion is likely to occur. The shield is made of iron or copper, and is put on spirally. Mr. C. E. Jackson is president of the company, and Mr. N. T. Greenwood is treasurer and manager.

The energy or heat developed in a circuit is proportional to the electromotive force multiplied by the current.

MINNEAPOLIS NOTES.

Fairmount, Minn., is to have an electric light plant.

Mr. Clift Wise, the chief engineer of the Interior Conduit and Insulation Company, of New York, is making a visit to this city. He was for several years consulting and constructing engineer of the Minneapolis Railway Company and his many warm friends here gave him a hearty welcome on his arrival. The Interior Conduit Company is to have a large plant at the World's Fair and Mr. Wise will superintend the installation.

A. M. Robertson, general manager of the Brush Company, and E. S. Corser are making a tour of the East inspecting the various underground systems with a view of placing their wires in this city underground, bids for which were opened recently. Among the bidders are the Standard Underground Cable, the Okonite, the Habirshaw, Safety Insulated, the John A. Roebling, Western Electric, Grimshaw and Edison Companies. The contract will not be awarded until the executive board hear the report of Messrs. Robertson and Corser.

PHILADELPHIA NOTES.

Clay, Pepper & Register, consulting and contracting electrical engineers, Chestnut and Fourth streets, Philadelphia, Pa., have for the past two years been engaged in a general contracting and installing business. The firm name was formerly Clay & Pepper, but on April 1 last, Mr. A. L. Register, who had been up to that time connected with the railway department of the Thomson-Houston Electric Company, was admitted into the firm, and the firm's name was then changed as indicated at the head of this article. The firm has lately undertaken the manufacture of motors and dynamos, and its factory is at 117-121 North Front street, Camden, N. J. As yet the company is making only small sizes, but will by the end of the year be able to supply machines up to 20 H. P. Larger machines will be built on order either from the firm's own design or others. From letters received from purchasers of its machines the firm believes that it has, if not the best in point of finish and mechanical design, at least equal to any other machine on the market at the present time. The firm is agent for the American Circular Loom Company's canvas jacket wire and the American Electric Elevator Company. It also installs complete electric mining plants, railway, light and power installations.

The Chester Foundry and Machine Company, Chester, Pa., manufacturers for the United States of the Brotherhood Three Cylinder High Speed engines, and all kinds of heavy machinery, boilers and wrought iron work, are at the present time building two large hydraulic riveting machines for the government, together with a hydraulic crane. One of these machines is for the Boston and one for the Brooklyn Navy Yard. The company is also building two similar machines of a very large size, capable of doing the heaviest boiler work, for private parties. It has also just cast a hydraulic cylinder for a cotton compress weighing about 59,000 lbs. The Three Cylinder High Speed Brotherhood engines manufactured by this company are used extensively for electrical purposes. The Pullman Car Company is using a number of them, and several have also been placed in some of the banks and the Stock Exchange in New York, and are giving general satisfaction. The company has supplied them for running dynamos for general lighting purposes and also for steam cranes, for which they are well adapted. The officers of the company are H. B. Black, president, William Porter, general manager, and Theodore W. Stone, secretary.

WESTERN NOTES.

Mr. Charles A. Baker, of Seattle, Wash., has secured a franchise for electric light and power privileges for the term of 25 years. The plant will be located on the shore of Lake Washington.

George P. Barton and Charles A. Brown have formed a co-partnership in Chicago for the practice of law, under the firm name of Barton & Brown, with offices in the Temple Court Building, 225 Dearborn street. Mr. Brown was formerly general manager of the Western Electric Company, Chicago.

An electric launch has just been supplied to a gentleman in San Francisco by the Pacific Electrical Storage Company of that city, to be run during the summer on Lake Tahoe. Its dimensions are: length 28 feet, beam 6 feet and draft 30 inches, and its average speed will be about 8 miles an hour. The launch will carry 56 accumulators of the "23 M" type and a 4 H. P. motor. It will run 70 miles on one charge.

The San Antonio Electric Light and Power Company has been organized for the purpose of supplying Pomona with power for light and manufacturing purposes. It is proposed to construct a tunnel of iron pipe with a carrying capacity of 3,000 inches of water with a fall of 300 feet. Water wheels and generators will be put in at the mouth of San Antonio canyon, 13 miles from Pomona, whence power will be conveyed over heavy copper wires.

The Central New York Electric Company, 607 Kirk Building, Syracuse, N. Y., reports a large demand for the electrical specialties which it carries. It has just published a small pamphlet describing several well-known electric light devices for which there has been a great demand. Among them are Cutter's lamp supporting pulley, Cutter's globe holder for arc lamps, Cutter's "E. L." insulator, and the Morris Swivel pole pulley. These devices are saving money wherever used.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the regular monthly meeting of Council of the American Institute of Electrical Engineers, the following delegates were appointed to attend the Frankfort Electrical Conference, in accordance with a resolution adopted at the general meeting, May 21: Carl Hering, chairman; Prof. R. O. Heinrich, Nikola Tesla and Dr. E. L. Nichols.

Prof. Heinrich is already in Europe and Mr. Hering sailed July 2, on the "Normannia." Mr. Tesla is not certain that he will be able to go.

The following associate members were elected:

Barnard, John H., General Manager, Asheville Street Railway Company, and Asheville Light and Power Company, Asheville, N. C.; Cram, Henry B., Treasurer, Bernstein Electric Company, 175 Prospect street, Cambridgeport, Mass.; Dame, Frank L., Superintendent, Vancouver Electric Railway and Light Company, Vancouver, B. C.; Emery, Charles Edward, Consulting Engineer, 22 Cortlandt street, New York; Fay, Thomas J, Maine Electric Improvement Company, 136 Liberty street, New York; Fisk, Walter C., Manager, Bernstein Electric Company, 620 Atlantic avenue, Boston, Mass.; Gans, John L., Superintendent and Electrician, The Electric Company, Connellsville, Pa.; Hadley, Warren B., Superintendent Wiring Department, Edison Electric Illuminating Company, 431 Fifth avenue, New York; Healy, Louis W., The Wightman Electric Company, 1205 Marion street, Scranton, Pa.; Kellogg, James W., Assistant to District Engineer, Edison General Electric Company, 140 East Twenty-seventh street, New York: Luquee, Thatcher T. P., Assistant in Surveying and Practical Mining, and Student in Electrical Engineering, Columbia College, N. Y. and Bedford, N. Y.; Rosebrugh, Thomas Reeve, Lecturer in Electrical Engineering, School of Practical Science, Toronto, Ont.; Taintor, Giles, Assistant Electrician, N. E. Telephone and Telegraph Company, 7 Walnut street, Boston, Mass; Wirt, Herbert C., Electrician, Marine Department, Thomson-Houston Electrical Company, 12 Millmont street, Roxbury, Mass.; Woodward, Francke L., Student in Electricity, 49 Grand street, Albany, N. Y.

Mr. Jesse M. Smith was transferred from associate to full membership.

No further meetings of the Institute will be held until September.

NEW BOOKS AND CATALOGUES.

ELECTRICITY AND ITS RECENT APPLICATIONS. A practical treatise for students and amateurs, with an illustrated dictionary of electrical terms and phrases, by Edward Trevert. 346 pages, numerous illustrations. Bubier Publishing Company, Lynn, Mass. Price, $2.00.

The numerous works by this author have become so familiar to students and amateurs of electrical science that any new publication from his pen will, no doubt, be favorably received. In this book Mr. Trevert, although still writing for the student, does not do so for the amateur alone, as in his former works, but describes some of the latest applications of electricity in a manner that will be acceptable to the practical electrician. Nearly all the latest forms of electrical machinery are described and illustrated, and instructions are given for making a large variety of apparatus. This is the best of Mr. Trevert's works, and it should be in the library of every student of electricity.

THE fifth annual edition of the "Metal Trades Directory" comes to us greatly improved over former editions. This year the whole of New York State is included, but kept separate from that of New York City. It is seldom a work of this kind, containing nearly 1,200 pages, is compiled so that by glancing at the contents any firm, or any branch of the many manufactured articles, or all the firms dealing or manufacturing any one class of articles, can be referred to without loss of time, but this is what Messrs. Price, Lee & Company, of New Haven, Conn., have accomplished in this valuable directory. The trades and manufactured articles are arranged alphabetically and in classified lists, and cover everything in the metal and mechanical lines. The publishers spared neither time nor expense to make this work complete in every respect.

The Card Electric Motor Dynamo Company, of Cincinnati, Ohio, have just issued their second catalogue of electric motors and dynamos. It is two years since the first was published, and during the interval many important mechanical and electrical changes have been made in the machinery, all of which are embodied in the new catalogue. The Card dynamos and motors have proven very satisfactory, demonstrating their efficiency wherever used. The company report a large business, and bright prospects for the future.

The Gila Bend Reservoir and Irrigation Company, of Tucson, Ariz., of which E. J. Horton is president, has just issued a neat illustrated pamphlet, setting forth the claims of that section of the country as a fruit producing land. The company has an office at 45 Broadway, New York, where Mr. Horton will explain the objects of his company to those wishing to settle in the glorious climate of Southern Arizona.

ELECTRIC LIGHT AND WIRES IN PARIS.

The manner in which Paris is now proceeding to introduce electricity in every portion of the municipal area is of the utmost importance to all other cities that have to do with similar problems. There has been no undue haste. On the contrary, the subject has been treated in a patient, scientific, systematic way. To begin with, the municipality has spent 2,000,000 francs or more in making a central electrical installation of its own in the basement of "Les Halles Centrales", the great central market of Paris. This plant is conveniently situated for the illumination of a number of public buildings and establishments, and it can be enlarged indefinitely. But it has never been intended to use this or any other municipal installation for the general work of lighting the city. It is for experimental purposes, and also for the purpose of acting as a regulator of charges. It enables the municipality to command the situation, and gives it a corps of men who understand the practical details of an electrical establishment. For the purpose of general illumination the city has been divided into seven "secteurs electriques." Paris is approximately a circle; and the secteurs are segments, the dividing lines of which radiate from the vicinity of the Halles as a centre and extend to the circumference. Each of these secteurs has been granted exclusively for a short term of years to a responsible electric company. Thus, Edison has been accorded one, the great Paris contractor, Victor Popp (using the Thomson-Houston system), has two, and the others are conceded respectively to the Messrs. Rothschild, the Societe Alsacienne, the Ferranti Company of London, and Naze & Co. (representing the Westinghouse system). Several of the secteurs were granted in the latter part of 1890, completing the distribution. As one of the conditions, it has been required that the companies proceed at once to make their installations, and that within two years their districts shall be completely served with main cables. Thus, before the end of 1892, such provision will have been made that, if desired, every street in Paris, as well as every house, can be illuminated with electricity. It is required that the companies shall supply street lighting upon terms that are as favorable as possible—at cost or even less—and a maximum rate of charge to private users is prescribed. Each company has been required to give a guaranty fund of several hundred thousand francs to insure the fulfilment of all the conditions imposed in the concession. No payment has been required for the charters, the terms being short, and permanent arrangements being deferred until use can be made of the results of five or ten years' experience. Meanwhile the city has its own central plant, and it is not debarred from laying its cables into any or all of the secteurs, with a view to regulating prices by competition. Thus Paris is on the point of being more completely supplied with electric lighting facilities than any other large city in the world.

It should be noted that the question how to dispose of wires—a question that makes so vast and so continually recurring an agitation in all American cities—never comes up at all in Paris, and is seldom mentioned in any European city. There are absolutely no obstructive wires in Paris. The government has purchased the telephone as well as the telegraph system, and all the wires for these services are placed in the subways of sewers. The wires of the electric companies are buried under the sidewalks. Armored cables are laid in simple conduits, or even in the bare soil, without the slightest difficulty from any point of view. In crossing streets it is forbidden to break the paving, and underground connection is made from the manholes of the sewers. The whole city of Paris will have been laid with a network of electric-lighting cables a few months hence, and traffic on the sidewalks and in the streets will have suffered a minimum of obstruction, while no injury whatsoever will have been done to the pavements. All these minor questions of practical municipal engineering, that we in our cities are attacking in a fumbling, rude, original way, heedless even of the experience of our nearest neighbors, while densely and contentedly ignorant of the experience of foreign cities, have been thoroughly solved in Europe. Instead of leading the van, we are from ten to fifteen years behind Europe in all these matters. Even in our own field of electrical methods, as a prominent American electrician assured me in Paris last December, we are now five years behind the Continent. He declared that the difficulties our American corporations still complain about, when asked to bury their telegraph, telephone, and lighting wires, were all met and vanquished in Europe several years ago, and that our fellow countrymen insist upon remaining in a state of invincible ignorance rather than learn anything from the technical and scientific achievements of Europe. But perhaps he stated the case too strongly. Doubtless he shall in time learn to be ashamed when we come to a realizing sense of the fact that the one city of Paris has at its command a larger and more brilliant array of engineering and architectural talent than all the important cities of the United States taken together can show, and that many a small European town is better supplied in this respect than many a large American city.—*Dr. Albert Shaw in Century Magazine.*

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOM 7–12, "WORLD" BUILDING,
NEW YORK, July 4, 1891.

Mr. C. A. Benton, General Manager of the Detroit Electrical works, Detroit, Mich., was in the city last week.

Mr. Henry Van Hoevenburgh, electrician of the Equitable Manufacturing and Electrical Company, of New York, has returned from Europe.

C. S. Van Nuis, 136 Cortlandt street, this city, has placed some of the largest switches in the market for central station and electric railway plants, the carrying capacity running over 1,000 amperes at 500 volts.

The Elektron Manufacturing Company, Brooklyn, two blocks below the Bridge, report that the demand for Perret motors and dynamos is up to their present facilities. They will furnish the trade with an interesting surprise shortly.

W. E. Crane has made his headquarters at 9 West 13th street, this city, for Ellis oil filters, and is prepared to supply every central station, railway plant or others using large quantities of oil. He agrees to save for the purchaser the price of a filter in two or three months.

Mr. George C. Baillard, connected with Alexander, Barney & Chapin, of 20 Cortlandt street, this city, has, since March 10 last, sold over 15,000 A. B. C. lamps. The average life of these lamps is from 3,000 to 4,000 hours, and all the leading hotels have adopted them.

The Hunt Engineering Company, 238 Washington street, Brooklyn, are as busy as ever filling orders for their H. E. sockets and H. E. switches for all systems. They are actively engaged on several large light and power contracts, and are bringing out several new specialties.

The McCreary Electrical Specialty Company, 136 Liberty street, New York, are as busy as ever with their reflector shades, as well as their half shades in all colors, for incandescent lamps. Large sales are being made of their flexible bracket for incandescent lamps. The convenience of this flexible bracket can be better appreciated by calling and examining the same. The firm has a number of other excellent specialties which will shortly be put on the market.

Charles A. Schieren & Co., 45-51 Ferry street, this city, manufacturers of the well-known perforated electric leather belting, has secured an order for six 13½-inch double perforated electric belting from the Columbus Consolidated Street Railway Company, Columbus, O. The firm has also furnished the belting for the Worcester, Leicester and Spencer Street Railway Company, consisting of one 40-inch and five 12-inch belts. The firm reports a good demand for its belting for street railway apparatus.

E. W. Hickcox, 112 Liberty street, this city, agent for the Buckeye incandescent lamp, says that the users of these lamps report them very satisfactory. The lamps are claimed to be always up to candle power and very economical in current with no blackening of the globe. The filament, which is a new one just patented, is very smooth and rigid. The average life of the lamp is 1,200 hours.

The trade generally appreciated our enterprise in issuing the parti-colored edition of the ELECTRICAL AGE the past week. I hear nothing but encomiums on the appearance of the paper, as the red and blue pages relieve the monotony of the usual black and white. We aim to bring the seller and the customer together, and we try to please the expert, the scientist and the general manager of a station or plant. That we are doing so most successfully is evident, judging from the testimonials received daily at this office. We like to have expressions of approval from our friends.

Mr. Z. Latshaw, manager of the New York office of the National Electric Manufacturing Company, 136 Liberty street, and the National Electric Construction Company, representing the National alternating and direct incandescent and arc systems of electric lighting, has this end of the business in lightning-like working order, and he is prepared to undertake an order of any magnitude for central station, isolated or special lighting installations at short notice. He carries in stock all sizes and styles of bare and insulated wires and cables in large quantities, as well as dynamos, arc and incandescent lamps for immediate delivery. He also has a large force of the best construction men and wiremen in the country.

Truex & Vail, 136 Liberty street, this city, the sole agents for the swinging ball lightning arrester, are meeting with unusual demand for samples, and some large orders have been filled. Many orders are awaiting their turn. The large number of inquiries for these arresters show the unusual conditions under which central stations are operating. A large number of stations have been damaged by lightning, on account of not having any protection. These swinging ball lightning arresters have been in use in a number of stations, and the managers testify to their worth in most glowing terms. Every station should be protected by a device that will protect, and Truex & Vail are a responsible firm and will not offer an inferior article. They are New York, New England and New Jersey agents for accumulators, Walker meters, etc., and are prepared to fill any size contract for accumulators for central station or isolated plants.

Mr. J. H. Longstreet, Bordentown, N. J., who was formerly a manufacturing electrician at No. 9 Barclay street, this city, is now running a large foundry at the first named place. He is a great lover of aquatic sports and owns a fine steam

pleasure yacht, which is a model of its kind. It is 45 feet 6 inches in length, 9 feet 6 inches beam, 4 feet 6 inches depth of hold and has a draught of 2 feet 6 inches. This yacht has a speed of twelve miles an hour. Her power plant consists of one compound condenser Shipman engine with cylinder 4½x9x6 inches, surface condenser, air and circulating pump and feed pump, and she is equipped with a Shipman oil boiler. There is on board a copper oil tank of 150 gallons capacity and one ice box. All the windows are furnished with Hartshorn rollers and curtains, and the yacht is said to be the finest of her length afloat. She is but one year old, and Mr. Longstreet wishes to dispose of her, as he intends to build a larger boat. Anyone desiring a yacht of this class would do well to inquire of Hawthorn & Co., 114 Liberty street, this city, the New York agents for the Shipman engine. This is an excellent opportunity to secure a fine boat at a low price. The boat has two masts, and the cabin extends about three-quarters of her entire length. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	3 00
American Private T'phone (N. Y.)..	50,000	100 00	98 00
American Telegraph and Cable....	14,000,000	100 00	79 75
Amsterdam Electric St. R.R (N.Y.)	250,000	100 00	75 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	110 00
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	190 00
Bell Telephone 7's	2,000,000		*112 00
Birmingham Ry & Elec. Co., 6's Ala	1,500,000		par
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brooklyn City R.R.	6,000,000	10 00	15 50
Brooklyn City R. R. 5's	6,000,000		*101
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	25 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	10 00
City Electric St. Ry. Co., 6's (Ark.)	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80.000		par
Cons. Gas Co. Batavia, (N. Y.)	100,000		par
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	12 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600.000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*99
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison General	14,000.000	100 00	99 50
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co	100,000	10 00	4 00
Empire City Subway Co. (N. Y.)		100 00	
Equitable G. & E. Co. (Utica)	4,000		†
Erie Telephone	4,800,000	100 00	48 50
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	12 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	par
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7 500,000	100 00	16 50
Laclede Gas, pref.	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*75
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Montague St. Ry., B'klyn	150,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	80 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	93 25
Nat'l Cordage, pref.	5,000,000	100 00	104 50
Nat'l Lead Trust	9,000,000	100 00	17 25
New England Butt Co.	100.000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	49 50
N. Y. and N. J. Tel. and Tel 6s	1,500 000		par
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	93 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,600,000	100 00	
North New York, Lighting	150,000	100 00	15 00
Northwest Elec. Co. 6's Manitoba	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pittsburg Reduct. Co. (Aluminum)	1 000.000	100 00	105 00
Plainfield, Electric Light	100 000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	60 00
Rockaway Elec. Lt. Co. 6's	75,000		par
Russell Electric Co. (Boston)	300 000	5 00	5 00
Saratoga Gas and Elec. Light 6s	300,000		*86
Saginaw E. L. & P. Co. 6's Mich.	50,000		par
San Diego Gas & Elec. Co. 6's Cal.	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation, N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co.	16,000		†
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	42 00
Thomson-Houston Pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100 000		par
T.-H. L. H. & P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.)	1.370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000 000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	800,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine Street Motor Co. 6's (Colo.)	100,000		par
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	79 00
Westinghouse Electric Co.	7,000,000	50 00	11 50
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			21 25
Winston-Salem Elec. St. R.R. (N C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent. †Registered Stock.

FINANCIAL.

What promises to be a very active and prolonged controversy between New York and Chicago capitalists for supremacy in gas has just been commenced. The gas and electric interests are now so closely allied to each other, that what affects one is immediately felt by both. Gas and gas engines are considerable factors in the generation of electric light and power, especially where it is to be conveyed short distances. Capitalists, who for years have looked upon their gas investment as the one nest-egg that could be counted on to produce with certainty, find, lately, that a small company with from $5,000 to $50,000 capital, can erect a little central station at some cheap corner of the village, secure a permit to run wires or perhaps a contract for a few street lamps, with the privilege of serving private parties, and as soon as the wire is stretched, the work of extending the gas main ceases, which of course gives electricity the outskirts of new and growing territory; then comes a hot season, the incandescent lamp enters the business portion, and gas as a paying investment, drops out altogether. Witness Fishkill-on-the-Hudson. With the large towns and cities, the consolidation of gas and electric interests is going on continually. There is plenty of demand for both, but there is a great deal more money in it, if the whole business is under one management. Of course, the next step is competition, and a battle royal between syndicates must redound to the benefit of the public. Already we hear the cry $1 per 1,000 for gas. Like the one cent postage it is bound to come, and if practical men, even if there is more than one company in the city, are permitted to control the distribution of the two illuminants they will find a way at that price to pay interest on all bonds, and dividends on all stocks.

The first of July is with us again and New York's barrel has been opened just far enough to see if the usual $100,000,000 or thereabouts had grown during the past six months, to disburse in the shape of dividends and interest; from appearances the money is in the barrel O. K. The banks and trust companies are advertising in the local daily papers the fact that they have counted their several proportions, and invite the holders of coupons or stocks to call and receive that which is their due. Can it be possible that a large majority, or in fact any considerable minority of these dividends are payable to the residents of New York City and vicinity? I have never heard the question discussed, and have very strong doubts about it. I think that as the money of the world seeks employment in London so does American savings from the length and breadth of this land come to New York to meet investments, and further, as one of the staff of the Electrical Age, somewhat cognizant of its peregrinations, I firmly believe this journal is regularly in the homes and offices of a great many investors in electrical securities who never have seen and only know by hearsay that such a thing exists as a New York daily paper. There are about $750,000,000 invested in electric industries and this child of ten or twelve years is growing and increasing rapidly. Most of this sum in one shape or another, directly or indirectly, is represented by a collateral in New York which is owned outside of this city. The electric disbursements made in this centre of finance should be published in an electrical journal which circulates among the electric investors; it would enhance the market value, make their exchange easier, and customers plentier. Try it the next half year.

DELAWARE & HUDSON COMPANY.

For the information of those who have never visited the Canadian metropolis, but who are intending to go to the Montreal meeting, it may be stated that the shortest and most interesting line between Montreal and New York is the Delaware & Hudson Railroad. Parties from the West can go to Schenectady or to Albany, connecting at either point with the "D & H." road, and see something of Saratoga, Lake George, Lake Champlain and the marvelous scenery of the Adirondack Mountains. The "D. & H." stands at the head in the number and importance of the summer resorts along its line, and in the number of Summer tourists carried in its trains.

Arrangements should be made to include a stop at the Hotel Champlain on the west shore of Lake Champlain, three miles south of Plattsburgh, which, architecturally and in beauty of location of surroundings is perhaps the finest affair of its kind in the world.

Mr. J. W. Burdick, general passenger agent of the Delaware & Hudson Railroad, Albany, N. Y., will be glad to send by mail an illustrated guide of the line, upon receipt of six cents in stamps, to cover postage.

BUSINESS NOTES.

The New York Electrical Works, 155 & 157 Leonard street, New York, have now a regularly organized department for fine model and experimental work. They are also prepared to take contracts for the manufacture of light machinery specialties and electrical apparatus generally.



A WEEKLY RECORD OF THE STREET RAILWAYS OF THE WORLD.

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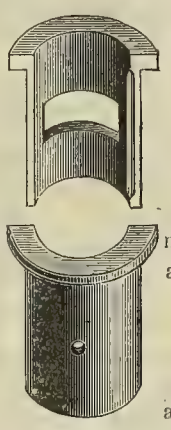
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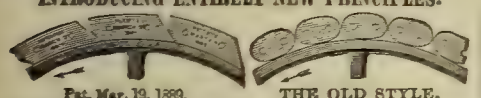
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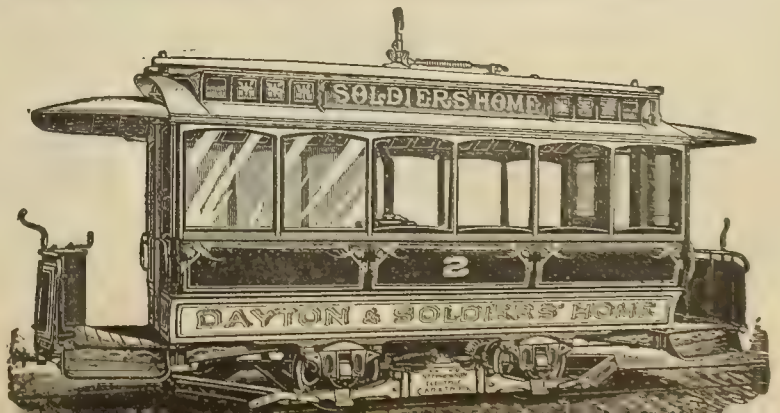
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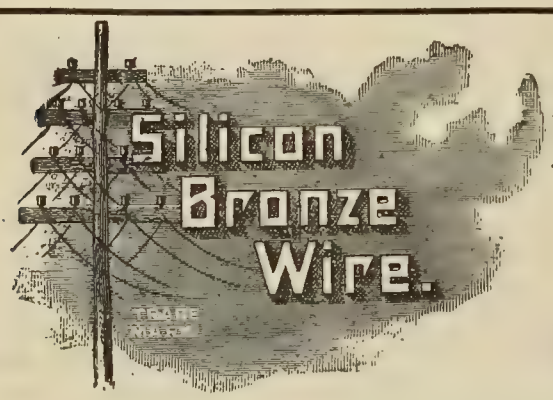
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STREET RAILWAY DEPARTMENT OF THE ELECTRICAL AGE—NEW YORK, JULY 11, 1891.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

J. B. TALTAVALL, *President*, T. R. TALTAVALL, *Sec. and Treas.*
W. T. HUNT, *Vice-President*, E. V. CAVELL, *General Manager.*

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OUR HOUSEHOLD AND OTHER GODS.

Nine years ago we set up our "Household God" under the name of *The Advocate* and during the years that have intervened since then, seed time and harvest have found us at our desk, plodding along, working, ever working to make our "Household God" one which would command the respect and confidence of our constituency. That, in this, success crowned our efforts, no one who studies the ELECTRICAL AGE to-day, will deny. As years rolled on, feature after feature was added to the paper—our "Household god" received a bit more burnishing, and now, in this year of our Lord, 1891, we set up our "other god" known as STREET RAILWAY NEWS, and one with which we have every reason to believe the "air and society" of this fair city of ours will agree.

We offer no apologies for our inception—no excuses for living: acting as we are, in the firm belief that the street railway interests of the world have now assumed importance enough to justify the publication of a weekly paper devoted exclusively to those interests, we bring it forth, submit it to the criticism of both friend and foe, and blanch not in contemplation of the verdict.

Crudities appear in this, our first number—we are only too painfully aware of that fact, but we will sleep peacefully in the knowledge that none of us are free from blemish, and that in improving STREET RAILWAY NEWS, as we shall, week by week, we shall be not only earning dividends for ourselves, but, by sheer importunity, compelling homage to this, our "other god."

AS SEEN FROM THE DOME.

A few days ago we looked over Manhattan Island from the top of the dome of the ELECTRICAL AGE—beg pardon—Pulitzer Building, perhaps we should say; and, as mile after mile of street stretched away to the northward, a realization of the imperative need of an immediate increase of rapid transit facilities came to us. We almost blushed to think how far behind other cities New York is in this respect.

Again, in viewing, we were in Cleveland—a city of not much over 200,000 inhabitants. The buzz of the cable as it ran over the pulleys came from below, and that of the trolley wheel greeted our ears from above, the jingle of the horse bell gradually growing fainter and fainter. In the same reverie, Kansas City passed before our eyes—Kansas City with its cable roads, its dummy roads, its elevated roads, its electric roads.

Minneapolis, Memphis, San Francisco and dozens of other progressive cities, where men say "we haven't time to take the horse car; we are in a hurry—" where the roll of the trolley, or the stroke of the piston has supplanted the click of the horseshoe—all fell into line and pointed a finger at this the great metropolis of the Western Hemisphere.

True, New York has its elevated railways, its cable road in Harlem, and will soon have one on Broadway and on Third avenue, but what about the other lines? Nineteen or twenty companies own or control street railway franchises in the city of New York, and but one affords rapid transit, and that for only 11½ miles out of its total of 28½.

Even Brooklyn is ahead in this respect, for besides its horse car lines it can also boast of a cable road (the shortest in the world, it is true, but a cable road nevertheless), and an electric line (illustrated in this issue). Truly such progress exhibited by smaller cities must reflect seriously upon that shown by our beloved Gotham, and let us express the hope that it may soon profit by the example led by dozens of its younger cousins and discard the time-honored horse as a motive power.

TRAILERS HANDICAP RAPID TRANSIT.

Ideal rapid transit will be attained only when cars run between given points at the highest rate of speed possible, consistent with safety, and the fewest number of stops are made. It is, of course, a well-known fact that there are numbers of accommodation trains on the steam roads which frequently run at the rate of a full sixty miles per hour between stations, and that their actual running time, averaged up, is fully equal to that allotted to limited or express trains. From this it is logically evident that there can be no real rapid transit—in its true sense—where many stops are made.

A single car—we refer to street cars, of course—with forty or fifty passengers aboard, stops much less frequently than when it is hauling a trailer carrying a second cargo of passengers, and so *ad infinitum*. Thus, a moment's thought will convince anyone that the hauling of trailers, or the running of cars in trains, is decidedly prejudical where true rapid transit is sought to be obtained.

There can be but little question as to the economy of judicious train-running. Experience has taught us the wisdom of the plan, so far as handling a vast number of passengers is concerned, but when it is desired to reduce to a minimum the actual time consumed in transit between two given points, we submit that cars must be run singly and at frequent intervals.

SMOKING ON THE FRONT PLATFORM.

The average man, especially he who is so situated that smoking during business hours is an impossibility, dearly loves to enjoy a few whiffs of the fragrant weed while riding on the car to or from his abiding place. That fact is undeniable, and as the genus man is the staple from which street railway companies obtain the coveted nickel, so should his comfort be duly considered.

Smoking on the front platform is very generally permitted, but, during the summer months when everything is open at the front end of the car, the aroma of fumes from pipes, cigars, and—worst of all—cigarettes, wafted through the car, is certainly not very conducive to the enjoyment of the ride to ladies and men who dally not with the weed.

The question as to whether or not smoking on the front platform should be permitted, is a very broad one, with many logical arguments *pro* and *con*, and cannot be properly decided off-hand; but, while we enjoy the luxury ourselves, we cannot but feel that the company operating a street railway should, out of consideration for the majority inside the car, absolutely prohibit smoking upon the front platform, at least during the time when it is necessary to keep the front end of the car open for ventilation.

STRIKE RUMORS.

As we go to press, rumors of a strike of drivers and conductors on the Ninth Avenue surface road of this city fill the air. The *casus belli* is the old, old story—capital taking steps to protect itself against labor, and labor resenting such injustice.

Since the trouble which occurred between the company and its employés, about two years ago, matters have been running smoothly, but it is claimed by the men that fully thirty of their number had been discharged on account of their being members of the Knights of Labor, and they also state that Supt. Faulk has reinstated a number of discharged men in the place of those whose severance of connection with the company had been decided upon by virtue of membership in said organization. It is too early in the day to predict just what may occur, but it will certainly be a very foolish move on the part of the employés to cut their own throats by resorting to the imbecility of the average strike or tie-up.

ACKNOWLEDGMENT.

WE desire to acknowledge, with many thanks, the receipt of two handsomely framed pictures from the Johnson Company, Johnstown, Pa., through the kindness of its genial New York manager, Major H. C. Evans. One is a view of Johnstown; the other—three photographs—showing the Johnson constructing track, connecting track with the steam road, and the Marshall Clip brace joint steel chair. These pictures now adorn our walls and are welcome additions to our "art gallery."

BROOKLYN'S NEW ELECTRIC ROAD.

Everything points to the probability that the Brooklyn City Railroad Company will in the near future generally adopt electricity as the motive power to take the place of horses.

On May 28 last, the first electric line within the Brooklyn city limits was put into operation. The road is known as the Bath, Bay Ridge and Bensonhurst Railroad, and is controlled by the Brooklyn City Railroad Company. The line extends from 39th street Brooklyn, to Bath, which is located on Gravesend Bay, opposite Coney Island. It is seven miles long and of double track.

The present power house is a temporary one. It is intended to locate the permanent power house a little nearer to New York Bay, not far from the present temporary house.

It is stated that upon the success of this plant depends the future extension of the system on other lines, and judging from the success already attained in the operation of this line, it is safe to say that the general adoption of the system is already assured. The cars run with remarkable ease and steadiness; they start and stop very easily and are readily controlled. The motors are practically wireless. The Lewis & Fowler Mfg. Co. furnished the cars, which are very handsome.

To Mr. R. H. Sherwood, electric railway contractor, 115 Broadway, N. Y., is due the credit of the consummation of the deal with the Brooklyn City Railroad Company, for the equipment of the Bath, Bay Ridge and Bensonhurst Electric Road.



FIG. 1—VIEW ON LINE OF BATH, BAY RIDGE AND BENSONHURST ELECTRIC ROAD, SHOWING CURVE CONSTRUCTION.

The rolling stock equipment, when complete, will consist of 20 motor cars and 20 trailers. Two Thomson-Houston 15 H. P. single reduction motors are used on each car.

In the power house, the interior of which we illustrate, are eight Thomson-Houston, 75,000 watt multipolar generators, all connected in multiple, each being rated at 80 H. P.

The generators are driven by two McIntosh-Seymour engines of the Tandem Compound type. Each engine runs four dynamos—two in tandem—there being two belts on the fly wheel of each engine. The belts are Schieren's perforated, which are well known all over the country.

The switchboard of the power house is well arranged. There are eight switches, one for each machine; eight circuit breakers, one to each machine; one ammeter in the main circuit, which registers the total amperage; also an ammeter to each machine. There is also to be placed in the station an exciter to excite the fields of the generators when desired. At the side of each switch is a double pole switch, for connecting the fields either for self-exciting or separate exciting.

In the field of each machine is a rheostat by which the voltage is controlled. At the side of each switch are connections with the terminals of each machine for taking voltage measurements.

At the back of the switchboard are two bus bars and an equalizer bar. All the machines are so connected with the equalizer bar that all the current is properly distributed between the machines. The switchboard is well protected by lightning arresters. Clark wire is used throughout the installation and the trolley equipment is that of the Thomson-Houston Company. Copper trolley wires are used. The poles are of iron of the telescopic pattern, furnished by Milliken Bros., with cross arms on top of each for the placing of wires. The trucks used are those of the McGuire Manufacturing Company of Chicago.

The boiler plant consists of four 400 H. P. Babcock and Wilcox boilers, and these are placed in the room adjoining that in which the generators and engines are located.

EARTH-CURRENTS AND THE CITY AND SOUTH LONDON RAILWAY.

A well-marked case of interference with the earth-currents recorded at the Royal Observatory, Greenwich, due apparently to the working of the City and South London Railway, has been communicated to *Nature* by Mr. William Ellis. For years past a continuous photographic register of earth-currents has been maintained at the Observatory. There are two circuits. For one circuit the earth-plates are at Angerstein Wharf (A. W.), on the Thames, near Charlton, and at Lady Well, Lewisham (L. W.), three miles distant; for the other circuit the earth-plates are on Blackheath (B), and at the North Kent East Junction (N. K. E. J.) of the South-Eastern Railway, two and a half miles distant. The earth connection is in each case made by an independent copper plate. The azimuth of the A. W.-L. W. line, reckoning from magnetic north towards east, is 50°. Towards the end of last year anomalous appearances began to be observed in both of the earth-current registers, and for some months past these interruptions have settled down into a regular order. A continuous vibration of the registering needles commences shortly before 7h. in the morning, and goes on all through the day, terminating shortly after 11h. in the evening. This went on for several months on week days only, ceasing on Sundays. But on Sunday, April 5, and on every succeeding Sunday to the present time, the interference has been experienced also on a portion of the Sunday, commencing at about 1h. P. M., and terminating usually at 10h. P. M., or shortly afterwards. Various experiments were made with the view of discovering the cause of these anomalous appearances, but without definite result. Quite recently, Mr. Leonard, the telegraphic superintendent of the South Eastern Railway, suggested that the exceptional appearances were most probably due to the influence of the Electric Railway. A comparison being made between the observed times of interference with the earth-current registers, and the published times of running of the trains, it was found that these were simultaneous. The line of the Electric Railway runs from about north-east to south-west magnetic, or, more accurately, the azimuth of the line, reckoning from magnetic north towards east, is about 50°. The nearest earth-plate to the railway is the N. K. E. J. plate, which is distant from the railway, in a perpendicular direction from it, about two and a half miles. The correspondence so far as the comparison goes is complete. During the periods of interference the registering needles at the Observatory are in continual vibration. Whether the impulses are in one direction only or in both directions, and what is their frequency, cannot be readily determined from the registers. Eye observation of the needles may, perhaps, reveal something to us on these points. The abnormal excursions of the needles indicate a change of potential varying from a small fraction of a volt to perhaps the one-third of a volt or more.—*London Electrician.*



FIG. 2—ANOTHER VIEW ON LINE OF BATH, BAY RIDGE AND BENSONHURST ROAD.

To find the horse-power of an electric motor, multiply the voltage by the amperage of the current supplied to the motor and divide the product by 746.

The watt is the unit of electric work, and is the product of one volt by one ampere. It is sometimes called a volt-ampere. One watt equals .0013406, and 746 watts equal one horse-power.

NEW RAILWAY SWITCHBOARD.*

The switchboard shown in the accompanying illustration is made in two sections, known as the "dynamo" section and the "feeder" section. The former contains the necessary apparatus for operating and governing the dynamos, irrespective of the feeders issuing therefrom. It consists of a substantial iron frame made as much as possible of angle iron, bent at the corners, without joints, assembled in such a manner that it can be shipped in flat sections, thereby wasting no space, and giving reasonable guarantee against bending or breaking during shipment. The similar parts of this iron frame are, of course, interchangeable, and the table can be increased in size at any time, as well as taken apart and assembled with equal facility.

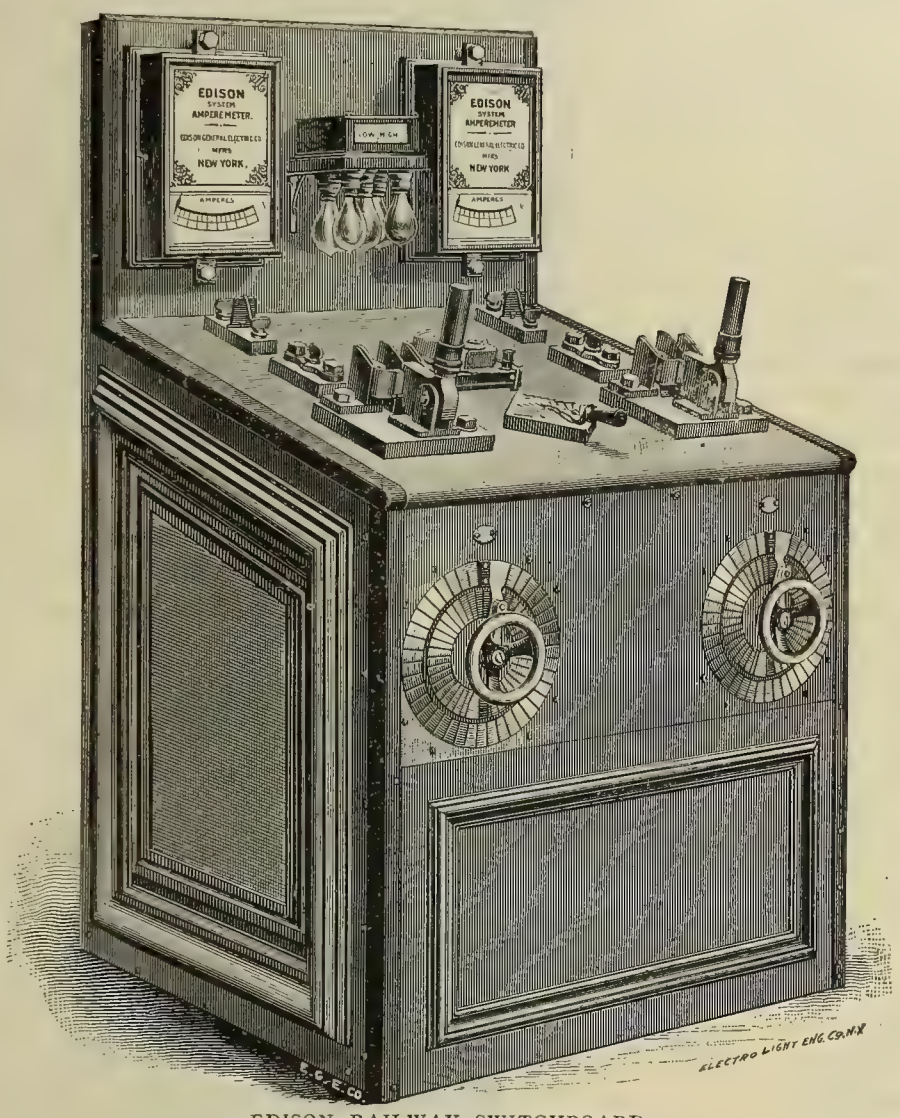
Upon this iron framework, slate or marble slabs are mounted, to suit the taste of the purchaser, and upon these slabs the apparatus is mounted. For each dynamo there is supplied a main switch, a safety fuse, an equalizing bar switch, a hand regulator, and an ampere meter. If there is more than one dynamo to be handled, there is supplied in addition, a galvanometer, a switch for the same, and a volt meter.

The general appearance of the dynamo section of the controlling table depends altogether upon the wishes of the purchaser. At present this can be manufactured in two styles, one cheap, and the other more expensive. On the cheaper table, slate slabs are used, and the metal parts are given a plain dipped and lacquered finish. On the more expensive table the slabs can be of marble, the metal parts buffed and the ampere meters furnished with brass covers with plate glass fronts. In both the more expensive and cheaper tables the apparatus is mounted directly upon the slabs, in every case including the ampere meters. The ends of the slabs are of metal, which covers the edges of the slate and gives the table a very handsome appearance.

* Edison General Electric Company, N. Y.

The feeder section consists of a vertical iron framework upon which the slabs are mounted. The apparatus for this section consists of a main ampere meter, an individual ampere meter, with a cable and plug connected thereto, with which the number of amperes flowing on each individual feeder can be determined, one switch for each feeder, and a main switch for throwing off a number of feeders at the same time. This last mentioned switch is of service in disconnecting the entire road, or any part of the road, quickly, as necessity requires. The feeder switches will carry 250 amperes, which gives ample margin. The main ampere meter is of the proper capacity for the station; and in cases where the capacity is too great to be measured by one ampere meter, two meters are supplied, with an arrangement for throwing either one or the other out of circuit, if necessary.

In the event of there being four feeders and one dynamo, as is often the case, they make a special feeder board to meet these requirements, supplying for the same four feeder switches, one individual ampere meter with cable and plug, for reading the number of amperes flowing on each individual feeder.



EDISON RAILWAY SWITCHBOARD.

RAILWAY TRAIN LIGHTING.*

BY WILLIAM LANGDON.

The author stated that the desirability of a better illumination of railway carriages had been long felt. The lamps originally provided were intended simply to enable passengers to enter and leave the carriages without inconvenience, but the exigencies of the present time called for the additional luxury of a reading light. The illuminants in use were rape oil, paraffin oil, compressed gas, and electricity, and the author dealt with the recent advances which had been made in connection with the last.

In October, 1881, a Pullman car, running between Victoria and Brighton, was lighted by electricity, and the experiment was so far successful that it was extended to the entire train, and at present there were 16 trains so lighted belonging to the Brighton Company. Mr. Houghton, the Company's electrician, and the late Mr. Stroudley, were the pioneers of the application of electricity to this purpose. An interesting experiment, devised by Mr. W. H. Preece, was tried on the London and South Western Railway in 1883–4. The movement of the train was employed to compress air into a chamber, and the air so compressed was used to drive a dynamo to furnish the current for the lamps. In July, 1886, the Great Northern Railway applied electric light to one of their metropolitan trains. The Taff Vale and Cheshire lines had made experiments in the same direction. In all these cases the lighting was effected by means of a dynamo driven from

*Abstract of a paper read before the Institution of Civil Engineers, London, May 5, 1891.

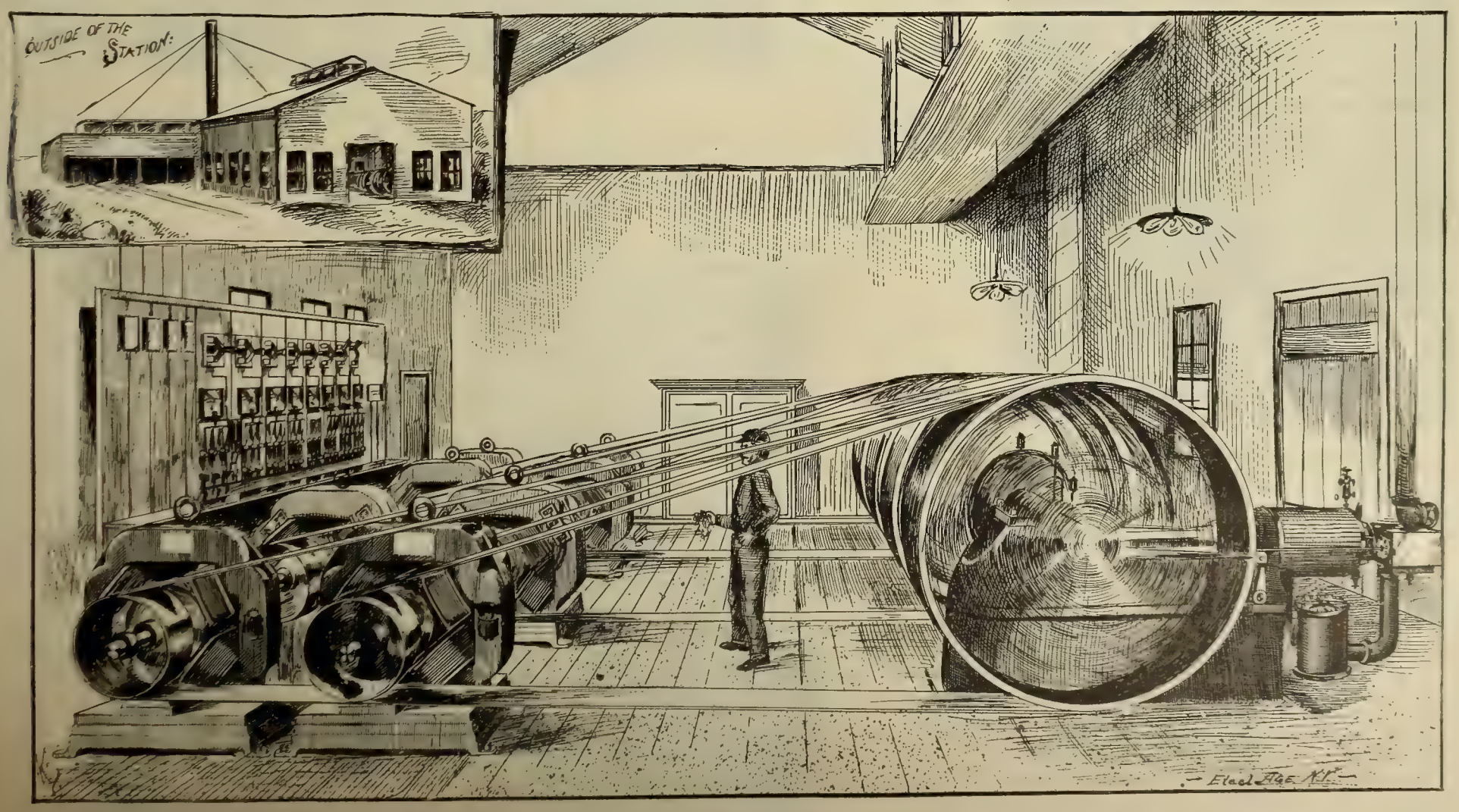


FIG. 3—POWER HOUSE OF BATH, BAY RIDGE AND BENSONHURST ELECTRIC RAILWAY.

the axle of the guard's van combined with accumulators stored in the same vehicle. In August 1884, the London and North-Western Railway tried a different principle in fitting up a short train which was still running between Manchester and Liverpool. The current was produced by a dynamo driven by a brotherhood engine fixed to the tender and supplied with steam from the boiler of the locomotive.

In this, however, as in the previous cases, the lighting was effected from one point, and should the train be broken up the part severed from the source of current would be left in darkness. In 1888, the directors of the Midland railway authorized the equipment of two trains to run between London, Manchester, and Liverpool, in which the following conditions were to be fulfilled, viz.:—(1) Each vehicle was to carry its own lighting power. (2) Each vehicle was to be capable of being coupled and uncoupled and turned about as needed, without the possibility of the connections being wrongly made. (3) The coupling must readily draw apart when coaches were slipped *en route*. (4) The act of drawing the coupling apart must make all the changes in the connections necessary to transfer the lamps from the dynamo circuit of the train to the accumulator circuit of the carriage itself. (5) Each compartment was to carry not less than two lamps.

(*To be continued.*)

THE GRAND VIEW BEACH ELECTRIC RAILWAY.

The Thomas Murray Company, Electrical Exchange Building, 136 Liberty street, New York City, engineers, contractors and builders of electric, steam and tram railways, have recently completed the construction of the Grand View Beach Railroad, which was organized to construct, maintain and operate an electric railroad from Charlotte to Manitou Beach, N. Y., along the shore of Lake Ontario, a distance of about 7½ miles.



FIG. 1—TERRACE IN FRONT OF GUILFORD BLUFF.

The above firm was under contract for the complete construction of this road, embracing track work, grading, cribbing, bridging, overhead construction, cars, motors, generators, power and car house, and in fact, everything in connection with the complete construction of an electric road, to be completed May 20. They had only sixty days in which to build this road, which is now in operation according to contract.

In view of the fact that ice was formed in places, some 6 feet thick, along where the track now runs, when work was commenced, they may pride themselves on having accomplished a task unparalleled in the history of electric railway construction. They had not only the unfavorable weather of the most inclement season of the year along the exposed shores of Lake Ontario to contend with, but had to build a crib of heavy timber in the waters of the lake for a distance of over 3,000 feet, to protect the shore line of Rigney Bluff, which was in danger of being washed away, and around the outside of which the railway company was compelled to run its lines, on account of the topography of the country. They then had to cut away the bluff, which is over 60 feet high, to get track room, as well as drive over 8,000 spiles in the many bays and inlets that dot the shore of the lake between Manitou and Charlotte. The company also constructed the power and car house; had the cars built, in fact, got all the material on the ground, which was in itself a herculean task to accomplish within the 60 days' limit.



FIG. 2—STATION ON GRAND VIEW BEACH ELECTRIC RAILWAY.



FIG 3—RIGNEY BLUFF AND CRIBBING.

The road-bed has been constructed of 45 lb. T-rail in the most substantial and thorough manner, and all special track work was furnished by the Johnston Company, of Johnstown, Pa. The total length of the road, including sidings and turnouts, is eight miles.

In the construction of this road particular attention was paid to trimming up the banks of the cuts and embankments to preserve the general beauty of the landscape. The country through which this road runs is the most picturesque that any electric road has yet opened up.

The motor cars were furnished by the J. G. Brill Company, of Philadelphia, which, contrary to the usual custom of car builders, had the cars on the ground the very day its contract called for their delivery. These cars are 18 feet long inside and, together with the fourteen trail cars, will enable the Grand View Railway Company to



FIG. 4—GENERAL VIEW OF CAR.

handle with ease 20,000 passengers per day over their long run.

The overhead lines were constructed with particular care, special effort being made to make the construction as inconspicuous as possible, a point always to be considered in putting up overhead wires. The line wire was furnished by the Benedict & Burnham Company, and the feeders by the New York Insulated Wire Company, whose general manager, Mr. J. W. Godfrey, was the first pay passenger carried over the line of the railway.

A new departure was inaugurated in the motor equipment. About March 20, the contractors entered into a contract with Mr. C. A. Benton, of the Detroit Electrical Works, to have built seven special motors of the Rae type, each of 40 H. P. capacity, and capable of attaining a speed of 20 miles per hour with two 18 feet trail cars fully loaded, and to develop under these conditions, a certain average electrical horse power. The horse power was so low that the contractors, in view of results accomplished heretofore by the various electrical companies in hauling heavy loads at high speed, had very serious doubts of their being able to meet the requirements. In spite of this doubt, however, the Detroit Electrical Works undertook the task and went bravely to work to make one step in advance of the then most perfect machine, and succeeded in turning out motors that have accomplished more than the extraordinary rigid requirements that the contract called for. These magnificent machines are built extra heavy in every working part; phosphor-bronze and wrought steel being substituted in almost every point where cast iron had hitherto been used. They were mounted on Hubbard wrought steel trucks, at the works of the Detroit Electrical Company, and thoroughly tested out, the result being that when they were delivered to the contractors and put in service they exceeded even the most sanguine expectations of their builders.

The road has a generating capacity sufficient to operate double the number of cars which the company has purchased. The engines, boilers and generators installed are of the most approved type for electric railroad work, the engines being manufactured by the McIntosh & Seymour Company, and the boilers by the Babcock & Wilcox Company. The generating plant consists of two 75,000 watt Thomson-Houston machines. The car barn has storage room sufficient for twenty cars.

The switchboard and entire inside finish of the power house is rock, maple and oak, worked up to a cabinet finish, making the general appearance of the engine room, even to the layman, a thing of beauty. The general contractors were ably assisted in the construction of this power plant by Messrs. Pierce and Thomas, the well-known engine men of 42 Cortlandt street, New York, who were the sub-contractors for part of the work.

The accompanying cuts have been selected from a large number of photographs taken, which illustrates the grading, cribwork and bridging. The eastern terminus of the road is in the village of Charlotte, in front of the pavilion of the Hotel Bartholomay. Close connection is thus made with the Boulevard, the Rochester Electric Railroad, the New York Central & Hudson River Railroad, the Rome, Watertown & Ogdensburg Railroad, all centering in Rochester, N. Y., a distance of about seven miles from Charlotte, commonly known as the "Coney Island of Western New York."

From the eastern terminus, the road runs along the lake shore, through the terrace in front of Guilford Bluff, skirts the shore of the lake across Rigney Bluff upon a terrace constructed upon the face of the bluff, and then runs along the beach or bar between the lake and the several ponds and bays, and at no point from Guilford Bluff west is the road more than 300 feet from the shore of the lake. The outlets of the various ponds are bridged, and the road reaches the hotel at Buck Pond, the Dan House at Long Pond, passes between many summer cottages and has its western terminus on the grounds of the Manitou Beach Hotel. These ponds and bays are much frequented by people in search of recreation and sport. The fishing and hunting is excellent, and many attractive cottages have been erected along the beaches where people living in Rochester spend the summer months. The only way heretofore of reaching any part of the shore has been by boat and private conveyances.

About three miles from Manitou Beach is the village of North Parma, with about 1,200 inhabitants. People living in this village who do business in Rochester, rely on one train each day on the Rome, Watertown and Ogdensburg Railroad. The Grand View Beach Railroad furnishes these people transportation to Rochester.

Thousands of people are carried during the summer months to Charlotte. Over one million of people were last year transported over the various railroads to Charlotte between July 1 and October 1, and it is considered a conservative estimate that at least one-quarter of the number of people will go over the Grand View Beach Electric Railroad to Manitou Beach.

The officers of the company are Henry H. Craig, president; Arthur Leutchford, treasurer; J. Miller Kelly, secretary.

The directors are Henry H. Craig, Arthur Leutchford, J. Miller Kelly, John N. Beckley, William H. Crennell, Valentine Fleckenstein, Michael Doyle and Halbert Thayer.

STREET RAILWAY NOTES.

The new car house in Minneapolis, Minn., of the inter-urban line, has been completed.

During a heavy thunder storm recently, the electric cars in Minneapolis were badly delayed by fuses burning out.

Mr. David Glass, President of the City Park Transit Company of Spokane Falls, Wash., also favored us with a call.

Mr. D. J. Murname, President of the Underground Traction Company of St. Louis, Mo., called at our office during the past week.

The Eighth avenue, South Sixth street and Harrison street line, Minneapolis, which make one continuous line, is now in operation.

Work on the extension of the Western avenue line on Second street, northeast, Minneapolis, is expected to be finished in about ten days.

The Hennepin boulevard line, Minneapolis, has been completed, excepting the overhead feed wires, which are expected to be ready in a few days.

Mr. E. A. Lewis, Superintendent of the Raleigh (N. C.) Electric Street Railway, has received instructions from the Edison General Electric Company to proceed at once with the erection of the trolley line for that road.

A franchise has been granted to John W. Hearst, Oakland, Cal., for the construction of an electric road in that city. The franchise is to extend for 50 years, and work must be commenced within six months.

Mr. A. J. Moxham, President of the Johnston Company, Johnstown, Pa., sailed on the North German Lloyd Steamer "Aller," on Saturday, the 27th ult., with his family, to enjoy a well earned holiday in Europe.

A franchise has been granted to I. B. Whitcomb & Co., of New York, to construct an electric railroad from Ballston Spa to Rock City Falls, N. Y., through Milton. The road is to be in operation in 90 days and will be eight miles in length.

A certificate was filed in Albany, June 30, showing the surrender of the capital stock of the Suburban Rapid Transit Company, New York, to the Manhattan Railway Company, the former receiving a corresponding number of shares of Manhattan stock in exchange. There are 40,000 shares of the Suburban Company's stock.

On Monday, June 29, the Long Island and Newton Electric Railway Company opened the extension of its road to Hunter's Point, L. I., which connects with the Thirty-fourth Street Ferry from New York. This road is 6½ miles in length, double track, and is operated on the Edison system, with Peckham motor trucks used under the cars.

The Santa Cruz Electric Railway Company, Santa Cruz, Cal., has awarded the contract for furnishing motor trucks and a 110 H. P. generator and appliances to the Thomson-Houston Electric Company. The California Electric Works, San Francisco, secured the electrical construction work. The railroad will be completed and in operation in 90 days.

Engineer Carr has perfected one of the most extensive curves in the country at the East Side car house, Minneapolis, Minn. The system includes no less than 30 curved tracks, all concentrating in one main track, with only 10 switches. This system dispenses with the use of turn tables, and will enable cars to run in and out of the building without the slightest difficulty or detention.

The Electric Merchandise Co., 11 Adams street, Chicago, is receiving a large number of inquiries for the Burton heater, which was described in our issue of June 13. These inquiries come not only from electric street, but also from a number of the leading steam roads, who are using electricity for lighting purposes on some of their trains, and who are anxious to adopt the heater in place of other means of warming their cars.

The first half of the $6,000,000 worth of bonds, which the Brooklyn City Railroad Company was authorized to issue, has been almost entirely disposed of. On the first inst., as early as 8 o'clock in the morning, a line began to form outside the company's office on Fulton street, and many seekers after the bonds were in line until late in the afternoon. President Lewis stated that all of the $3,000,000 of bonds, excepting $75,000, had been taken. These bonds were issued to meet obligations of the company.

The Newark Passenger Railway Company, Newark, N. J., has been granted an extension of six months in which to build an electric road from Newark to Orange, on the overhead system, to replace the present horse car railroad, on condition that the other provisions of its contract with the township be observed, one of which is that the rate of fare between any part of East Orange and any part of Newark from and after July 1, be five cents instead of ten. The company objected to the condition for the extension of time, but finally yielded.

A number of residents of the annexed district of New York city met in the office of the Rapid Transit Commissioners a few days ago and urged the necessity for improved transportation facilities in the 23d and 24th wards. One gentleman urged that a road be built along certain streets, and claimed that such an improvement would result in the building up of the section through which the road would run. Another gentleman suggested the continuation of the present railway system from the Grand Central Depot to the Post-Office or the Battery. Other plans were suggested but no definite action was taken.

Mr. Payson K. Andrews, of Chicago, western selling agent of the J. G. Brill Co., who has been on an Eastern trip, dropped in to see us and renew old acquaintance. On his way East Mr. Andrews booked an order for cars and trucks for Jackson, Mich., to be delivered in September. Mr. Andrews is very well known among street railway men, and makes friends wherever he goes. He returns to Chicago this week.

The Baxter Electric Motor Company, Baltimore, Md., manufacturers of electric railway power equipments, and motors and generators for all purposes, is doing an active trade in street railway equipments. On June 8 it shipped three trucks, with motors attached, to Beatrice, Neb., and on the 12th an 80 H. P. generator was shipped to the same place. At the same time an expert electrician was dispatched from the works to put the road in operation. On June 27 the second car was started on the road, and on Sunday, the 28th, no less than 2,500 passengers were carried without a hitch of any kind. The company has a large number of orders for cars and motors throughout the South and West, and is shipping the goods just as fast as they are finished. Motors made by this company are now used by the Richmond and Manchester Street Railway Company, Richmond, Va.; at Dayton and Cleveland, O.; Chicago, Ill.; Washington, D. C., and many other places.

The electric road that was projected on Elston avenue, Chicago, has been sold to the Cicero and Proviso Electric Railway Company. The Elston avenue line was known as the Northwest Chicago Electric Railroad, and had made some important steps towards beginning building operations. It had secured the right of way along Elston avenue from Irving Park to Western avenue, and was preparing to obtain the same privilege along other streets, when it met with considerable opposition from property holders along the contemplated line of way. It is understood that the Cicero and Proviso Company has already secured the necessary right of way, so that there is nothing to prevent the early completion of the roads into the city. Better transportation facilities along the line of these roads will greatly benefit the villages of Irving Park, Jefferson, Graylands and Bormanville.

The new electric road in Allentown, Pa., was opened June 30 with great success and enthusiasm. Reed & McKibben, consulting engineers and contractors, No. 2 Wall street, New York, built and equipped the road, which is known as the Allentown and Bethlehem Rapid Transit Railway. The electric system used is that of the Thomson-Houston. The firm has contracted to install a number of electric railway plants, among which is that for the White Plains and Elmsford, N.Y., Electric Railway; and early in the Fall they will commence the building of 18 miles of track for an electric road in Mobile, Ala. They have also secured the contracts for five miles of road in Meriden, Conn., and five miles for the Allentown & Catasauqua, Pa., electric road. The electric system to be used on the White Plains road has not yet been decided upon. The McGibben rail construction will probably be used.

"L" ROAD IN BATTERY PARK.

A long petition from a resident of Staten Island was addressed to the Board of Aldermen of New York city last week favoring the retention of the elevated structures in Battery Park, the petitioner claiming to represent the class most interested by any change. The interested people were classified into those who habitually frequent the park; those who occupy business premises in the immediate vicinity, and those who pass through the park on the elevated trains.

A comparison was made between the cost of maintainance and the value of the park with the small number of the first class named, which is placed as not higher than one thousand at any time, and rarely above one-quarter of that number, which class, the petitioner averred, the elevated road did not inconvenience in any manner.

With regard to the residents in that vicinity of the park, the gentleman said they would not only make an outcry if the terminus was removed to Rector street, but "if the present agitation means the removal to either State street or to Whitehall street the business men of the lower part of the city will be heard from in a manner vastly more pronounced than any sentiment which has yet been evolved in favor of such a step."

The petition dealt more fully with the third class—those who pass through the park on the elevated railroad, and the claim is made that a gap of over half a mile would be created in the stream of traffic between the systems of ferries and the West side of the city should the tracks be removed. This traffic is estimated at about 6,000,000 during the year, going to and from South Brooklyn and Staten Island, and the injustice to this class was fully set forth. The petitioner also dealt with the future growth of South Brooklyn and the numerous towns of Staten Island, and asked the Aldermen to give the question their deepest thought, as by any hasty decision they might render useless the only communicating point between Staten Island and the city.

On June 30 the Board of Aldermen by a vote of 16 to 8, emphasized their opposition to the occupancy of the city's public parks by the elevated railways. The resolution adopted, it is said, will fail to have any legal bearing upon the "L" road's present tenure of Battery Park. It is simply an expression of opinion by the Board upon the question of such occupancy of the city's parks. The resolution adopted was introduced several weeks ago and is as follows:

Resolved, That the public parks of this city are set apart and dedicated to the use and enjoyment of the people, as places of resort for health and recreation, and that the use of any portion of said parks for railroad purposes is a violation of this doctrine and should be prohibited.

The West End Railroad Company, of Boston, gave notice July 3 of an increase of capital of $4,500,000, of which 33,000 shares recorded July 1 at pat value of $50 are offered to stockholders. West End Land stockholders of record of July 20 may subscribe to 62,500 shares of common stock in the railroad on the same conditions.

MISCELLANEOUS NOTES.

Electric lighting plants and power stations require protection against fire, more than almost any other manufacturing industry, and yet how often do we see such appliances about? Buckets are the best general protection against fire and the "Indurated Fibre" buckets for which Cordley & Hayes, 173 and 175 Duane street, New York, are sole agents, are the best. Write for their catalogue if you want to fit up with fire apparatus.

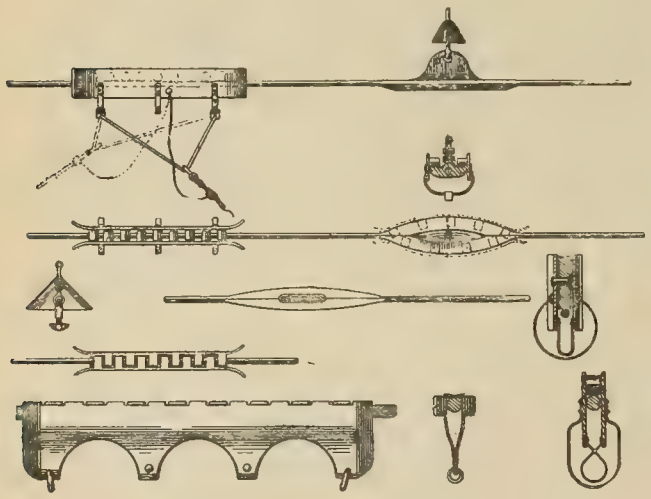
A new book on Telephones, their Construction and Fitting, will shortly be issued by E. & F. N. Spon, 12 Cortlandt street, N. Y. It will be a Practical Treatise on the Fitting up and Maintenance of Telephones and the auxiliary apparatus, by F. C. Allsop. Illustrated by numerous engravings, all of which are fully described in the text. The price will be $2.00, postage prepaid.

If you want a Water Cooler these hot days, ask for an Indurated Fibre Cooler. Tin and galvanized iron coolers are slightly cheaper in first cost, but one season is about all they will stand. You will find the "Indurated Fibre" Cooler as good as new five years hence. If your dealer hasn't these goods, write to the general agents, Cordley & Hayes, 173 and 175 Duane street, New York, and they will tell you where you can get your wants in this line supplied.

THE ELECTRICAL AGE'S ILLUSTRATED PATENT RECORD.

STREET RAILWAY PATENTS—Issued June 30th, 1891.

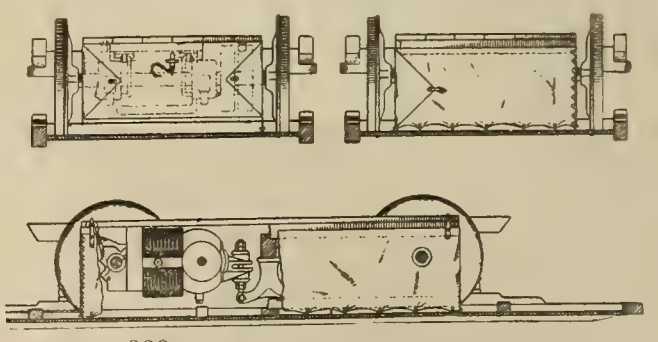
454,858. Automatic Safety-stop for Inclined Cable Railways. Elias R. Duckwall, Bantam, Ohio. Filed Feb. 24, 1891.



454,881—OVERHEAD ELECTRIC CONDUCTOR SYSTEM.

454,881. Overhead Electric-Conductor System. Gordon J. Scott, Minneapolis, Minn., assignor of one-half to Calvin G. Goodrich, same place. Filed Dec. 10, 1890.

The combination in an electric-conductor contact system of a conductor-wire with supporting-arms whereby it is held, plates or strips adapted to pass on opposite sides of the conductor, projections or roller-lugs on the strips adapted to engage the top of the conductor, and spreaders provided in connection with the supporting-arms, the upper surface of which, are of sufficient width to permit the passage of the plates and the lugs thereon engaging the surface about the supporter-arms without striking the same, and the plates being adapted to spread apart to pass the spreaders.



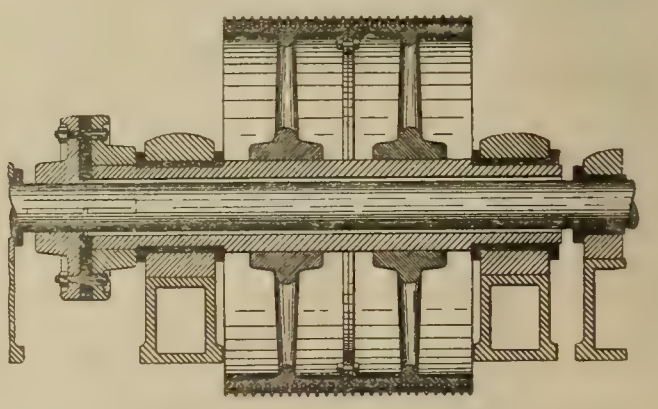
454,888—ELECTRIC CAR MOTOR JACKET.

454,888. Electric Car Motor-Jacket. John Stephenson, New York, N. Y. Filed Dec. 12, 1890.

A car with its electric motor incased, wholly or partly with flexible vertical walls, with their upper and lower verges of rigid material by which they are secured to the covering and to the bottom of the case.

454,894. Driving Mechanism for Cable Railways. John Walker, Cleveland, Ohio. Filed April 16, 1890.

In cable winding mechanism for a cable railway, a driving-shaft, a series of engines or motors having shafts, a series of clutch connections between the engine-shafts and driving shaft, a series of sleeves through which the driving shaft passes, clutches for connecting the driving-shaft to the sleeves, a series of rope-driving drums, one of which is secured to each sleeve, and a series of cable-winding drums adapted to be driven by the rope-driving drums, the construction and arrangement being such that the driving-shaft may be operated by any one engine of the series or any number or all of them, and any one cable-winding drum or any number or all of the drums may be driven by the shaft.



454,894—DRIVING MECHANISM FOR CABLE RAILWAYS.

STREET RAILWAY PATENTS—Continued.

454,903. Means for Connecting Trolley and Feed Wires. John R. Fletcher, Chicago, Ill. Filed Sept. 30, 1890.

A connector from the feed wire to the trolley-wire, consisting of a short conductor in contact with the feed-wire having a curved piece connected with it, and a downwardly-depending contactor from such curved piece to the trolley-wire.

454,904. Aerial Cut-out. John R. Fletcher, Dayton, Ohio. Filed Sept. 30, 1890.

In cut-outs for feeders and the like, the combination of a non-conducting connector with sockets, in which it is secured at each end, transverse bolts to firmly secure it in such sockets, shanks on the sockets provided with apertures in which the conductors are secured, and removable plates and a connecting fuse-wire, the plates adapted to be secured each to its respective socket and the conductors and the non-conducting connectors.

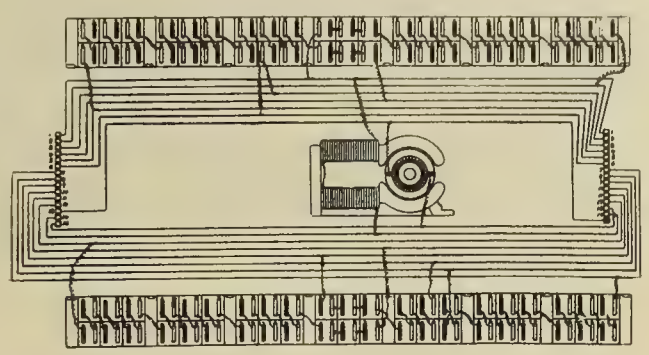


454,921—CONVERTIBLE CAR.

454,921. Convertible Car. Michael B. Ryan, Denver, Colo. Filed Oct. 18, 1890.

A convertible open and closed car, the sides of which consist of stationary standards and removable sections, suitably secured to the top and bottom of fhe car and engaging the standards, the edges of the sections being provided with strips adapted to overlap and conceal the standards, one of the strips being provided with a bead, which covers the joint formed by the meeting edges of these strips.

454,954. Gate for Railway Cars. Robert D. Wilson, Boston, Mass. Filed Aug. 18, 1890.



455,019—CIRCUIT CONNECTIONS FOR ELECTRIC CAR MOTORS.

A hinged or pivoted-step connected to a hinged or pivoted gate-bar, which prevents entrance to or exit from the cars. The mechanism connecting the step and gate-bar turns up the step and throws down the gate-bar, and vice-versa.

455,019. Circuit Connection for Electric Car Motors. Arnold A. Ingraham, New York, N. Y. Filed Nov. 18, 1889.

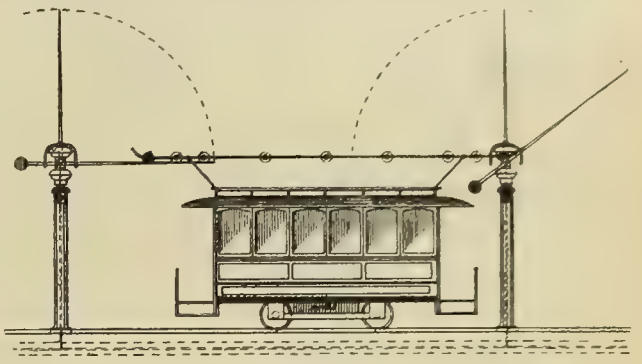
The combination, with a car and an electric motor for propelling the same, of secondary batteries and two ranges of contact-blocks, one near each end of the car, and two cylinders containing circuit-connecting devices, one adjacent to each range of contact-blocks, the handle to each cylinder for rotating the same, a pointer and index to indicate the respective positions to which each cylinder is to be turned, and the circuit-connecting wires to the batteries, field-helices and armature-helices, substantially as set forth, the connections to the helices being transposed at the ranges of contact-blocks, in order that the motor may be rotated in one direction when the circuit-connections pass through one of the cylinders and in the other direction when the circuit-connections pass through the other cylinder.

455,233. Electric Railway. James F. Munsie, Brooklyn, N. Y. Filed May 8, 1891.

In an electric railway, the combination, with the feeding-conductor of a trolley-track consisting of a series of sections suspended in an upright position and adapted to swing downwardly.

455,234. Electric Railway. James F. Munsie, Brooklyn, N. Y. Filed May 8, 1891.

In an electric railway, the combination, with the feeding-conductor, of a trolley-track consisting of a series of sections suspended in an upright position and adapted to swing downwardly, the sections being normally out of conductive connection with the feeding-conductor.



455,234—ELECTRIC RAILWAY.

455,265. Truck for Street Cars. Henry F. Shaw, Boston, Mass., assignor of one-third to Samuel A. Randall, same place. Filed March 7, 1891.

The combination with pivoted truck-frames of pivoted diagonal connecting-bars, pivoted parallel connecting-bars and pivoted cross-bar.

ELECTRICAL PATENTS.

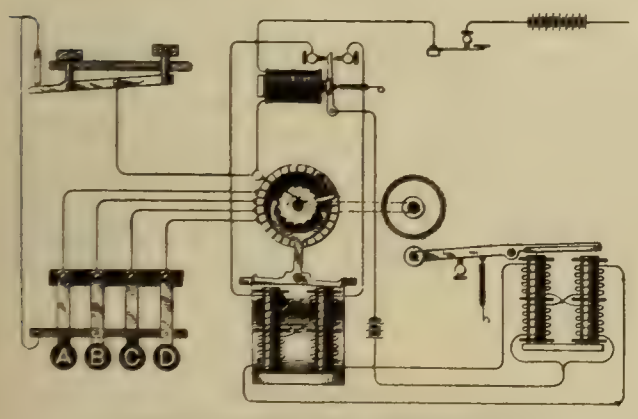
454,867. Electrical Transmission of Telegraphic and Time Indications. Henry J. Haight, New York, N. Y. Filed March 27, 1889.

454,873. Carbon for Electric-Arc Lamps. Washington H. Lawrence, Cleveland, Ohio. Filed April 9, 1887.

A carbon rod for electric-arc lights having a compressed seamless spheroidal end.

454,882. Electro-Dynamic Machine. Gordon J. Scott, Minneapolis, Minn., assignor of one-half to Calvin G. Goodrich, same place. Filed Jan. 2, 1891.

454,883. Motor Generator or Transformer. Gordon J. Scott, Minneapolis, Minn., assignor of one-half to Calvin G. Goodrich, same place. Filed Jan. 14, 1891.



455,075—PRINTING TELEGRAPH.

454,884. Printing-Telegraph Instrument. Frederick Sedgwick, Chicago, Ill. Filed June 1, 1886.

454,890. Apparatus for removing Inductive Effects From Electric Lines. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed April 8, 1889.

454,924. Hotel-Indicator. Frank B. Wood, New York, N. Y., assignor to Theodore W. Bayaud, same place. Filed August 2, 1890.

454,926. Protector for use in Electric Circuits. William H. Clausen, Melrose, assignor to Joseph W. Larish, trustee, Boston, Mass. Filed Dec. 22, 1890.

454,938. Method of Laying Electric Conduits. Alexander C. Chenowith, New York, N. Y. Filed June 30, 1887.

A method of forming continuous conduits, consisting in the preparation of a centering of the required shape and size by spirally winding a properly-shaped core with the material out of which the centering is constructed, withdrawing the core, then sustaining the centering in position without its core, surrounding the centering with material out of which the conduit is to be constructed while the material is in a plastic condition, and after the latter has hardened or set, finally withdrawing the centering.

454,939. Means for Constructing Electric Conduits. Alexander C. Chenowith, New York, N. Y. Filed March 7, 1891.

454,941. Phonograph Recorder or Reproducer. Thomas A. Edison, Llewellyn Park, N. J. Filed May 24, 1890.

A phonograph recorder or reproducer and a phonograph-diaphragm made thickest at its centre and thinnest at its periphery and controlling the recording or reproducing point.

454,942. Phonograph. Thomas A. Edison, Llewellyn Park, N. J. Filed July 30, 1890.

454,947. Reproducer for Phonographs. William McMahon, Rahway, N. J. Filed Nov. 19, 1890.

A resonant box or case having an attached stylus.

454,949. Electric Meter. Herbert M. Pilkington and Roger S. White, Brooklyn, N. Y. Filed Sept. 26, 1890.

454,969. Electric-Current Regulator or Rheostat. Charles D. Sigsbee, U. S. Navy, and Thomas S. Hayward and Frank S. Anderson, Easton, Md; said Anderson and Hayward assignors, by direct and mesne assignments, to said Sigsbie. Filed March 10, 1891.

A resistance for rheostats, composed of relatively long elastic fibers coated with a conducting substance.

454,973. Electric Signalling Apparatus. Morris Martin, Malden, assignor to Frederick P. Fish, Cambridge, Mass. Filed Nov. 5, 1888.

454,974. Circuit for Electric Signalling. Morris Martin, Malden, assignor to Frederick P. Fish, Cambridge, Mass. Filed Nov. 5, 1888.

454,979. Electric Heater. Charles W. Drew and Edward R. Francis, Minneapolis, Minn.; said Francis assignor to said Drew. Filed Feb. 20, 1890. Renewed Dec. 1, 1890.

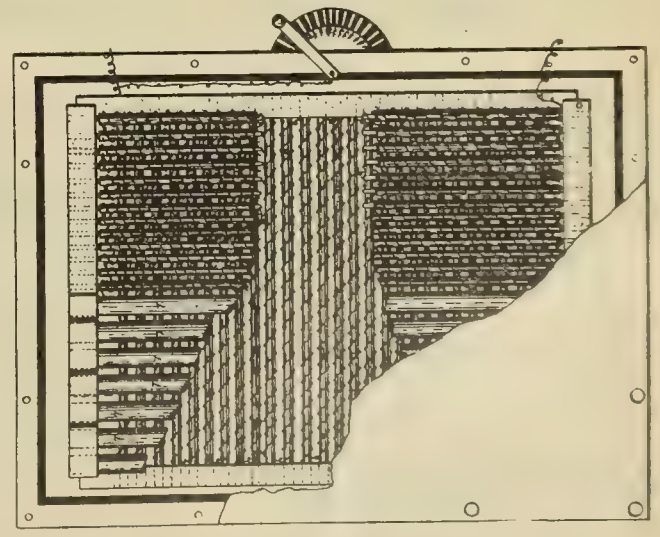
454,985. Electric Temperature-Controller. Emer H. Parker, Evanston, Ill. Filed Dec. 24, 1890.

454,995. Electric Switch. James Des Brisay, New York, N. Y. Filed Dec. 10, 1890.

455,005. Circuit-Closer for Burglar-Alarms. Don A. Palmer, Chicago, Ill. Filed May 26, 1890.

455,010. Electric Soldering-Iron. Arthur E. Appleyard, Boston, assignor to Henry L. Millis, trustee, Millis, Mass. Filed Oct. 1, 1890.

455,016. Electrical Annunciator. William F. Harte and Clifford A. Gerold, Omaha, Neb.; said Gerold assignor to said Harte. Filed Mar. 28, 1891.



454,979—ELECTRIC HEATER.

455,037. Apparatus for Boring Wells. Fulton Gardner, Chicago, Ill., assignor to himself and A. M. Butz, same place. Filed Sept. 1, 1890.

455,038. Pneumatic Fire-Alarm Telegraph Apparatus. Albert Goldstein, Baltimore, Md. Filed Aug. 6, 1890.

455,041. Electric Clock for use in Electric Lighting and other Systems. Friedrich von Hefner-Alteneck, Berlin, Germany. Filed Feb. 25, 1891. Patented in Germany, England, Belgium and France.

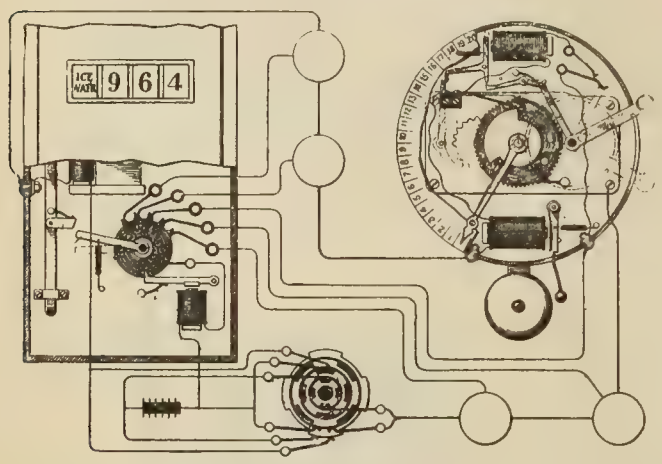
ELECTRICAL PATENTS—Continued.

455,055. Electric Time-Denoting Device. William Ramsay, Washington, D. C. Filed Jan. 15, 1891.

455,067. Electro-Magnetic Motor. Nikola Tesla, New York, N. Y. Filed Jan. 27, 1891.

In an alternating-current motor, the combination, with the field-magnets and energizing-circuit, of an armature-circuit and a core adapted to be energized by currents induced in its circuit by the currents in the field-circuit, and a condenser connected with the armature-circuit only.

455,068. Electrical Meter. Nikola Tesla, New York, N. Y. Filed March 27, 1891.



454,924—HOTEL INDICATOR.

A meter composed of an electrolytic cell and two conductors passing through the same, the conductors being in or connected with the main circuit, and so that a potential difference uniform throughout the whole extent exposed to the solution will be maintained between them.

455,069. Electric Incandescent Lamp. Nikola Tesla, New York, N. Y. Filed May 14, 1891.

455,071. Clutch for Arc Lamps. Frank H. Thompson, Philadelphia, Pa., assignor of one-half to Daniel Killion, same place. Filed Oct. 18, 1890.

A clutch having a lever with an adjustable jaw thereon and a base with an adjustable jaw opposite the adjustable jaw of the lever, the jaws being horizontally arranged and slotted, and having their opposing edges adapted to engage with an inserted carbon-rod.

455,075. Printing-Telegraph. Henry Van Hoevenbergh, New York, N. Y., assignor to the Equitable Manufacturing and Electric Company, same place. Filed Feb. 24, 1891.

455,086. Push-Button. Granville W. Wright, New Haven, Conn., assignor to Sargent & Company, same place. Filed April 10, 1891.

455,087. Electric-Arc Lamp. Craig R. Arnold, Chester, Pa. Filed May 28, 1890.

455,092. Automatic Electric Switch. Carl O. C. Billberg and Paul A. N. Winand, Philadelphia, Pa. Filed Nov. 11, 1890.

455,107. Insulator. James F. Munsie, Brooklyn, N. Y. Filed March 28, 1890. Renewed March 28, 1891.

455,109. Electric Motor. Frederick L. McGahan, Indianapolis, Ind. Filed Feb. 11, 1891.

An electric motor composed of an electro-magnet, its core provided with friction-wheels on its ends and adapted to contact with the inner face of a wheel to be driven, in combination with such wheel mounted on a suitable shaft having bearings in the frame-work.

455,110. Electric Motor. Frederick L. McGahan, Indianapolis, Ind. Filed Feb. 16, 1891.

455,126. Electric Post-Office Box. Will A. M. Smith and Robert T. F. Smith, Morrison, Ill. Filed March 4, 1891.

The combination, with a post-office box provided with a door arranged to open automatically, of an electro-magnetic door releaser.

455,138. Electrical Signal for Steam-Vessels. Dyson D. Wass, San Francisco, Cal., assignor of one-half to Edwin W. Tucker, same place. Filed Jan. 5, 1891.

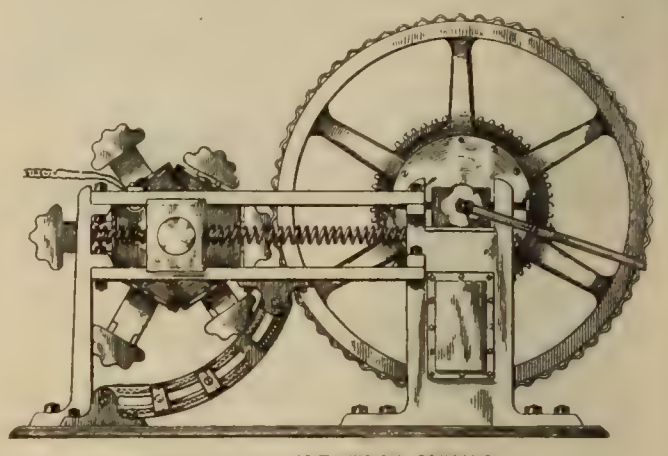
455,187. Filament for Incandescent Electric Lamps. George Erlwein, Berlin, Germany, assignor to Siemens & Halske, same place. Filed Feb. 18, 1891.

A carbon filament with a coating of nitride of boron.

455,223. Lightning-Arrester. Frank Mansfield and Chas. W. Wason, Cleveland, Ohio. Filed July 22, 1890.

455,266. Electric Railway-Signal. Winslow Stevens and Henry J. Hovey, New Haven, Conn., assignors to the Hall Signal Company, Portland, Me. Filed Nov. 11, 1890.

455,267. Automatic Regulators for Electric Motors or Dynamo-Electric Machines. Schuyler S. Wheeler, New York, N. Y., assignor to the Crocker-Wheeler Electric Motor Company, same place. Filed Nov. 8, 1890.



455,110—ELECTRIC MOTOR.

455,268. Telethermometer. Frederick W. Weisebrook, New York, N. Y., assignor of one-half to Richard M. Bruno, same place. Filed Aug. 9, 1890.

445,287. Socket for Incandescent Electric Lamps. Benjamin B. Keyes, Chelsea, Mass. Filed Oct. 6, 1890.

455,294. Printing-Telegraph. David H. Bates and Henry Van Hoevenbergh, New York, N. Y. Filed March 4, 1891.

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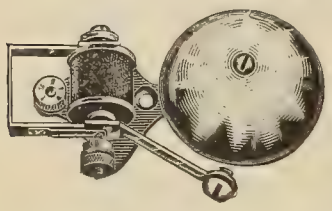
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WEEKLY.

Vol. IX. NEW YORK, JULY 18, 1891. No. 29.

BRUNSWICK ELECTRIC LIGHT AND POWER COMPANY'S PLANT.

We illustrate herewith the central station of the Brunswick Electric Light and Power Company, located on the Androscoggin River, at Brunswick, Maine.

The illustrations were reproduced from the working drawings furnished by the Maine Electrical Improvement Company, who recently secured the contract for the enlargement of the plant.

In Brunswick the lighting, both municipal and commercial, covers a vast area, and the old methods of electrical distribution were the cause of great electrical losses in conduction as, for the most part, the company employed 96 volts constant potential, excepting to a limited extent, where storage cells were used for the greatest distances. The arc lighting, of course, was not subject to these disadvantages, and was, therefore, a successful source of revenue.

The power plant consisted, prior to the present

pany has changed its incandescent system from 96 volts constant potential to 1,000 volts alternating current. The town has been rewired throughout to meet this new state of affairs, and on the whole the entire installation has been transformed into a model.

The energy displayed both by the past and present management of this plant is worthy of the highest consideration by the community, and in electrical circles the gentlemen connected with it may be looked upon as fearless investors and developers of electrical industries.

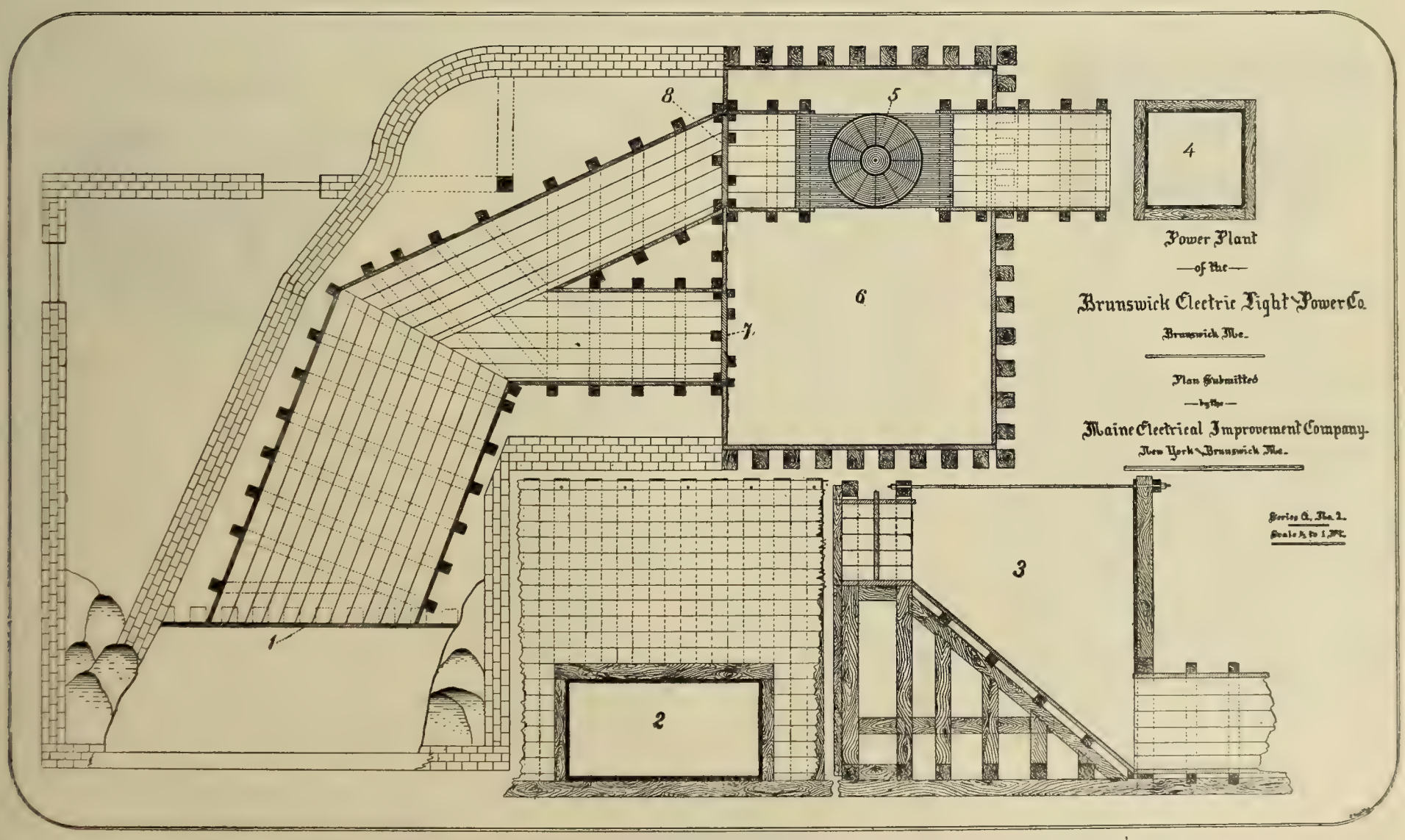


FIG. 1—PLAN OF WATER POWER CONSTRUCTION BRUNSWICK ELECTRIC LIGHT AND POWER COMPANY'S PLANT.

The Brunswick Electric Light and Power Company was incorporated some time ago, for the purpose of supplying the town and citizens of Brunswick with electric lights, both arc and incandescent, and also electrical power. Owing to the increased demand, both for light and power, it found the plant inadequate. The company decided to increase its dimensions, and at the same time take advantage of more recent developments in the electrical art, as it was considered that the apparatus and methods of installing at the time the plant was constructed did not compare favorably with the much improved methods of to-day.

changes, of an improved water power capable of developing about 200 horse power on the line shaft, the fall of water being about 20 feet. The plant is now, as the illustrations show, much improved and will deliver about 500-horse power. The old water power construction was of brick and natural rock formation; the present one is of wood, constructed in the latest and most improved methods known to the hydraulic engineer, and will last fully forty years without serious depreciation. The flume may then be covered with hydraulic cement, as three sides are surrounded by natural rock in a fair state of preservation; it will then be indestructible. The com-

Referring to figure 1: Fig. 1 is a plan view of the entrance for water from the head-gate to the flume; 2 is a cross-sectional view of the same; 3, longitudinal section of the same; 4, end view of flume at the outlet; 5, water-wheel; 6, space reserved for second water-wheel; 7 and 8, tail gates admitting water to wheels.

Fig. 2, on page 439, shows a plan view of the power plant of the Brunswick Electric Light and Power Company. The cut was made from the plans of the Maine Electrical Improvement Company, and shows in a very clear manner the relative positions of the various apparatus used in this interesting plant.

EXPERIMENTS WITH ALTERNATE CURRENTS OF VERY HIGH FREQUENCY, AND THEIR APPLICATION TO METHODS OF ARTIFICIAL ILLUMINATION.*

BY NIKOLA TESLA.

Continued from page 420.

All these experiments and observations would be of the greatest interest to the student, but their description would lead me too far from the principal subject. Partly for this reason, and partly on account of the vastly greater importance, I will confine myself to the description of the light effects produced by these currents.

In the experiments to this end a high tension induction coil or equivalent apparatus for converting currents of comparatively low into currents of high tension is used.

If you will be sufficiently interested in the results I shall describe as to enter into an experimental study of this subject; if you will be convinced of the truth of the arguments I shall advance, your aim will be to produce high frequencies and high potentials; in other words, powerful electrostatic effects. You will then encounter many difficulties, which, if completely overcome, would allow us to produce truly wonderful results.

First will be met the difficulty of obtaining the required frequencies by means of mechanical apparatus, and, if they be obtained otherwise obstacles of a different nature will present themselves. Next it will be found difficult to provide the requisite insulation without considerably increasing the size of the apparatus, for the potentials required are high, and owing to the rapidity of the alternations, the insulation presents peculiar difficulties. So, for instance, when a gas is present the discharge may work through by the molecular bombardment of the gas and consequent heating, through as much as an inch of the best solid insulating material, such as glass, hard rubber, porcelain, sealing wax, etc.; in fact, through any known insulating substance. The chief requisite in the insulation of the apparatus is, therefore, the exclusion of any gaseous matter.

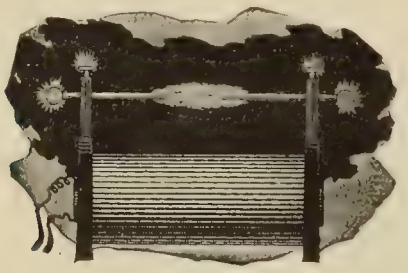


Fig. 8.—Fifth Typical Form of Discharge.

In general, my experience tends to show that bodies which possess the highest specific inductive capacity, such as glass, afford a rather inferior insulation to others, which, while they are good insulators, have a much smaller specific inductive capacity, such as oils, for instance, the dielectric losses being no doubt greater in the former. The difficulty of insulating, of course, only exists when the potentials are excessively high, for with potentials such as a few thousand volts there is no particular difficulty encountered in conveying currents from a machine giving, say 20,000 alternations per second to quite a distance. This number of alterations, however, is by far too small for many purposes, though quite sufficient for some practical applications. This difficulty of insulating is fortunately not a vital drawback; it affects mostly the size of the apparatus, for, when excessively high potentials would be used, the light-giving devices would be located not far from the apparatus, and often they would be quite close to it. As the air-bombardment of the insulated wire is dependent on condenser action, the loss may be reduced to a trifle by using excessively thin wires heavily insulated.

* A lecture delivered before the American Institute of Electrical Engineers, at Columbia College, May 20, 1891.

Another difficulty which will be encountered is the capacity and self induction necessarily possessed by the coil. If the coil be large, that is, if it contain a great length of wire, it will be generally unsuited for excessively high frequencies; if it be small, it may be well-adapted for such frequencies, but the potential might then not be as high as desired. A good insulator and preferably one possessing a small specific inductive capacity, would afford a two-fold advantage. First it would enable us to construct a very small coil capable of withstanding enormous difference of potential; and secondly, such a small coil, by reason of its smaller capacity and self-induction, would be capable of a quicker and more vigorous vibration. The problem then of constructing a coil or induction apparatus of any kind possessing the requisite qualities I regard as one of no small importance, and it has occupied me for a considerable time.

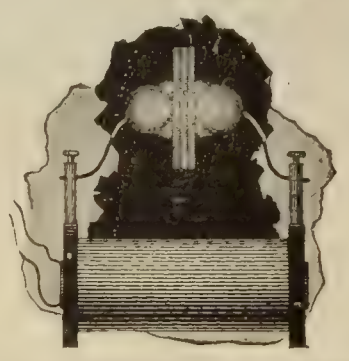


Fig. 9.—Luminous Discharge with Interposed Insulators.

The investigator who desires to repeat the experiments which I will describe, with an alternate current machine, capable of supplying currents of the desired frequency, and an induction coil, will do well to take the primary coil out and mount the secondary in such a manner as to be able to look through the tube upon which the secondary is wound. He will then be able to observe the streams which pass from the primary to the insulating tube, and from their intensity he will know how far he can strain the coil. Without this precaution he is sure to injure the insulation. This arrangement permits, however, an easy exchange of the primaries, which is desirable in these experiments.

The selection of the type of machine best suited for the purpose, must be left to the judgment of the experimenter. There are here illustrated three distinct types of machines, which, besides others, I have used in my experiments.

Fig. 1 represents the machine used in my experiments before this Institute. The field magnet consists of a ring of wrought iron with 384 pole projections. The armature comprises a steel disc to which is fastened a thin, carefully welded rim of wrought iron. Upon the rim are wound several layers of fine, well annealed iron wire, which, when wound, is passed through shellac. The armature wires are wound around brass pins, wrapped with silk thread. The diameter of the armature wire in this type of machine should not be more than 1/6 of the thickness of the pole projections, else the local action will be considerable.

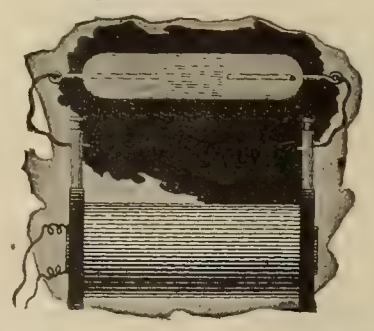


Fig. 10.—Discharge Through Highest Vacuum.

Fig 2 represents a larger machine of a different type. The field magnet of this machine consists of two like parts which either enclose an exciting coil, or else are independently wound. Each part has 480 pole projections, the projections of one facing those of the other. The armature consists of a wheel of hard bronze, carrying the conductors which revolve between the projections of the field magnet. To wind the armature conductors, I have found it most convenient to proceed in the following manner: I construct a ring of hard bronze of the required size. This ring and the rim of the wheel are provided with the proper number of pins and both fastened upon a plate. The armature conductors being wound, the pins are cut off and the ends of the conductors fastened by two rings which screw to the bronze ring and the rim of the wheel respectively. The whole may then be taken off and forms a solid structure. The conductors in such a type of machine should consist of sheet copper, the thickness of which, of course, depends on the thickness of the pole projections; or else twisted thin wires should be employed.

Fig. 3 is a smaller machine, in many respects similar to the former, only here the armature conductors and the exciting coil are kept stationary, while only a block of wrought iron is revolved.

It would be uselessly lengthening this description were I to dwell more on the details of construction of these machines. Besides they have been described somewhat more elaborately in *The Electrical Engineer*, of March 18, 1891. I deem it well, however, to call the attention of the investigator to two things, the importance of which, though self evident, he is nevertheless apt to under-estimate; namely, to the local action in the conductors which must be carefully avoided, and to the clearance, which must be small. I may add, that since it is desirable to use very high peripheral speeds, the armature should be of very large diameter in order to avoid impracticable belt speeds. Of the several types of these machines which have been constructed by me, I have found that type illustrated in Fig. 1 caused me the least trouble in construction as well as in maintenance, and, on the whole, it has been a good experimental machine.

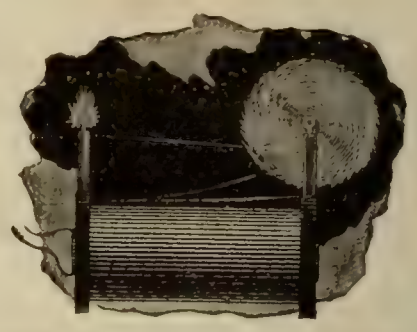


Fig. 11.—Pinwheel Driven by a Powerful Brush.

In operating an induction coil with very rapidly alternating currents, among the first luminous phenomena noticed are naturally those presented by the high-tension discharge. As the number of alternations per second is increased, or as—the number being high—the current through the primary is varied, the discharge gradually changes in appearance. It would be difficult to describe the minor changes which occur and the conditions which bring them about, but one may note five distinct forms of the discharge.

First one may observe a weak, sensitive discharge in the form of a thin feeble-colored thread, (Fig. 4). It always occurs when, the number of alternations per second being high, the current through the primary is very small. In spite of the excessively small current, the rate of change is great and the difference of potential at the terminals of the secondary is therefore considerable, so that the arc is established at great distances; but the quantity of "electricity" set in motion is insignificant, barely sufficient to maintain a thin, threadlike arc.

(*To be continued.*)

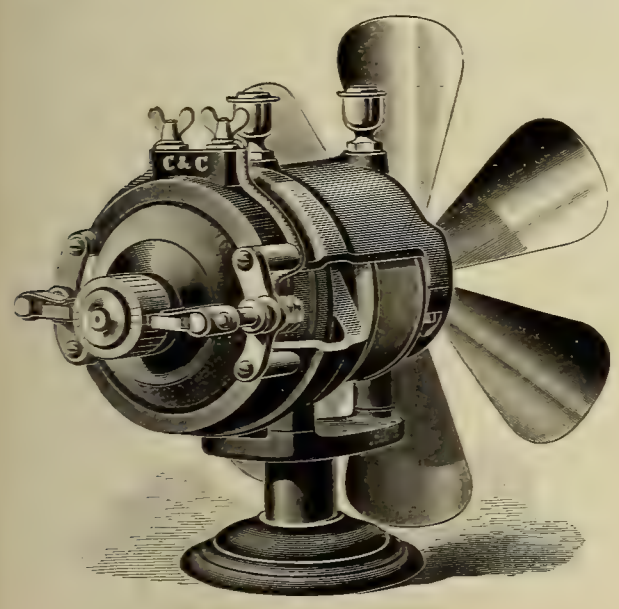
FIVE HUNDRED VOLT FAN OUTFIT.

The great increase in street railway and other power circuits of a pressure of 500 volts has recently led to a demand for small motors and fan outfits adapted to this voltage.

The problem of designing a ⅛ or ¼ H.P. motor for so high a voltage has many factors that do not occur in building larger machines, while some of the main objects to be attained in large machines assume a very different aspect in these pigmies.

Another difficulty in designing is the limitation in size, especially in fan outfits, which must be small enough to move from place to place, while at the same time the area of the pole pieces must be large enough to reduce the armature turns to a reasonable number. Finally, the cost of construction must be reduced to rock bottom as the wire alone on a high volt machine may cost as much as a whole motor of low voltage.

With these points in view the motor herewith illustrated has been designed by Mr. F. V. Henshaw, of the "C. & C." Electric Motor Company, of New York.



C. & C. FAN OUTFIT.

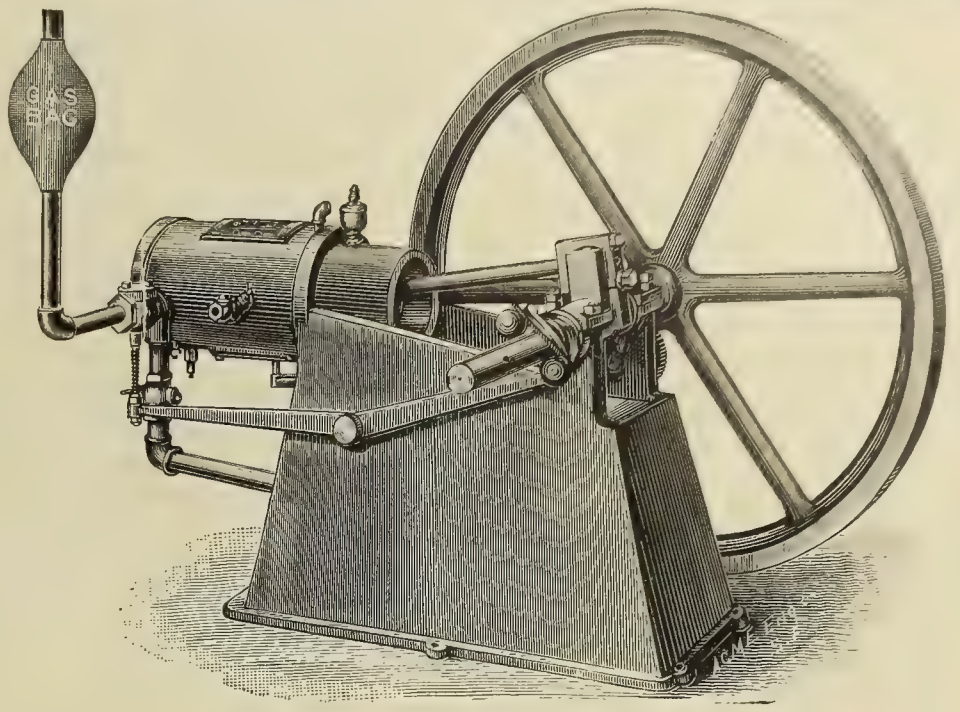
The field magnet is semi-ironclad, being formed of two castings joined at one end and held by a single bolt, while the opposite projecting ends form the poles. The lower casting has a cylindrical core over which the single field coil is slipped. This core is cast hollow and the shaft passes through it, having bearings at each end. The armature is of the ring type supported on the shaft by three arms. The whole front of the armature is covered by a rubber disc against which the commutator is fastened. This disc serves to keep the frail connecting wires in place and also as a protection to the armature. The brush-holders carry two or more round carbons of standard size. With duplicate sets of armatures and field bobbins of the proper winding it is but the work of a few minutes to change these machines from one voltage to another, which is sometimes convenient.

The ⅛ H.P. motors are finished with bearings requiring very little oil, while the larger motors have self-oiling bearings.

The "C. & C." Electric Motor Company, is turning out large numbers of these machines, the demand for which is constantly increasing.

THE REGAN VAPOR ENGINE.

Herewith we give our readers a cut and description of a four horse-power horizontal Regan vapor engine, which illustrates a type of machine that has been developed to a large extent during the last few years and which may be used in the house, the store or the barn with perfect safety. The engine which we illustrate is operated by means of vapor drawn into a cylinder by the suction of a piston and ignited by an electric spark. The carburetor or oil tank is a small circular tank containing a spiral chamber which has a suction-pipe at one end, and is connected with the gas box or bag at the other. The carburetor is partly filled with gasoline and connected with the engine by a pipe. At each revolution of the fly-wheel a current of cool air is drawn through the carburetor and into the cylinder. In passing through the carburetor the air vaporizes a quantity of the gasoline; this when mixed with more air drawn through the pipe and air valve, forms the charge, which upon combustion, develops the power.



REGAN VAPOR ENGINE.

The charge is drawn into the cylinder as the piston is drawn out by the crank and fly-wheel. On the return stroke it is compressed in the head of the cylinder and just before the piston arrives at its dead centre a shoulder or point projecting from it comes in contact with a flexible projecting piece in the end of the cylinder. As these two points are the poles of an electric battery, their contact forms an electric circuit. Just as the piston passes its "centre" and commences to return the electric circuit is broken emitting a spark which fires the charge. On every other stroke of the piston this is repeated automatically, except when the supply is "cut off" by the governor.

The governor, depending upon centrifugal force, is very simple in its construction, positive in its action and perfectly effective.

When running at maximum speed and power about one-eighth gallon of gasoline or twenty cubic feet of illuminating gas per horse-power per hour is used.

Over 200 of these engines are now in use and letters to the manufacturers, Thomas Kane & Co., Chicago. Ill., would indicate that every one is giving perfect satisfaction. F. P. Jones & Co., agent, 301 Main street, Buffalo, N. Y., dealers in all kinds of electrical equipment construction supplies has furnished a number of these engines for isolated electric light plants, for which they are especially appropriate. L. J. Wing & Co. are the New York Agents.

IMPROVED LIGHTNING ARRESTER.

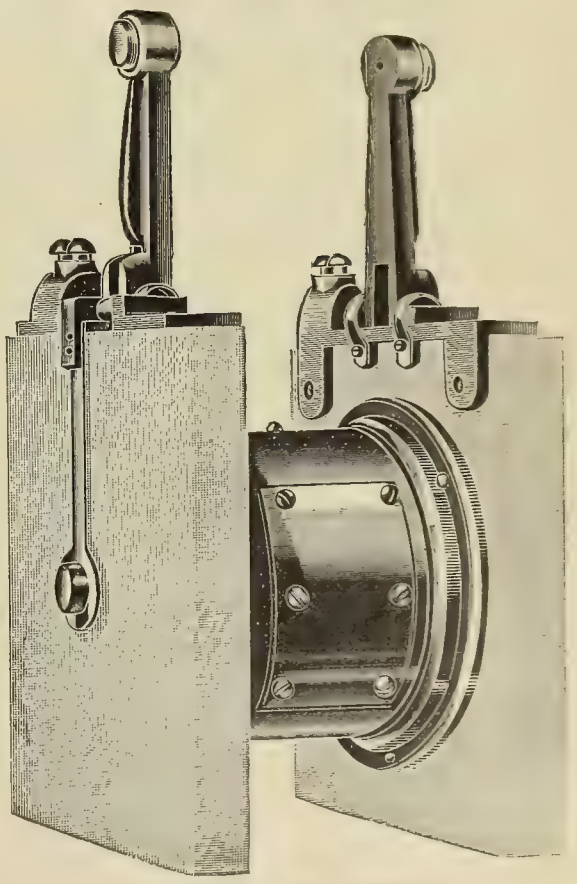
Since the Wurts-Winsor lightning arrester was brought out by the Westinghouse Electric and Manufacturing Company, the demand for these appliances has greatly increased, and to-day lightning arresters are considered to be an essential feature in all electric light and power stations. Thousands of these useful contrivances are now in use throughout the country.

Mr. Wurts has lately made many improvements in the construction of this apparatus, and while it was unnecessary to modify the principle embodied in the first one, the changes made add much to its simplicity.

The accompanying illustrations represent the new style of the arrester for incandescent circuits.

Its distinctive features are that it is made out of incombustible material, it operates without any electro-magnetic device, and its arc is self-destructive.

The cut represents the lightning arrester in its normal position ready for a discharge. The apparatus is compact, consisting of very few parts. It has a cylindrical air chamber of brass, each end of which is covered with a marble plate. Two discharge points on opposite sides of the air chamber, consisting of brass tubes tipped with carbon, are attached to brass lever arms in such a manner as to swing freely through circular openings in the marble plates. Within the air chamber is a carbon ball held stationary in the centre, and the two discharge points approach this ball to within one-sixteenth of an inch. The carbon ball is grounded and the lever arms connected to the respective poles of the generator.



NEW LIGHTNING ARRESTER.

The operation of a discharge is as simple as it is effective. The entire operation is automatic, and when the lightning arrester is once placed in position it requires no further attention.

The Westinghouse Electric and Manufacturing Company also makes lightning arresters on the same principle, but differing in construction, for power house installations and car equipments of Electric Street Railway Companies.

The City Council of Waterville, Me., has voted to build an electric lighting plant for the town, and have appropriated $20,000 for the same. A plant has already been contracted for, and work is to be commenced immediately. Both arc and incandescent lamps will be used.

THE ELECTRICAL AGE

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J. B. TALTAVALL, Pres. W. T. HUNT, Vice-Pres.

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NOTES.

STREET RAILWAY NEWS, the street railway department of the ELECTRICAL AGE, is published weekly and should be read by every street railway man in the United States. It gives all the news of the street railway world three or four weeks in advance of all other street railway journals.

On July 7, four condemned murderers paid the death penalty in Sing Sing prison for their crimes and were ushered into eternity by the electric method. All reports agree that the executions were successful so far as the manipulation of the apparatus was concerned, and that the victims died instantly. It is said that none of the revolting features of the Kemmler execution were repeated in these four cases, and that the work was a success in every respect. Notwithstanding this, there is evidently a great sentiment in favor of repealing the electrical execution law.

The New York Electrical Society is the oldest one of its kind in New York, and has done much good. It has a high standing in the estimation of electricians, and we are glad to know that its members think so well of it that they will resist any effort to impair its independence. In his annual report, Secretary Guy gives the reasons for the separation of the society from the American Institute, which, hitherto, had not been fully understood by outsiders. Rather than sacrifice the name of the society in order to become entitled to a grant from the American Institute the members resolved to sever relations with the American Institute. This was done, and now the New York Electrical Society stands alone and independent, and deserves the good will and support of all who admire an independent spirit.

The Street Railway News department of the ELECTRICAL AGE has already scored a great triumph. We are receiving words of encouragement and compliment from every direction, and it is a great satisfaction to us to know that our enterprise is appreciated by the electrical and street railway fraternity. The street railway business is one of such vast and growing importance that it requires a weekly publication to record everything that is transpiring in this direction before the news gets too old, and the STREET RAILWAY NEWS now enjoys the distinction of being the first paper ever published weekly in the interest of the street railway people. No effort or expense will be spared to make it interesting and valuable to every street railway man. This department of the ELECTRICAL AGE, as has already been mentioned, will be devoted exclusively to street railway news, and whatever is new our readers may be sure to find in the STREET RAILWAY NEWS each week.

With the introduction of the dynamo for electric lighting, the necessity for better steam engines became at once apparent. This gave a great impetus to the steam engineering trade, the result of which, apart from the pecuniary benefits derived by the builders, was the development of some makes of steam engines to a high state of efficiency. While the steam engine now meets every exacting requirement for electric lighting purposes, engineers have in late years been working on the problem of securing cheaper power. The amount of water power that runs to waste in this country every year is stupendous, and this naturally engaged their attention. There are now many electrical plants throughout the country driven by water power, and this form of power is becoming more and more applied to the driving of machinery, and in conjunction with electricity forms a combination which produces results that cannot be attained in any other way. The energy of the water may be utilized in driving machinery in the immediate locality of the water power, but by the use of no other means than electrical can the water power be transformed and carried to any distance to be retransformed into power at the spot where work is to be performed. This work may be in the form of light or mechanical power, and the cheapness of water power is the one great incentive for its development. Engineers are giving more and more attention to this subject, and with the aid of electricity much of the power that has been running to waste will in the future be harnessed to do man's work. We publish elsewhere in this issue a description of a water power electric plant in Brunswick, Me., which embodies every improvement in hydraulic engineering and represents the best work in combining water and electric power for useful purposes. By the aid of the illustrations given the reader will be able to form a better idea of the plant, which is said to be a very efficient one. Electrical engineers cannot find a better field for the development of their genius than in this one.

It is not given to every man to prophesy, as is abundantly proved by the dismal failures to predict the result of horse races and other sporting events in which the element of chance exists. A philosopher once said that our "hindsight was better than our foresight," but once in a while some one is favored with an insight into the future. There have been so many failures of prophecies that most people have come to the conclusion that prophesying is a lost art. The other day while we were in a meditative mood the veil separating the present from the future, was for a moment lifted. We could not, with our mortal eyes, take in the entire scene presented to us, but what little of it we did see was convincing proof that it was the Electrical Age. Everything was electricity and electricity was everything. What attracted our attention most was the part electricity played in domestic life. The houses for the most part were built without chimneys. There was no need for them. The consumption of coal in houses was a thing of the past and quite forgotten. All the heat was generated by electricity. Every house was wired, and connected with immense street mains. These mains were fed from a central station, and these stations were multiplied in number according to the size of the town. Wires covered the surface of the walls in the houses in artistic and elaborate designs, and when it was desired to heat a room or the house all that was necessary was to turn a convenient switch and in a few moments the place would be comfortably and evenly warmed. Lighting was accomplished about as it is now, except that it was more abundant. For cooking purposes, the stoves had a zig-zag arrangement of heavy wire inside, which in a few moments became white hot after the current was turned on. All domestic work was accomplished by the aid of electric power. By simply pressing a button electricity did the rest—whatever was required. The fan motor was everywhere. In the summer time the temperature of the house was kept delightfully cool. On the hottest of nights a fan attached to the foot of the bed created cool breezes, and such a thing as sleepless nights on account of heat was unheard of. The children read of them in their books and pitied their ancestors. If during the night the weather suddenly changed and the temperature descended from its lofty height, a thermostat in circuit with the motor, fixed to operate at a certain temperature, cut the motor out, and if the temperature still continued its downward course another thermostat, set to operate at a lower temperature than the first, became active and put into operation certain mechanism which gently dropped extra bed covering over the slumberer without disturbing him. The converse took place when the weather changed from cold to hot during the night. In winter time the heat was regulated by thermostats. When it became too cold more current was turned on, and when too hot it was turned off. In this way, both summer and winter, an even temperature was maintained. Those houses not having connection with street mains obtained their supply of electricity in accumulators, which were delivered to the houses early in the morning, in much the same manner as milk is now. The very general use of electricity necessarily led to many inventions. In New Jersey they had an electrical apparatus which was an absolute protector to the inmates of a house against the attacks of a dipterous insect of the genus *Culex*, commonly called the "mosquito." Incidentally we were shown the report of the Insurance Commissioners. There were no fires caused by exploding gasoline stoves, and the fires from unknown causes, which used to be charged to electricity, were properly credited. Fires from electricity were unknown and the insurance men were glad to take electrical risks. It was the Electrical Age.

PALISADES AMUSEMENT COMPANY'S LIGHT PLANT.

On the night of July 10, the members of the New York Electrical Society and many other electricians, visited and inspected the electric light plant of the Palisade Amusement Company, whose grounds, 35 acres in extent, are situated on the high bluff at Weehawken, N. J., overlooking the Hudson River and New York City.

The plant consists of 3 L. D., 12 Thomson-Houston Arc Dynamos, each of a capacity of 53 lamps of 1500 c. p. nominal, with the customary automatic regulators, wall controllers, etc., of the Thomson-Houston Arc System. These dynamos feed 150 arc lamps scattered about the grounds on three circuits.

The wire employed is of the highest class of insulation, and all circuits, both arc and incandescent, are protected by lightning arresters.

There is also installed one D. 50 Thomson-Houston Incandescent Dynamo of 700 16 c. p. capacity. This supplies the incandescent lamps under the grand stand, in the castle, the restaurant building, the offices, ladies' reception building, the orchestra and dressing-rooms under the stage. The dynamo is of the low tension, direct current type, with automatic regulation, being compound wound. The total number of lamps already arranged for is 628.

It is proposed to change a number of the 16 c. p. for 10 to enable a further increase of the present plant.

The engines are of the McIntosh & Seymour automatic type specially designed for electric lighting. One of the engines, 60 H. P., drives two arc dynamos employing Underwood cotton leather belts.

The other engine is rated at 90 H. P.

The boiler plant consists of two 80 H. P. single return tubular boilers, and are furnished with heavy cast iron fronts with the name of the Palisades Amusement Company upon them.

The engines and boilers, and in fact the whole steam equipment, was installed by Messrs. Pierce & Thomas, of 42 Cortlandt street, New York, who contracted for this portion of the work with the Thomson-Houston Company.

There is one 4½ x2¾x4 inch Worthington & Knowels' Duplex boiler feed pump with ample capacity to feed the two boilers, and an injector to back up the same. There is also one No. 11 brass coil feed-water tower, having bypaths arranged to cut the same out in case of necessity.

The station in which the plant is erected is a two-story frame building which stands in a hollow in the rear of the ground back of the grand stand. The second story is equipped as a store room and repair shop, with a testing power for lamps.

The electric lighting plant, which is large enough for a large town, was installed by the Thomson-Houston Company under the superintendence of their representative, Mr. Fred A. Bowman, and the entire work was supervised by Mr. W. J. Hammer, consulting and supervising electrical engineer, who was retained as expert by the Palisades Amusement Company.

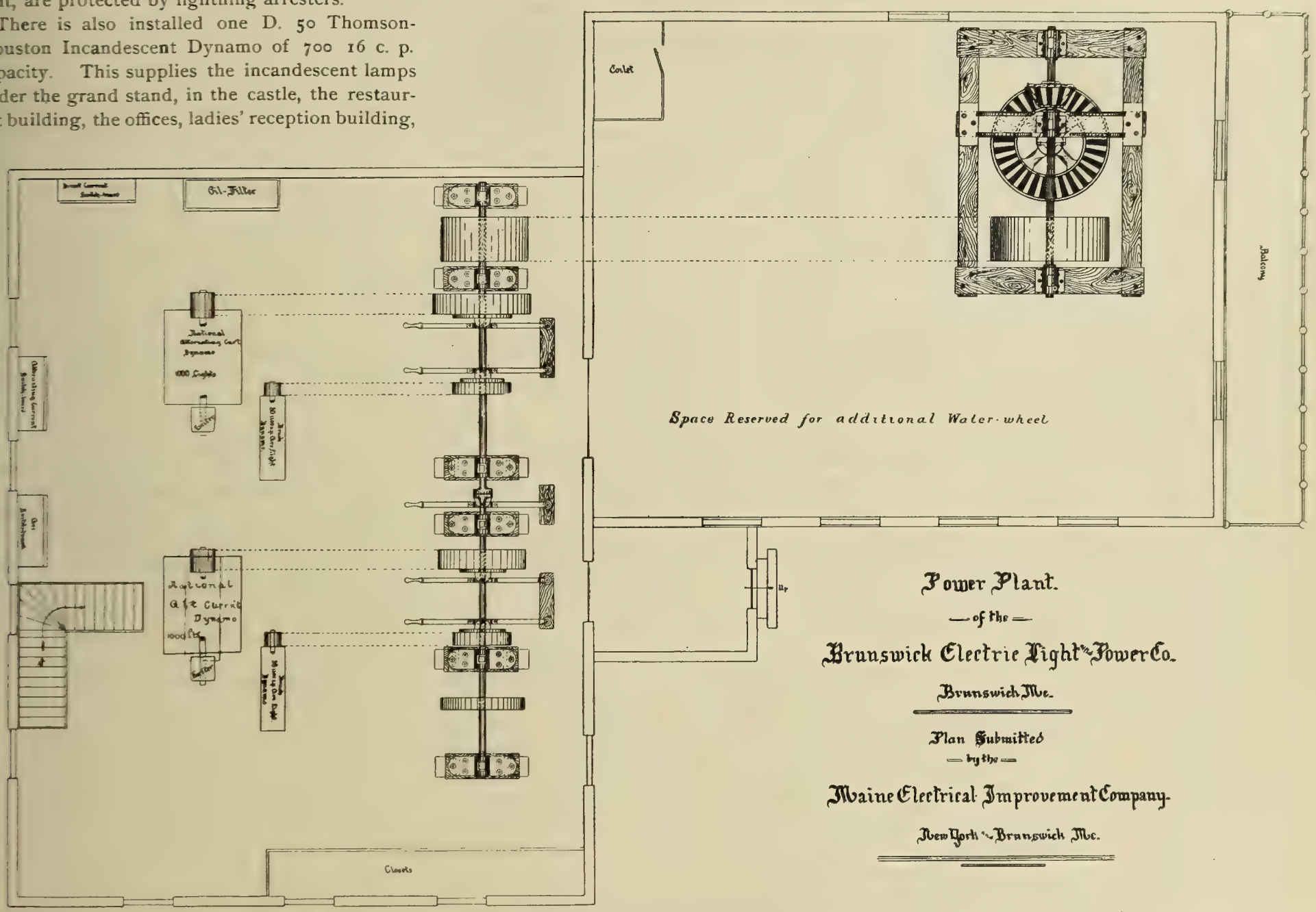


FIG. 2—PLAN OF POWER PLANT OF BRUNSWICK ELECTRIC LIGHT AND POWER COMPANY. (SEE PAGE 435.)

MOVING AN ELECTRIC STATION IN HALF A DAY.

The Sewickley Electric Company at Sewickley, Allegheny County, Pa., owing to increase of business and to narrow limit of space in its old quarters, decided some time ago to relocate its station on a larger lot situated on the Ohio River, and P. Ft. W. & C. Ry. at Quaker Valley Station.

The company has been operating two Westinghouse dynamos, one an arc machine of 40 lights capacity, and the other a 750-light incandescent, both run by a Westinghouse 75 H. P. engine. In order to make the move in daylight, and thus have all consumers supplied with light continuously, Mr. E. P. Young, the secretary and treasurer, had a new battery of boilers erected, and all lines of wire run to the new station before the day of moving. Mr. James Updegraff acted as mechanical engineer, having his engine and dynamo foundations completed, with bolts bedded in the solid masonry, ready to receive the massive machinery on its arrival, and the switchboard was in place ready for the voltmeters, ammeters, lightning arresters and switches. As far as possible steam connections were made with the new boiler, leaving however three nipples to cut in order to establish the connection between the engine and boiler.

The distance between the old station and the new is about one mile. The current was maintained on the arc and incandescent circuits until 3:15 A. M., June 25. Then Mr. Young and his assistants, with workmen and teams, commenced the work of moving and before noon the engine, weighing 9,000 pounds, was safely bolted down on its new foundation. All connections were made, belts arranged and wires connected up by 7 P. M., and when the engine started up (still hot from its morning work at the old station), the lights were turned on without a hitch of any sort. The station is now supplied with one 60 H. P. and one 91 H. P. Root safety boiler, and the company expects to shortly add new engines and dynamos.

TACHOMETERS.

Queen & Co., of Philadelphia, Pa., are just now making a specialty of tachometers for indicating the speed of engines, dynamos and motors. These instruments are quite as essential to the economical operation of a plant as ammeters and voltmeters, which fact is being demonstrated by the greatly increasing demand for them. By means of a tachometer it is possible to tell at a glance the exact rate of speed at which an engine or dynamo is running. For portable work a special instrument is made which takes up but little space and can easily be carried about. This tachometer is as accurate in its readings as the larger type mounted on a strong base and designed for permanent attachment in the engine or dynamo room.

MEETINGS OF SOCIETIES.

NEW YORK ELECTRICAL SOCIETY.

The annual meeting of the New York Electrical Society was held in the restaurant building El Dorado, Weehawken, N. J., Friday night, July 10. The following officers were elected for the ensuing year: President, Prof. F. B. Crocker; Vice-Presidents, T. C. Martin, G. H. Stockbridge, E. L. Bradley, Charles Steinmetz, W. J. Hammer and Frank Sprague; Secretary, George H. Guy, and treasurer H. A. Sinclair. All but Messrs. Steinmetz, Hammer and Sprague were re-elected.

Secretary Guy's report was read. It was very interesting inasmuch as it explained the cause which led to the separation of the Society from the American Institute, with which it was affiliated for some years, and of which it formed the Electrical Section. The history of the affair in brief is given by secretary Guy as follows: "For some years previous to last year, the Society had been associated with the American Institute, of which it formed the Electrical Section. This affiliation gave the Society a home and a lecture room in the Institute building, but beyond that practically nothing. The financial help which the Society, as one of a number of sections which were freely subsidized, had reason to expect from this source was not forthcoming, and in the opinion of many, the work of the Society was not furthered by maintaining the connection. Matters were brought to an issue by an application from the Society to the Institute for a yearly grant. The Institute in reply, insisted that the Society must drop the name of 'The New York Electrical Society,' and become merely the 'Electrical Section of the American Institute,' before any question of subsidy would be considered. A meeting was called to discuss this important question and the result was a unanimous decision to decline to accept the terms on which the Institute insisted, and moreover, to terminate the connection with that body."

Secretary Guy then reviewed the work of the Society during the past year; and gives an outline of the various lectures delivered in that time.

"The programme for the coming season," says the report, "includes a class of lectures which the Society has not hitherto been in a position to give, viz: a series of object lessons. It is proposed to illustrate by experiment the fundamental laws of electricity and their application in various branches, and it is believed that the course will be an exceedingly popular one."

The membership of the Society now numbers 264. There were 31 new members added during the past year; fifteen resigned and two died, leaving a net increase of fourteen members.

After the adjournment of the meeting, through the courtesy of the Palisades Amusement Company, the members went in a body to witness the performance of the spectacular play "King Solomon and the Destruction of Jerusalem," and later visited the electric light station on the grounds. The machines, switchboard, engines, etc., were critically examined and discussed by those present. Mr. W. J. Hammer the consulting engineer, who supervised the installation of the plant, explained all the details to those present.

There were between 400 and 500 in the party, including many ladies, and the evening was a most enjoyable one to all.

MASSACHUSETTS ELECTRICAL ASSOCIATION.

The annual meeting of the Massachusetts Electric Association was held at Hotel Pemberton, Hull. The following officers were elected for the ensuing year:

President, F. A. Gilbert, Boston; first vice president, Hon. Theodore C, Bates of Worcester; second vice-president, Hon. George W. Fifield of Lowell; secretary, E. W. Burdett of Boston; assistant secretary, B. W. Cutter of Boston: treasurer, Samuel S. Sias of Boston; executive committee, C. L. Edgar, Boston, H. F. Coggeshall, Fitchburg, Elisha Morgan, Springfield, and James F. Almy, Salem.

The secretary reports that the Association now has upon its roll of membership, representatives of 36 Massachusetts companies. These embrace eight-tenths of the capital invested in electric lighting in the State. At the conclusion of the meeting the members repaired to the main dining hall where a banquet was held. A few remarks of an informal character were made by several members of the party, and at the close of the festivities the party returned to Boston by boat.

EDUCATIONAL.

AN EVENING CLASS IN STEAM ENGINEERING.

During the summer of 1888, the committee in charge of the educational classes of the Young Men's Institute, located at 222 and 224 Bowery in this city, decided to enlarge their facilities and start an evening class in steam engineering for the purpose of instructing those employed as engineers, machinists, firemen and like employments, and desirous of acquiring knowledge in the theoretical features, rules and elements of steam calculations and practice.

After considerable inquiry and deliberation, the committee offered the position of instructor to the class to Mr. Wm. H. Weightman, of this city, a gentleman highly recommended to them as especially fitted and fully capable of organizing and making a success of the class. The position was accepted by Mr. Weightman, and the first class was organized in the fall of 1888. That the selection of instructor was good is best shown by the fact that the class has now been in recognized satisfactory and successful operation for the three winter sessions of 1888–'89, 1889–'90 and 1890–91 and will again be opened on Wednesday the 30th of September next. The sessions continue throughout the winter, and are held on Wednesday and Friday evenings of each week, from 8 to 10 o'clock. The expenses are exceedingly moderate.

The success of the class is an admitted fact, and it is now one of the leading features and attractions of the Institute. A knowledge of the ordinary rules of arithmetic including decimals and fractions is all that is required for entrance, but the better the education the greater the progress. The course at present extends over two winters. To the one standing highest in his grade for the winter in attendance and proficiency a special award is made.

Aid and encouragement have been given to the members of the class and their instructor by the Babcock and Wilcox Boiler Company, the Buckeye Engine Company, and the American Casualty Insurance and Security Company; they having presented to each of the students a copy of their valuable publications; also by Jenkins Brothers and by Geo. I. Roberts & Bros., for samples of valves etc., for use and instruction. Other contributions are expected by Mr. Weightman for the coming class term.

ELECTRIC LIGHT IN VENEZUELA.

On July 24, 1883, for the first time in the history of Venezuela the electric light was turned on. This was in the city of Caracas, the capital of Venezuela, and the occasion was the celebration of the first centennial of the Liberator, Simon Bolivar, who was a native of Caracas. Forty arc and thirteen incandescent lamps were used.

In 1885 a plant of 550 incandescent lamps of 16 c. p. each was installed for the purpose of lighting the Opera House. In 1889 an addition of 100 lamps was made to this plant. These were put in to light the rooms of the artists and the several vestibules of the theatre.

During the present year three small electric plants have been installed to light stores in Caracas, where the electric light is very popular.

Three cities in Venezuela are now lighted by electricity, namely, Maracaibo (which is next to Caracas in point of population), Valencia and Puerto Cabello; and recently a contract has been closed to light La Guayra, the port of Caracas, by electricity.

The Opera House at Caracas is said to be one of the best lighted theatre buildings in the world, even surpassing the Grand Opera House in Paris. The plant consists of three Weston dynamos and one Maxim dynamo. The Weston dynamos are used to supply the current for the incandescent lamps and the Maxim machine for the arc and focusing lamps. There are 650 incandescent 16 c. p. lamps distributed throughout the building—two arc lamps of 2,000 c. p. each and one focusing lamp of 8,000 c. p. There are besides these four incandescent lamps of 150 c. p. Some of the incandescent lamps are provided with reflectors of artistic designs, which give a beautiful effect. The power to drive the dynamos is supplied by two steam engines, one of 45 H. P. and the other of 12, both of the New York Steam Safety Power Company's make. The first engine is provided with a Buckeye cut-off.

The people of Caracas are anxious to have the city lighted by electricity, and it is quite possible that before the termination of the present gas light contract circumstances may lead to the adoption of electricity for street lighting, notwithstanding the long term contract between the city and the gas company.

GENERAL NOTES.

A press dispatch from Montreal states that the Bell Telephone Company has removed what little opposition there existed in Canada, and now enjoy the monopoly of the telephone business there. The Bell Company has absorbed the Federal Telephone Company of Montreal, and by the new agreement all the Federal stock is taken by the Bell Company, which issued new stock to an equivalent amount. The Bell directors have taken the place of the Federal board.

Mr. Allen R. Foote, special agent of the Electrical Division of the Census Bureau, on June 10, last, celebrated the 30th anniversary of his enlistment as a Union soldier, by gathering about him at his residence in Takona Park, D. C., 24 other veterans of the late war, and they spent the evening very pleasantly together exchanging reminiscences, etc. An original poem by Comrade Nelson was read and elicited great applause.

The Globe Carbon Company, of Cleveland, O., is building new works at Ravenna, which will be completed September 1. This will increase the company's productive capacity to 100,000 carbons per day.

The Columbian Light, Heat and Power Company of Chicago, has been incorporated. The capital is $3,000,000.

The workshop and yards of the Inter-Colonial Railway at Moncton, N. B., are to be lighted by electricity, on the recommendation of the company's chief electrician, Mr. A. A. Dion. The "Wood" system of arc lighting has been adopted, and the contract for the installation of the same has been awarded to Mr. A. J. Corriveau, of Montreal.

The New York Electrical Works, 155 & 157 Leonard street, New York, have now a regularly organized department for fine model and experimental work. They are also prepared to take contracts for the manufacture of light machinery specialties and electrical apparatus generally.

ST. JOHN, N. B., NOTES.

Mr. A. A. Knudson, formerly of New York, and well-known in the electrical trade, is manager of the Eastern Electric Company.

Three electric light companies supply St. John with incandescent and arc lights. These are The Gas Company, the Eastern Electric Company and the New Brunswick Electric Company, the latter also being known as the St. John Electric Light and Power Company.

The City Railway, which is owned by the Eastern Company, has contracted with the Edison Company to equip a number of cars and begin operations on the road this summer. Owing to the streets being repaved along the line of the road, however, it is doubtful if the work of equipping the line for electric power can be done before next spring. The company do not care to begin operations at the beginning of winter, as that season of the year in this latitude is very severe. The Eastern Company is also supplying power for business and other purposes, and has several motors in use.

The Gas Company uses the Thomson-Houston alternating system and the Thomson-Houston arc. The Fort Wayne Jenney alternating and Wood arc systems are used by the New Brunswick Company. The latter company has the contract for lighting the city, which calls for about 125 lights at $75 each, a year. The company is just beginning in this branch of the work, a few lights now being in operation; the price, however, is not thought to be a profitable one. The Edison direct system is used by the Eastern Electric Company. From its central station the company is able to cover the lighting portion of the city. This company has a new power station and an exceptionally fine steam plant consisting of McIntosh-Seymour compound engines and Heine safety boilers. The dynamos have a capacity of 3,000 incandescent 16-candle power lamps, nearly the entire number of lamps being used. A number of "Ward" arc lamps are also being installed.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOM 7–12, "WORLD" BUILDING,
NEW YORK, JULY 11, 1891.

The International Okonite Company of New York, are now manufacturing the Acme lead cable for high tension currents.

Mr. Voorhees, of the Norwich Insulated Wire Company, this city, is meeting with very good success with the paper insulated wire of this company.

H. C. Corson, of the Goodrich Publishing Company, Akron, O., sailed July 11 for Scotland. The trip combines business with pleasure.

Mr. A. Davenport has been elected treasurer of the Hunt Engineering Co., 238 Washington street, Brooklyn, N. Y. This is only one line additional to this company. It will have some more big things to talk about soon.

The Edison General Electric Company has declared a quarterly dividend of two per cent. on all that company's stock, payable August 1 next, to holders of record July 11, 1891. The books closed July 11 and will be reopened August 3.

Prince George of Greece, who was a recent visitor in this city, while sight-seeing paid a visit to the laboratory of Mr. Thomas A. Edison, Orange, N. J. The Prince was shown through the building and spoke into a phonograph.

W. H. Gordon & Company, 115 Broadway, are pushing Simplex rubber covered wire, and the New York trade and architects are beginning to fully appreciate its advantages. The firm has sold thousands of feet of it lately. See their advertisement elsewhere in this journal.

Mr. Winslow Stevens has been appointed electrician of the New York, New Haven and Hartford Railway, at New Haven, Conn. He has been employed on this road in charge of signals, and is a thoroughly practical man. Every one that knows him speaks in the highest terms of the appointment and congratulate him.

Mr. P. W. Mitchell, of the Parmly-Mitchell Company, has just returned from a short trip through Pennsylvania. He introduced the Columbia incandescent lamp in Pittsburg, and made a good record for orders on general supplies. The Parmly-Mitchell Company are doing well with the above-named lamp in New York.

On July 9, the Thomson-Houston Electric Company obtained a judgment against the Manhattan Electric Light Company and the Harlem Lighting Company of this city for $35,466. The judgment was procured on seven promissory notes of $5,000 each, made on October 22, 1890, by the Harlem Lighting Company and endorsed by the Manhattan Company.

The excellent electrical plant in the Central Building, Liberty street, this city, which is owned by the Central Railroad of New Jersey, and which was installed by J. P. Hall, of Tucker & Hall, the well-known electrical engineers of this city, performs double duty. Besides lighting the building, it supplies light for piers 12, 13, 14 and 15 N. R., which are owned by the railroad company. There are in use 38 Ward arc and 175 incandescent lamps. It required 18 miles of Okonite wire to make the connection.

Truex & Vail report that the following railroad companies and electric light stations have adopted their Swinging Ball Lightning Arrester since they have been handling it: The Ball Electric Light Company, of New York; The Hamilton & Lindenwald Electric Railroad, Hamilton, O.; The Federal Street and Pleasant Valley Railroad, Allegheny, Pa.; The Edison Co., Paterson, N. J.; The Danville Gas and Electric Light Street Railway Co., Danville, Ill.; The Cincinnati Electric Light Co., Cincinnati, O.; Porter Rawlings, Helena, Ark., electric light station; The Canton Electric Light and Power Co., Canton, O.; The City of Ottawa, Ill., on their local plant; The Jenkintown Electric Light Co., Jenkintown, Pa.; Utica and Mohawk Railroad, Utica, N. Y.; The Lindell Railroad Co., St. Louis, Mo., and The Edison Electric Light Co., at New Brunswick, N. J.

The H. W. Johns Manufacturing Co., 87 Maiden Lane, this city, announces the consolidation with that concern of the following named companies: Chalmers-Spence Co., Asbestos Packing Co., Chas. W. Trainer & Co., and Shields & Brown Co. All manufactures of these companies will be made and sold by the H. W. Johns Manufacturing Co. The officers of all the separate companies and their chief employés will remain with the new company. It will thus have the advantage of the combined skill and experience of the other companies, with largely increased manufacturing facilities which will be secured by the completion, within a year, of a new asbestos works, the most extensive in the world. The branch offices of the company are: Eastern Branch, 44 Oliver street, Boston; Western Branch, 240 and 242 Randolph street, Chicago, and Philadelphia Branch, 170 and 172 North Fourth street.

Mr. F. H Thompson, General Manager of the electrical department of the Spanish-American Light and Power Co., Havana and Matanzas, Cuba, is at the present time in this city on business connected with his company. He speaks very favorably of the progress electric lighting is making in the two named cities. The field of operations in both cities has been rapidly enlarging since the company first started. In Havana the increase in the number of incandescent lamps during the past year was from 1,000 to 4,000, and 350 arc lights are used throughout the city. In Matanzas there are 1,000 incandescent and 250 arc lamps. The company operates in the two places Thomson-Houston arc and Westinghouse incandescent systems, and the power plants consist of Armington & Sims and Westinghouse engines. In the Havana station four Hazelton "porcupine" upright boilers of 150 H. P. each are used with very satisfactory results. These boilers are economical and safe, and should find a ready sale for electrical plants, as Mr. Thompson speaks in the highest terms of their operation.

W. T H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co.(N.Y.)	1,000,000	25 00	3 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	110 00
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	189 00
Bell Telephone 7's	2,000,000		*112
Birmingham Ry & Elec. Co., 6's Ala	1,500,000		par
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	80 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	15 50
Brooklyn City R. R. 5's	6,000,000		*104
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	10 00
City Electric St. Ry. Co., 6's (Ark.)	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500 000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80 000		par
Cons. Gas Co. Batavia, (N. Y.)	100.000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	12 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600 000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000.000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*90
Edison Elec. Ill. 6's (N. Y.)	30.000		par
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison General	14,000,000	100 00	100 00
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Equitable G. & E. Co. (Utica)	4,000		†
Erie Telephone	4,800,000	100 00	48 50
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	12 00
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*102
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1 000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*90
Jamaica & Brooklyn Road Co.	197 480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7 500,000	100 00	15 00
Laclede Gas, pref	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*75
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*90
Long Branch Electric Light	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Montague St. Ry., B'klyn	150,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	75 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00

Names of Companies.	Capital.	Par.	Price.
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Cordage	10,000,000	100 00	91 75
Nat'l Cordage, pref.	5,000,000	100 00	104 50
Nat'l Lead Trust	9,000,000	100 00	18 00
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	51 00
N. Y. and N. J. Tel. and Tel 6s	1,500.000		par
N. Y. and N. J. Telephone Stock	2,535.000	100 00	93 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co	20,000		†
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150.000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,600,000	100 00	
North New York, Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6's Manitoba	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston		25 00	25 50
Pittsburg Reduct Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	65 00
Rockaway Elec. Lt. Co. 6's	75,000		par
Russell Electric Co. (Boston)	300,000	5 00	5 00
Saratoga Gas and Elec. Light 6s	300,000		*86
Saginaw E. L. & P. Co. 6's Mich.	50,000		par
San Diego Gas & Elec. Co. 6's Cal.	750,000		par
Sawyer-Man Electric Light Co (N. Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation, N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co	16,000		†
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	42 00
Thomson-Houston Pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5's Boston	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100.000		par
T.-H. L. H. & P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.)	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	40 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine Street Motor Co. 6's (Colo.)	100,000		par
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	79 75
Westinghouse Electric Co.	7,000,000	50 00	11 50
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			19 50
Winston-Salem Elec. St. R.R. (N. C.)	250,000	100 00	75 00
Yonkers, L. & P	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent. †Registered Stock.

FINANCIAL.

We regret to announce under the circumstances the death of that old "financial war horse" of two continents, Alexander McEwen. After having fortune on his side for many years the jade deserted him in his old age. His latter days would have been much happier had all the Americans who were under obligations to him on the other side chipped in a small stack for his benefit. After sixty years of active life on change one cannot complain if called on to pay the debt of nature, but there are some who are entitled by their life actions to depart in peace and from pleasant surroundings. He was such.

Investors should at stated times examine their securities with the day book in one hand and their certificate of stock in the other, and form an opinion later of their selection. Electrical art advances rapidly and among the strongest evidence of the phenomenal development of the electrical business in the United States—particularly that branch which relates to the placing of wires underground—is given in the many large contracts received by the Standard Underground Cable Company, of Pittsburgh, New York and Chicago. The following from its Eastern district alone will give a fair idea of the Standard Company's progress: For the fire department, New York, previously laid, 3,000,000 feet; now being laid, 600,000 feet. Police department, New York, contract awarded for 460,000 feet for the lower part of the city. For the Western Union Telegraph Company now being laid a 100-wire cable from Broadway and Dey street to John and Pearl streets; a 40-wire cable from Broadway and Dey street to Leonard street, and a 60-wire cable from Leonard street to Twenty-third street and Broadway. For the Postal Telegraph Cable Company, a 60-wire cable through Broadway and Dey street to Fifty-eighth street, in addition to about 1,000,000 feet of conductor in cables of from 10 to 100 wires for the down town districts. Buffalo fire department, over 300,000 feet. For a prominent street railway company, twenty miles of No. 0000 B. & S. G. underground cable. Work is now in progress on all of these contracts. In addition to the above, large quantities of underground cables are in use in almost every prominent city in the country, among which are Washington, Chicago, Cleveland, Boston, Denver, Philadelphia and Pittsburg.

Canada, also, seems to have kept pace with the times, as large quantities of underground cable have been used there.

It may be interesting to mention that the Standard Underground Cable Company were the pioneers in the underground business, and the success that they have met with is a just tribute to American enterprise and ability.

Neither this company or this particular class of investment should hold all your money. It is well to distribute the risk as much as possible if you use your own judgment, and even more if you expect others to take absolute control of your holdings and do your work beside their own. I wish every electric corporation could make as good a showing as the above with an equal chance for a long and prosperous existence.

Now that the execution at Sing Sing has passed with the late subjects of a commonwealth's wrath along down the dim vistas of the past, it is in order to immediately patent several methods of electrocuting, incorporate companies, and fill column after column of the dailies with elaborately descriptive prospectuses setting forth the advantages and economics of the various systems, with the ever present law suit between claimants to priority, and possibly offering special inducements to the victims to pass out by their painless operation, that investors may see for themselves which will pay the greatest dividend from actual use by the State. Personally I don't see any difference between investing in such a company and Court House and jail bonds. One electrocuting outfit would serve several jails just the same as a thrashing machine accommodates a number of farms. All these institutions are operated by joint stock companies, and I look forward with considerable curiosity to the day when it will be my duty to announce the successful floating of the first parent corporation, bonds at par and shares well up in the nineties. We have passed the experimental stage and proven absolutely that an electric current will kill; so will a rope manufactured by the National Cordage Co., but it need not change the value of the shares.

The July dividends are the largest of the year, and this July larger than ever. Philadelphia with her $10,000,000, and Boston with $15,000,000 show a grand increase over late years. New York with her $100,000,000 disbursed, offers investors still other securities in which part or all the profits may be at once again placed, and continue their earnings; among these are the bonds and stocks of many electric corporations which pay 6 per cent. upward. The list of them is increasing fast, and one beauty of this class is that you can purchase almost any amount in sums from $100 up to $10,000, and see your result in the shape of weekly or monthly collections for a necessity which ever goes on growing.

Gold to the extent of between $63,000,000 and $64,000,000, beside silver between $7,000,000 and $8,000,000 has been exported from the port of New York during the first half of the year, and the end of foreign demand for it is yet unknown. That the method of tiding over the unsatisfactory condition of things decided on by the Court of the Bank of England, and those whom they honored by a joint discussion of the situation will be carried out if possible, goes without saying, but what is termed in financial parlance, lack of public confidence, lingers too long to be pleasant, and is fed from time to time by other errors of judgment, and occasional breach of trust. Our money depositories are at the moment very cautious. It is reported that for time loans on what have been considered good names now requires dollars to borrow dimes in Philadelphia. The great West will soon be jubilant with plenty of cereals for which there is no lack of demand. Enterprises requiring large sums, and many active minds, are very quiet, and no doubt will continue so until the financial horizon becomes clearer.

NEW CATALOGUES, ETC.

We have just received the combined annual catalogues of the Brown & Sharpe Mfg. Co., and Darling, Brown & Sharpe of Providence, R. I. We notice a large number of improvements in the milling machines of the former firm, including a variety of new attachments that make these machines something to be desired in every workshop. There are also a number of new designs in grinding, screw, and tapping machines, chucking machines, gear cutting machines and in their engine and hand lathes. Darling, Brown & Sharpe are keeping up their well-earned reputation as manufacturers of United States Standard rules, cast-steel try squares, gauges of all kinds, and tools for accurate measurements.

W. R. Ostrander & Co., the well-known manufacturers of everything relating to speaking tube, electric bell and annunciator work have just issued the eighth edition of their catalogue. It contains a complete list of everything manufactured by the firm, divided into six divisions: Speaking Tubes, Electric Call Bells, Electric Burglar Alarms, Electric Gas Lighting, Mechanical Door Bells and Pneumatic Call Bells. The classification includes everything used in each line.

BUSINESS NOTES.

The Philadelphia and Reading Railroad, by means of its fine equipment, fast trains, luxurious parlor and sleeping cars, and the general foresight of its management, has succeeded in building up a great reputation as one of the most attractive routes to the various summer resorts. The prosperity of Atlantic City is due to a great extent to the enterprise of this company. This line affords unsurpassed facilities for reaching the sea, and it is said that it carries the majority of passengers to the coast resorts. The ride from Philadelphia to Atlantic City is a delightful one. The road is double-tracked, steel railed and stone ballasted, and the distance between Philadelphia and the sea is made in an hour and twenty minutes.

The Pettingell Andrews Company, 192–202 Summer street, Boston, Mass., is now prepared to furnish incandescent lamps of any candle power or voltage for any make of socket, at short notice. The company has secured control of the largest incandescent lamp factory in the country, and the lamps it makes has a large reputation for long life and brilliancy. It is said to be the most economical lamp on the market.

The resistance of ordinary electric light carbons is about .15 ohm per foot. This resistance is reduced by the copper coating usually applied to the carbons.

STREET RAILWAY NEWS

A WEEKLY RECORD OF THE STREET RAILWAYS OF THE WORLD.

ELECTRIC MERCHANDISE CO.,

11 ADAMS STREET, CHICAGO.

The Only Company Dealing in

ELECTRIC RAILWAY SUPPLIES

EXCLUSIVELY.

Everything needed for complete equipment and maintenance of electric roads of all systems.

W. R. MASON, General Manager.

SEND FOR CATALOGUE.

PARMLY, MITCHELL & CO.

Electric Light and Railway Supplies,

Telephone Building, 18 Cortlandt Street,

ROOM 375. NEW YORK, N. Y.

INTRODUCING ENTIRELY NEW PRINCIPLES.



Pat. Mar. 19, 1889. THE OLD STYLE.

THE ACME LINK BELT

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BRANCHES: Boston, New York, Chicago, San Francisco. Also, manufacturers of all the staple grades of Leather Belting and Lacing. Send for Illustrated Catalogue—a valuable treatise on belting, Free.

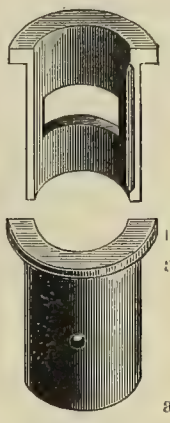
Electric Cars for Sale.

Eight or ten 14-foot cars, built to order for the Company but have never been used. Sold only because we must have longer cars. Made by Richmond Locomotive and Machine Works. Painted green. Trucks are same as Brill Truck with 30-inch wheels and six feet wheel base, and are ready for motor. Price of cars, seven hundred and fifty dollars; cos one thousand dollars.

For further particulars address

Richmond Railway & Electric Co.,

110 SOUTH 7th ST., RICHMOND, VA.



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We extend to all Street Railway and Electrical men an invitation to call on us—inspect our samples and get prices on

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We are constantly adding new agencies, and are prepared to manufacture and exploit INVENTIONS OF MERIT.

ELECTRIC RAILWAY SPECIALTY CO.,

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J. G BRILL COMPANY, Philadelphia.



Builders of Tramway Cars of all kinds, Patented trucks for motor cars, Electric, Cable, etc. Inventors and builders of the patented Maximum Traction Pivotal Trucks. Special attention given to cars of new designs. Prices and information furnished promptly on application.

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ELECTRIC RAILWAY SYSTEM.

LESS COAL CONSUMPTION

Per Passenger Carried than Any Other System.

RAILWAY DEPARTMENT,

EDISON BUILDING, NEW YORK.

ESTABLISHED 1881.

JOHN STEPHENSON COMPANY, Limited.

TRAM CAR BUILDERS,

47 East 27th St., New York.

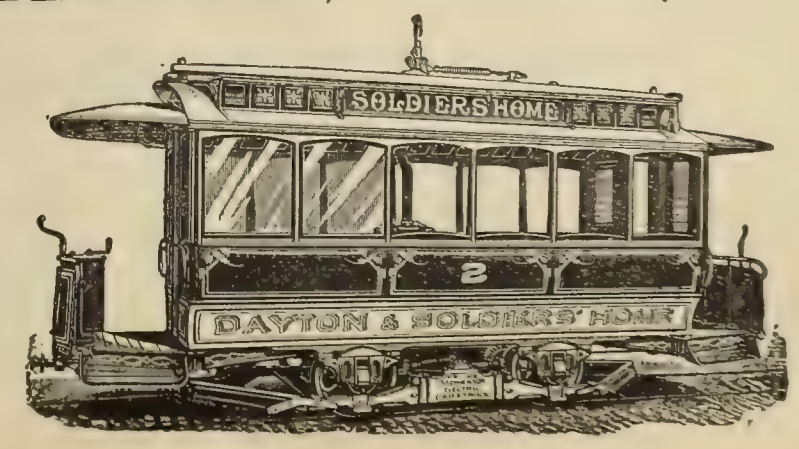
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TRAMWAY CARS

AND FOR THEIR ADAPTATION TO THE VARIOUS SCHEMES OF ELECTRIC PROPULSION.



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GENERAL ELECTRICAL SUPPLIES,

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Over 100 Electric Railways

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STREET RAILWAY DEPARTMENT OF THE ELECTRICAL AGE—NEW YORK, JULY 18, 1891.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

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IMPROVEMENTS.

To this issue we have now added a separate directory of electric railways, and, for the accommodation of busy men, have arranged a very careful classification of our Street Railway Notes, etc., one so complete that news from any point given may be seen at a glance.

Improvements will be added to STREET RAILWAY NEWS each week, and its publisher will be glad to receive suggestions in that line at any time.

WOMEN AS TICKET SELLERS.

Several months ago the King's County Elevated Railroad Company of Brooklyn, N. Y., essayed the experiment of employing women instead of men in its ticket offices, and experience has now demonstrated the wisdom of the plan. The company now employs about sixteen women as ticket sellers and is immensely pleased with their work.

The opening of this field for female labor will, we think, prove alike beneficial and satisfactory to both the operating company and the traveling public. To the company because women are decidedly easier to manage than men:—they rarely mortgage themselves to any labor organization, losing their identity in that of an aggregation, and pledging themselves to obey implicitly the imperious mandates of arbitrary and large-salaried chiefs. In the making of change rapidly, women are proverbially quicker than men, and that is a weighty consideration in the ticket office of an elevated or rapid transit road, where sometimes fifty or one hundred impatient passengers, all in a furious hurry, are standing in line.

The innovation is one which promises well, and the drawbacks to the general adoption of which appear to be infinitesimal as against the advantages. We shall watch an enlargement of the experiment with much interest, feeling reasonably sure, however, that it will continue to prove a success.

KICKERS.

As we journey on through life, whether on foot, on car, or howsoever, it is almost wonderful to realize how many human beings there are whose habitation properly belongs within the biblical caves of Adullum. Never contented, never truly happy! Kicking against this thing and that thing—making themselves and everybody else utterly miserable.

A few nights ago it was our pleasure to be a passenger to Bath Beach on one of the splendid cars running on the "B" line (Bath Beach, Bay Ridge and Bensonhurst) electric railway, [views and a description of which we published in our last week's issue,] one of those chronic kickers was aboard the car: nothing suited him; the car went too fast—there were too many passengers allowed on the car—the car should be twice as large, etc, etc.—Imagine that man at home—a man of that calibre disgusts everyone who is compelled to listen to his senile drivellings. A man like that nobody can please—he would kick if his legs were cut off. No matter how liberal a corporation is—and President Lewis certainly spared no expense in the construction or equipment of his road—men will be found whom nothing will satisfy and for whom the following is eminently appropriate:—

Dost love a man who always kicks, no matter what you do,
Who kicks with most prodigous ease the whole long car ride thro'
Who kicks because the car goes fast, who kicks if it goes slow—
Who kicks because another chap knows what he wants to know.
We've met some wondrous kickers in this transportation sphere
Who came on earth by accident and kick because they're here.
They make themselves uncomfortable and other people sick,
They drive one nigh to suicide, and yet they always kick.
The man we met was kicker great, he'd kicked the livelong day
And if there's naught to kick about, he's kicking anyway.
At times when everything is bright and other men would smile
He kicks on general principles, and kicketh all the while.

UNDERGROUND CONDUCTORS.

We illustrate and describe elsewhere in this issue a new system of placing electric railway wires underground, and from what we have seen of the operations of the working model, it appears to us as if a tremendous stride had been made toward accomplishing what inventors have yet failed to accomplish, *viz.:* the construction of an economical and practical conduit system. The idea of having a conduit for simultaneous use of both the cable system and the electric, while not exactly original, is certainly alike novel and fascinating and the development of the invention will be watched with deep interest.

MISLEADING STATEMENTS.

If the managing editors of papers catering to the interests of the public in general, would only study the electrical and other technical journals, they would become richer men—richer in wisdom regarding the subject matter, the publication of which in their progress meets with their approval, but the utter nonsense of which arouses the risibilities of thoughtful men. In spite of the fact that about three hundred cities have not only countenanced the use of the overhead system of electrical propulsion, but their inhabitants speak in enthusiastic terms of the operation of the system; in spite of the fact that up to the present writing, not one single human life has ever yet been sacrificed to the trolley wire; in spite of the well-known and now, thoroughly established, fact that scores of men—men working around motor cars, men employed by electric railway supply companies, have received the maximum voltage of 500, without injury, we find a paper of good and reputable standing, the *Citizen* of Brooklyn, coming out with a two or three column article, referring to the probable adoption of electricity by the Atlantic Avenue Company, headed "THE DEADLY TROLLEY" and in an editorial in the same issue, it refers to the trolley wire as "a dangerous nuisance," claiming that "the people of the city do object" to the system, and "their decision will be final."

Of the many street railways in this great republic, perhaps the Altantic Avenue Company is one of the most conservative, and its officers would be among the last to decide upon the adoption of any system of street car propulsion until, by close investigation and the strictest kind of examination, they found it perfectly safe, so far as human life was concerned. "It costs too much to kill a man, or a woman or child, for us to adopt a dangerous system," one officer of the company is reported as having said, and certainly there is more cold fact than romance in the statement. Let the editor of the *Citizen* be just to the "trolley system," and save the objectionable adjective of "deadly" for application where it properly belongs.

SIXTH AVENUE BARNS ABLAZE.

At noon July 8, a fire broke out in the stables of the Sixth Avenue surface road, New York, which for a time threatened the destruction of the entire building. The stables are located on Sixth avenue, between 43d and 44th streets. The buildings occupied the entire block on Sixth avenue between 43d and 44th streets, and ran back half way to Fifth avenue. They consisted of a series of brick buildings four stories high. The upper floors were used for the storage of hay and grain, and it was among this material that the fire started. There were 900 horses in the building at the time the fire broke out, and drivers, conductors and all other employés of the company were pressed into service to remove the horses and get them out of harms' way. They came down the gangways from the different floors on the jump, and 43d street, as far as Fifth avenue was filled with them. Some of them were cared for in neighboring stables, and after the fire was under control they were led back to their stalls, which had not been damaged in the least by the fire.

The fire was confined to comparatively small quarters, and excepting the damage to the building the only property destroyed was hay and grain stored in the lofts. There were between 5,000 and 7,000 bales of hay and 10,000 bushels of corn and oats. All of this was burned enough to render it unfit for use. The damage by the fire amounted to about $30,000, of which $25,000 was represented in stock.



VIEW OF RUINS OF SIXTH AVE. CAR STABLES AFTER THE FIRE.

The accompanying picture of the damaged building, was taken by the Electrical Age special artist from the roof of a building on the opposite side of the street, before the fire had been completely extinguished. The picture shows the firemen playing water on the ruins, from which smoke is still arising.

BUFFALO HAS AN "OPENING."

Despite the formidable opposition the electric road on Niagara street, Buffalo, N. Y., is now in practical operation. The first car, which is of the vestibule type, was run over the road July 1, and it was greeted by an immense crowd of people. It was gaily painted, and was brightly lighted by electricity. Electrical Engineer J. B. Craven was in charge of the car. The greatest enthusiasm was manifested all along the route; women waved their handkerchiefs, boys shouted, and citizens generally gave vent to their feelings in a very enthusiastic manner. Many houses were brilliantly illuminated, and at every street crossing a crowd of people cheered as the car moved along the road. It was one continuous ovation from one end of the road to the other.

The trip from the power house to the Main street end of the line, a distance of a little over two miles, was made in just nine minutes; less than half the scheduled time of the horse cars. The car was then headed for the other terminus of the road, the distance, four and a half miles, was covered in twenty minutes, regular horse car time being forty-five minutes. After running back to Main street in the same time, several trips were made, affording the enthusiastic spectators a free ride over the line. Since then regular service has been maintained with the electric cars.

The Niagara street line is probably one of the best equipped electric roads in this country. The road bed is practically new and very substantial, having been specially relaid with heavy girder rails and additional ties, the tracks being separated to six feet.

The overhead construction is on centre poles, which carry the mains, besides the trolley and guard wires.

The power plant is located in about the centre of the line, on the banks of the Niagara River, and provides for an ultimate capacity of over 5,000 H. P. It is laid out with a purpose of obtaining the greatest perfection in details.

The plant is contained in two separate, but adjoining buildings.

The boiler house is a spacious building 55x180 feet, in which is already installed two batteries of Babcock & Wilcox sectional water tube boilers, being about one-third of the capacity the building is designed to accommodate. These boilers are fitted with the latest and most improved appliances for efficiency and economy. Roney's mechanical stokers are employed for feeding the coal, although it is the intention of the company to shortly substitute natural gas, from the immense gas fields a few miles distant across the border, for fuel. An underground tramway leads from the ash pits for conveniently conveying the ashes outside of the building.

The power house is a new and handsome brick structure, about 90x150 feet, and has an iron trussed roof.

Only a part of this room, however, is required at present, the remainder being provided for future growth. It is safe to assert that this is the finest electric power room to be found, and it contains at present, in operation, three 150 kilowatt Edison compound generators each driven by a 250 H. P. Ball cross-compound engine. Three other Edison generators of equal capacity are in position. These and probably another generator will be driven by two vertical compound engines of 500 H. P. each. This installation occupies all of the floor space now provided; the rest of the room is left uncovered down to the concrete bed. The steam piping which to secure reliability is in duplicate, thus affording two paths for supplying steam to the engines, is placed underneath the floor, between which and the concrete bed is a space some eight feet high. In this basement are also carried the leads from the dynamos to the switch gallery. This arrangement clears the space overhead for the large electric traveling crane, which covers all parts of the room.

The switch gallery is run across the front end of the room. Here is located all of the controlling apparatus; switches, rheostats, ampere-meters, volt-meters, etc. The switches are on slate slabs which rest on iron racks and incline out from the wall, the ampere-meters being placed on the wall directly above. The gallery above the switch commands a complete view of all the machinery in the room.

Although in the operation of the present road the underground system is not brought into use, the company has laid an extensive system of conduits for the purpose of operating lines in other parts of the city. The work on these is being pushed forward rapidly.

The underground tubes are of indurated fibre pipe and cement lined pipe. About equal quantities of each have been laid. In these are drawn well insulated lead and jute covered cables, containing stranded conductors equal to No. 000 and No. 0000 wire, to be used as feed wires.

The Niagara street line is equipped with 22 35-foot vestibuled cars built by the Gilbert Car Works of Troy, and are run on a three minute schedule. The cars are provided about equally with the Edison (Sprague) ordinary double geared motors, and the Thomson-Houston single reduction motor, placed on Bemis trucks, a 15 H. P. motor on each truck—two trucks under each car. The company also has one car on Brill Maximum trucks, and another on the Robinson six-wheel radial truck.

This line at present extends from Hertel avenue to Main street, but these cars will run out Seneca and Elk streets as soon as some odds and ends are finished up on those streets.

The Field Engineering Company, of New York, has had charge of the entire construction of this plant, including the buildings, power plant, road bed, lines and conduits. Mr. J. B. Craven, electrical engineer of that company, having the immediate supervision of the work, with W. D. Gharky and C. J. Goldmark in charge of the underground work, while Walter Scott and J. E. Lloyd supervised the overhead construction.

The success with which the change from horses to electricity was effected, and the remarkable smoothness of the service since, and that, too, at a time when the travel on the cars was enormous owing to the great number of visitors in the city attending the reunion of the Army of the Potomac, reflects with great credit on the skill of the gentlemen who planned and carried out the work.

It is stated that this change represents an expenditure by the Buffalo Street Railway Co. of $2,000,000.

The Dielectric Properties of Mica at High Temperatures.—In a paper recently read before the Academie des Sciences, M. E. Bouty described some investigations carried out by him with regard to dielectric properties of mica at high temperatures. The result of M. Bouty's researches is to demonstrate the almost complete invariability of the dielectric constant of mica, which, between 0° and 300°C., certainly does not alter by one-fiftieth of its original value. Above 300°C. experimental complications occur, and tend to obscure the result. M. Bouty made use of silvered sheets of mica, and when the temperature was carried beyond 300°C., the silver was attacked if in contact with the air, and the mica was soon covered by a transparent electrolytic film. This defect may be minimized by covering the silver with a fairly thick layer of copper. Above 300°C. the charge furnished by the battery is no longer entirely recoverable, which is doubtless due to the formation of the conducting film, since the conductivity of the same temperature rapidly increases if the application of the heat is prolonged.

A PRACTICAL SYSTEM OF PLACING ELECTRIC RAILWAY CONDUCTORS UNDERGROUND.

A model of an underground conductor system for electric railways, which system is said to absolutely and perfectly solve the problem of practically placing the conductors underground, is now in practical operation and on exhibition in room 48, World Building, New York, the office of the Underground Electric Traction Company.

This system is the invention of Mr. D. J. Murnane and James B. Sheldon and is known as the "Murnane Underground Contact System," of which the above named company is the sole owner.

The most important feature of the system is the entire practicability of using one conduit for both cable and electric systems.

The electric conductor, which is perfectly insulated throughout its entire length, is attached to the side of the conduit, and in no way interferes with the operation of the cable system.

This point is mentioned as showing that it is possible to change an existing cable line to an electric line with great facility, or operate both systems independently on the one track. No new construction is necessary to equip the cable line for electric power, excepting of course, the laying of the conductor. The latter is at no point throughout its entire length exposed to dampness or air, and the method of avoiding leakage is an extremely ingenious one.

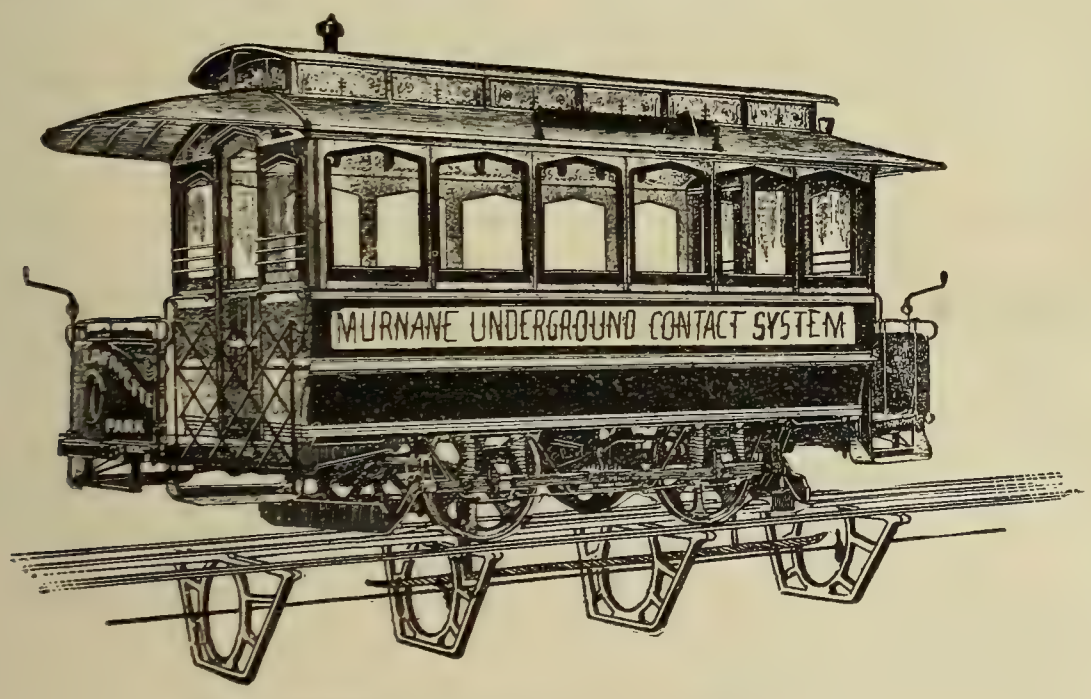


FIG. 1—GENERAL VIEW MURNANE UNDERGROUND SYSTEM.

Attached to the bottom of the car are "hangers," which pass through the slot on the surface of the conduit. At the lower end of the hangers (within the conduit) is a contact plate, which, as the car moves along, comes in contact with the switches. (See Fig. 1.)

The switch is a very ingenious piece of apparatus, and may be said to be the strong point of the system. Fig. 2 shows the apparatus in detail. It consists of a moisture-proof metallic case pivoted to the side of the conduit on a bracket in such a way that it always, by gravity, assumes an upright position when not acted upon by the contact plate of a passing car. At each brush the main conductor is tapped, the branch wire leading to and through the pivot to the inside of the case. On the inside of the case are also two spring contacts, one on each side of the pivot, which are connected electrically with the branch wire leading to the main conductor. On the top of the case, on the outside, is a projecting brush which comes in contact with the contact plate of the car as the latter passes along. The resulting pressure upon the extending brush causes the case to swing to one side or the other, according to the direction of the car, and this in turn brings one of the spring contact points in connection with the projecting lug on the pivot inside of the case. As this lug is in permanent contact with the main conductor, it will be readily understood that by swinging the case to one side or the other a new path for the flow of current is presented, and in practice this path includes the motor on the car.

As soon as the car passes the switch, the latter assumes its normal upright position, thus severing electrical connection with the main conductor.

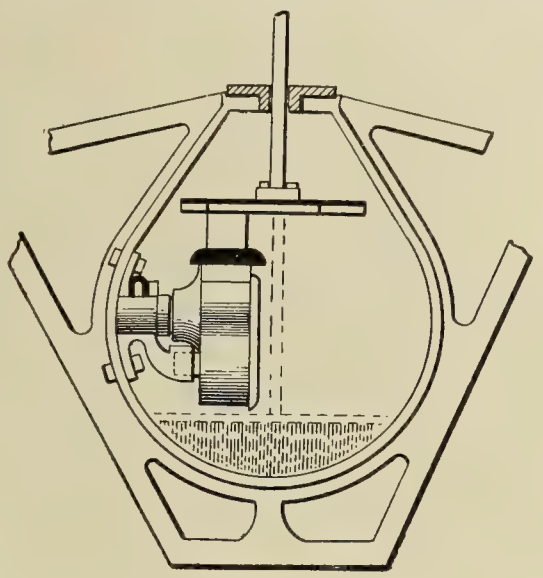


FIG. 4—METHOD OF KEEPING CONDUIT CLEAN.

These switches are placed distances apart equal to the length of the contact plate on the car, and a new contact is made before the preceding one is broken. By this means there is no sparking when contact is broken.

Fig. 3 shows, besides a view of the switch and its connections, the method of keeping the conduit clean. On account of the position of the electrical contact switches in the conduit it is possible to attach to the motor car or trailer a sweeping brush, which, as the car moves along, will sweep the conduit and keep it clean, and free from the accumulation of dirt, etc. This is a very important feature of the system.

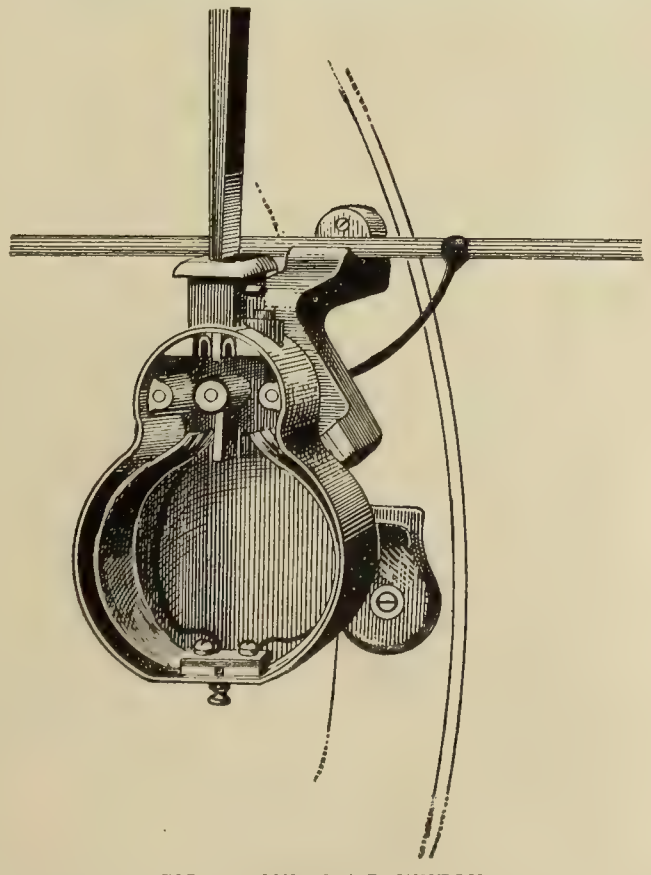


FIG. 2—MURNANE SWITCH.

The main thing to be attained in any system of placing the conductors underground is to avoid loss of current through leakage, etc. In this system this very important point seems to be completely and practically met, and it would seem that in practice there would be comparatively no avoidable loss. The conductor is not exposed at any point, and the current does not get beyond the switches until the latter are operated by a passing car.

The system is an extremely interesting one. It has already been examined by many electrical experts, and there is remarkable unanimity of opinion that the practical solution of the difficult problem seems to have been attained in the Murnane system.

SCHENECTADY'S NEW ELECTRIC ROAD.

On July 2, Schenectady, N. Y., was the scene of an event the consummation of which had been long and anxiously looked forward to. On that date electricity took the place of horse power on the Schenectady Street Railway, and from that time to this the road, under the new conditions, has been in constant and successful operation, without a single hitch.



VIEW ON SCHENECTADY ELECTRIC ROAD.

The line is three miles in length and of standard gauge—4 feet 8½ inches. There are nine curves on the road, varying in radius from 45 feet to 110 feet, and the maximum grade is 11 per cent., which is on a curve of 95 feet radius.

The complete equipment of the road will consist of six motor cars with trailers, all of which it was expected would be in operation about this time.

The latest style of single reduction street car motors of the Edison General Electric Company's make are used, each of 25 H. P. The motor cars are of the vestibule type, and were manufactured by the Gilbert Car Manufacturing Company, of Troy, N. Y. They are 18 feet in length inside, and 27 feet over all. They are provided with Anger trucks.

The generating plant consists of two 100 "KW" generators of the Edison General Electric Company's make and are driven by one Armington Sims 200 H. P. engine.

The iron poles on the road were manufactured by the Edison General Electric Company, and are constructed on the truss principle, tapering toward the top. These poles are very strong as well as light.

The trolley wire used is hard drawn copper.

We give herewith two views taken at different points on the line, which show in a very clear manner the appearance of the cars.

RAILWAY TRAIN LIGHTING.*

BY WILLIAM LANGDON.

Continued from page 430.

(6) The lighting throughout the train was to be capable of being turned on or off from any one of the guard's vans. For the sake of experiment, one of these trains was equipped on the "parallel" system, the other on the "series" system. The former, having proved the best, had been adopted by the company, and there were now five trains leaving St. Pancras daily which were electrically lighted, and in which the dynamo was driven off the axle of the guard's van, each vehicle being provided with accumulators capable of supplying the necessary current without the assistance of the dynamo.

There was also a local train traveling between Manchester and Stockport lighted after the plan adopted by Mr. Houghton on the Brighton line, but equipped with two sets of accumulators and two dynamos driven from the axle. In addition to the foregoing, there were two trains running between London and Bedford, the dynamos, of which were driven by small high-speed engines placed on the locomotive.

Dynamos.—The first trains fitted on the Midland Railway were furnished with machines giving a practically constant output of current, no matter how few or how many were the carriages attached. Messrs. Holmes & Co., of Newcastle, had since succeeded in making a dynamo which afforded a current proportional to the resistance of the circuit, and these machines were employed on all main line trains in which the dynamos were driven from the axle.

Accumulators.—These were of the "E. P. S." type. With main-line trains, where each vehicle carried its own batteries, the type employed was C 15 for the larger, and C 11 for the smaller carriages. In all cases the electrical pressure was 35 volts, so that 18 cells were necessary for each.

Electrical Coupling.—Where trains were not broken up, the difficulty of providing an efficient electrical coupling was not so great, but where the marshalling of carriages had to be smartly dealt with at terminal or intermediate stations, the coupling must be such as not only to provide a good electrical connection, but to admit of easy handling. The form adopted by the Midland Company effected these objects in a perfectly satisfactory manner. On a coupling being separated, the lights were automatically turned on. If the lamps were not required, the coupling, instead of being allowed to hang down, was placed upon a "dummy," the effect of which was to turn the current off. For slip coaches special provision was made.

By the insertion of a small resistance in each battery parallel, a fair distribution of the current throughout the different vehicles was attained, and in order to meet the increased pressure when the dynamo was in circuit, a sufficient additional resistance was automatically introduced. The lamps were of 8 c. p., and there were two in each compartment.

With regard to the second mode of generating the current, namely, by dynamos placed on the locomotive, it was believed that at present no other trains save the three already referred to were equipped in that way.

The total number of electrically-lighted vehicles now in operation on the Brighton, Great Northern, and Midland systems was 365 coaches and 57 vans.

In conclusion, the author pointed out that the main points to be determined were whether electricity was safe, reliable, and less dirty than other illuminants. The fact that electrically-lighted trains had now been running for a considerable period without accident would appear conclusive evidence of its safety, and experience had shown that there was no reason to doubt its reliability where efficient provision had been made; and the author believed that, when the cost of applying any of the illuminants, whether oil, gas, or electricity, to a complete railway system was taken into account, the latter would be found the most economical. The cost of oil was between ½d. and 1d. per lamp per hour. So far, compressed gas had never been employed for lighting the entire stock of any railway, with the exception of the Metropolitan Railway—which was specially adapted for its application. To consider the cost as applied to stock devoted to certain traffic would hardly afford a true basis of comparison. Where gas was used entirely, depots must be established at each point at which trains were made up, whilst at busy centres it would probably have to be conveyed some distance by pipes laid down for the purpose. The cost of fitting coaches for gas varied from £4. 8s. to £7 per lamp, while for electricity it was £4. 3s. 4d. per lamp. For trains running which were not broken up on the journey the cost per lamp amounted to £3. 12s. Vans with dynamos cost from £250 to £300 each. Statistics were given showing that the cost for maintenance in the case of gas was from .045d. to .250d. per light per hour. There was reason to believe that the total cost of compressed gas, when applied to an entire system, would exceed ½d. per lamp per hour, while the actual cost for electricity, as used on the Midland Railway, had not greatly exceeded ¼d. per lamp per hour.

*Abstract of a paper read before the Institution of Civil Engineers, London, May, 1891.

STREET RAILWAY NOTES.

ALABAMA.

Anniston.—A street car line is to be built to the lake from Twenty-third and Noble streets.

Selma.—A plant for the manufacture of freight and street cars is to be established here. The company proposes to commence operation with a paid up capital of $100,000, with the privilege of increasing it to $500,000.

CALIFORNIA.

Oakland.—A popular subscription is being taken to aid in the construction of the Oakland, San Leandro & Haywards Electric Road. It is expected that $10,000 will be contributed by the citizens of Oakland.

San Diego.—Jonathan Begg, of this city, recently exhibited a model of a new electric elevated railroad track and car. The track has a single rail, and the apparatus seems to be adapted to mountain country service. The car mounts steep inclines with great facility. It is said that an exhibition will be made of the system at the World's Fair.

COLORADO.

Denver.—Seventeenth street is to have a cable line, and not an electric, as has been generally supposed.

The City Cable Company will build a cable line on Seventeenth street to the Union Depot, and also one on Curtis street to West Denver.

F. J. Flynn has leased the Aspen Street Railway.

The Colorado Springs Rapid Transit Company's road to Manitou has been double tracked.

CONNECTICUT.

Norwich.—The people of this town are very much in favor of electric cars, and have expressed their desire to the City Council three times, but for some reason no action has been taken by the proper authorities.

DELAWARE.

Wilmington.—The frame work of the new stables of the Front Street Railway Company at Front and Union streets is being rapidly constructed.

ILLINOIS.

Chicago.—The West Chicago Street Railway Company has been allowed to continue work on the Blue Island Avenue cable. Operations had been suspended by Street Superintendent Worth, but at a subsequent conference between Commissioner Aldridge and Judge Jamison of the above named company, an arrangement was made for the resumption of work.

INDIANA.

Michigan City.—The street railway of this place has passed into the hands of a Chicago syndicate.

IOWA.

Clinton.—The State Electric Company, which has a franchise to build an electric railway on a number of streets now occupied by the Clinton and Lyons Horse Railway Company are meeting with considerable opposition from the latter. The new company with the aid of the city authorities, are now in possession of the disputed territory but it is said the courts will finally be called upon to settle the controversy.

MAINE.

Augusta.—The electric railroad has placed a third generator in the new power house.

Belfast.—An electric road will be built between Belfast, Northport and the Camp Ground as soon as possible.

Calais.—An electric railroad is to be constructed here and surveys are now being made.

Gardiner.—On August 3 the people of this place will vote on the question of the construction of an electric railroad.

MANITOBA.

Winnipeg.—A motion has been adopted by the council instructing the city engineer to take such action as is necessary to have the poles on River avenue, used by the electric street railway, removed from the street; such action to be taken subject to the advice of the city solicitor.

MARYLAND.

Baltimore.—We understand the Belt Line Railroad is endeavoring to purchase a portion of the old Bolton depot property from the city.

At a recent meeting of the stockholders of the Baltimore City Passenger Railway Company, steps were taken to increase the capital stock and bonded indebtedness of the company so that a portion of the road may be cabled and rapid transit introduced to enable that road to successfully compete with the new cable road.

Cumberland.—The new electric street railway here began operations July 1.

MASSACHUSETTS.

Boston.—South Boston residents expect to have an electric road by the end of the year. The West End Company, who will supply the current, thinks the power house will be completed about September 15.

Lawrence.—It is expected that cars will be running on a portion of the electric railway by July 15, and that the whole road, including the power house, will be fully equipped and running by August 1.

Construction work on the new electric road is progressing favorably, and it is thought that electricity will supplant horse power by August.

New Bedford.—At a meeting of the directors of the Union Street Railway July 7, a quarterly dividend of $2 per share, payable July 15, was declared. The directors were pleased with the business of the last quarter and report the affairs of the company in a prosperous condition.

Newburyport.—The Newburyport Car Company has a contract for six box and four open cars for the Merrimac Street Railway Company at Lawrence.

Salem.—The Essex Electric Road has been

granted permission by the city Council to construct a turnout on its Willow's branch, on condition that the trolley wires are provided with a guard.

Taunton.—The East Taunton Electric Road is for the present held in abeyance and will not materialize just yet.

The Union Street Railway Company has declared a quarterly dividend.

MICHIGAN.

Detroit.—It is reported that Mayor Pingree will veto the street railway ordinances which are claimed to give the railway companies unlimited rights, but it is thought the council will pass them over the veto.

Street railway officials in this city are much interested at the present time over the Healey electric motor. On July 1 a party consisting of the officers of the Detroit Street Railway Company and some friends, went to Grosse Point to witness a practical test of this motor. The motor, with two cars attached, covered a distance of 13 miles in one hour and ten minutes, including a stop of 15 minutes at the power house.

Grand Rapids.—At the annual meeting of the Valley City Street and Cable Railway Company, it was decided to apply to the legislature for permission to alter the articles of association so that the name of the company could be changed to that of the Consolidated Street Railway Company of Grand Rapids. It was at the same meeting voted to increase the capital to $3,000,000.

MISSOURI.

St. Joseph.—The Union Street Railway Company is removing its tracks from Charles street near Fourth. The street will be repaved.

NORTH CAROLINA.

Asheville.—Track laying began on the Asheville and Sulphur Springs Railway, June 30.

NEW HAMPSHIRE.

Dover.—The people of this place are enthusiastic over their new street railroad. The receipts and travel are continually increasing, and the company is jubilant in consequence.

NEW JERSEY.

Burlington.—An effort is being made to build a pneumatic road between this point and Mt. Holly.

New Brunswick.—The City Railroad Company began running over its newly constructed extension to the city limit July 1.

Jersey City.—There is some talk of establishing an electric road from Jersey City to Newark, N. J. The proposed route is along the old plank road, which runs between the two cities, and which belongs to the Pennsylvania Railroad. In Newark there are two electric roads, which have been in operation nearly a year, and in Jersey City there is one which, though running but a comparatively short time, has proved the superiority of electric power over all others for street railway purposes. The idea is now, to join the Jersey City road with those in Newark, and run cars directly from the ferry in Jersey City as far out as Orange, which is 15 miles beyond the former place. The tracks will pass through Marion and across the meadows, much of which is waste land and uninhabited. It is believed that the road would pay well from the start, as the traffic between the two terminal points on existing steam roads is very great, and the Pennsylvania Railroad Company is willing that its own traffic should be relieved in this way as its facilities are now severely taxed. An officer of the Jersey City Railway is authority for the statement that the electric road between Newark and Jersey City is to go through. It is proposed to lay tracks upon each side of the plank roadway, with poles at the side of the road, and trolley wires suspended from steel cross wires. It is said that a speed of 25 or 30 miles an hour could be attained in crossing the meadows.

NEW YORK.

Amsterdam.—On July 4, the electric railway here, carried nearly 7,000 passengers over its two and one-half miles of track with but five cars.

Batavia.—The citizens at this point are again agitating the question of a street railway. Rochester capitalists were after a franchise but it is said they failed to get one, because unwilling to agree that the road would be constructed within a specified time.

New York.—The road running from Vesey street to South Ferry, through Church and Greenwich streets, has not been operated for three weeks or more, and Corporation Counsel Clark is now endeavoring to ascertain if the franchise of the road has not been forfeited. The road is owned by Henry Hart, and was expected to be used for an extension of the Third avenue line to South Ferry. The railroad company claims that the condition of Church street has been such of late that it was impossible to run the cars through it.

The Sixth Avenue Railroad Company obtained on July 10 a temporary injunction restraining the Broadway and Seventh Avenue Railroad Company from disturbing the roadbed of the first named company, at the intersection of Broadway and Sixth avenue. At this point the Broadway and Seventh avenue road is making excavations for the introduction of the cable.

Salamanca.—An electric street railroad is to be built from Great Valley to West Salamanca, and arrangements have been completed for the same.

Syracuse.—The first car over the new East Genesee street electric road made the trip on July 1 in about 40 minutes, without a single mishap or inconvenience. The heaviest grades on the road are nearly four miles from the power house, but the car, laden with a party of prominent citizens and members of the press, climbed the hills with celerity.

Yonkers.—There is a strong sentiment here in favor of rapid transit on street car lines. Many of the citizens favor the cable system, but they are discouraged when the first cost and cost of maintenance is considered. The only solution to the problem is to adopt electric power, which the press of this place very much favor on account of the low cost of maintenance.

OHIO.

Findlay.—The new street railway began operation June 29.

Mansfield.—An electric line to be constructed here is to be equipped with the Westinghouse system. Contracts between the two companies have already been closed. There will be five motor cars 16 feet in length, made by the Fiegel Car Company, New Utrecht, N. Y. The cars will be equipped with Westinghouse motors, and a 100-horse power generator will be installed in the power station, all of which are included in the contract. The equipment is to be delivered within 30 days, and it is expected that the road will be put in operation a few days later.

Toledo.—The street railroads here are fighting for exclusive franchises.

The Consolidated Street Railway Company has opened its Oak street extension and the cars are now in regular operation.

ONTARIO, CAN.

Toronto.—We understand that a syndicate of Cleveland, O., capitalists is negotiating with the municipal authorities of this city for the purchase of the street railways. The city has about 65 miles of road on its hands. If the syndicate succeeds in its purpose about $300,000 will be expended in improvements. Electricity is to be used as the motive power.

PENNSYLVANIA.

Allentown.—The equipment of the Allentown and Bethlehem Rapid Transit Electric Railway consists of fifteen motor cars. Each car has double motor trucks and the motors are of the latest pattern Thomson-Houston single reduction type. This road was constructed and equipped by Reed & McKibben, consulting engineers and electric railway contractors, No. 2 Wall street, New York.

Meadville.—The citizens are anxious to have an electric road, and are earnestly discussing the subject.

Pittsburg.—The South Side Electric Company has placed a neat screen 10 inches high on its cars the entire length of the windows, making it almost impossible for careless passengers to meet with an accident at the Smithfield street bridge from allowing their arms to hang out of the windows.

RHODE ISLAND.

Providence.—The Pawtucket Street Railway Company has presented a petition for an amendment to the ordinance of the company, asking for permission to extend the tracks of the company from Broad street to Ashton.

TENNESSEE.

Nashville.—The United Electric Street Railroad Company is extending its track on Line street to the junction of the Clift turnpike and the old Charlotte road.

Work on the Maplewood line is progressing rapidly.

TEXAS.

Fort Worth.—Grading has been commenced on the Polytechnic street car line

New Incorporations.

Chicago, Ill.—The National Light, Heat and Power Company has been incorporated here with a capital stock of $100,000, to establish an electric light plant, electric railway and furnish power.

The North Chicago Elevated Railway Company has been incorporated with a capital stock of $10,000,000. It proposes to build an elevated road from Monroe and Clark streets to Evanston.

Columbus, O.—The Columbus Electric Railway Company, filed articles of incorporation July 1. The company is to furnish transportation to the extreme northeastern and northwestern sections of the city. The capital stock is $100,000 divided into 1000 shares of $100 each.

Indianapolis, Ind.—The Broad Ripple Railway Company, composed of Cincinnati capitalists, was incorporated here July 6, with a capital stock of $50,000. Immediately after incorporation the company filed petitions with the County Board of Commissioners and the Board of Public Works for right of way over several streets of the city.

Franchises.

Detroit, Mich.—The Bay City belt line has had its franchise extended.

Fall River, Mass.—The Globe Railway Company has been granted a franchise to use the overhead trolley system for its cars.

Hutchinson, Kan.—An ordinance has been adopted here granting a franchise for an electric street railway. The ordinance grants the use of centre poles on all the streets and avenues excepting such as are sixty feet or less in width, on which the railway company is to exercise its own discretion.

Milton, N. Y.—The official board of this place has granted to I. B. Whitcomb & Co., of New York City, a franchise and the right of way in the highway to construct and operate an electric rail-

way for freight and passengers between Ballston Spa and Rock City Falls, a distance of eight miles. The road is to be in operation in ninety days.

Casualties.

Atlanta, Ga.—On July 1, an electric car on the Monte Sano line, got beyond the control of the driver while on the hill. The car went tearing down the grade and in turning a curve the passengers were thrown off. The arm of one man was broken.

Chicago, Ill.—On July 4, a street car while crossing the tracks of the Northwestern Railroad on Rockwell street, was struck by a freight train. One passenger was killed and four injured. Gross carelessness is charged on the part of the men at the crossing, and it is reported that there were no proper guards on the track.

New York, N. Y.—Vincenzo Dellaro, aged nine years, was run over and killed by a car on the Second avenue line a few days ago. Some playmates pushed the boy against the horses and the driver could not stop in time to prevent him from getting under the wheels.

Pittsburg, Penn.—A collision took place July 7, between a Duquesne electric car and an electric feeder of the Pittsburg Traction Company. The feeder was badly wrecked and a boy 14 years of age was fatally hurt. Several of the passengers were slightly injured.

MISCELLANEOUS.

The Richmond Railway & Electric Co., of Richmond, Va., is offering for sale eight or ten, 14 foot cars. The cars are finished in cherry and are in first-class condition.

The West End Electric Railway, of Rockford, Ill., has obtained permission to extend its road along 3d street.

George S. Rice has been appointed engineer for the Rapid Transit Commission of Lowell, Mass. He is a native of Boston and 42 years of age.

The Street Railway Company, of Charleston, W. Va., is extending its line up Virginia street from Capitol. It is intended to adopt electricity on this line in the near future.

Mr. Nesmith, of the Central Thomson-Houston Electric Company, has obtained a franchise for an electric road to run between Canton and Massillon, Ohio.

Arrangements have been made for the introduction of an electric road in Mattoon, Ill.

Mr. Altenberg, of Cincinnati, is about to construct an electric road in Hamilton, Ohio.

A few days ago while a gentleman was riding on an elevated train in New York his baby girl, which he was holding on his lap, fell out of the window. Every one thought, of course, that the little one would meet with instant death, but when the train was stopped and several men went back to look for the child, they were surprised to find it lying on the road-bed unhurt.

La Société des Tramways de Paris et du Department de la Séine are about to start a regular service of electric cars from the Rue Lafayette, near the Opera, to St. Denis, over a line having some very steep gradients. The electrical rolling stock will consist of twenty 54-passenger cars.

The Queen City Electric Street Railway Company has been organized to build electric roads in Marion, Ind. The capital stock of the company is $150,000 and the officers are Russell B. Harrison, president; George L. Mason, vice-president and general manager; Frederick E. Mason, treasurer, and William H. Wiley, secretary. The company is also empowered to furnish electric power and light, and has secured the contract for lighting the city of Marion. A road is now being built in Marion, jointly by the Westinghouse Company and the United States Railway Equipment Company. The road-bed is graded and the rails are being laid. It is expected that by August 10 cars will be running over 5½ miles of the line. Handsome vestibule cars will be used. The Marion Street Railway Company, which operates the present horse car line, is putting in the Thomson-Houston system on its six miles of road.

KIND WORDS.

We desire to acknowledge receipt of a number of letters from various quarters commenting on the introduction of this department into the Electrical Age, and we are truly grateful for the kind words of commendation and encouragement. We regret that lack of space makes the publication of all these letters in this issue impossible, but we have picked two from the number at random and submit them herewith.

Westinghouse Electric and Manufacturing Company,
Pittsburg, Pa., July 11, 1891.

E. V. Cavell, Esq., General Manager.

Dear Sir:—I have before me the last issue of the Electrical Age and note with considerable interest the extension of that journal by the addition of a new department devoted to street railway news. The action of the Electrical Age in creating the new branch is praiseworthy and should meet with most favorable criticism from its readers. The electric street railway industry is making such rapid strides that those interested in electrical matters are desirous of familiarizing themselves with the subject to a much greater extent now than heretofore, and therefore, it gave me pleasure to notice the wish on the part of the Electrical Age to cater to the demands of its readers by devoting the space which it has done to important street railway news. With hearty wishes for its prosperity and success, I am, Yours very truly,

H. McL. Harding.

Railway Register Manufacturing Co.
Edward Beadle, Manager, 1193 Broadway.
New York, July 8, 1891.

E. V. Cavell, Esq.,
Gen. Mgr. Railway Dept. Electrical Age.

Friend Cavell:—I have just received the first issue of your Street Railway News and cannot but commend the enterprise of your company in giving the street railway men "a weekly record of street railways of the world," as you say under your title heading. The paper looks well, is well edited and I predict for it a bright future, and for which future you have my heartiest wishes.

Yours very truly,
Edward Beadle, Manager.

DELAWARE & HUDSON COMPANY.

For the information of those who have never visited the Canadian metropolis, but who are intending to go to the Montreal meeting, it may be stated that the shortest and most interesting line between Montreal and New York is the Delaware & Hudson Railroad. Parties from the West can go to Schenectady or to Albany, connecting at either point with the "D. & H." road, and see something of Saratoga, Lake George, Lake Champlain and the marvelous scenery of the Adirondack Mountains. The "D. & H." stands at the head in the number and importance of the summer resorts along its line, and in the number of summer tourists carried in its trains.

Arrangements should be made to include a stop at the Hotel Champlain on the west shore of Lake Champlain, three miles south of Plattsburgh, which, architecturally and in beauty of location of surroundings, is perhaps the finest affair of its kind in the world.

Mr. J. W. Burdick, general passenger agent of the Delaware & Hudson Railroad, Albany, N. Y., will be glad to send by mail an illustrated guide of the line, upon receipt of six cents in stamps, to cover postage.

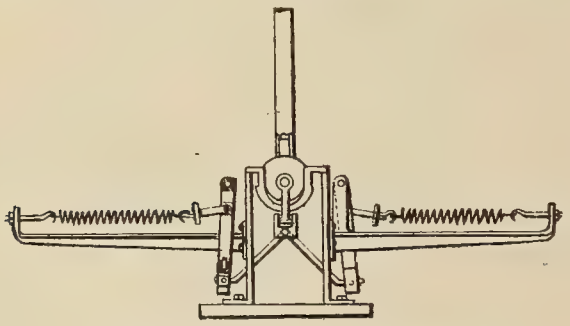
THE ELECTRICAL AGE'S ILLUSTRATED PATENT RECORD.

STREET RAILWAY PATENTS—Issued July 7th, 1891.

455,298. Electric Locomotive. Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. Filed Oct. 30, 1890.

The combination, with the wheels and axles of an electric motor car, of the electric motor having a spring support upon each axle and an auxiliary spring-support at a point between the axles.

455,322. Trolley-Pole Stand. James R. Griffiths, Allegheny, Pa. Filed Jan. 20, 1891.



452,322—TROLLEY POLE STAND.

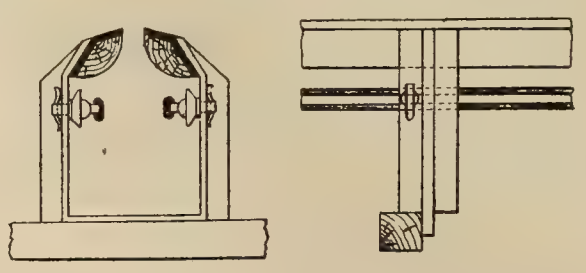
In a trolley-pole stand the combination of a supporting frame having a socket, a trolley-pole having a ball-bearing therein, fixed brackets, with vertical links pivotally secured in them, and having their upper ends connected by springs with the ends of the brackets, and the arms or links pivotally secured to the ball and connected with the lower ends of the vertical arms.

455,339. Conductor for Electric Railways. Walter H. Knight, Cleveland, Ohio. Filed May 11, 1885.

A slotted conduit flush with the street surface and having its inner surface adapted to shed water away from the slot, with the insulators placed at intervals, and having a water-shed flange, and the electric conductor connected thereto having a bare contact-surface parallel with the slot.

455,340. Electric Railway. Walter H. Knight. New York, N. Y. Filed May 11, 1885.

The combination, in an electric railway, of a supply-conductor and an electrically-propelled vehicle with a contact device connected to the vehicle by a joint, permitting freedom of movement about a vertical axis, and a spring maintaining the traveling engagement between the contact device and supply conductor, but not interfering with the free movement of the contact device about the vertical axis.



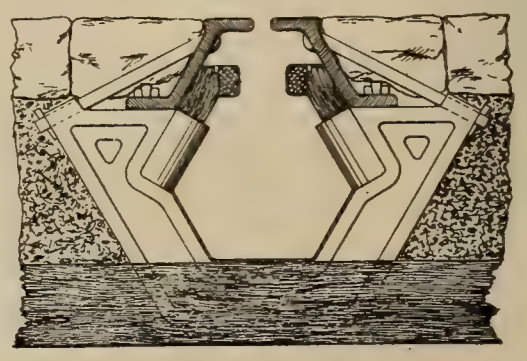
455,339—CONDUCTOR FOR ELECTRIC RAILWAYS.

455,341. Electric Railway. Walter H. Knight, New York, N. Y. Filed April 29, 1887.

A conduit inclosing a line conductor and constructed of two parts; first, a substructive beneath the pavement, consisting of yokes placed at intervals with intermediate filling, and supporting the conductor by projecting insulators holding it free from the side walls, and second, slot rails extending through the pavement forming the upper part of the conduit, the insulators being so placed that the slot rails serve as a water shed, guarding them from matter entering behind the rails.

455,342. Electric Railway. Walter H. Knight, New York, N. Y. Filed Oct. 16, 1888.

A conduit comprising a rail of the girder type, constituting both a track-rail and the inner slot-rail, and consisting of an upright contracted web having a transverse flange at its upper end affording a bearing for the car wheel in line with the web and extending beyond the web to form one edge of the slot, in combination with an insulated supply-conductor in the conduit to one side of the slot, where it is shielded by the overhanging transverse flange.

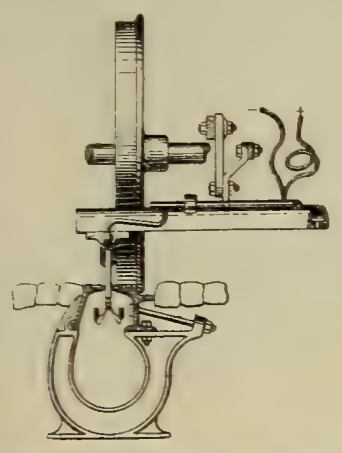


455,341—ELECTRIC RAILWAY.

STREET RAILWAY PATENTS—Continued.

455,343. Electric Railway Plow. Walter H. Knight, New York, N. Y. Filed Mar. 5, 1889.

An intermediate contact device extending into the con-

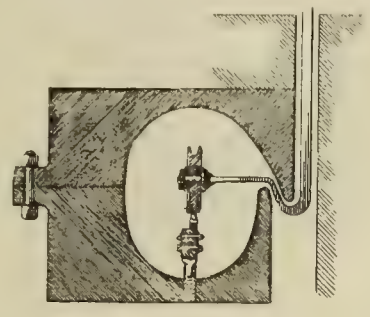


455,342—ELECTRIC RAILWAY.

duit and connected by a joint having a vertical axis with a transversely moving piece connected to the vehicle.

455,447. Conduit for Electric Railways. William Bradley, Fort Wayne, Ind. Filed Nov. 24, 1890.

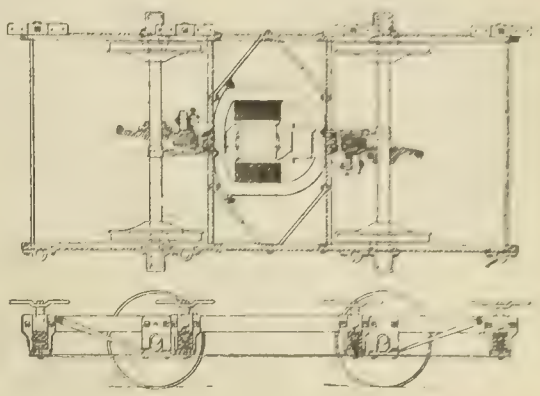
In a conduit for electric railways the combination of a box or pipe constructed in two sections secured to each other, a projection of the upper part over the lower section adapted to form a slot for the trolley-lever to pass through and be operated, a standard attached to the interior of the conduit, adapted to support and firmly hold a flange, a trolley-wire provided with flanges rigidly secured thereto,



455,447—CONDUIT FOR ELECTRIC RAILWAYS

and insulating material adapted to confine the current to the conductor.

455,454. Electric Railway. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Mar. 30, 1891.



455,581—ELECTRIC MOTOR CAR TRUCK.

The combination, in an electric railway, of two or more supply-conductors parallel therewith, connected, respectively, to generators of different electro-motive forces, and a vehicle on the railway provided with apparatus for bringing the propelling-motor into circuit with either of the supply conductors at will.

ELECTRICAL PATENTS.

Issued Tuesday, July 7th, 1891.

455,320. Telegraph Key. Robert W. Green, St. Thomas, Canada. Filed Feb. 10, 1890.

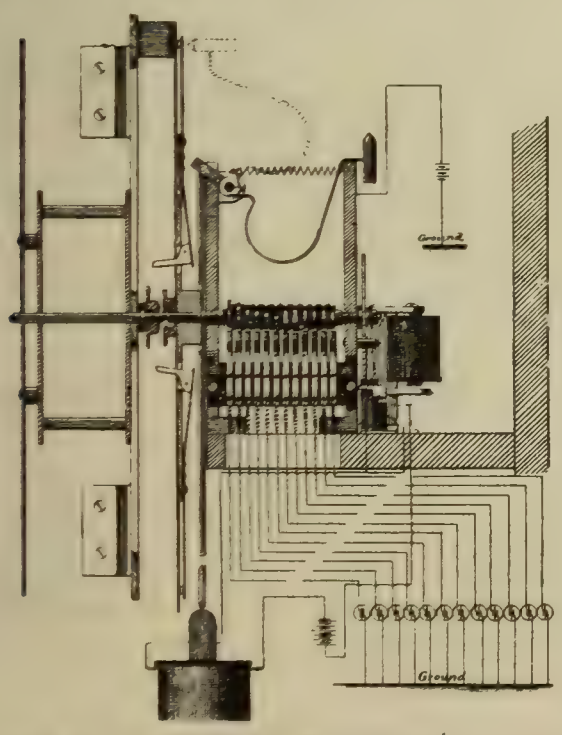
A key having a spring-backed sliding contact-strip with a latch to hold it in an advanced position, and a lever for withdrawing the strip, adapted to co-operate with the latch-lever, so as to operate the latter.

455,352. Electrical Watchman's Clock. Harvey S. Park, Chicago, Ill. Filed July 1, 1890.

455,366. Combined Fuse-Block and Incandescent Lamp. Horace E. Swift, Boston, Mass. Filed Sept. 29, 1890.

An incandescent lamp, combined with a bar, screw-threaded at its lower end to receive the lamp and fuse-wires and a socketed handle secured to the bar.

455,398 Quadruplex Telegraphy. Charles D. Haskins, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed Nov. 19, 1887.



455,352—ELECTRICAL WATCHMAN'S CLOCK.

The local circuit of a neutral quadruplex relay, in combination with the contact-points of the relay, a battery, a signaling device, and the contact-points of another relay, the electro-magnet of which is included in circuit, with a third winding or helix upon the magnets of the quadruplex neutral relay, whereby the local circuit through the signaling device is closed when the armature-levers of both relays are simultaneously on their back contacts.

455,410. Watchman's Time-Detector. Abraham Newman, Brooklyn, N. Y. Filed March 11, 1890.

455,420. Method of Electric Welding. Elihu Thomson, Swampscott, Mass., assignor to the Thomson Electric Welding Company of Maine. Filed Feb. 19, 1891.

Current-bearing contacts or electrodes adapted to make contact with the work and supplemental rings or blocks of copper or other material that is a good conductor of heat, adapted to be applied to the work between the point of heating of the work and the points of application of the electrodes.

455,440. Watchman's Time-Recorder. John A. Lannert, Cleveland, Ohio. Filed Jan. 5, 1891.

A recording mechanism comprising a series of magnets to record units, a series of magnets adapted to record tens, and electric connection between them, so that the current will make one magnet of each series record.

455,446. Grave-Annunciator. William H. White, Topeka, Kans. Filed May 22, 1890.

A flue composed of two separable sections, the one above the other, the lower of the sections communicating with the coffin, a contact-maker, and a diaphragm within the lower section, a valve within the diaphragm mechanically connected with the contact-maker, a wire passing upward from the contact-maker and through the diaphragm and upper section of the flue, and an annunciator connected with the wire.

455,488. Friction-Gearing for Dynamos. Frederick L. McGahan, Indianapolis, Ind. Filed Dec. 26, 1890.

A dynamo armature rigidly mounted on a shaft having bearings in a frame work, and a circular ring or plate connected to such armature between the bobbins and the shaft, in combination with a friction-roll journaled in bearings at one side of the armature-shaft and adapted to contact with the inner face of the circular plate for driving the armature.

455,510. Train-Signaling Apparatus. Linwood F. Jordan, Somerville, Mass., assignor of one-half to Henry B. Bennett, Portland, Me. Filed Nov. 16, 1889.

In a railway car telegraph, the combination, with a single-stroke bell located on the engine, a battery, a push-button and a switch also located on the engine, of a three-way circuit leading from the switch and push-button and bell to the cars, and each car provided with a trembly-bell normally included between two of the circuits, and a switch arranged to break the bell-circuit and close the circuit through the third conductor, whereby a signal may be sent from the car to the engine and the bells in the car rung at the same time, and whereby the engineer can signal to the cars without operating the bell in the engine.

455,517. Multipolar Dynamo. Andrew L. Riker, New York, N. Y. Filed Feb. 7, 1891.

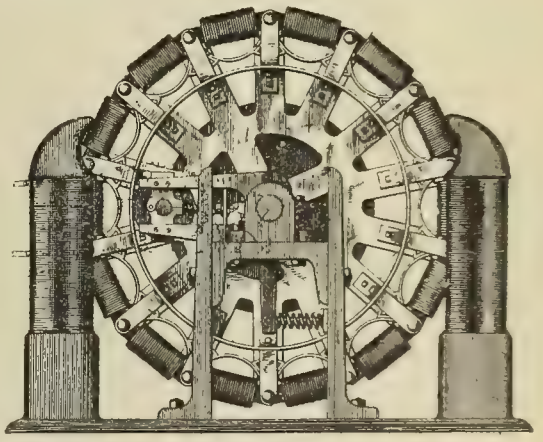
A blank for building up a continuous multipolar field-magnet, the blank being a stamped-out plate of soft sheet-iron of small size comparatively to the circumference of the field, and comprising a core portion, a coil-space, pole-pieces on each side thereof, and an extension from one pole-piece provided with a bolt-hole equi-distant between adjacent cores when the blanks are assembled, so that the parts will all register when some of the blanks forming a single segment of the field are reversed with respect to the others.

455,520. Pulsating-Current Reciprocating Electric Engine System. Charles J. Van Depoele, Lynn, Mass. Original application filed March 23, 1889. Divided and this application filed June 26, 1889.

The combination, with a source of pulsating or rising and falling currents, of an electro-magnetic reciprocating engine having a motor coil or coils and a magnetic piston moved within the coil or coils in synchronism with the rise and fall of energy therein.

455,524. Electric Meter. James J. Wood, Brooklyn, N. Y. Filed Oct. 30, 1890.

The combination, with an electric meter as a means for correcting the registry thereof, of a shunt around the meter and automatic means in the nature of a rheostat controlled by the current being measured for diverting through the shunt varying proportions of current from time to time as



455,488—FRICTION GEARING FOR DYNAMOS.

the total current varies, such rheostat being so proportioned that the current diverted shall be graduated for each quantum of current proportionally to the normal over-registry for such quantum, whereby the registry is reduced to direct ratio to the current.

455,532. Self-Winding Electric Clock. Fred. L. Gregory, Niagara Falls, assignor of one-half to John G. Rich, Auburn, N. Y. Filed April 2, 1891.

455,545. Electrical Walking Toy. John B. Kibler, Minneapolis, Minn. Filed March 17, 1891.

In an apparatus adapted for automatic progression, a motor, pedal extremities pivotally connected to a common support and arranged to be alternately advanced by means of the motor, electro-magnets carried thereby, electric connections and means for switching a current, and a base with which the magnets co-operate.

455,547. Automatic Supporting and Locking Device. John H. Morgan, Jr., Chicago, Ill., assignor to George Cutter, same place. Filed Jan. 24, 1891.

A supporting and locking device comprising, in combination, a cable having an enlargement or knob thereon, a case or frame having an anti-friction surface, over which the cable is passed, an inclined guide against which the knob is caused to impinge in its upward movement, a seat on the upper side of the guide, and a second guide above

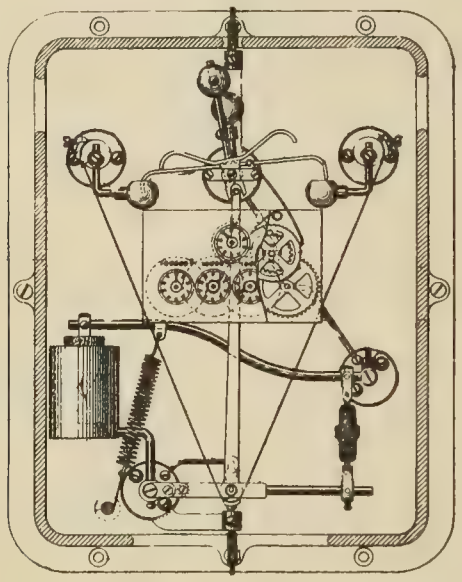
ELECTRICAL PATENTS—Continued.

the first and angularly disposed with reference thereto and provided with shoulders to form a stop to arrest the upward movement of the knob.

455,559. Lamp-Socket and Switch and Circuit-Closer Therefor. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed Dec. 16, 1890.

The combination, in a lamp-socket, of terminals for the circuit, a potential or disruptive circuit closer in the base of the socket, consisting of two conducting members, a film of insulating material between the members, and means operated by insertion of the lamp for moving the parts of the potential or disruptive circuit-closer near together.

455,575. Electric Meter. Johan W. T. Olan, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed Dec. 29, 1890.



455,524—ELECTRIC METER.

The method of measuring electricity, which consists in decomposing an electrolyte into its constituent gases at successive pockets in a rotating body by means of the current to be measured rotating the body by the buoyancy of the gases thus produced, and moving an indicator in accordance with movement of the body.

455,576. Electric Arc Lamp. Johan W. T. Olan, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed Jan. 12, 1891.

455,631. Apparatus for the Defecation of Saccharine Juices by Electricity in the Manufacture of Sugar. Elias Maigrot and José Sabates, Havana, Cuba. Filed April 15, 1889.

In apparatus for the defecation of saccharine juices by electrical currents in the manufacture of sugar, the combination of a series of troughs provided with longitudinal porous partitions dividing the troughs into longitudinal compartments, connecting-pipes connecting the two sets of compartments in two separate series, one series for the circulation of water upon one side of each porous partition, the other for the circulation of saccharine juices on the opposite side of the porous partition, and electrodes suspended in the compartments and connected with an electric generator.

455,680. Electric Belt. Charles A. Bogardus, Syracuse, N. Y. Filed Feb. 24, 1891.

In an electric belt, the combination of a flat zinc folded over on one end, a covering of absorbent material, a wire wound around over the absorbent, then twisted at one end of the zinc and absorbent, then bent outwardly from the twist, then bent inwardly, forming hooks, and bent to form forward-projecting points.

455,683. Transmission of Alternating Currents of Different Phase. Michael Von Dolivo-Dobrowolsky, Berlin, Germany, assignor to the Allgemeine Elektricitats-Gesellschaft, same place. Filed March 28, 1891.

The combination of a dynamo-electric machine having a plurality of coils or sets of coils in which independent alternating currents of relatively differing phases are induced, a transformer provided with as many primary coils as there are induction-coils or sets of coils in the dynamo, and with a smaller number of secondary coils, separate connections between the induction-coils of the dynamo and the primary transformer-coils, and mains connected to the secondary coils of the transformer.

455,693. Galvanic Battery. Henry C. Sample, Ravenswood, assignor to Hugh W. Matthews, Chicago, Ill. Filed Dec. 2, 1889.

A galvanic battery cell having a circular peripheral wall and an end wall extending from the centre of the cell to the outer wall, with a filling-opening.

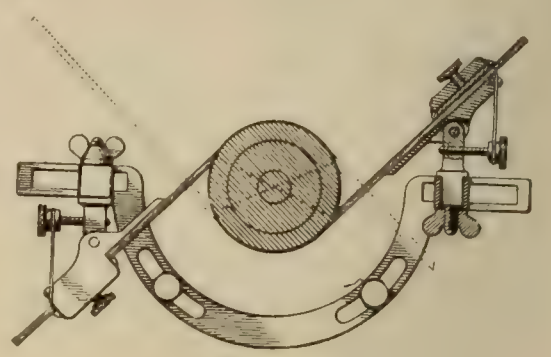
455,696. Switchboard for Electric Fence Stations. David H. Wilson, Normal, assignor to the American Electric Fence Company, Chicago, Ill. Filed Aug. 25, 1890.

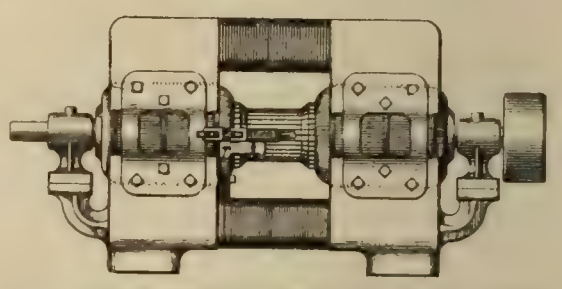
455,711. Electric Motor. Lemuel G. Goode, Jersey City, N. J., assignor to the Paterson Electrical Manufacturing Company of New Jersey. Filed Aug. 22, 1890.

The combination of an electric circuit, a plurality of stationary coils, a reciprocating or oscillating armature, a commutator, a movable brush carried by the armature and having two contact-surfaces for alternate contact with the commutator, and means for automatically moving the brush to change the position of its contact-surfaces for reversing the direction of the armature.

455,722. Support for Telephones. William J. Myers, Allegheny, Pa., assignor to the R. D. Nuttall Company, same place. Filed June 3, 1890. Renewed June 13, 1891.

A support for telephone-receivers, formed of a vertical bar, a bracket longitudinally adjustable thereon and having a socket thereon, and a rest or support formed of wire and having the ends thereof twisted into a spiral and entering said socket.





455,726—ELECTRIC MOTOR OR GENERATOR.

455,726. Electric Motor or Generator. Walter F. Brown, St. Paul, Minn., assignor of two-thirds to William F. Bailey, George N. Bailey and Charles N. Nitterauer, all of same place. Filed Aug. 21, 1890.

The combination, in an electric motor or generator, of two armatures upon a common shaft with an intermediate commutator upon the same shaft, the several windings of the two armatures being connected, respectively, to the opposite ends of the commutator-segments, so that the portions of the two armatures in the same plane and upon the same side of the shaft have opposite polarities and pole-pieces arranged on opposite sides of the armatures with cores connecting the adjacent pole pieces.

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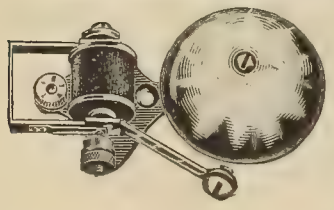
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WEEKLY.

Vol. IX. NEW YORK, JULY 25, 1891. No. 30.

THE ALLEGHENY COUNTY LIGHT COMPANY OF PITTSBURG, PA.

The history of each single central electric light station is invariably one of constant growth. The case of the Allegheny County Light Company is no exception and an interior view of their engine-room given herewith shows that they have utilized every particle of space at their command.

In the early days of electric lighting such a development was never even considered and this plant was located in the centre of the city of Pittsburg, so surrounded by business blocks as to prevent increase beyond certain narrow limits. The business of this company has now become so large that they operate two additional Central stations in Allegheny.

In the foreground, at the left, is shown the first compound engine built by the Westinghouse Machine Company, which is giving as good service as their latest pattern.

In station A there are one Corliss, six Westinghouse standard and four Westinghouse compound engines, with an aggregate of 2,155 H. P.; five 3,000-light and one 1,800 Westinghouse alternating current machines; three 500-light and three 300-light direct current machines and nine 60-light Brush arc machines.

Station B has five Westinghouse alternating current dynamos aggregating 14,000 lights; five direct current Westinghouse machines of a total capacity of 500 lights and six Brush arc machines of a total of 360 lights. The engine plant consists of three Westinghouse compound and four standard engines with a given total of 1,700 H.P.

The equipment of station C consists of one compound and one standard Westinghouse engines with an aggregate of 350 H.P. and six 60-light Brush arc machines.

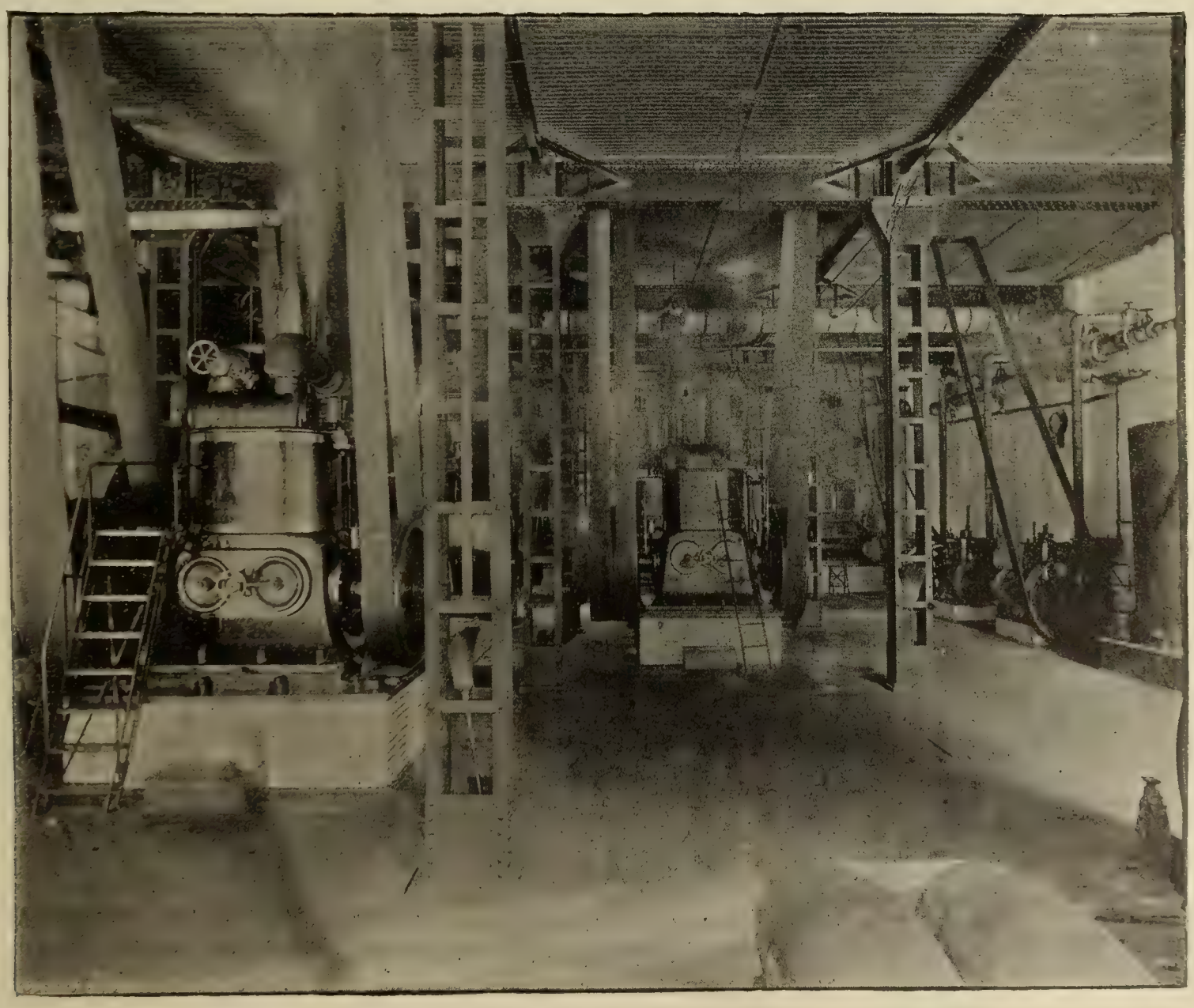
The grand total light capacity is 33,700 incandescent, and 1,260 arc.

In the original plant, Corliss engines were gradually replaced by the Westinghouse high-speed engines, closely grouped on the ground floor and belted direct to the dynamos in the second story. In some cases three dynamos are driven by one engine, while the exciter engines and dynamos have been run over thirteen months without a stop.

There is little to recommend in this arrangement of machinery, except where it is desirable to crowd a large amount of power into a very small space.

In the boiler-room the use of natural gas as fuel has permitted the erection of a second series of boilers over the first, without in the least interfering with its proper working.

In spite of the structural drawbacks of this station and its division into three parts, the service is excellent. The company will erect a new station in a short time and concentrate its force under one roof. With the valuable experience which the officers of this company have had since the early days of electric lighting, it seems hardly necessary to say that the proposed new station will be a model of its kind.



POWER ROOM OF CENTRAL STATION "A" ALLEGHENY COUNTY LIGHT COMPANY.

DECISION IN THE EDISON LAMP CASE.

In the suit of the Edison Electric Light Company against the United States Electric Lighting Company, Judge Wallace, of the Circuit Court of the United States for the Southern District of New York, on July 14 rendered a decision in favor of the Edison Company.

The following is the decision in full:

WALLACE, Circuit Judge:

Two claims of Letters Patent No. 223,898, granted Thos. A. Edison, January 27, 1880, for an improvement in electric lamp, are in controversy in this suit. These are claims 1 and 2. It is not asserted for plaintiff that the defendant infringes the other claims of the patent, consequently they will require no attention further than to see whether their terms may assist in defining the meaning of the claims in litigation.

The plaintiff contends that these claims are for fundamental inventions of great merit, and are entitled to a construction by which every incandescent lamp for electric lighting, consisting essentially of a filamentary carbon burner, hermetically sealed in a glass vacuum chamber, is within their terms. The defendant contends that unless the claims are limited to narrow inventions, not employed by the defendant, they are invalid for want of patentable novelty. The questions of the validity and scope of the patent have been adjudicated in the Courts of England and Germany with a diversity of opinion by the Judges who have considered them. The specification is a perplexing one. The difficulty lies in its shadowy demarkation of the line between the essential and non-essential features of the invention described. It catalogues a number of discoveries which Mr. Edison has made; it sets forth some of the essential features of the lamp, and then it leaves to be found by inference from generalities what the elements are of the combinations included in the extremely elastic terms of the two important claims. Nevertheless, when a sufficient knowledge of the prior state of the art to which it relates has been acquired, the new departures from old devices which it describes, and which, presumably, the inventor proposed to incorporate into the claims of his patent, are reasonably apparent. The specification states that the object of the invention is "to produce electric lamps giving light by incandescence, which lamps shall have high resistance so as to allow of the practical subdivision of the electric light." The subdivision of the electric light is the concrete term for the division of the electric current into numerous small units and their conversion into luminous centres. By practical subdivision is meant a distribution and division of the current and its conversion into lights comparable with those of ordinary gas jets, on a scale and under conditions of convenience and economy adequate to a system of illumination for domestic purposes, in villages and cities, analogous to that of gas. Prior to 1879 there was no method known by which this could be done practically. The problem involved the perfection of devices for the proper distribution and regulation of the current as well as those for translating it into light. No reference to the pre-existing devices for generating electricity, conducting it to the translating devices, or regulating its pressure and quantity, is necessary except to state that the principles governing the relation of the resistance of translating devices to the character of the circuit in which they are arranged, whether in series or in multiple arc, were well known to electricians and had been applied in various forms of electrical apparatus. There were two well-known devices for converting the current into light—the arc lamp and the incandescent lamp. In the former the current is forced to leap an air gap separating two conductors, usually of carbon, and in overcoming the resistance of the air space heats the adjacent surfaces of the conductors and produces a light of great intensity. In the latter light is produced by the incandescence of an electrical conductor, a conducting strip or burner, placed in a continuous circuit through which the current passes and which develops heat by its resistance to the flow. The arc lamp was suitable for use in streets, open spaces and large halls, but its light was too concentrated and powerful for the illumination of dwellings or rooms of small dimensions. It was the generally accepted opinion of electricians that the hope of progress in the subdivision of the electric light was to be found in modifying the features of the arc lamp. The reasons for this conclusion need not be mentioned; it suffices to say that Mr. Lane-Fox in England, and Mr. Edison in this country, seem to have been the only notable dissidents, and each of them had expressed the conclusion that subdivision might be accomplished by the incandescent lamp when provided with a conductor of high resistance and small radiating surface arranged in a system of multiple arc. Lane-Fox had set forth the advantages of such a lamp in three patents granted to him in England, two in October, 1878, and one in March, 1879, and in a letter to the *London Times* published in December, 1878; and Mr. Edison had done so in a patent granted to him in France, May 28, 1879, for improvements in electric lighting.

By arrangement in multiple arc no greater electro-motive force is required for a large number of translating devices than for a single one, and the amount of current can be graduated to the number employed; consequently, a lamp with a conductor of high resistance can be utilized as efficiently as one with a conductor of low resistance. Higher resistance in the conductor permits the use of a weaker current, and consequently, of smaller and less expensive main conductors. With a small surface of conductor less energy is required to produce a candle-power, and the small incandescent mass will radiate a moderate light, like the domestic lamp. Electricians knew how to make conductors of high resistance, and how to make them with a small radiating surface. They knew that with material of the same specific resistance the total resistance of the conductor could be varied by varying its length or cross-section, high resistance being imparted by length and small section. They knew what materials were preferable, and what processes of treatment, to make conductors of high or low resistance. If they had only known how to construct a lamp in which the conductor would have adequate mechanical strength and durability for practical commercial use, while having the small radiating surface and high resistance desirable, there would have been nothing wanting, and electric lighting by incandescence would soon have been an accomplished fact. Although Lane-Fox and Edison had contributed to the state of the art the recognition of the principle that the conductor must have high resistance and small radiating surface, and each of them had embodied the principle in lamps for which they had severally obtained patents, neither of them had invented a lamp which satisfactorily met all the conditions of success, because a burner of the necessary materials, form and complementary adjuncts was yet to be devised. As to materials, experiments had been tried with platinum, iridium and alloys of these metals, and with carbon of various kinds. It was known that platinum, being a poor conductor, could be readily brought to incandescence by the electric current, but to do so it was necessary to raise it to a temperature very near the fusing point, and a minute increase would melt it. On the other hand, carbon was known to possess at an equal temperature much greater power of radiation than platinum, but the difficulty was that it would combine with oxygen at high temperature and rapidly disintegrate. It could only be used, therefore, in a vacuum from which the oxygen had been excluded, and a perfect vacuum was practically unattainable. From the earliest lamp (disregarding the Geissler tube, because it has no burner in the true sense), patented in England by King in 1845, to the latest examples, like those of Lane-Fox or Edison's platinum lamp, patented in 1878–9, the history of the art shows a variety of experiments to perfect a lamp in which a carbon burner, or a platinum burner, would have a sufficiently long life for practical requirements. The results of these experiments may be succinctly shown by quoting two well-known electricians. Mr. Schwendler, in an article published in 1879, in the *Telegraphic Journal*, said: "Unless we shall be fortunate enough to discover a conductor of electricity with a much higher melting point than platinum, and the specific weight and the specific heat of which conductor is also much lower than for platinum, and which at the same time does not combine at high temperatures with oxygen, we can scarcely expect that the principle of incandescence will be made use of for practical illumination." Mr. Sawyer, in a patent to Sawyer and Man, granted in June, 1878, said: "At the present day it is not new to produce a light by causing the electric current to heat a carbon conductor to incandescence in a vacuum, or in nitrogen, or in other gas: but no lamp has yet been devised which would be practically operative, and for these reasons: First, the methods which have been adopted for charging the lamp with the artificial atmosphere, such as a displacement of mercury, water or air by the gas, or the combustion of phosphorous in the lamps, are imperfect. A perfect vacuum is unattainable. Some oxygen, or other element or compound, remains in the lamp, and slow consumption or disintegration takes place, for the remaining gas or vapor other than hydrogen or nitrogen attacks the carbon, which in turn is decomposed with a result of depositing the carbon upon the globe and setting free the oxygen to attack fresh carbon. Second, it has been found practically impossible under the varying degrees of heat and pressure to maintain perfect joints, and the result is that expansion of the artificial atmosphere by the heat from the luminous conductor expels a portion of the same, and the contraction of the atmosphere upon cooling causes a portion of the external air to penetrate the globe, thus supplying oxygen, which at the next lighting feeds upon the carbon. Third, the unequal expansion of the carbon and its holders has resulted in fractures of the former, so that, however perfect the atmosphere in the globe, the lamp has never been permanent."

The most advanced type of carbon burner lamps in 1875 were the lamps of Lodyguine or of Konn, and until the spring of 1879, lamps like those of the Sawyer and Man patent or the patent of Mr. Farmer. It was thought to be the merit of Lodyguine's lamp that it obviated the difficulty of the short life of the burner by using two burners, rods of diminished section at the luminous focus, in a glass receiver hermetically sealed and filled with nitrogen, electrically arranged so that the current could be passed to the second carbon when the first had been consumed. Mr. Konn provided his lamp with five carbon burners in the form of rods or pencils and devices for bringing them successively into circuit In the lamp of Sawyer and Man the carbon burner was a rod or pencil maintained in a globe charged with nitrogen gas, and the globe and its stopper (both of glass) were held together by a clamping device. In the lamp of the patent granted to Mr. Farmer in March, 1879, the burner was a carbon rod or pencil enclosed in a globe filled with nitrogen or other analogous gas, and the globe was closed by a rubber stopper. In none of the lamps, except the one described in Mr. Edison's prior French and English Patents of 1879, had any attempt been made to make the vacuum chamber wholly of glass with the parts sealed together by fusion, or to seal the conducting wires leading to the burner through the glass by fusion of the glass. The impracticability of maintaining a carbon burner under such conditions that it would be sufficiently durable had apparently so impressed those who were studying lighting by incandescence, that we find that as late as in the early part of 1879 both Lane-Fox and Edison were trying to perfect a burner of other material. Edison's burner, in his French Patent of May 28th, 1879, and his English Patent of June 17th, 1879, was of platinum wire coiled upon a bobbin composed of an infusible oxide; and Lane-Fox's burner, in his patent of May 14th, 1879, was of platinum-iridium alloy, or of spiral strips of metal surrounding a tube of glass, fireclay, steatite, or lime, with the surface of the metal strips covered with asbestos or same vitreous material.

This cursory view of the prior state of the art is sufficient for an intelligent reading of the specification. The specification describes the general nature of the invention as follows:

"The invention consists in a light-giving body of carbon wire or sheets coiled or arranged in such a manner as to offer great resistance to the passage of the electric current, and at the same time present but a slight surface from which radiation can take place."

"The invention further consists of placing such burner of great resistance in a nearly perfect vacuum to prevent oxidation and injury to the conductor by the atmosphere. The current is conducted into the vacuum bulb through platina wires sealed into the glass."

"The invention further consists in the method of manufacturing carbon conductors of high resistance, so as to be suitable for giving light by incandescence, and in the manner of securing perfect contact between the metallic conductors or leading wires and the carbon conductor."

The specification then recites that previously light by incandescence had been obtained from rods of carbon of one to four ohms of resistance, placed in closed vessels in which the atmospheric air had been replaced by gases that did not combine chemically with the carbon; that the vessels holding the burner had been composed of glass

cemented to a metal base; that the connections between the leading wires and the carbon has been obtained by clamping the carbon with the metal; that the leading wires had always been large, so that their resistance should be many times less than the burner, and generally the attempts of previous persons had been to reduce the resistance of a carbon rod. It then points out the disadvantages of such a lamp, stating that it could not be worked in great numbers in multiple arc without the employment of main conductors of enormous dimension; that, owing to the low resistance the leading wires have to be of large dimensions and good conductors, and a glass globe cannot be kept tight at the place where the wires pass in and are cemented, and consequently the carbon is consumed because there must be almost a perfect vacuum to render it stable, especially when it is small in mass and high in electrical resistance; and that the use of gas in the receiver at the atmospheric pressure serves to destroy the carbon by attrition.

The specification then states in substance that the patentee proposes a new departure; that he has discovered that even a cotton thread properly carbonized and placed in a sealed glass bulb exhausted to one-millionth of an atmosphere offers from one hundred to five hundred ohms resistance to the passage of the current, and that it is absolutely stable at very high temperature; that if the thread be coiled as a spiral and carbonized, or if any fibrous vegetable substance which will leave a carbon residue after heating in a closed chamber be so coiled, as much as two thousand ohms resistance may be obtained without presenting a radiating surface greater than three-sixteenths of an inch; that if such fibrous material be rubbed with a plastic composed of lamp-black and tar its resistance may be made high or low, according to the amount of lamp-black placed upon it; that carbon filaments may be made by a combination of tar and lamp-black, the latter being previously ignited in a closed crucible for several hours, and afterwards moistened and kneaded until it assumes the consistency of thick putty; that small pieces of this material may be rolled out in the form of wire as small as seven one-thousandths of an inch in diameter and over a foot in length, and the same may be coated with a non-conducting, non-carbonizing substance and wound on a bobbin, or as a spiral, and the tar carbonized in a closed chamber by subjecting it to high heat, the spiral after carbonization retaining its form; that he has carbonized and used cotton and linen thread, wood splints, papers, coiled in various ways, also lamp-black, plumbago, and carbon in various forms, mixed with tar and kneaded so that the same may be rolled out into wires of various lengths and diameter; that each wire should be uniform in size throughout; that all these forms are fragile and cannot be clamped to the leading wires with sufficient force to insure good contact and prevent heating; that if platinum wires are used and the plastic lamp-black and tar material be molded around it in the act of carbonization, there is an intimate union by combination and by pressure between the carbon and platinum, and nearly perfect contact is obtained without the necessity of clamps; that the burner and the leading wires should be connected to the carbon ready to be placed in the vacuum bulb, and when fibrous material is used the plastic lamp-black and tar should be used to secure it to the platina before carbonizing.

The specification proceeds as follows:

"By using the carbon wire of such high resistance I am enabled to use fine platinum wires for leading wires, as they will have a small resistance compared to the burner, and hence will not heat and crack the sealed vacuum bulb. Platina can only be used, as its expansion is nearly the same as that of glass."

"By using a considerable length of carbon wire and coiling it the exterior, which is only a small portion of its entire surface, will form the principal radiating surface; hence I am able to raise the specific heat of the whole of the carbon and thus prevent the rapid reception and disappearance of the light, which on a plain wire is prejudicial, as it shows the least unsteadiness of the current by the flickering of the light, but if the current is steady the defect does not show."

The specification then gives directions for carbonizing the carbon thread in a manner to prevent its distortion, for blowing a glass bulb over it after it is formed, for exhausting the glass bulb, and for hermetically sealing the bulb when a high vacuum has been reached.

The claims are as follows:

"1. An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires, as set forth."

"2. The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted, for the purposes set forth."

"3. A carbon filament or strip coiled and connected to electric conductors so that only a portion of the surface of such carbon conductors shall be exposed for radiating light, as set forth."

"4. The method herein described of securing the platina contact wires to the carbon filament, and carbonizing of the whole in a closed chamber, substantially as set forth."

The specification is addressed to those who were skilled in the art to which it relates; who appreciated the advantages of arranging incandescent lamps in a system of multiple arc, and of providing the lamp with a burner of high resistance and small radiating surface; who knew how high resistance, both specific and total, is imparted to a conductor; who knew that the rods, pencils, or other forms of carbon burners previously used had not been designed to embody the principle of high resistance; who knew how desirable it was to maintain the burner in a perfect vacuum, or in gases that would exclude the oxygen; who knew what had been attempted and had proved impracticable in that behalf; who knew that such materials as are mentioned in the specification (even the tar putty compound seems to have been used in Gauduin's process) would compose a carbon of high resistance when subjected to a proper process of carbonization; and who knew how to practice proper processes for the carbonization of such materials.

Read by those having this knowledge, the radically new discovery disclosed by the specification is that a carbon filament, as attenuated before carbonization as a linen or cotton thread, or a wire seven one thousandths of an inch in diameter, and still more attenuated after carbonization, can be made, which will have extremely high resistance and be absolutely stable when maintained in a practically perfect vacuum. It informs them of everything necessary to utilize this discovery and incorporate it into a practical lamp. It describes, with the assistance of the recital in the second claim, as the vacuum in which the burner is to be maintained, a bulb made wholly of glass, exhausted of air, sealed at all points by the fusion of the glass, and in which platinum leading wires are sealed by the fusion of the glass. It describes the materials of which the burner is to be made and instructs them that the materials are to be shaped into their ultimate form before carbonization. It describes the use of platinum for the leading wires, and a method of securing the leading wires and filaments, intended to dispense with clamping, which consists in molding tar-putty about the joints, and carbonizing the whole in a closed chamber. Besides stating that the resistance of the burner will be greatly increased and the radiating surface still be kept within moderate limits by coiling it in the form of a spiral, the specification states that by increasing the length of the filament coiled, the exterior only will be the principal radiating surface, and greater steadiness of illumination will be promoted.

The first claim must be read with several limitations. The filament is to be made of carbon of high resistance; that is, as the experts agree, of high specific resistance. The filament is to be made as described; that is, the materials are to be of some of the kinds described, and are to be shaped in filamentary form and then carbonized. The filament is to be secured to metallic wires according to the method of the patent; because the claim implies the elements of a globe and metallic conductor arranged in circuit with the burner, otherwise the combination would not be operative, and it would have been needless to specify the securing of the metallic wires to the filament unless it was intended to import into the claim the specific method of doing so emphasized in the specification.

The defendant does not infringe this claim, if for no other reason, because the leading wires in its lamps are not secured to the filament according to the method of the patent; that is, by cement carbonized *in situ*, but by clamps such as the specification condemns.

The second claim is broad enough in its phraseology to secure the real invention described in the specification, and can be read consistently with its language so as to import into it every essential limitation.

It was a remarkable discovery that an attenuated thread of carbon would possess all the long-sought qualities of a practical burner when maintained in a perfect vacuum. The extreme fragility of such a structure was calculated to discourage experimentation with it, and it does not detract in the least from the originality of the conception that previous patents had suggested that thin plates, or pencils, or small bridges could be used. The futility of hoping to maintain a burner in vacuo with any permanency had discouraged prior inventors, and Mr. Edison is entitled to the credit of obviating the mechanical difficulties which disheartened them, but what he did in this respect was a matter of only secondary merit and was no longer new in the art, because he had already disclosed it in his French and English patents. What he actually accomplished was to unite the characteristics of high resistance, small radiating surface, and durability in a carbon conductor by making it in a form of extreme tenuity out of any such materials as are mentioned in the specification, carbonizing it, and arranging it as he had previously arranged his platinum burner in an exhausted bulb made wholly of glass and sealed at all points, including those where the leading wires entered, by the fusion of the glass. He was the first to make a carbon of materials and by a process which was especially designed to impart high specific resistance to it; the first to make a carbon in the special form for the special purpose of imparting to it high total resistance; and the first to combine such a burner with the necessary adjuncts of lamp construction to prevent its disintegration and give it sufficiently long life. By doing these things he made a lamp which was practically operative and successful, the embryo of the best lamps now in commercial use, and but for which the subdivision of the electric light by incandescence would still be nothing but the *ignis fatuus*, which it was proclaimed to be in 1879 by some of the learned experts who are now witnesses to belittle his achievement and show that it did not rise to the dignity of an invention.

The coiled form of the burner is only an alternative feature, and is not a constitutent of the second claim. It is the subject of the third claim. Nor is the bent form or any form other than the filamentary. It may be that in the haste which has always seemed to characterize Mr. Edison's efforts to patent every improvement, real or imaginary, which he has made or hoped to make, he had not stopped to reflect when he framed his application for the patent that the filamentary burner would do its work just as well uncoiled as coiled provided the same length and cross-section were used. It is true that it is said in the general statement of the nature of the invention that the burner is so "coiled or arranged" as to offer high resistance and present a small radiating surface; but this description is satisfied by any arrangement, whether by coiling a considerable length in a small globe or using the same length uncoiled in a larger globe, by which sufficient total resistance is obtained from a filament of small diameter. It certainly would not involve invention to omit the coiling and elongate the globe; hence, it is manifest that the invention described is the same thing essentially whether the coiled form is used or not. The language is satisfied, if the burner is filamentary and so arranged as to offer great resistance and slight radiation, without importing into it anything which is not of the essence of the invention. No precise limitation upon the maximum diameter of the filament can be defined from the specification or is required as an element of the claim. The specification mentions by way of illustration the threads of linen or cotton which become more attenuated after carbonization, and the carbon wire which after carbonization would be from four to five one-thousandths of an inch in diameter; while the smallest rods of carbon previously known were about a millimeter in diameter, thus having a cross-section fifty times as great as the carbon wire. It is to be implied from the suggestions in the specification that it is to have sufficiently high total resistance for efficient use when the lamps are arranged in multiple arc, and to be used with leading wires of fine platinum. The claim is not limited to a carbon filament made of non-fibrous material. The conductors of the claim are the platinum wires mentioned in the specification. The receiver is the vacuum described in the specification. The peculiar method of securing the conductors to the filament, made a constituent of the first claim, is not imported into the second claim. A more exact interpretation of the meaning of the claim than has thus been indicated is not necessary in the present case, because each of the three lamps representing the kinds used by the defendant embodies the invention of the claim as thus interpreted.

(*Continued on page 455.*)

THE ELECTRICAL AGE
DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT

Established 1883.

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THE EDISON LAMP DECISION.

On July 14, Judge Wallace, of the Circuit Court of the U. S. for the Southern District of New York, rendered his decision in the suit of the Edison Electric Light Company against the United States Electric Lighting Company in favor of the first named company, the full text of which we print elsewhere in this issue.

This suit, which involved millions of dollars already earned and the future of one of the leading electrical industries, stands, with the Bell Telephone case, as one of the most important ever decided in a law court.

Two claims of letters patent No. 223,898, granted to Thomas A. Edison, January 27, 1880, for an improvement in electric lamps, are in controversy in this suit. These claims read as follows:

"1. An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance made as described, and secured to metallic wires, as set forth.

"2. The combination of carbon filaments with a receiver made entirely of glass, and conductors passing through the glass and from which receiver the air is exhausted, for the purposes set forth."

In 1881, the United States Electric Lighting Company began the manufacture of incandescent lamps, and has continued to do so ever since. It acquired at an early date inventions and patents of Hiram S. Maxim, Prof. Moses G. Farmer, Edward Weston and many other early and more or less successful workers in the field of incandescent lighting.

The Edison Company formally protested against this alleged infringement of their patent, but nothing resulted until 1885, when the suit just decided was instituted against the United States Company. The testimony was taken before a referee and was almost entirely of an expert character. Among those who testified for the plaintiff were Prof. G. F. Barker, of the University of Pennsylvania, and Prof. Cyrus F. Brackett, of Princeton. Prof. Charles F. Cross, of the Massachusetts Institute of Technology, and Prof. Henry Morton, of Stevens Institute, were among those who testified for the defendant company. The mass of testimony taken was enormous, enough to fill seven large volumes.

The case was finally brought up for decision and the argument of counsel of both parties was begun May 27 and concluded on June 5. On July 14, the Judge rendered his decision sustaining the Edison claim, and ordering a decree for an injunction and an accounting of profits for past manufacture.

Referring to the claims in controversy, Judge Wallace says in his decision: "The plaintiff contends that these claims are for fundamental inventions of great merit, and are entitled to a construction by which every incandescent lamp for electric lighting, consisting essentially of a filamentary carbon burner, hermetically sealed in a glass vacuum chamber, is within their terms. The defendant contends that unless the claims are limited to narrow inventions, not employed by the defendant, they are invalid for want of patentable novelty." In these few words the substance of the case is given.

"The questions of the validity and scope of the patent," says the judge, "have been adjudicated in the courts of England with a diversity of opinion by the judges who have considered them." The specification was a perplexing one, and the difficulty lay in its shadowy demarcation of the line between the essential and non-essential features of the invention described.

Touching Mr. Edison's faith in the ultimate production of a practical lamp and his persistent work in this direction in spite of the failure of others, Judge Wallace says: "It was a remarkable discovery that an attenuated thread of carbon would possess all the long-sought qualities of a practical burner when maintained in a perfect vacuum. . . . The futility of hoping to maintain a burner in vacuo with any permanency had discouraged prior inventors, and Mr. Edison is entitled to the credit of obviating the mechanical difficulties which disheartened them; but what he did in this respect was a matter of only secondary merit and was no longer new in the art, because he had already disclosed it in his French and English patents. What he actually accomplished was to unite the characteristics of high resistance, small radiating surface and durability in a carbon conductor by making it in a form of extreme tenuity, out of such materials as are mentioned in the specification, carbonizing it, and arranging it, as he had previously arranged his platinum burner, in an exhausted bulb made wholly of glass and sealed at all points, including those where the leading wires entered, by the fusion of the glass. He was the first to make a carbon of materials and by a process which was especially designed to impart high specific resistance to it; the first to make a carbon in the special form for the special purpose of imparting to it high total resistance, and the first to combine such a burner with the necessary adjuncts of lamp construction to prevent its disintegration and give it sufficiently long life. By doing these things he made a lamp which was practically operative and successful—the embryo of the best lamps now in commercial use."

What the ultimate result of the decision, will be is of course, impossible to predict. The defeated company will take an appeal at once to the Circuit Court of Appeals, and it is expected that a final decision will be reached in six months. The court meets in October next.

In some quarters the prompt decision of Judge Wallace was a surprise, while in others it was expected Naturally, of course, there is difference of opinion as to the justice of the decision, and the parties affected directly and indirectly by it take a hopeful view of the future. The Edison company very naturally considered their cause a just one, and it was backed up by strong testimony and argument.

There is one thing certain with regard to the commercial incandescent lamp. Mr. Edison certainly is entitled to the credit of making the lamp a practical thing; he worked hard and long to perfect it and battled with the problem until it was solved. Others before him had tried it and given it up; but Edison, with his proverbial persistence of purpose, stuck to it until he settled to his own satisfaction the question whether the thing could be done or not.

If the decision is confirmed by the Court of Appeals, the Edison company will practically have the monopoly of the lamp business in this country. Some idea of the magnitude of this industry may be inferred from the fact that there are about 50,000 lamps turned out a day, and only 25,000 of these are made by the Edison company.

With the application of electric power to various uses in mining, mines which formerly were, for various reasons, considered non-paying are put on a paying basis. For whatever purpose power may be required, electricity is always available, and it is applicable in many situations where other forms of power could not even be considered. The original source of power—water or steam—may be located many miles from the mine, and the power laid down at the exact spot where work is required, whether it be on the surface of the ground or hundreds of feet beneath. Electric locomotives are already quite familiar objects in some mines and electric drills are revolutionizing the old methods of drilling. Apparatus of both these classes have been recently described and illustrated in these pages, and in this issue, on another page, we describe and illustrate an electric mining pump made by the Edison General Electric Company. It is a combination of a 25 H.P. motor and a double acting pump, both placed on the same bed. Pumps are important to mining operations, and an electric pump possesses many great advantages over the ordinary steam pump—one of the main ones of which is the facility to putting it into operation. There is no steam fitting to be done and all of the annoyances attending the establishment and maintenance of steam apparatus are a minus quantity.

Our article in the issue of July 11, headed "Give the Little Fellows a Chance," has had a good effect. We have been called upon by many of the dealers in whose interest the article was written to thank us for so ably and effectively championing their cause, and they report that the case is now beginning to be looked at in the proper light by the large houses. No doubt the custom grew so gradually that, like some insidious disease, it got a big hold on the trade before they realized its enormity, and probably they would not have realized it yet had attention not been called to its existence.

The "Question Box" will be a feature at the Montreal Convention of the National Electric Association next September, and it, no doubt, will be greatly appreciated and extensively used. It will afford an excellent opportunity to secure information that could not very well be otherwise obtained, and no doubt its use will develop facts of interest and value to every one engaged in the electrical industries.

Continued from page 453.

It is of little import what Mr. Edison, or his patent solicitor, may have thought about the meaning of the claim during the pendency of the application for a subsequent patent, or that Mr. Edison may have supposed a resistance as high as one hundred ohms in the burner would be required for use with the means of distribution which he expected to employ with his system of lighting. There are many adjudicated cases in which it appears that the inventor builded better than he knew; where a patent has been sustained for an invention the full significance of which was not appreciated by the inventor when it was made. In the case of the Bell Telephone patent there was great room for doubt whether the speaking telephone had been thought of by Mr. Bell when he filed his application for a patent, but the Court said: "It describes apparatus which was an articulating telephone, whether Bell knew it or not" 22 Blatch., 532.

The nearest approach in the prior art to the invention of the second claim is undoubtedly the lamp of Edison's French and English patents with a platinum burner. It seems almost preposterous to argue that the substitution of the carbon filament for the platinum burner of that lamp was an obvious thing to electricians. It would have been probably, if there had been such a thing as a filamentary carbon in the prior art. But the nearest approximations to it were the ribbon shaped carbon burner of low resistance of Mr. Farmer (which was not a part of the prior art but an isolated example known only to a select few) and the low resistance carbon rod burners of the patent of Sawyer and Man.

Undoubtedly the improvements that have been made in the art, such for instance as the method of electrical carbonization of the filament, since Mr. Edison's invention, have been of great value, and the perfected commercial lamp of to-day is far superior to the one which could be made by applying to the description of the patent all the knowledge and skill then possessed by those to whom it was more particularly addressed. But as was said by BOWEN, L. J., in the Court of Appeal in England, "the evidence shows that lamps made solely on the patent will and do succeed, although subsequent improvements have been engrafted on the original design." It is impossible to resist the conclusion that the invention of the slender thread of carbon as a substitute for the burners previously employed opened the path to the practical subdivision of the electric light.

The questions which have seemed the most meritorious of those argued at the bar have now been considered. Others, to which no reference has been made, have not been overlooked, and may be dismissed without discussion and with the single remark that nothing which has been presented by the voluminous proofs and the exceedingly able and elaborate arguments of counsel seems to supply any valid reason for refusing to decree for the plaintiff.

The usual decree for an injunction and accounting is accordingly ordered.

EDISON MINING PUMP.

The great value of electric power for mining purposes has been frequently demonstrated in these pages of late, and that the power is appreciated by the practical miner may be inferred from the fact that manufacturers of electric mining apparatus are very busy filling orders for machines for all sorts of mine work.

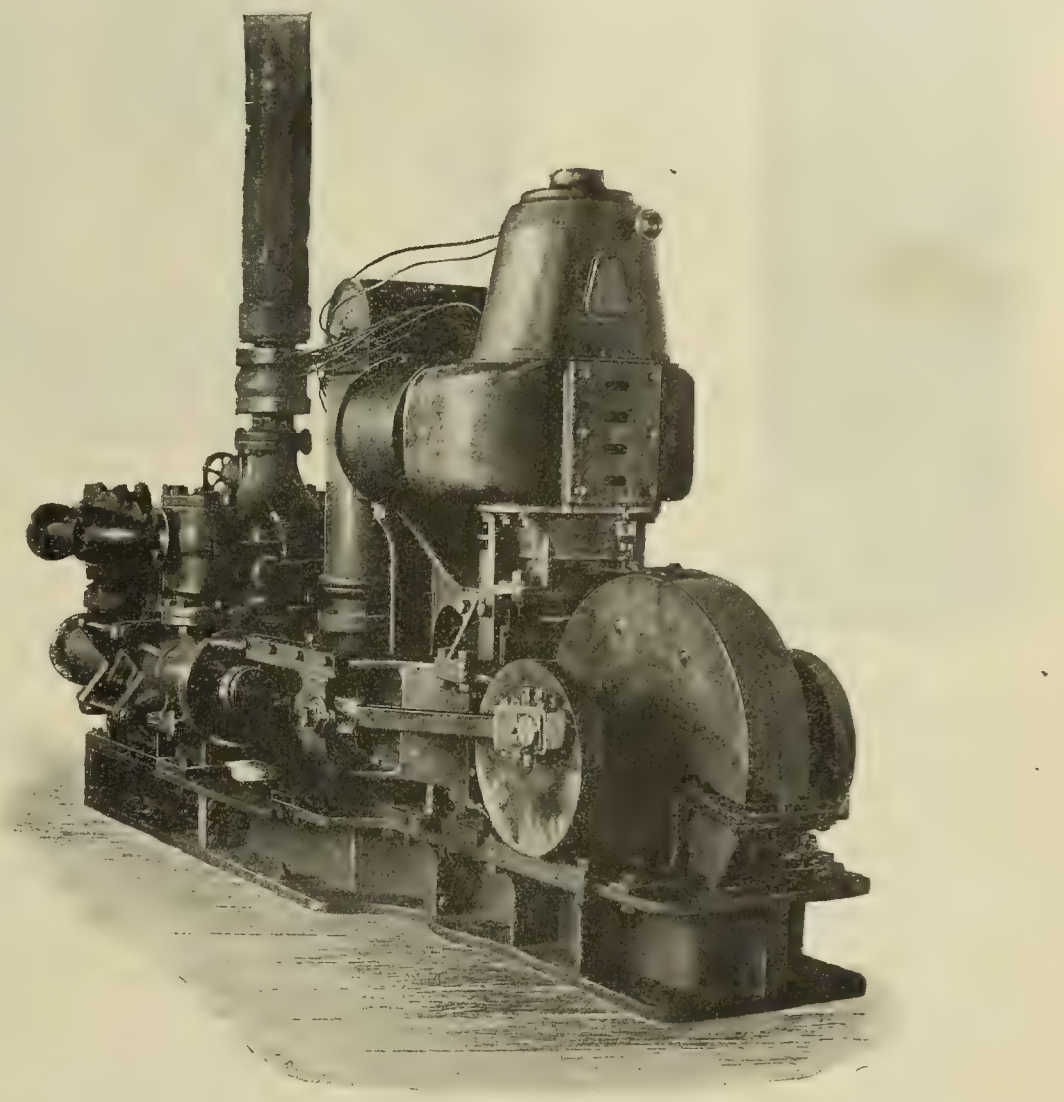
The Edison General Electric Company, of New York, is giving much attention to this branch of electrical engineering, and is in the foremost ranks as manufacturers of electric machinery for mines. We have quite recently described and illustrated various machines built by this company for mining purposes, and we herewith describe and illustrate a mining pump just brought out by it.

This pump is a combination of 25 H. P. motor and a Blake Double-Acting pump, all placed on the same bed-plate.

The general arrangement of the pump is as follows:

The motor used is of 25 H. P. rated capacity, is series wound, and designed to operate at 800 volts; it can be supplied, however, wound for any of the standard voltages. The field coils are divided into three sections, and the regulation of speed is effected by commutation of these sections by means of an ordinary car-controlling switch.

The armature shaft is connected by a worm driving a large gear wheel to a pair of crank discs, one on each side of the machine. Wrist pins, placed at an angle of 90° with each other, carry the connecting rods operating the plungers of the double-cylinder pump, which is mounted on the same bed-plate with the motor. Each pair of plungers being connected together by outside rods work together like one plunger, and the connection with the crank discs being at an angle, one pair of plungers is drawing while the other is forcing water, thus making them double-acting. The size of each cylinder is 5 inches diameter by 12 inches length. The following figures on the performance of this pump were obtained during a recent test:



ELECTRIC MINING PUMP.

Strokes per Minute.	Press. lbs. per sq. inch.	Water Delivered per Minute.		Elec. Energy Required. H.P.	Effective work done. H. P.	Commercial Efficiency.	Theoretical Height Water.
		Gals.	Lbs.				
56	0	0	0	8.04	0	0	0
38	25	155.04	1290	15.08	2.26	15	57.73
37	50	150.96	1256	15.08	4.4	29.8	115.46
35	75	143.8	1188	18	6.25	34.7	173.19
31	100	126.5	1052	19.44	7.38	38	230.92
30	125	122.4	1018	20.4	8.92	43.7	288.65
28	150	114.24	950	23.46	10	42.6	346.38
26	175	106.08	883	26.27	10.83	41.2	404.11
24	200	97.92	815	28.15	11.42	40.57	461.84

The height given in above table is the height of a column of water at 60° F., with the barometer at 30 inches, which could be supported by the given pressure per square inch. The actual height to which the given number of gallons per minute could be raised would depend on the length and diameter of pipe and the number of bends, and in any case case would be less than its theoretical height.

THE MONTREAL CONVENTION.—The Montreal Citizens' Committee for the reception of the National Electric Light Association had a meeting a few evenings ago. Prof. Bovey presided, and the chairmen of the several sub-committees handed in highly satisfactory reports. Some 16,000 feet of space has now been applied for by intending exhibitors. President C. R. Huntley, of the Association, informs us that a new feature will be introduced this year, as suggested by the Executive Committee, which will add to the interest and the diffusion of practical information on the details of work in connection with the operating of central station and other plants. A "Question Box" will be placed at headquarters in Montreal for the reception of written questions upon any pertinent subject. This box will be opened prior to each session, the questions read in open convention, and answers requested from those who are willing to speak upon the subject. This plan will, no doubt, be favorably received, and will give excellent practical results.

A NOVEL APPLICATION OF WATER POWER.

One of the best examples of the utilization of waste water is that at Watsonville, Santa Cruz county, California. The Corrillitos Water Company get their supply from the Corrillitos creek at a point 7½ miles from the town. Their distributing reservoir is located 1½ miles distant, at an elevation of 90 feet. The water is brought from the Corrillitos creek, six miles above, in a 15-inch pipe and discharges into the reservoir under a considerable head.

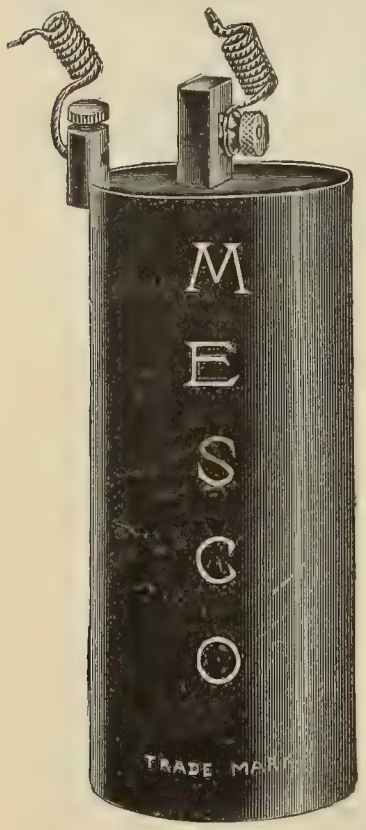
It occurred to the water company not long ago that this pressure might be utilized to light the town, and after conference with the Pelton Water-Wheel Company the scheme was found to be perfectly practicable, and a contract was at once entered into with that company to erect the power plant, and with the Thomson-Houston Company for the electric installation.

The plant consists of a 4-foot Pelton wheel, which runs under a pressure of 60 pounds, equal to a head of 140 feet, the water being discharged onto the wheel through a 2¼-inch nozzle. Close regulation is afforded by a deflecting nozzle and hydraulic governor, which gives perfect steadiness to the lights. The dynamo is a T.-H. alternating current, which runs 300 16 candle power lights, the current being carried to the town, 1½ miles distant.

We have just received a copy of "Hewlings' Directory of Steam Specialties and Engineering Appliances" for 1891, published by A. J. Hewlings, of 218 Lake street, Chicago. It contains 242 pages of classified lists of articles and an alphabetical index to the manufacturers of them. The principal object of compiling this book was to include and represent complete lists of all the manufacturers of specialties, and every effort has been made to omit none.

THE "MESCO" DRY BATTERY.

The Manhattan Electrical Supply Company, 36 Cortlandt street, New York, has just invented a new dry battery, for which it has applied for a patent. The firm christened the new cell the "Mesco" and registered the same as a trade-mark. It is cylindrical in shape, with a central porous cup containing the negative element and a depolarizer surrounded by an exciting agent containing sufficient moisture to keep the battery in operation. The diameter of the cell is 2½ inches, and the height 6



NEW DRY BATTERY.

or 7 inches to the top of the protruding carbon element. It is claimed that the battery has as long life as any other open circuit cell on the market, and has worked a 2½-inch bell for 21 days through a resistance of 15 ohms. It is proposed to supply new batteries in exchange for those becoming exhausted at a price not to exceed the cost of a porous cup.

NEW BATTERY FIRM.

Mr. Chas. G. Taylor and Mr. Louis Walsh on July 16, became associated in partnership in this city for the purpose of manufacturing and selling fibrous batteries. They will be the sole manufacturers of the fibrous battery—dry and liquid—and Leclanche fibrous porous cups, with headquarters at 100 South Fifth avenue, this city.

Mr. Louis Walsh is well known to the electrical trade and his extended experience in the electrical business generally and particularly with the Crosby Electric Company and Messrs. Alexander, Barney and Chapin, in their battery departments has given him a thorough knowledge of the requirements of the trade in both dry and liquid batteries.

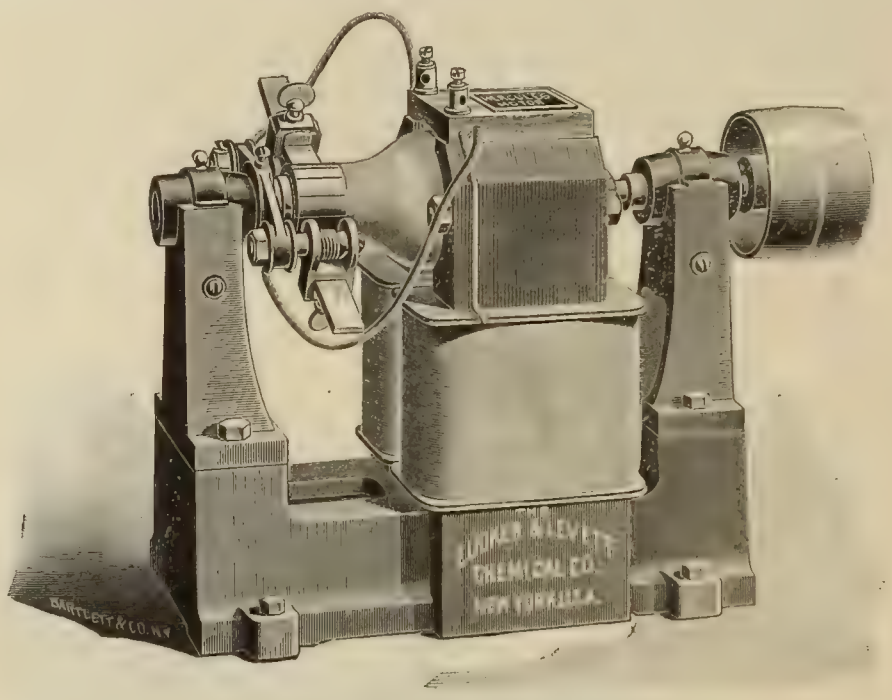
The first order received by the new firm was from one of the largest export houses, which sent in a large order after having given the fibrous battery a thorough test. This test is said to have shown better results than has ever been attained by any other dry battery in the market. The fibrous battery is said to be unquestionably the best dry cell yet produced and the fibrous Leclanche porous cup is an article that will likely meet with a great demand. The fibrous material used is excellently suited for the purpose.

The fibrous dry battery is a radical departure in its construction from other forms of batteries of this character now in use, and exhaustive tests have proved its superiority in the matter of constancy, efficiency, durability and adaptability to every requirement of a first class dry battery. The battery is for open-circuit work only.

Mr. J. Hart Robertson is the electrician for the new house and no other concern in the trade will be held in higher esteem than the new firm of Taylor and Walsh. All of the gentlemen are well known and popular, and no doubt all their friends will wish the new concern a long and busy career.

THE HERCULES ELECTRIC MOTORS AND DYNAMOS.

The accompanying cut illustrates a new motor which is placed on the market by the Zucker & Levett Chemical Co., of this city. As can be seen, the motor is of the inverted horse-shoe type in which the whole of the field cores are stamped



HERCULES MOTOR.

out of one sheet of best Swedish iron, the number of sheets being bolted together to form the magnet frame.

The plates of the armature, which is of the modified "Siemens" type, have teeth forming longitudinal channels on its periphery in which the coils are wound. These teeth, besides reducing the magnetic resistance to a minimum, entirely prevent the coils from being displaced by centrifugal force and consequent burning out of the armature.

The magnet frame is bolted to an iron base, having iron standards and self-oiling bearings, even in the smallest size of machines. By this method of construction a highly efficient and simple form of motor is obtained.

There is absolutely no sparking if the commutator and brushes are kept in fair condition.

The automatic motors are mostly plain shunt wound with an armature of extremely low resistance. The fan motors are plain series wound and run a six blade 12-inch propeller fan at 1,600 revolutions per minute, taking one ampere at 120 volts.

The mechanical details of these machines have been very carefully worked out and all parts are adjustable. Quite a number of the Hercules Fan Outfits are in daily use and are giving universal satisfaction. These machines will be manufactured in all sizes, from one-eighth horse power up, for both light and power.

NEW CATALOGUE.

The Ball & Wood Company, builders of improved Ball automatic cut-off engines, office 15 Cortlandt street, this city, have issued a catalogue illustrating the improved Ball engines made by that company. The catalogue is devoted mainly to the description of the more recent type of engines and the subject is presented chiefly from a commercial rather than an engineering standpoint. Excellent illustrations of the various engines made by this company are given, also illustrations of some of the parts in detail. The works of this company are at Elizabeth, N. J.

It is stated that the Oshkosh, (Wis.) Street Railway may be turned into an electric road.

NEW INCORPORATIONS.

July 8, 1891.—The San Antonio Light and Power Company, of Pomona, Cal.; capital, $240,000; to supply electric light, power and heat, the power to be obtained from the waters of the San Antonio creek. Incorporators, Thos. R. Bard, Hueneme, Cal.; N. W. Blanchard, Santa Paula, Cal.; John D. Hooker, Los Angeles, Cal.

July 9, 1891.—The Carolina Light and Power Company, of Aiken, S. C.; capital, $20,000; to furnish and supply Aiken with electric light, water, etc. Incorporators, R. A. Chafee, B. F. Turner, G. W. Croft.

July 10, 1891.—The Herzog General Electric Company, Newark, N. J.; capital, $1.000,000; for the manufacture, sale and exploitation of all kinds of electrical appliances and other articles. Incorporators, F. B. and P. Herzog, of New York City, and G. G. Frelinghuysen, of New Jersey.

July 11, 1891.—The Shelbyville Water and Light Company (incorporated in West Virginia); capital, $50,000; for the purpose of operating an electric light plant, gas, water and power works at Shelbyville, Ill.; principal office, New York city. Incorporators, C. W. Pelham, Manor, N. Y., H. J. James, Mt. Vernon, N. Y.; J. Frank Waters, Brooklyn, N. Y.; A. F. Babcock, Brooklyn, N. Y.; C. B. Ludwig, Roseville, N. J.

July 14.—The Carpenter Electric Light and Motor Company, of the District of Columbia (incorporated in West Virginia); principal office, Washington, D. C.; capital stock, $100,000; to deal in all kinds of electrical appliances. Incorporators, H. H. Carpenter, J. E. Carpenter and J. T. Burch, Washington, D. C.

July 14.—Beatrice Light and Power Company, Beatrice, Neb.; capital stock, $250,000; to construct and maintain a system of gas and electric light works in Beatrice and other places in Gage county, Neb. Incorporators, Fred. J. Maxwell and William Pickrell, Beatrice, Neb.

July 14.—The Columbian Light, Heat and Power Company, of Chicago, Ill., capital stock $3,000,000; to manufacture the necessary apparatus, to do general light, heat and power business and to buy, furnish, deal in and sell all such apparatus. Incorporators, Newton A. Partridge, Samuel E. Moore and John Irvine.

July 15.—The Wisconsin Gas Company, of Chicago, Ill.; capital stock, $2,000,000; to build and operate gas and electric plants. Incorporators, William J. Lee, Truman M. Hall and Calvin C. March.

July 15.—Harvey Transit Company, Chicago, Ill.; capital stock, $150,000; to construct and operate a railroad in Harvey, Ill. Incorporators, Hiram H. Badger, Charles D. Stanwood and Willets G. Wanzer.

BUFFALO NOTES.

Half of the big Niagara street cars ran to the park, over the Forest avenue line, Sunday afternoon, July 12. The double four-wheel trucks did not take kindly to the sidings and curves on that line. The patience of both passengers and employés was sorely tried by the cars leaving the rails frequently, and slow time was the result. The six-wheeler, however, took to them philosophically, and gave no trouble.

Teamsters are finding out by sad experience, that they cannot block an electric car with the same impunity they did the horse cars and the passengers rather enjoy seeing them shoved off the tracks, if the horses do not suffer by the bullheadedness of their drivers.

The designer of the seats in the Buffalo electric cars either shaped them to a round shouldered man with a hump on the small of his back, or he has an insatiable grudge against Buffalonians. One would almost rather stand.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOM 7–12, "WORLD" BUILDING,
NEW YORK, JULY 18, 1891.

Mr. A. P. Brayton, president of the Pelton Water Wheel Company, sailed for Europe July 14, for a six weeks trip.

The Short Electric Railway Company of Cleveland, Ohio, is about to establish an Eastern office in the World Building, this city.

The Eureka Electric Company, 18 Broadway, recently sold an one hundred light incandescent plant complete, to Vaslier & Mosquera, Cuba.

Mr. C. C. Curtiss, of the Short Electric Railway Company of Cleveland, Ohio, was in the city last week looking after some special large negotiations which his company have on hand in the East

E. T. Copeland & Co., 106–108 Liberty street, general agents for the Case engine, sold to Messrs. Vaslier & Mosquera of Havana, one 13 H. P. Automatic Case engine for electric lighting on a sugar plantation of Cuba.

A. F. Stanley, of Stanley & Hall, 32 Frankfort street, has just returned from his wedding trip through Canada, looking well and happy. His many friends are making special trips to the well filled store on Frankfort street to congratulate him.

M. A. Daverin & Company, Room 34, No. 63 Broadway, have just had placed with them for sale 6,000 Thomson-Houston incandescent lamp key-sockets. As the sockets are new and perfect in every way this is a chance to purchase at a bargain.

Mr. W. E. Crane, the manufacturer of the Baker Waste Oil Filter still with his headquarters at 9 West 13th street, is packing up his effects preparatory to removal to Passaic, N. J. By an error in our issue of July 11 last, the Baker Waste Oil Filter was referred to as the Ellis filter.

Messrs. Vaslier & Mosquera, of Havana, Cuba, are still in this city buying supplies for their electrical supply house. The business of this firm is increasing very rapidly and there is no doubt but that they will be compelled to make their headquarters in this city or open a commission house. The gentlemen are very popular in Cuba. Mr. Vaslier is electrician for the largest steam railway on the island. It will pay manufacturers and dealers of electrical supplies to mail their catalogues and lowest price list to this firm at their Havana address: O'Reilly 114.

The Empire City Electric Company, having gone into voluntary dissolution, Mr. C. P. Beardsley, the receiver appointed by the Supreme Court, is endeavoring to wind up the affairs of the corporation with as little delay as possible. All parties having an interest in the company desire its affairs to be settled, and to help that end the stock is being disposed of at a sacrifice. Everyone in the electrical trade is familar with the quantity and quality of the goods carried by this house, and they will find this an excellent chance to purchase anything in the electrical line.

The following named gentlemen were among the callers at the ELECTRICAL AGE office during the past few days: D. J. Murnane and G. L. Van Beek, of the Underground Electric Traction Co.; E. T. Barberie, of the Safety Insulated Wire Co.; Mr. Hyde, electrician of the Manhattan Electric Light Co., New York; G. H. Usher, manager of the Postal Telegraph Office, New York; Messrs. Vaslier & Mosquera, dealers in general electrical supplies, Havana, Cuba; J. H. Rhotehamel, president of the Columbia Incandescent Lamp Co., St. Louis, Mo.; E. W. Van Wagner, Van Wagner Electric Company, Harrisburg, Pa.

Mr. Charles A. Schieren, of the firm of Charles A. Schieren & Co., manufacturers of patent perforated electric leather belting, left July 16, on the steamer "Fuerst Bismarck," on a short trip to Europe. He will visit the International Electric Exposition at Frankfort, where he will inspect the various devices exhibited there for transmitting power by belting. A recent letter from a visitor to the exposition says that the American leather link belt exhibited by the American Leather Link Belt Company, attracts such universal attention, and is so much superior to all European link belts exhibited, that the other exhibitors have withdrawn all belts of this class from the exposition.

Mr. W. F. D. Crane, of the Engineering Equipment Co., 143 Liberty street, has recently returned from a trip west, and reports a very satisfactory growth of interest in the railway goods being pushed by the company, notably the Kellogg tapering steel pole, which is attracting the well-deserved attention of electric railway constructors and engineers all over the country, inquiries having been received from the far West; the well-known Boston trolley Habirshaw wire, Anderson's line materials and the various other specialties they are interested in introducing. The present business of the Engineering Equipment Co. augurs well for its still more rapid development in the near future.

The Peckham Street Car Wheel and Axle Company, which has its offices at 45 Broadway, this city, and factory at Kingston, N. Y., is kept busy filling orders for its trucks. The truck is receiving much praise for the convenience with which a wheel can be removed. The wheels are entirely insulated from the axle. The Essex Street Railway Company, of Newark, N. J., is using the Peckham truck and testify to the ease with which the cars ride. All oscillation is avoided, giving to the passengers ease and comfort. Mr. B. A. Hughes, the agent for the Peckham car trucks, axles, etc., is meeting with big success in the sale of these trucks. He is receiving duplicate orders from points where they have been introduced.

Mr. Robert A. Keasbey, of Magnesia Sectional Covering fame, 50 Warren street, this city, is without doubt doing more business in covering steam boilers and pipes with Magnesia Sectional Covering than is done by all other boiler or pipe covering methods extant. This covering is the best, and the highest heat resisting material used; always retains its properties and will not decay. It is without doubt superior and cleaner than asbestos. Among a few concerns that have given Magnesia Covering the preference are the Buffalo Street Railway Company, Buffalo, N. Y, for which concern Mr. Keasbey covered over 7,000 feet of pipe and the boilers; the Eastman Dry Plate Company, of Rochester, N. Y., the makers of the Kodak camera, for whom he covered 3,000 feet of steam pipe and boilers, and the Iroquois Hotel, Buffalo, N. Y., where 2,500 feet of magnesia sectional covering were used.

Mr. L. E. Bathrick, 153 Harrison street, Passaic, N. J., with New York office at 9 West 13th street, the manufacturer of the Bathrick patent electric dissipator for printing presses, has taken the agency for the Baker waste oil filters. Mr. Bathrick installed his first electric dissipator on one of the presses of the immense printing establishment of the Butterick Publishing Company (limited), two or three years ago. At the time, the company had thousands of dollars worth of paper on hand which they could not use on account of the frictional electricity generated in printing, causing the sheets to adhere to each other and otherwise delaying the pressmen The use of Mr. Bathrick's Dissipator enabled the firm to use paper possessing electrical qualities with as equal facility as non-electrical paper, and all the presses of the company have been equipped with dissipators ever since. The dissipator effects a saving of several cents on each pound of paper used. The Butterick Company appreciated his attachment so much that they gave him all their electrical work, with offices in their publishing building, 9 West 31st street. Mr. Bathrick has placed a speaking-tube system throughout the entire establishment, and also an electric bell system to notify the thousand or more employés of the morning, noon and evening hours. A large reservation in New Hampshire, owned by the officers of the printing company, was completely equipped with a telephone system by Mr. Bathrick.

We were pleased to welcome to our office and "annex" a few days since, Mr. W. R. Mason, the General Manager of the Electric Merchandise Co., of Chicago. He reports the business of that flourishing company as increasing beyond its fondest hopes, which is not surprising, from the fact that it confines itself exclusively to the manufacture and sale of electric railway supplies and are consequently considered headquarters for such material. The object of Mr. Mason's trip was a meeting with the officials of one of the largest steam roads in the country, who desire to use the Burton Electric Heater in place of stoves and steam heat on some of their special first-class trains. After consulting with Mr. S. Dana Greene, the consulting electrician of the Burton Company, as to electrical details, arrangements were made and another step is taken which will in time result in a strictly electric train. The Burton Electric Company is to be congratulated on the favorable outlook for their product, due in great measure to the ability of their new president, backed by the standing of the Electric Merchandise Co., whose facilities for handling such appliances are unequalled.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany (Elec.) Railway Co. (N. Y.)	750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Aluminum Co.	350,000	100 00	100 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co. (N.Y.)	1,000,000	25 00	3 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Atlantic Ave. Ry. Bkln	2,000,000	100 00	102 00
Aut. Phon. Exb. Co	25,000		+
Averell Insulating Conduit	3,000,000	100 00	5 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	188 00
Bell Telephone 7's	2,000,000		*112
Birmingham Ry & Elec. Co., 6's Ala	1,500,000		par
Boston Electric Light.	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	81 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brooklyn City R.R.	6,000,000	10 00	15 50
Brooklyn City R. R. 5's	6,000,000		*104
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N. Y.)	500,000	20 00	10 00
City Electric St. Ry. Co., 6's (Ark.)	200,000		par
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	164 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co. (N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80,000		par
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 50
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	12 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*99
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill Convt. Certs	70,000		+
Edison General	14,000,000	100 00	164 00
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Equitable G. & E. Co. (Utica)	4,000		+
Erie Telephone	4,800,000	100 00	48 50
Essick Printing Tel.	5,000,000	100 00	40 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	12 00
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00

Names of Companies.	Capital.	Par.	Price.
Hackettstown Elec. Light (N. J.).	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*103
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7 500,000	100 00	14 50
Laclede Gas pref	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*75
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Montague St. Ry., B'klyn	150,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	75 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	17 25
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	52 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	93 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,600,000	100 00	
North New York, Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6's Manitoba	50,000		par
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	92 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston.	200,000	25 00	25 00
Pittsburg Reduct. Co. (Aluminum)	1 000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	65 00
Rockaway Elec. Lt. Co. 6's	75,000		par
Russell Electric Co. (Boston)	300 000	5 00	5 00
Saratoga Gas and Elec. Light 6s	300,000		*86
Saginaw E. L. & P. Co. 6's Mich.	50,000		par
San Diego Gas & Elec. Co. 6's Cal.	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation., N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co.	16,000		†
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L., H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	39 50
Thomson-Houston Pref.	4,000,000	25 00	24 50
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100,000		par
T.-H. L. H. & P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.)	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	30 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine Street Motor Co. 6's (Colo.)	100,000		par
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	79 75
Westinghouse Electric Co.	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			19 25
West End St. Ry. Boston	4,500,000	100 00	66 00
Winston-Salem Elec. St. R.R. (N C.)	250,000	100 00	75 00
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent. †Registered Stock.

FINANCIAL.

Every stock or bond holder in every corporation in the United States using an incandescent lamp is interested in the decision of Judge Wallace rendered a few days since in the United States Circuit Court, and were this the court of last resort, each incandescent lamp used from this date to the end of the Edison patent would be forced, and properly, to obtain a license, which would no doubt be granted without needless delay, and pay a fair patent royalty to the Edison General Company. This would not apply to Edison subcompanies; they in fact might in their territory add the royalty to their dividends or sell light for the amount of the royalty less than other systems. Where the shoe would pinch the hardest, is in the hundreds of cases where contracts have been signed to furnish incandescent light for several years to come at a commercial profit. These companies for the term of their contract can make no extra charge to cover this new expense. There is no uncertain sound in the decision; it covers thirty-three pages of type-written legal cap; that many words substantially includes it all; practically, that Mr. Edison discovered the carbon or filament, overcame the mechanical difficulties, invented the present incandescent lamp, patented it, introduced it commercially for the peoples' benefit, and that he and his assignees are entitled to all the profit for the life of the patent. This means about $3,000,000 for money collected in the past and $12,000,000 in royalty payable during the next six years, when the patent expires. It will pay all incandescent shareholders to watch the patent list, as granted, in the Electrical Age each week, and secure a positive knowledge of patent incidents. An appeal was immediately taken which may possibly be argued this fall, call it next May; then, if this decision is upheld, we may look for consolidation and compromise which will give the public the benefit of the best and most economical light, and the investors an absolutely satisfactory security.

Notwithstanding the decision in the Edison case, and a rise from 98.50 to 105.50 in the price of the "single member" on the New York Stock Exchange, the reorganization of the Westinghouse Co. was perfected. The new board of directors are respectable, eminent in finance, will very soon eliminate all errors of the past, and make every action in the company's machinery progressive. The 40 per cent. loss will soon be recovered, and even the non-assenting stockholders if ever found, will gradually but surely be absorbed into the family. The company will start off with $3,000,000 to operate with, plenty of legitimate demand for their goods at remunerative prices, and if the directors at once list the whole of their present securities and their future bonds as soon as taken by the public on the New York Stock Exchange, permitting the people to join in their profits, they will find, should dark days again come upon them, that the investors will protect their own.

WESTERN NOTES.

The Central Electric Company of Chicago is showing samples of a new porcelain insulator, which it will place upon the market within a few days.

The Electric Merchandise Company, No. 11 Adams street, Chicago, Ill., has just secured the exclusive agency for Pratt's Patent Register, for registering fares on street cars. The company is continually on the lookout for new and good things and is full of enterprise. It has learned by experience that business men appreciate enterprise.

The Partridge Carbon Company, manufacturers of electric light carbons and battery material, Sandusky, Ohio, is meeting with an excellent trade. The quality of the goods manufactured by this company is first class and unsurpassed. It is said that it makes the best motor brushes on the market, and as there is an increasing demand for these brushes the reputation is evidently well founded.

The Central Electric Company of Chicago has recently taken some very large orders for electroliers and other electric light fixtures for several public buildings in the Northwest. It reports a large trade on these articles and that the demand is constantly for better goods than have heretofore been supplied. At a recent life test of one hundred Packard lamps, by a superintendent, who is generally considered extremely finical on the question of lamp efficiency, the average life was found to be 2,113 hours. The Central Electric Company of Chicago is handling these lamps in the West and reports that its sales are constantly increasing and that the capacity of the factory is now being doubled to meet this new demand.

The new Chicago *Herald* Building has placed an order with the Western Isolated Lighting Department of the Thomson-Houston Electric Company for a plant consisting of one 10,000 and one 15,000 watt arc dynamo with 50 double carbon arc lamps, which will be novel in some respects. Special permission was obtained from the city electrician for the concealing of the arc light wires in this building, and a high grade of rubber covered wire will be used, protected by interior conduit and laid in the cement flooring. A circle of six lights will be placed on the flag staff, so arranged that they can be raised or lowered at will with perfect ease by one man. Special fixtures for suspending the arc lamps, a number of which will be placed on the front of the building, have been designed and the wires leading to these fixtures will be brought through the building front. In order to accomplish this, it will be necessary to drill in some places through five feet of brick and terra cotta, and in other places through about three feet of solid granite.

FOREIGN NOTE OF INTEREST.

The Berliner Elektricitätswerke is about to reduce its charges for motive power, so that small electric motors will be able to be run at a lower cost than those using any other form of energy.

KIND WORDS FROM FRIENDS.

New York Electrical Society,
Office of the Secretary, New York, July 16, 1891.

Editor Electrical Age, N. Y,

Dear Sir:—Allow me to thank you for the exceedingly nice report in the Electrical Age, of the meeting of the N. Y. E. S. at El Dorado, Yours truly,

Geo. H. Guy.

New Haven, Conn., July 15, 1891.

We note with pleasure the steady growth and development of your paper and congratulate you on the same.

We are well aware that it only comes from hard and persistent work on your part, and it is certainly worthy of a just reward.

We gladly admit the great benefit which we weekly receive from a careful reading of your excellent paper.

Yours truly,
The Denison Electrical Engineering Co.,
J. F. Denison, Electrician and Manager.

BUSINESS NOTES.

At the fourth annual exhibition of the Amateur Photographers Society of New York, held in May, 1891, the Clark Electric Company was awarded a silver medal of excellence for their arc lamp for electric optical lantern apparatus. This is the first and highest medal ever issued by the society for electric light for optical purposes in photography, and opens up another channel of usefulness for the Clark apparatus.

The New York Electrical Works, 155 Leonard street, (Simmons Building), are prepared to make contracts for the manufacture of electric light specialties, small motors, etc. Their machinery is of high grade, and the workmen employed of exceptional skill and intelligence. Correspondence solicited.

Inventors and draughtsmen will be interested in the Engineer's Sketch-book of Mechanical Movements, which gives nearly two thousand illustrations of movements, devices, appliances, contrivances and details employed in the Design and Construction of Machinery. By T. W. Barber, price $3.00 E. & F. N. Spon, 12 Cortlandt street, N. Y.

The Electric Age Publishing Co., World Building, New York, keeps all electrical books for sale. Send for catalogue.



A WEEKLY RECORD OF THE STREET RAILWAYS OF THE WORLD.

ELECTRIC MERCHANDISE CO.,

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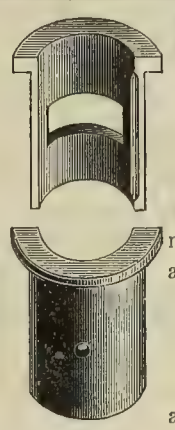
Strictly Noiseless and More Durable than Steel.

As steel is to iron, so is new process raw hide to all other raw hide.

THE NEW PROCESS RAWHIDE CO.,

Patentees and Sole Manufacturers,

Syracuse, N. Y., U. S. A.



REMOVED

TO 29 BROADWAY, N. Y.



We extend to all Street Railway and Electrical men an invitation to call on us—inspect our samples and get prices on

STREET RAILWAY SUPPLIES.

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SEE STREET RAILWAY DIRECTORIES, PAGES XIX TO XXV.

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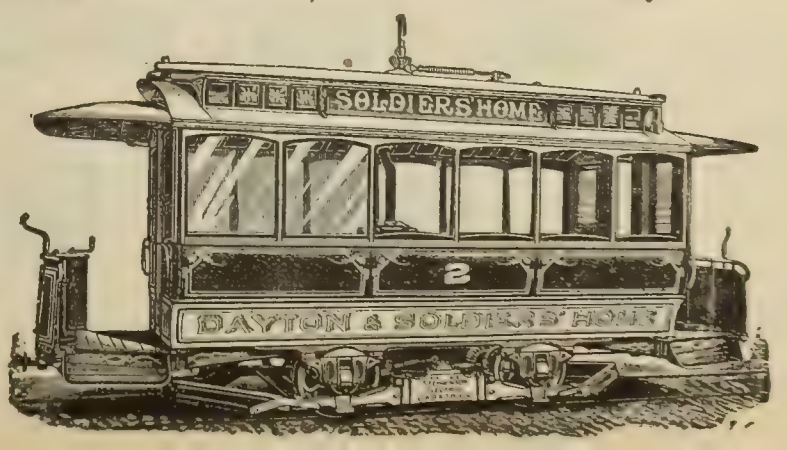
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STREET RAILWAY DEPARTMENT OF THE ELECTRICAL AGE—NEW YORK, JULY 25, 1891.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,

Publisher.

J. B. TALTAVALL, *President*, T. R. TALTAVALL, *Sec. and Treas.*

W. T. HUNT, *Vice-President*, E. V. CAVELL, *General Manager*.

ADDRESS ALL COMMUNICATIONS TO

RAILWAY DEPARTMENT ELECTRICAL AGE,

WORLD BUILDING,

Telephone, 2361 Cortlandt. NEW YORK.

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"ITS WHEELS GO ROUND."

Those who have carefully examined the two first issues of the STREET RAILWAY NEWS and enlightened themselves with this, its third number, cannot but admit that "its wheels go round." Not for one moment since its inception has its wheels of progress and improvement ceased to revolve—nor will they cease to revolve until their revolutions cease to accomplish anything. The elimination of electric railways from the general list and their classification in a list of their own—the arrangement of the first directory of street and suburban railways using dummy locomotives, steam or tramway motors, ever published—the publication of no less than 27 cuts—cuts of deep interest to the street railway constituency—cuts which have not appeared in any form, before or since, in any other paper, pamphlet or catalogue—the splendid aggregation of "Street Railway Notes," "New Incorporations," "Franchises," "Casualties," etc., closely classified for ready reference—the superb list of illustrated street railway patents, together with many other exclusive features should be sufficient to convince anyone that the wheels of the STREET RAILWAY NEWS "go round."

The publisher of STREET RAILWAY NEWS, the railway department of the ELECTRICAL AGE, is determined to give "*News*"—news in both its closest and broadest sense—no cut which of the publisher's knowledge has appeared in any other paper; no three or four weeks' collection of items from street railways will be permitted to find place in STREET RAILWAY NEWS.

In the establishment of this, its weekly railway department, the ELECTRICAL AGE clearly foresaw and realized that it would have to make it first or nowhere, and now realizes more fully than ever how highly its enterprise is appreciated and how general is the consensus of opinion that "its wheels go round."

EIGHTEEN MILLION CAR MILES PER ANNUM.

One of the first really authentic detailed statements ever made regarding the comparative cost of operating both horse and electric lines, has just been made by President Whitney, of the West End Street Railway Company, of Boston.

The statement goes to show that in spite of the West End Company still being imperfectly equipped electrically, in fact having to purchase some of its power, the company has increased its net earnings for the month of June, '91, almost $30,000 over those of the corresponding period last year, which, if kept up, will bring the net earnings up to very nearly $200,000 for the present month—a splendid increase over that of a year ago, and a significant endorsement of the overhead system of electric traction.

One of the most interesting facts developed in the comparative statement is that the percentage of operating expenses shows for

Animal traction	71.95
Electric "	58.18
	13.77

a difference of nearly 14 per cent. in favor of an electric road. Regarding motive power: electric traction shows up only 8.22 per cent. as against 10.86 per cent. for animal. The net earnings per mile show a record of 16.07 per cent. in favor of the electric system as against that of 9.60 for horses. The car record shows a total annual mileage of 18,000,000 miles.

Experience has taught the West End Company that long cars are economical investments, the increased capacity netting about 47 per cent. per car mile last month.

A detailed statement of the operating expenses, etc., of the West End Co. will be found elsewhere in this issue, and which will show the splendid foresight of President Whitney when he decided upon the substitution of electric for animal traction.

"SCOOPED."

A very amusing incident comes to our knowledge as we are about to go to press, and which tends to show that STREET RAILWAY NEWS is very much alive in news gathering and in the exploiting of new devices.

A week or two ago the promoters of a certain system of underground conduit for street railways located in the *World* Building; cuts of the device appeared almost immediately in STREET RAILWAY NEWS; after the discovery of the publication of which, we understand that more than one gentleman connected with a paper having offices in the same building, paid a visit to the promotors (having discovered the address of the company in STREET RAILWAY NEWS), prepared to investigate the system, and, incidentally of course to boom their paper.

The value of STREET RAILWAY NEWS as an advertising medium was, in this case, clearly demonstrated, but the enterprising publishers of the paper in question must, in all fairness, admit themselves to have been "scooped."

RINGING UP FARES.

Our attention was recently called to a custom prevalent among the conductors on the line of the Bath, Bay Ridge and Bensonhurst Railroad, of ringing up the fare immediately upon the car being boarded by a passenger. We ascertained that in one particular case a party boarded an open car with a friend, that the two fares were rung up at once, and paid; after a while rain and wind drove the parties into the front car, which was a closed one, whereupon the conductor of the latter immediately rang up two more fares, and which, to save a row, were paid.

Just what the rule is with regard to the ringing up of fares on the cars in question, we do not exactly know, but it looks to us as though the present system cannot but be a faulty one, as should a conductor occasionally get left by being overzealous, the odds are dollars to doughnuts that he will reimburse himself at the company's expense before he turns in his register, a state of things to be avoided to the greatest possible extent.

IMPROVEMENTS.

Attention is called to the improvements in this issue; the elimination of the electric railways from the general list, and their close classification in a list of their own, etc., all of which improvements are in direct line with our determination to leave nothing undone to make STREET RAILWAY NEWS second to no paper in its particular sphere.

CABLE ROAD AND CONDUIT.*

In these days of rapid progress and development, one of the chief wants of the people of most every community is rapid transit in some form, so that it may travel from one part of the town to another part in the shortest time possible. The horse car is fast becoming an historical relic, and as a means of conveyance has outlived its usefulness. It is fast being supplanted by more modern methods.

In populous towns, where rapid transit is a necessity, the question is at some time or another presented, "What form of rapid transit shall be adopted in place of the horse car?" Steam cannot be generally permitted for street traffic for obvious reasons; so then the question is narrowed down to a choice of two systems—cable or electric. These represent the highest development of rapid transit in cities and towns up to the present time.

In some communities the cable system is preferred for many reasons, but as usually constructed it is very expensive to establish and maintain. Cable roads have heretofore been built for the sole purpose of carrying passengers. Now, it happens that in most places where these roads are constructed, underground pipes and wires are come in contact with during the construction operations, and these have to be relaid at considerable additional expense.

If the pipes and wires are relaid below the level of the cable conduits, there will always exist the possible necessity of digging up the streets at any time to effect repairs. Such operations are necessarily injurious to the stability of the cable conduits, and are to be avoided as much as possible. Any cable system, therefore, that provides for the accommodation of underground wires, etc., in such a manner that all future necessity for digging up the streets to make repairs is removed, would seem to be a great improvement on existing methods.

Such a system we now illustrate, and which is designed to meet all of the objections and overcome all difficulties incident to the ordinary construction and operation of cable roads.

In this system no yokes are used; no pipes need be disturbed, electric wires of all kinds may be laid in suitable troughs or pipes placed in the conduit wherever desired, and there is no liability of the grip slot closing up. The conduit can be constructed of sufficient height to allow a man to walk along under the beams, and can be connected with sewers for drainage purposes. Entrance to the conduit is by manholes. It is claimed by the inventor that by the use of this system there is absolutely no need of disturbing pavements to get at pipes or wires, and all annoyance and interference with public traffic in consequence of torn up streets is entirely avoided.

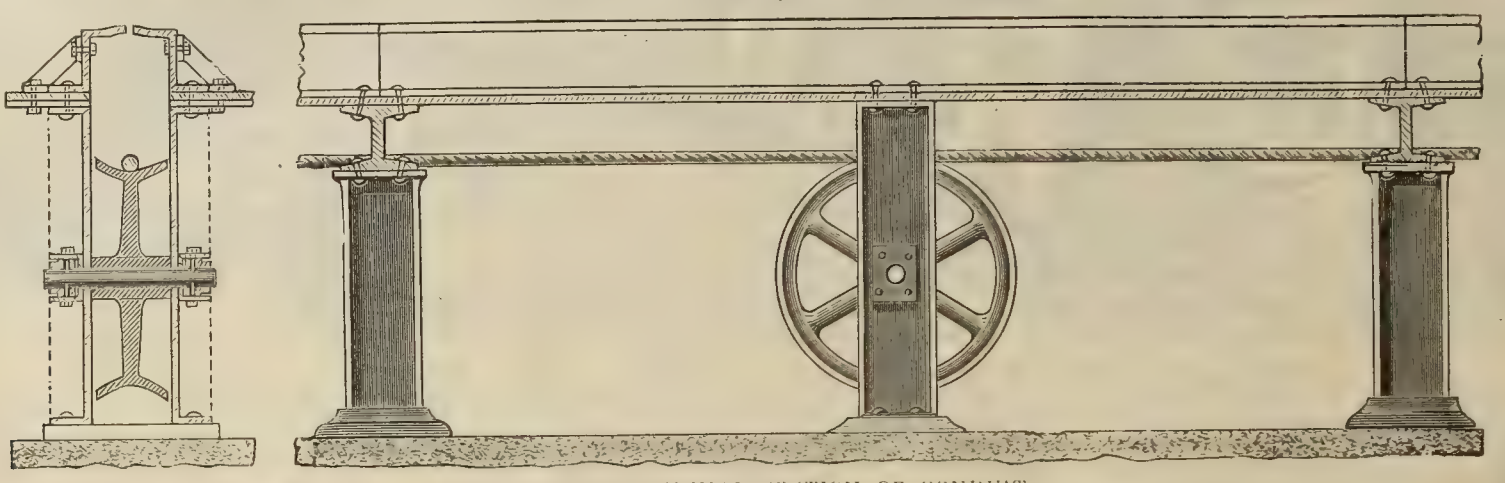


FIG. 1—LONGITUDINAL SECTION OF CONDUIT.

Fig. 1 gives a side view of the cable conduit, and Fig. 3 represents a plan view of one section of the same.

Fig. 2 represents a vertical cross section of the cable road and conduit, with a manhole between the two tracks. The posts under the two outside rails, between the main girders, serve as an extra support to the road bed.

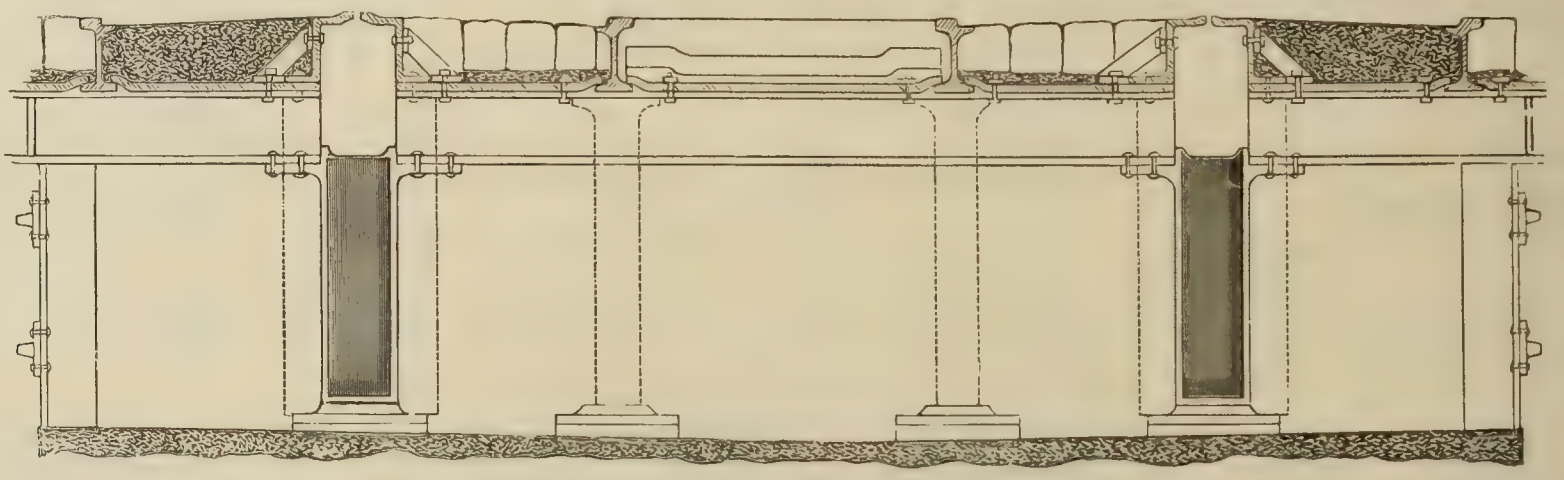


FIG. 2—VERTICAL CROSS SECTION CABLE ROAD AND CONDUIT.

Fig. 4 represents the foundation or main post, the I beam girder that supports the road-bed and the grip slot braced from the girder and covering plates to the upper edge of the angle iron. The ends of the I beams are set into sockets on the top of the posts, thus preventing contracting of the grip slot. The posts are made of cast iron, resting on a bed plate set in concrete, and all the beams, covering plates and angle irons are of steel.

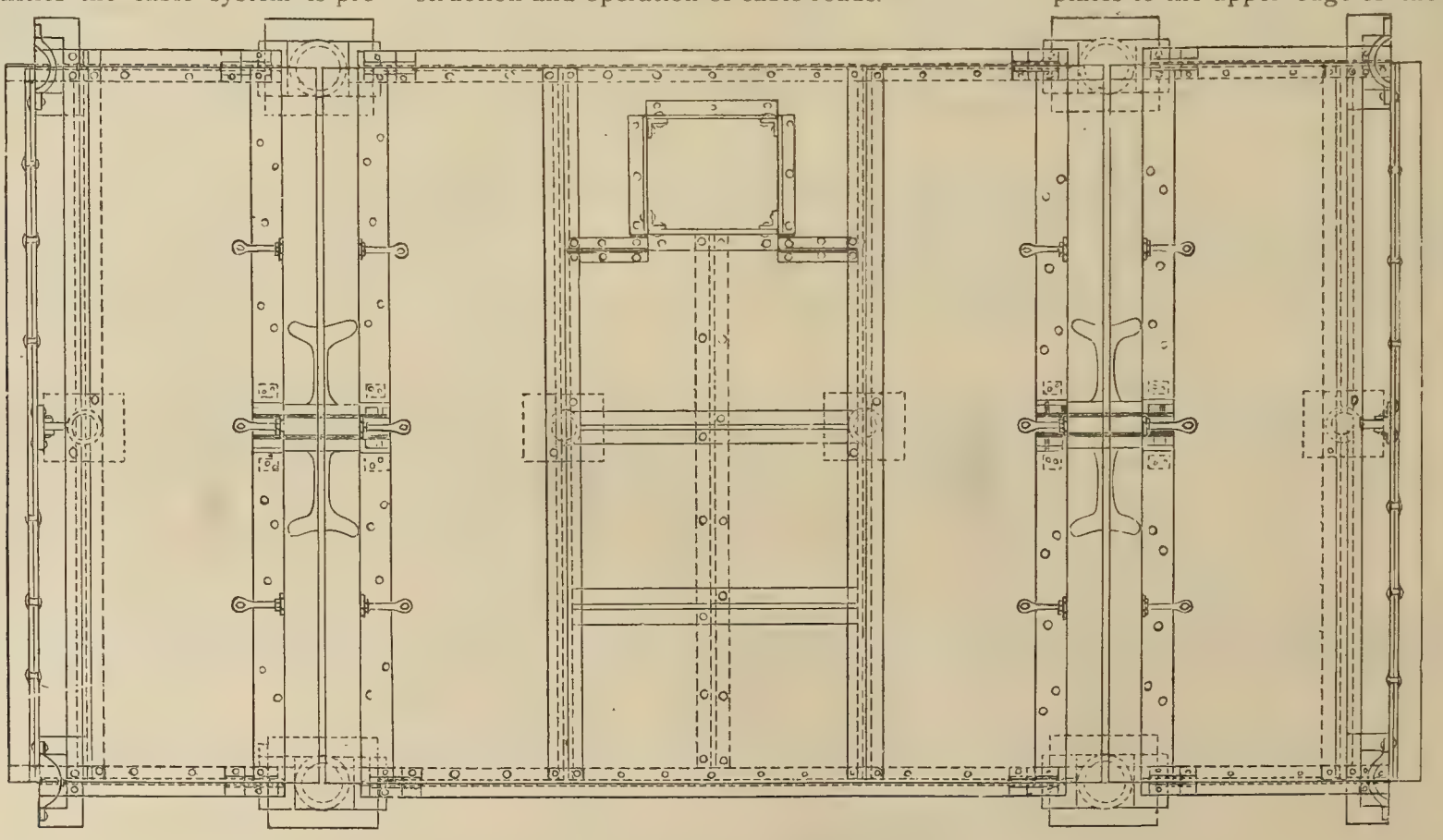


FIG. 3—PLAN VIEW CABLE ROAD AND CONDUIT.

*R. T. White, New York.

ELECTRICITY VS. THE HORSE.

The following statistics concerning the comparative operation of the West End Street Railway, of Boston, as respects horses and electricity in the months of April and May have been obtained officially and are believed to be the first authentic statements made public in detail as to the comparative cost of horse and electric lines in operation.



FIG. 4—MAIN POST CABLE ROAD CONDUIT.

The West End is as yet imperfectly equipped electrically, buying its power where it has not had time to complete its own plant and has labored under the many organization disadvantages arising from so great a change as from horse to electricity, and President Whitney has, therefore, only very reluctantly consented to give these figures for publication after many requests.

APRIL STATEMENT.

	Electric.	Horse.	Total.
Gross receipts.....	$134,321.00	$344,396.00	$478,717.00
Total operating expenses	85,834.00	276,947.00	362,781.00
Net earnings.....	48,487.00	67,449.00	115,936.00
Per cent. operating exp.	63.36	80.62	76.82
Earnings per mile run..	34.05	31.77	32.39
Total exp. per mile run..	21.75	25.55	24.54
Net earned per mile run.	12.30	6.22	7.85

MAY STATEMENT.

	Electric.	Horse.	Total.
Gross receipts.....	$144,638.00	$374,605.00	$519,244.00
Total operating expenses	84,163.00	296,556.00	353,720.00
Net earnings.....	60,475.00	105,049.00	165,524.00
Per cent. operating exp.	58.18	71.95	68.12
Earnings per mile run..	38.43	34.22	35.29
Total exp. per mile run..	22.36	24.62	24.04
Net earned per mile run.	16.07	9.60	11.25

The long electric cars make even a better showing than the above. They are operated by the same-sized Thomson-Houston motors as the smaller cars and by reason of increased capacity earn considerable more per mile. The Company is operating 75 of these cars now, has 75 more in the shops awaiting adjustment of trucks and will eventually have many more in operation. These long cars earned $83,000 or 44 cents per mile operated in May and 46.9 cents per mile operated in the first half of June, the latest obtainable figures.

When the West End has finished its own power houses, it is calculated that it can reduce expenses of operating its electric cars to at least 20 cents per car mile and with the long cars earning above 40 cents per car mile, it can considerably extend the long car service and still operate them upon a basis of 50 per cent. for expenses. The Tremont street line is the next to be equipped with the Thomson-Houston electric system.

The West End service covers about 18,000,000 car miles run per annum and it is not difficult from this fact and the data above given to figure that the change from horse to electricity is more than worth the expenditure upon capital account.

The net earnings of the West End gained over the previous year—$15,000 in May—and though the figures are not yet made up, it will probably show a gain of $30,000 net for June. The net earnings of June and July should be about $200,000 for each month.

SNOW PLOW AND SWEEPER.*

With the introduction of electricity as power for propelling street cars came the necessity for providing means for keeping the tracks free from snow in the winter time. Naturally, inventive genius was turned in the electric channel with the result of the production of the electric snow plow and sweeper which is a familiar object during the winter in places where electric roads are operated. Sweepers operated by horse power are clumsy and objectionable in many respects, and everyone knows the difficulty drivers experience in handling several teams of horses attached on one sweeper in the crowded streets of a city. Electric power, however, has changed all this. The electric snow plow and sweeper goes along performing its work without any of the noise and excitement which usually accompany the operation of the horse-driven sweeper.

The electric snow plow and sweeper, moreover, performs its work in a more satisfactory manner. The plow at the front end digs up and throws the snow to one side and the sweepers at the rear end brush it off, leaving the tracks perfectly clean and free from obstruction.

The accompanying illustration shows a form of snow plow and sweeper recently placed upon the market.



ELECTRIC SNOW PLOW AND SWEEPER.

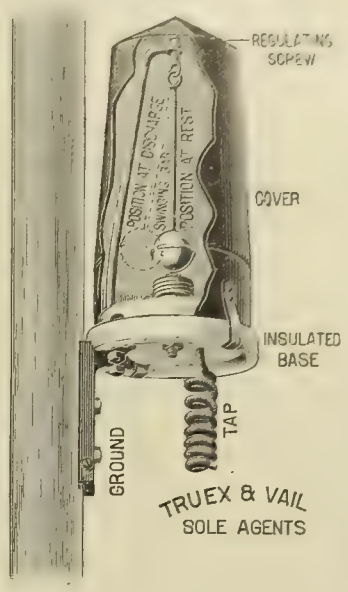
The entire apparatus is driven by two 15 H. P. or larger Edison motors, and the sweeper is operated by an additional motor connected to them, the whole of the machinery being easily handled and under the direct control of the man in charge. The use of these machines avoids much trouble on electric roads after snow storms.

A 50 years' concession for working electric railways in Spandau has just been granted to the International Electric Company of Boston. Work has to be commenced within three months.

*Edison General Electric Company of New York.

LIGHTNING ARRESTER FOR ELECTRIC RAILWAY LINES.

A new arrester has been placed upon the market by Truex & Vail, known as the Swinging Ball Lightning Arrester, which we illustrate below. It is especially adapted for street railway companies. It has undergone some very severe practical tests on some of the largest electric lighting plants in the country, and it has never met with a single case of failure.



LIGHTNING ARRESTER.

For the trolley system, where they are placed on every fourth pole, and also at the station to protect the dynamos, it will reduce the liability of damage from lightning to a minimum.

Any company's system being thus equipped would be perfectly safe as far as lightning is concerned.

The arrester is attached to the line by a tap shown in the cut. This also connects with the discharge plate. The bracket by which it is attached to the pole also has a binding post for the ground connection. When the lightning strikes the line, it jumps from the discharge plate to the swinging ball, at the same time causing the ball to swing aside, thus avoiding the following arc.

We have received through the courtesy of Secretary William J. Richardson, of the American Street Railway Association, a copy of the verbatim report of the ninth annual meeting of that association, which was held at the Hotel Iroquois, Buffalo, N Y., October 15 and 16, 1890. The report contains 177 pages and is gotten up in the best manner possible, both as to typography and quality of paper. An elegant steel engraving of Mr. Thomas Lowry, the president of the association, adorns the frontispiece of the book, and at the back is a very complete list of the companies that are members of the association, with the names of their officers.

STREET RAILWAY NOTES.

ALABAMA.

Anniston.—Col. Savage and those associated with him, intend to run a new street railway north from 23d and Noble streets to a lake a mile north of the city.

CALIFORNIA.

Sacramento.—The City Trustees have refused the Central or Electric Street Railway the privilege of running upon P street, on the ground that it would injure the business of a road partially paralleling such a line.

W. B. Rayford of Auburn, is endeavoring to induce capitalists here to construct an electric road in Auburn. The road, as proposed, will make a circuit of about three miles. Sacramento capitalists are favorably impressed with the project.

DELAWARE.

Wilmington.—The Wilmington City Railway Company began laying tracks down French street from Fourth toward the P. W. & B. station, July 13. The company is pushing the work as rapidly as possible. The new passenger station at Delaware avenue and Du Pont street will be 220 by 68 feet. It will have iron walls and a slate roof. The company expect to have electric cars running on Delaware avenue in about 30 days.

ILLINOIS.

Chicago.—The Canadian Pacific Railroad desires to purchase the Lake street elevated road for the purpose of increasing its terminal facilities.

The South Side Alley "L" road is meeting with some difficulty in obtaining condemnation of certain school property between 28th and 29th streets. The matter is now before the courts.

The citizens of the southwestern part of the city want better street car facilities in their section, and will spare no efforts to secure that end.

East St. Louis.—The residents along the line of the electric street railway between Broadway and the rolling mill, are anxious to see the line in operation. The delay seems to be caused by the non-arrival of machinery from the East.

Freeport.—The street car lines here will likely change ownership within the next few days, and will pass into the hands of Indiana capitalists. Capt. Barnes stated that the deal would probably go through.

INDIANA.

Indianapolis.—Work on the Irvington electric line, which was stopped on account of the non-arrival of iron poles, has been resumed. The poles have been delivered and have been set as far west as the deaf and dumb asylum. The track of the North Indianapolis road has been laid as far as Michigan road bridge over Fall Creek.

The new Broad Ripple Street Railway Company, composed of Cincinnati capitalists, is considering a proposition to take hold of the property and franchise of the old Broad Ripple Rapid Transit Company, to reorganize the company and to build a line to Broad Ripple over the Central avenue private right of way.

IOWA.

Atlanta.—W. H. Applegate of this place is the patentee of an electric railway system which is somewhat novel. It is the combination of the cable system and electricity, the current passing through the cable and the car picking up the cable with a grip.

Dubuque.—The Key City Electric Street Railway Company, has been ordered to complete its line of railway in West Dubuque by August 10; otherwise the City Council will declare forfeited all rights granted to the company.

Creston.—Steps have been taken to build a street railway in this place, and there is a sentiment in favor of using electricity as the motive power.

KANSAS.

Salina.—The power house of the street railway company will have a 200 H. P. boiler and a fine Corliss engine.

Objections have been made against the laying of T rails by the street car company here, and work has been suspended temporarily.

KENTUCKY.

Covington.—The South Covington & Cincinnati Electric Car Co., have contracted for additional engines and generators. It is thought the increased power will be sufficient to run all of its Newport lines.

MARYLAND.

Baltimore.—Mr. James F. Lewis of New York, representing the Makarskie American Compressed Air Motor Company, is endeavoring to secure permission from the City Passenger Railway Company to try his motor on that company's line. The system is now in operation in several European cities.

Forty-five thousand dollars was offered by the Belt Line Road, to purchase a portion of the Bolton lot for the purpose of erecting a passenger depot. The city officials have declined the offer, on the ground that the amount is insufficient.

MASSACHUSETTS.

Newburyport.—The Newburyport and Amesbury Street Railway Company is preparing plans for a new brick car house. Architect J. E. Bailey is drawing the plans.

New Bedford.—An electric road is talked of on Summer street.

Worcester.—The 400 H.P. Corliss engine to be used in generating the current for the Worcester, Leicester & Spencer Electric Railway, is now being put in place.

Marblehead.—At a meeting of the selectmen July 14, that body was unanimously in favor of granting permission to the Naumkeag Street Railway to string overhead wires for an electric system.

Quincy.—A handsome street car built by the Burnham & Dugan Railway Appliance Co., has just been bought by the electric street railway here. The car is 18 feet long, and is three inches wider than the ordinary cars. The motive power is the invention of John Christiansen, using but one motor to a car, placed on the inside above the floor. The power is transferred from the motor to the two axles by means of an endless belt. The gearing is placed in a tight box, and runs in oil. A flooring placed under the belt keeps the dust and water from it. By means of a lever on each platform changes of gearing can be made, giving a variety of speeds to the car. The flanges of the car wheels have teeth to cut the ice from the groove inside of the rail in winter, allowing the car to run as easily as in summer. The trial trip is to be made at once.

MICHIGAN.

Grand Haven.—The City Council has authorized the Mayor and Recorder to contract with the Electric Construction and Supply Company of New York for a street railway and lights. The work is to be begun byAugust 1 and to be finished by November 1.

Flint.—The Fenton and Lone Lake Street Railroad has been a decided success from the start.

Detroit.—At a meeting of the Common Council July 7, Major Pingree's veto of the new street railway ordinances was sustained.

MINNESOTA.

Minneapolis.—Mr. Thomas Lowry, the president of the newly consolidated Twin City Street Railway Company, estimates that the improvements in the street railway service in Minneapolis and St. Paul for the past 15 months, have cost in the neighborhood of $6,000,000.

NEW YORK.

Brooklyn.—It was expected that the Montague Street Cable road would be in operation July 14, as everything was in readiness for starting on that date, but President Lewis postponed the opening of the road until the 20th.; the cable was spliced by an electric welding machine.

The property owners of the 8th ward held a mass meeting on the night of July 11, in opposition to the proposed introduction of the electric trolley system on Third Avenue.

Buffalo.—The citizens are complaining that there are not enough cars on the new electric road.

Salamanca.—Eugene Ellery and F. B. Pickering of New York, have secured the contract for the construction of an electric railroad, to connect Killbuck, West Salamanca and Salamanca. The road is to be completed before December 1.

Canandaigua—The street railway officials are talking seriously of adopting electricity on their lines. They have secured the necessary permission from the authorities.

New York.—The elegant storage battery cars that were run on the Fourth avenue line up to a few months ago, remain unprotected from the weather in a vacant lot back of the Fourth avenue car stable. Their decorations are fast going to ruin.

Waverly.—A franchise has been granted for the construction of an electric street railroad.

NEBRASKA.

Omaha.—The street railway company has substituted the dial fare registers on its cars, for the bell punches used by the conductors.

TRACK EXTENSIONS.

CALIFORNIA.

Sutter Creek.—Steps have been taken to organize a company and secure a franchise for an electric railway from the Ione terminus of the Southern Pacific Railroad to this place, with branches to Plymouth and Jackson. The distance is twelve miles.

CONNECTICUT.

Ansonia.—The street railroad has been double tracked from the Green to Railroad Grove.

Bridgeport.—The Street Railway Company has obtained permission to lay its tracks along Park Avenue.

ILLINOIS.

Rockford.—The West End Street Railway Company wants to secure the right of way over Middle Bridge to Kishwaukee street.

Chicago.—Efforts are being made among the influential citizens on the West Side, with a view to securing cross town car lines throughout that section of the city.

MASSACHUSETTS.

Beverley.—The Beverley & Danville Railroad Company wants to run its cars over the Naumkeg tracks on Rantoul and Cabot streets, making a circuit by Elliott street.

Boston.—The West End Railroad Company is putting down new rails in Roxbury. The trolley wires will be erected very soon, and in a short time electric cars will be running. The electric line on Tremont street will be running to the ferry in a few weeks.

Gloucester.—The Street Railroad Company is to extend its line to Lanesville.

Taunton.—The Taunton Street Railway Company contemplate extending their line to East Taunton.

Worcester.—Work in laying the tracks of the Shrewsbury Street Railway is progressing rapidly. It is probable that the Westinghouse single trolley system will be used on this line. Two Fiegel cars have arrived from New Utrecht, L. I. President Platt says the road will be over two miles long, and its construction (for the road bed alone) cost $15,000 per mile.

MICHIGAN.

Detroit, Mich.—The Gratiot avenue street car line is to be extended out as far as Leesville, and

the Healey motor will be used between the latter place and the city limits.

SAGINAW.—The Union Street Railway Company is extending its line along South Washington avenue.

MINNESOTA.

DULUTH.—Work on the extension to West Duluth of the street railway has been begun. Manager Chase will push the construction.

NEW HAMPSHIRE.

CONCORD.—The Concord Street Railway Company has been granted leave to change the location of its line on Turnpike street, from the intersection of Main and West streets to its southern terminus.

NEW YORK.

BROOKLYN.—A majority of property owners' consents have been secured and the extension of the Fifth avenue line of the Brooklyn elevated road to Fort Hamilton, and its East New York branch to the city line, will be commenced before Fall.

Application has been made to the Jamaica Town Board by the Brooklyn City Railroad Company for permission to extend its Myrtle avenue line to Richmond Hill. The proposition is regarded with favor. It is the intention of the company to eventually operate the whole road by electricity.

MT. VERNON.—The East Chester and Yonkers Surface Railway Company wants permission to run the overhead trolley system through some of the principal avenues here.

SYRACUSE, N. Y.—The Syracuse Consolidated Street Railway Company has petitioned for a franchise to lay a double-tracked road on Midland avenue, from Colvin street to the city line, and on Brighton avenue, from Midland avenue to South Salina street, and to use electricity as a motive power on the extension.

PENNSYLVANIA.

McKEESPORT.—The McKeesport Passenger Railway Company is extending its lines, and double tracking a portion of the road.

WESTCHESTER.—A right-of-way between Chester and Media has been secured by the Rapid Transit Company, and it is expected to have the road bed completed October 1.

WILKESBARRE.—The Suburban Electric Railway Company has obtained permission to extend its line into Parsons.

TEXAS.

FORT WORTH.—Considerable progress is being made on the new street car line to the Cotton Mills and College. It is expected that the line will be in operation by September.

WASHINGTON.

SPOKANE.—The Spokane Street Railway Company has completed part of its extensive electric system, the work on which was begun last January. The cost of the improvements is about $250,000.

WISCONSIN.

MILWAUKEE.—There is quite a fight in progress over the efforts of the Villard syndicate to extend its street railway line up Fond du Lac avenue. The opposition from the residents and property holders along that thoroughfare is determined and strong.

INCREASE OF CAPITAL.

NEW BEDFORD, Mass.—The East Wareham, Onset Bay and Point Independence Street Railway Company voted at a stockholders' meeting, July 14, to increase their capital stock to $26,000. A portion of the increased stock will be sold to provide funds for additional equipment.

MORTGAGE.

LAWRENCE, Mass.—The Merrimac Valley Street Railway Company has executed a trust mortgage to secure the payment of $350,000 first mortgage 5 per cent. gold bonds. The International Trust Company holds the mortgage.

FINANCIAL.

BALTIMORE, Md.—The cable traction syndicate has made application to the Baltimore Stock Exchange to list $1,500,000 first mortgage 5 per cent. bonds and $5,000,000 stock of the company.

DETROIT, Mich.—The sum of $5,170 has just been paid into the City Treasury by the street railway company, which represents one and one-half per cent. of its gross earnings for the six months ending June 30.

The street railways of this city pay 9 per cent. of their gross earnings into the City Treasury.

STATISTICS.

BOSTON, Mass.—On July 4 the West End Street Railway carried about 500,000 passengers. The present earnings of the company continue to gain at the rate of about $1,000 a day.

BUFFALO, N. Y.—On July 4 the Buffalo street cars carried 35,000 more passengers than on any previous day in the history of the roads, and 60,000 more than the daily average. The electrics handled the lion's share; they were literally packed all day.

CUMBERLAND, Md.—The electric street railway was opened July 4, and the cars were very liberally patronized. The receipts for the day were $700. The completed line is ten miles long.

NEW YORK.—The 1,500 horse cars in this city each earned on an average $20 a day last year.

The Twenty-third Street Railway Company on July 9 paid into the City Treasury $21,482 for car licenses on the Bleecker street line, covering the period from 1869 to 1873.

ONEIDA, N. Y.—During the year just ended the Oneida street railway carried 103,541 passengers; an increase of 6,024 over last year.

ELECTION OF OFFICERS.

AUBURN, N. Y.—At the annual meeting of the stockholders of the Auburn City Railway Company, July 7, the old board of directors was re-elected with the exception of H. E. Cobb, of Boston, who was succeeded by E. K. Sibley, of the banking house of Marquondley & Palmer, New York. The board of directors subsequently re-elected all the old officers of the company.

DULUTH, Minn.—On July 8 the street railway company held its annual meeting. Thomas Lowry and Samuel Hill were re-elected, and Luther Mendenhall was elected vice-president. Mr. A. S. Chase will act as manager until the next meeting, Aug. 1, when he will retire.

POUGHKEEPSIE, N. Y.—At the annual meeting of the stockholders of the Poughkeepsie City Railroad Company, held July 7, directors were elected for the ensuing year as follows: John I. Platt, Edmund Young, Silas Wodell, James Reynolds, William R. Innis, Edward S. Atwater, A. V. V. Haight, Ferdinand R. Bain, William H. Young. The following officers were also elected: President, William H. Young; Vice-president, Edward S. Atwater; Secretary, Silas Wodell; Treasurer, Edmund Young.

WILMINGTON, Del.—At a meeting of the stockholders of the Wilmington City Passenger Railway Company, July 15, the following directors were elected for the ensuing year: Daniel W. Taylor, Charles S. Howland, Edward Bringhurst, Jr., Preston Lea, William Canby, Willard Saulsbury, Jr., and William Du Pont.

INCORPORATIONS.

BELLVILLE, Ill.—The citizens of this town want to organize a company to operate an electric road in this place, and eventually extend it to East St. Louis.

CHICAGO, Ill.—The Homewood, South Harvey & Harvey Electric Dummy Railroad Company, has been organized with a capital of $50,000. Incorporators: Wm. C. McClintock, Isaac A. Hartman and Fred. A. Bangs.

The Norwood Park & Maine Electric Railroad, of Chicago, has been organized with a capital stock of $250,000. The company proposes to operate lines of street railway from the village of Desplaines to some point in the city.

The Blue Island Railroad Company has been incorporated with the object of running a street railway from the village of Blue Island to Calumet. Capital stock $25,000. Incorporators: J. B. Crooker, E. M. Warren, Wm. J. Heather, Henry Biehl and Harry M. Sacklary.

The Applegate Electric Conduit Railway Company has been organized to sell electric patents and power and engage in general electric business. The capital of the company is $2,500,000. Incorporators: Wm. H. Applegate, Wm. H. H. Thomas and Albert S. Wright.

CORPUS CHRISTI, Tex.—The Gussett Street Railway Company has been organized with a capital of $10,000.

LOCKPORT, N. Y.—The Lockport & Olcott Beach Electric Railroad Company has been organized with a capital of $120,000. The company propose to build an electric road from Lockport to the village of Olcott on Lake Ontario; the line will be 12 miles in length.

MILWAUKEE, Wis.—The first move in the direction of the construction of an electric elevated road between Milwaukee and Chicago has been taken. The Interstate Electric Railway Company has been incorporated with that object in view, at Madison, Wis., capital $1,000,000.

SUTTER CREEK, Cal.—The Amador Electric Railway and Light Company, with a capital of $500,000, was incorporated July 8, for the purpose of constructing, acquiring, operating and maintaining a line of railroad, and to maintain and operate telegraph and telephone service along the line thereof. Incorporators: E. C. Voorhies, R. C. Downs and S. N. Knight, all of Sutter Creek.

FRANCHISES

BERKELEY, Cal.—Application for a franchise to run a street railroad on San Pablo avenue has been made by F. B. Hoskins, E. L. Fitzgerald, E. M. Green and others.

COLUMBIA, Pa.—An ordinance has been passed granting the use of the streets to the Columbia and Ironville electric railway. The road must be in operation by July 1, 1893, and is to be free from taxation until July 1, 1895.

DAYTON, Ohio.—Two fifty-year franchises have been granted to the Wayne & Fifth Street and Oakwood Street Railway Companies. Charles B. Clegg is president of the latter road, and George W. Shaw president of the former.

EAST LIVERPOOL, Ohio.—A franchise has been granted for the building of a street railroad here. Mr. A. Armstrong has been instrumental in bringing the matter to a conclusion.

NEWTON, Mass.—It is likely that a franchise will be granted to the Garden City Street Railway Company for a storage battery line between Newtonville and Newton Centre.

PRESCOTT, Ariz.—An ordinance has been passed granting right-of-way to the Santa Fé, Prescott and Phœnix Railway Company through a number of streets of this city. There are no restrictions as to the kind of motive power to be used.

ZANESVILLE, Ohio.—A franchise has been granted to build a street railway here.

Foreign.

Toronto, Ont.—On July 13, the Street Railway Committee decided by a vote of 9 to 7, to give a street railway franchise to the Kiely-Mackenzie-Everett syndicate.

Casualties.

Altoona, Pa.—The stable of the Altoona City Passenger Railway Company was destroyed by fire during the night of July 13. An engine and other machinery and seven cars were burned. The horses were taken out safely after considerable effort.

Attleboro, Mass.—The electric railway suf fered a heavy loss by the burning out of one of the large generators, July 13.

Buffalo, N. Y.—While Jake Sweeney was driving along Main street on July 5 his buggy was struck by a trolley car and smashed. The horse received slight injuries, but Sweeney and his two companions escaped unhurt.

Mr. Frederick Pike was severely injured by being thrown out of a carriage, the horses having become frightened at a trolley car corner of Niagara and Massachusetts streets, July 4.

Brooklyn, N. Y.—On July 12 a fire engine, while on the way to a fire, collided with a car on the Myrtle Avenue line. A passenger on the street car was thrown off by the shock and slightly injured

Alphonso Miszkovke was killed Sunday night, July 12, by falling from the elevated train at Lori mer street. It is claimed by the dead man's sis ters and friends that he was pushed off the train by one of the guards.

Charlestown, Mass.—While attempting to board a car on the West End road July 8, Andrew J. Smith fell and broke two ribs

Detroit, Mich.—The Detroit Street Railway Company has been sued for $5,000 by Peter F Kean, for injuries alleged to have been received in a collision of two cars on that road.

New York.—There exists a dangerous condition of affairs on Broadway, between 26th and 28th streets, where the cable construction work is being carried on for the Broadway Railroad. The temporary tracks are laid so close together that there is not room for a person to stand between two cars passing in opposite directions. A few evenings ago a colored man stuck his head out of a car window at this point, and got a crack, the noise of which was heard 100 feet away. He was not seriously injured.

Newark, O.—The manhead of the boiler in the power house of the Newark City Electric road blew out on July 8, causing some damage and a delay of about five hours. No one was injured.

Pittsburg, Pa.—Viasi Vito, a little Italian four years of age, was run over and killed by a cable car on the Pittsburg Traction Company's line, on Fifth avenue, July 8. The gripman could not stop the car in time.

Rochester, N. Y.—On July 9 one of the engines in the power house of the electric road broke down, depriving the system of the use of two of the generators for twenty-four hours or more

Worcester, Mass.—Mrs. Caroline E. Riley has sued the Worcester Consolidated Street Railway Company for $5,000, for injuries received on one of the cars of the company about a month ago.

Miscellaneous.

The following-named cities in Texas operate electric roads; the name of the system used and the number of miles of track of each road are also given: San Antonio, Westinghouse, 45; Galveston, Rae, 29; Fort Worth, Thomson-Houston and Sprague, 17; Houston, Sprague, 12; Dallas, Sprague, 9; Waco, Thomson-Houston, 7; Austin, Westinghouse, 4; Sherman, Thomson-Houston, 3.

Personal.

Mr. F. H. Holmes, representing C. H. Davis, of New York City, was in Brattleboro, Vt., a few days ago, and advocated the use of electric power on the proposed street railway.

MORE KIND WORDS.

Letters continue to reach us from readers of the Electrical Age regarding the introduction of Street Railway News within its covers. From the number that have reached us, we pick out the following two:

Office of the Easton, South Easton and West End Passenger Railway Co.
Easton, Pa., July 15, 1891.

E. V. Cavell, Esq.,
Gen. Mgr. Railway Dept. Electrical Age.

Dear Sir:—I have just received a copy of the Electrical Age of July 11, and find you are General Manager of its "Street Railway Department". In your coming East to assist in the management of the Electrical Age, the great West will find it has lost an indefatigable worker, an earnest writer and a very pleasant gentleman, always looking after the interests of street railway people and their requirements.

Sincerely hoping you will have success far beyond your hope in your new position, that Street Railway News will flourish under your management and that you will be long with us, I am, with sincere regards,

Yours very truly,
H. A. Sage, President.

The New Process Raw Hide Company.
Syracuse, N. Y., July 18, 1891.

Mr. E. V. Cavell,
Gen'l Manager, Street Railway News, N. Y. City.

Dear Sir:—The two copies of the Electrical Age with your Street Railway News Department, devoted entirely to street railways, have interested us to the extent that we herewith enclose a contract for one year.

The work you have accomplished in these two issues is wonderful, and if you keep on for a year at the rate you have started out, you will have the satisfaction of finding yourselves without an equal in the field.

Wishing the Street Railway News the broadest measure of success, we remain,

Very truly yours,
The New Process Raw Hide Co.,
A. C. Vosburgh, Sec'y.

A. W. Rounds, President Russell Electric Company, Boston, Mass., writes: "We fully appreciate the merits of your paper, and for railway work we consider it at the head."

DELAWARE & HUDSON COMPANY.

For the information of those who have never visited the Canadian metropolis, but who are intending to go to the Montreal meeting, it may be stated that the shortest and most interesting line between Montreal and New York is the Delaware & Hudson Railroad. Parties from the West can go to Schenectady or to Albany, connecting at either point with the "D. & H." road, and see something of Saratoga, Lake George, Lake Champlain and the marvelous scenery of the Adirondack Mountains. The "D. & H." stands at the head in the number and importance of the summer resorts along its line, and in the number of summer tourists carried in its trains.

Arrangements should be made to include a stop at the Hotel Champlain on the west shore of Lake Champlain, three miles south of Plattsburgh, which, architecturally and in beauty of location of surroundings, is perhaps the finest affair of its kind in the world.

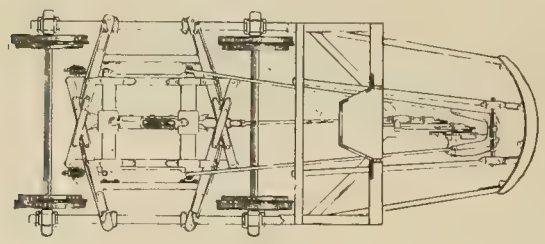
Mr. J. W. Burdick, general passenger agent of the Delaware & Hudson Railroad, Albany, N. Y., will be glad to send by mail an illustrated guide of the line, upon receipt of six cents in stamps, to cover postage.

THE ELECTRICAL AGE'S ILLUSTRATED PATENT RECORD.

STREET RAILWAY PATENTS—Issued July 14th, 1891.

455,763. Subway and Connection for Electric Railways. William Osuer, Chicago, Ill. Filed Oct. 13, 1890.

A subway for electric railways, formed by a supplemental rail or bar having a bearing upon the foot of the track-rail and clamping-plates, whereby conductors forming



455,774—CABLE CAR.

parts of an electrical circuit or circuits are secured to one of the rails which are so placed as to provide between them a continuous slot for the passage of a connector between the motor and the conductors.

455,774. Cable Car. John Stephenson, New York, N. Y. Filed Nov. 8, 1890.

A cable car having a truck-bearing, a grip-machine carrier extending to the car-front, with a grip-operating lever fulcrumed in the grip-carrier extension, and a rod in two sections united and adjustable in length by a turn-buckle, the rod connecting the grip-machine with its operating lever.

455,798. Trolley for Electric Cars. Walter H. Knight, Newton, Mass. Filed April 8, 1891.

An alarm for electric-railway trolley-arms having an actuating device connected to and operated by the movement of the trolley-arm.

455,842. Street Car. Friend W. Smith, Jr., and Samuel S. Williamson, Bridgeport, Conn. Filed Feb. 16, 1891.

In an electric motor car means for facilitating the stopping of the car without arresting the revolution of the motor or motive car wheels, consisting in instrumentalities for raising the wheels from the track.

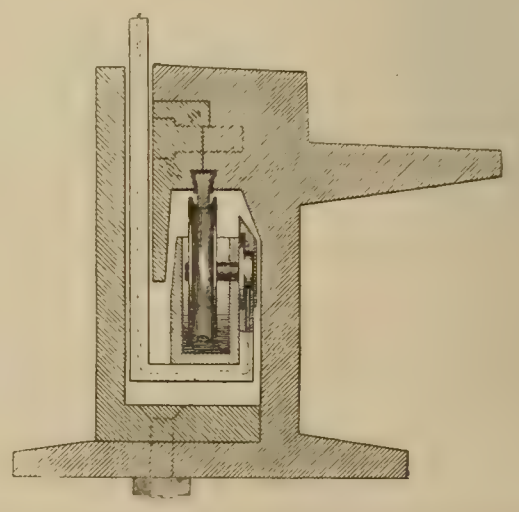
455,956. Electric Railway System. Samuel P. Wilcox, Elkhart, Ind., and Joseph D. Partello, Rochester, Mich. Filed June 16, 1890.

The combination of two electrical conductors forming the main electrical circuit, a series of disconnected conductors, a cylinder for each disconnected conductor, each cylinder having electrical connection with one of the disconnected electrical conductors and one of the main electrical conductors, each cylinder being journaled in suitable supports and having electrical conductors within adapted to be brought together and separated by the rotation of the cylinder and means for rotating the cylinder.

455,990. Car Truck. John Taylor, Troy, N. Y. Filed Nov. 28, 1890.

Side beams with corner castings attached thereto, having inwardly-projecting extensions, to which end bars are bolted.

456,098. Street or Station Indicator for Cars. Geo. H. Tietjen, San Francisco, Cal., assignor of one-half to Geo. H. Bahrs, same place. Filed Jan. 20, 1890.

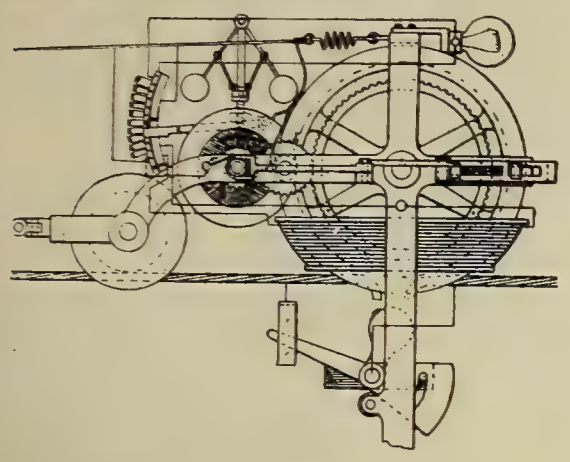


455,763—SUBWAY AND CONNECTION FOR ELECTRIC RAILWAYS.

The combination of a casing, a card-carrying shaft mounted therein, a plate depending from the casing and forming part of a circuit-breaker, and an electric motor driving the shaft and having electrical connections with the circuit-breaker, the whole arranged to be actuated alternately by the several cards upon the shaft, so as to break the circuit to the motor and stop the rotation of the shaft.

STREET RAILWAY PATENTS—Continued.

456,101. Truss for Elevated Structures. Ephraim M. Turner, George L. Van Beek, and Lewis A. Brown, St. Louis, Mo., assignors to the National Unicycle Elevated Railway Construction Company, East St. Louis, Ill. Filed Oct. 2, 1890.



455,796—ELECTRIC RAILWAY.

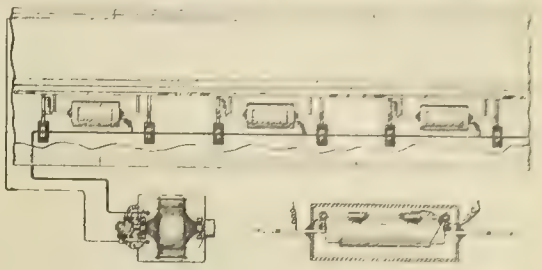
A single main rail having a series of apertures formed in its web at intervals of its length, in combination with suitable supports, and strap-hangers passing through the apertures and supporting portions of the structure located beneath the rail.

456,102. Truss for Elevated Structures. Ephraim M. Turner, George L. Van Beek, and Lewis A. Brown, St. Louis, Mo., assignors to the National Unicycle Elevated Railway Construction Company, East St. Louis, Ill. Filed Oct. 2, 1890.

In a truss, the combination of the upper chord, a lower chord comprising parallel headed and based rails, supports therefor, U-shaped straps applied to the bases of the rails at intervals of their length, base blocks supported by the straps or stirrups, braces applied to connect the blocks, and tension-posts and straining devices.

456,103. Motor-Truck for Elevated Railways. Ephraim M. Turner, George L. Van Beek, and Lewis A. Brown, St. Louis, Mo., assignors to the National Unicycle Elevated Railway Construction Company, East St. Louis, Ill. Filed Oct. 2, 1890.

A motor-truck for three-rail electric railways, having a roofed body through which the main supporting-wheel pro-



455,956—ELECTRIC RAILWAY SYSTEM.

jects upwardly with substantially vertical shafts pivotally connected at their upper ends to it, and guide-wheels mounted upon the lower portions of the shafts and adapted to yieldingly ride against the guide-rails.

ELECTRICAL PATENTS.

Issued Tuesday, July 14th, 1891.

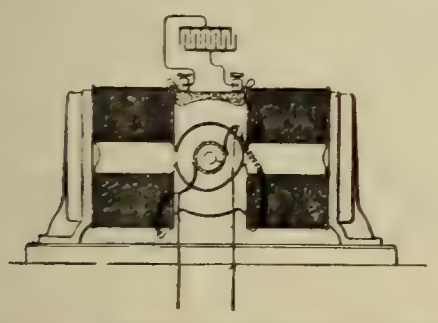
455,747. Loop Switch. William M. Goodridge, Highland Park, assignor to the Western Electric Company, Chicago, Ill. Filed March 4, 1887.

The combination, with the handle, of a cylinder of insulating material, two springs mounted near their centre, one upon each end of the cylinder, insulated contact-pieces included between one pair of opposing ends of the two springs and other insulated contact-pieces adapted to be included between the other pair of opposing ends of the two springs when the handle is moved to the proper position.

455,765. Electric Motor. Harry H. Porter, New York, N. Y. Filed Jan. 17, 1891.

In an electric motor suitable field magnets having parallel connecting-yokes wound with magnetizing coils.

455,773. Alternating Current Motor. William Stanley, Jr., Pittsfield, Mass., and John F. Kelly, New York, N. Y. Filed April 10, 1891.



455,773—ALTERNATING CURRENT MOTOR.

The combination with an electro-magnetic motor provided with a commutator and having its field and armature circuits in derivation, of a condenser included in the circuit having the higher self-induction.

455,788. Thermostat. Henry A. Chase, Boston, Mass. Filed Oct. 29, 1888.

In a thermostatic fire-alarm system, the combination of a thermostat comprising a spring-actuated circuit-changing lever, material for sustaining the lever in position against the tension of its actuating-spring, electric contacts for the circuit-changing lever, and a resistance-coil normally short-circuited or shunted out by the circuit-changing lever, an electric circuit in which the thermostat is placed, and a receiving-relay responsive to a weakening in the circuit caused by the introduction of the resistance-coil,

455,789. Process of Manufacturing Insulated Conductors. Charles Cuttriss, New York, N.Y. Filed Aug. 6, 1890.

The art of insulating electric conductors consisting in applying to or winding on a conductor the loose fibers of a material such as cotton and compacting the same to form a felted or matted sheathing.

455,790. Dynamo-Electric Machine or Motor. Justus B. Entz, New York, N, Y. Filed Nov. 24, 1890.

A field-magnet system consisting of two coils of wire on a single core and two sets of pole-pieces, one set connected with the ends of the core and the other set connected with the core at a point or points intermediate of the coils.

455,796. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Original application filed May 22, 1886. Divided and this application filed Oct. 6, 1886.

In a system of a telpherage, the combination of a conductor divided into sections, switches which normally bridge from one section to the other, traveling trains or vehicles, one or more electric motors on the trains or vehicles by which they are driven, and devices operated by the trains or vehicles to move the switches successively and divert the current to the motors on the trains or vehicles, so that the motors are connected in series through the divided conductor.

455,800. Electric Cut-off Apparatus. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 15, 1886.

In a circuit-closing device for an electric circuit, the combination of a set of opposing strips or wires connected, respectively, to the positive and negative terminals of the resisting path traversed by the current, and an interposed insulating-film between the strips or wires, with the device whereby an arc may be produced in proximity to the film for the purpose of destroying the film and bringing the strips or wires into electric connection with each other.

455,808. Electro-Magnetic Ore Separator. Jonas Wenstrom, Orebro, Sweden, assignor by direct and mesne assignments, of two-thirds to Olof Wenstrom and William W. Manning, Marquette, Mich. Filed Dec, 24, 1890.

A feed mechanism for magnetic separators, provided with a series of adjustable presenting-rolls, a carrier-belt, and an adjustable drum over which the carrier-belt passes.

455,809. Magnetic Separator. Jonas Wenstrom, Orebro, Sweden, assignor by direct and mesne assignments of two-thirds to Olof Wenstrom and William W. Manning, Marquette, Mich. Filed Dec. 24, 1890.

In a magnetic separator, the combination, with suitable armatures, of a magnet for the armatures, and means whereby the distance between the magnet and armatures may be varied.

455,813. Thermostat. Henry A. Chase, Boston, and Howard F. Eaton, Cambridge, Mass. Filed Nov. 1, 1888.

In a thermostat, two independent levers and co-operating contacts, and means affected by changes in temperature of different degrees, for moving them successively, whereby the normal condition of the circuit may be changed by one lever and thereafter restored by the other lever, combined with an inclosing case or shell.

455,815. Electro Phonometer and Phonoscope. Isaiah H. Farnham, Wellesley, assignor to the New England Telephone and Telegraph Company, Boston, Mass. Filed Feb. 13, 1891.

A method of comparing disturbing currents in electric circuits, which consists in causing them to vary the field of a magnet-pole exercising attraction upon a vibratory diaphragm, in noting the sounds produced by the diaphragm under the variation, and then in withdrawing the currents gradually from the pole until the sounds cease, and noting the extent of separation.

455,837. Electric Switch. Carl G. Dahlgren and John H. Svensson, Gothenburg, Sweden. Filed Dec. 24, 1890.

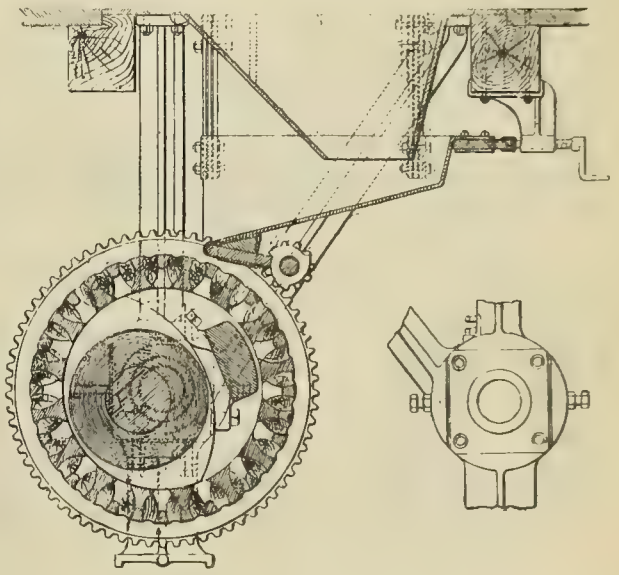
455,855. Electric Indicator. Earl C. Eldredge, Springfield, Mass. Filed Feb. 9, 1891.

The combination of an electro-magnet having curved pole-pieces formed in the segment of a circle, with an armature-bar pivotally mounted between its ends, and with its ends arranged to traverse the lines of pole-pieces, and means to move the bar backward to its normal position.

455,856. Holder for Carbon Brushes of Commutators. Clarence H. Farrington, Milford, Mass. Filed Oct. 21, 1890.

455,873. Signaling Apparatus. Howard F. Eaton, Quincy, assignor to George W. Gregory, Boston, Mass. Filed Sept. 23, 1889.

One or more signal-transmitters and a signal-receiving relay connected by an electric circuit, the transmitters being constructed and arranged to change the condition of the circuit for intervals of different duration, combined with



455,809—MAGNETIC SEPARATOR.

a register contained in a local circuit governed by the armature of the signal receiving relay and a bell contained in another local circuit, but governed by the same armature, and a retarding device for the armature, whereby it is caused to differentiate.

455,887. Armature for Dynamo-Electric Machines, Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 21, 1891.

The combination, with a ring-armature having its coils wound through the ring and supports therefor engaging with its core, of two or more separate segmental coil-supports bearing against the inner side of the coils and radially adjustable.

455,898. Electric Motor or Dynamo-Electric Machine. Charles G. Curtis, New York, N. Y. Filed March 9, 1891.

The field magnet or magnets for multipolar electric motors or dynamo-electric machines, composed of opposite pole-pieces with straight bars, portions, part of which form the other pole-pieces, connecting cores and the field coils or windings placed upon the cores so as to form the four magnetic circuits, the field coils being each surrounded by a water and oil tight shell or casing.

455,904. Insulated Electrical Conductor. Edwin D. McCracken, Alpine, N. J., assignor to the Norwich Insulated Wire Company, New York, N. Y. Filed March 5, 1891.

An electrical conductor having an insulating tape formed of twisted paper or paper cord flattened, wound thereon in an open spiral.

ELECTRICAL PATENTS—Continued.

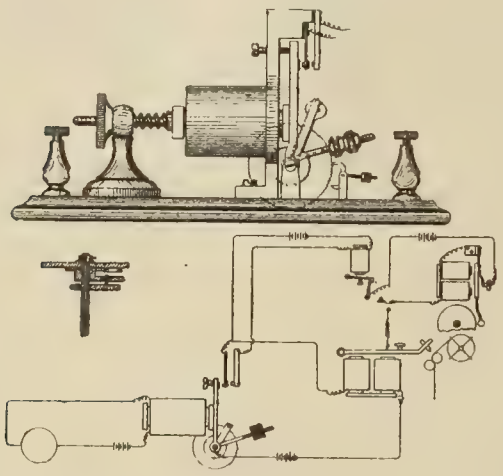
455,953. Cut-out for Arc Lamps. Charles E. Scribner, Chicago, Ill. Filed Nov. 4, 1890.

455,955. Lightning Arrester. Charles S. Van Nuis, New Brunswick, N. J., and Jonathan H. Vail, New York, N. Y. Filed Oct. 16, 1890.

455,968. Secondary-Battery Plate. John R. MacLaughlan, Philadelphia, Pa., assignor to Simon Miller, same place. Filed June 3. 1890.

455,971. Armature for Dynamos. Frederick L. McGahan, Indianapolis, Ind. Filed Dec. 26, 1890.

An armature provided with an external friction-rim con-



455,873—SIGNALING APPARATUS.

centric therewith, such friction-rim supported upon brackets bolted or secured to the body of the armature between the bobbins.

455,972. Electro-Medical Lighting Apparatus. Paul Oudin and Henri O. Kratz-Boussac, Paris, France. Filed Oct. 13, 1890.

An incandescent electric lamp having a section or support adapted to be mounted upon the extremity of the finger, a second section adapted to be secured upon another joint of the finger, and contacts at the adjacent ends of the sections whereby the circuit is completed through the lamp by flexing or reflexing the finger.

455,981. Apparatus for Administering Electricity. George H. Bethel, Sydney, New South Wales, assignor to the Bethel Electric Medical Baths Company, Limited, Melbourne, Victoria. Filed Oct. 13, 1890.

In an apparatus for adminstering electricity to the human body, the combination, with a cradle or support provided with an inclined back of a vertically-adjustable plate adapted to be inserted in the water behind the inclined back and connected with a supply of electricity.

455,984. Magnetic Separator. Henry G. Fiske, New York, N. Y., assignor to John D. Cheever, same place. Filed March 26, 1891.

A centrifugal acting feeding device for feeding the mixed mass of magnetic and non-magnetic particles across the field on the under side of the magnets.

455,985. Magnetic Ore Separator. Henry G. Fiske, New York, N. Y., assignor to John D. Cheever, same place. Filed March 26, 1891.

The combination of a feed-belt or conveyer, a transverse belt or separator crossing the feed-belt a short distance above the same, and a series of magnets having their poles in close proximity to the separator, the poles alternating in polarity in the direction of motion of the separator.

455,986. Terminal for Electric Batteries. Hammond V. Hayes, Cambridge, Mass., and Angus S. Hibbard, Morristown, N. J., assignors to the American Bell Telephone Company, Boston, Mass. Filed Jan. 19, 1891.

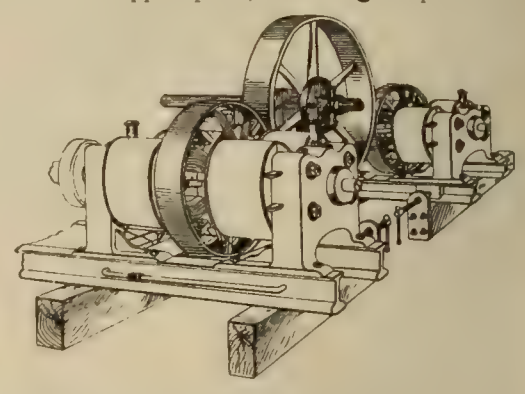
A battery-terminal connection dispensing with binding-screws and consisting of terminal wires having one of their ends molded into or imbedded in the battery-plates, respectively, and having their other ends coated by dipping or otherwise with easily fusible alloy for mechanically and chemically homogeneous attachment to circuit or instrument wires.

456,006. Street or Station Indicatro. William T. Snedden, San Francisco, Cal., assignor by mesne assignments to the Electric Street and Station Indicator Company, same place. Filed Jan. 14, 1891.

In a street or station indicator, the combination, with one or more electro-magnets, of one or more levers of the third order having pivotally mounted upon their ends a pawl, a card-cylinder having a ratchet engaged by the pawl, one or more levers having an armature upon their rising and falling ends and connected at the ends to the levers of the third order, a circuit for the magnets, and a circuit making and breaking device.

456,021. Electric Belt. Lewis N. Fancher, Kansas City, Mo. Filed April 6, 1891.

The combination of a cell formed with a copper core, an absorbent material surrounding the core, a copper plate passing on either side of the absorbent material, return bends in the copper plate, and a U-shaped zinc plate



455,971—ARMATURE FOR DYNAMOS.

engaging the outer copper plate and return-bends in the same.

456,023. Railway Time Signal. Joshua C. Dickover and Walter Scott, Hot Springs, S. D., assignors of one-half to Joseph B. Dickover and Charles G. Fargo, both of same place. Filed Feb. 24, 1891.

456,110. Automatic Circuit Closer for Telegraph Keys. James W. Brown, Van Wert, Ohio, assignor of one-half to Augustus L. Sweet, Henry W. Blachly, and John M. Tryon, all of same place. Filed April 16, 1891.

456,120. Insulated Electric Conductor. Edwin D. McCracken, Alpine, N. J.. Filed March 4, 1891.

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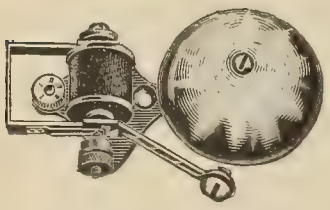
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WEEKLY.

Vol. IX. NEW YORK, AUGUST 1, 1891. No. 31.

DECISION IN THE ACCUMULATOR CASE.

The following is the full text of the decision of Judge Coxe, of the Circuit Court of the United States, Southern District of New York, in the case of the Brush Electric Company *vs.* the Electrical Accumulator Company *et al:*

THE BRUSH ELECTRIC COMPANY,
vs.
THE ELECTRICAL ACCUMULATOR COMPANY *et al.*

W. C. WITTER and W. H. KENYON, for the complainant.

FREDERIC H. BETTS, for the defendants.

COXE, *J.:* This is an equity action founded upon three Letters Patent, granted to Charles F. Brush for Improvements in Secondary Batteries, as follows: No. 337,299, granted March 2, 1886, No. 260,654, granted July 4, 1882, and No. 266,090, granted October 17, 1882.

These patents and one other, No. 337,298, granted March 2, 1886, were before this Court in *Brush Co.* vs. *Julien Co.*, 41 Fed. Rep., 679. The Court there decided that No. 337,298 and No. 337,299 were for the same invention, and intimated, as the inventor and his expert apparently regarded the former as the broader patent, that the difficulty might be met by a surrender of the latter or by a disclaimer of similar claims therein. This solution of the difficulty was thrown out as a suggestion merely, the final disposition of the patents being left till the settlement of the decree.

It was not the intention of the Court to decide that one of these patents was entitled to preference over the other. For the reason stated and for convenience of illustration No. 337,298 was given prominence in the discussion, but the conclusion would have been the same had the position of the patents been reversed.

Upon the settlement of the decree the complainant selected No. 337,299 as the patent upon which it chose to rely, and withdrew No. 337,298 from the consideration of the Court. This was done without objection by the defendant in that case.

On the 15th of July, 1890, after the decree in the *Brush-Julien case* was entered, the complainant withdrew No. 337 298 from this cause and an order was entered dismissing the bill as to that patent. The cause has since proceeded upon the three patents as stated.

In the prior litigations involving the subject matter of these patents the following propositions have been decided:

First.—That Mr. Brush was the first in this country to hold absorptive substance, in the form of dry powder, in place on the supports of a secondary battery by paper or equivalent material, and the first who rammed or pressed it into grooves or receptacles in the plates.

Second.—That No. 337,298 and No. 337,299 are for the same invention and that the complainant was not entitled to both patents, but was entitled to one.

Third.—The complainant having elected to hold No. 337,299, it was decided, by the decree, that claims numbers one, two, three, six, seven, eleven, twelve and thirteen were valid, the word "perforations" in claims numbers six and seven being constructed as synonymous with "cells or cavities."

Fourth.—That the claim of No. 260,654 was not infringed by the application of the absorptive substance to the grids by a trowel or spatula.

Fifth.—That the defendants, by the use of supports filled with rows of uniform square holes, did not infringe the "rib claims" of No. 266,090.

Sixth.—That claims numbers seven and fourteen of No. 266,090, the latter claim being limited to the "perforations" described, were valid and infringed.

Seventh.—That No. 337,298 (and by implication No. 337,299) was not invalidated by patents Nos. 261,512 and 261.995, granted to Mr. Brush, July 18, and August 1, 1882, respectively.

Eighth.—That No. 337,298 (and by implication No. 337,299) was not invalidated by the expiration of the Brush Italian patent.

Brush vs. Julien, 41 Fed, Rep., 679;
Accumulator vs. Julien, 38 Fed. Rep., 126.

All of these conclusions were reached after careful study and mature deliberation, and now, after having been re-examined in the light of the present record, arguments and briefs, except as to claims numbers eleven and thirteen of No. 337,299, are reaffirmed. No useful purpose would be subserved by again discussing them, as such a task would only involve a repetition of what has been said already in the other cases.

The proof of infringement is substantially the same as in the *Brush Julien case.* It is more complete as to the manner in which the active material is applied to the plates, but in this respect it only emphasizes the former decision as to the non-infringement of the claim of No. 260,654. That claim is as follows:

> "The method of forming the plates of a secondary battery, consisting in forming receptacles for oxide of lead in its surface, then applying oxide of lead to the plate and within such receptacles and afterwards subjecting the oxide of lead to pressure."

The claim clearly contemplates not only the treatment adopted by the defendants, but *afterwards* subjecting the oxide to pressure. The defendants apply the oxide to the plates and within the receptacles with a wooden trowel in the hands of the workman, and there they stop. They do not subject the oxide to pressure afterwards.

The questions arising upon the expiration of the Italian patent and as to the validity of the "red lead claims" are, however, presented by this record in a new and different aspect and may, with entire propriety be examined *de novo*, together with the question, not heretofore considered, relating to the effect of the Brush patents Nos. 260,653 and 276,155 upon the broad patent in suit.

First.—It is thought that claims numbers eleven and thirteen of No. 337,299—the red lead claims—are void for lack of invention. The specification, after referring to lead oxide as the active material, which is primarily and mechanically applied to the plates, proceeds:

> "Peroxide is the best oxide of lead to use in the preparation of the plates; but as this is rather expensive to prepare, red lead or minium may be used."

If the record contained nothing but this statement the claims could not be upheld. After the invention of a support primarily coated with mechanically applied oxide of lead, merely coating the plate with the commonest, cheapest and best known form of lead oxide, did not require the exercise of the inventive faculties. Especially is this so when the patentee himself asserts that the best results can be obtained by using peroxide. It would seem that the use of red lead would at once occur to anyone who had even a superficial knowledge of the art. There is no more novelty in using red lead for the coatings than there is in using cast lead for the plates.

Brush vs. Julien, supra, p. 692.

The following paragraph taken from defendants' brief states with clearness and precision the views of the Court upon this subject:

> "The specification says, that red lead is inferior to the peroxide, and we submit that no valid claim can be founded upon the use of an inferior article when it is shown that the use of the superior article is old."

Patent No. 337,299, at least as far as its broad claims are concerned, is not invalidated by anything contained in the Brush patents No. 260,653 and No. 276,155. The application for the former (No. 260,653) was filed June 15, 1882, a year and two days after the application of No. 337,299.

No one can read the specification of No. 260,653 without being impressed with the fact that the inventor intended to confine the patent to a single point, namely the form of the electrodes. He expressly says so.

> "This application is a division of my application designated as 'Case I' [337,298–9] filed June 13, 1881, in which other features of my invention are claimed. For convenience in distinguishing this invention among others of mine in the class of secondary batteries I have denominated it 'Case I, Division A.'"

Again he says:

> "My invention consists essentially in a secondary battery element consisting of a structure of etagère-like form, containing in the spaces between its shelves lead in a finely-divided state."

The claim is:

> "In a secondary battery, an element consisting of a structure of etagère-like form containing in the spaces between its shelves lead in a finely-divided state, substantially as set forth."

It is true that the broad invention is described, but it is equally true that it is not claimed. It was hardly possible for the patentee to describe the subsidiary invention without disclosing his main invention. Having disclosed it, had he permitted the patent to issue without warning or reservation, and, after the broad invention became public property, had filed an application covering what he had thus relinquished to others, it is probable that he would have been informed, either in the Patent Office or in the courts, that his application came too late. But that is not this case. Before his application for the subordinate invention he had applied for the superior one. In the former he expressly informed the public that it was but a division of the latter. He could do no more. The delay in the Patent Office cannot be charged to him. Even though the inventor were responsible for the issue of the divisional before the principal patent—and he was not—the fact of such prior issue in no way misled the public. They never for a moment acquired the right to use the broad invention. An infringer, with the statements on the face of No. 260,653 before him, would scarcely have the hardihood to assert that he supposed the broad invention was released. No court would listen to such a plea. The claims of that patent did

not protect Mr. Brush in the use of the broad invention. A person who did not use an "etagère-shaped" plate, could, if no other patent prevented, use the broad invention with perfect impunity. No. 337,299 was intended to prevent such use.

The Court has not been able to discover an authority holding a broad patent invalid in such circumstances. None has been cited by counsel.

What is true of No. 260,653 is also true of No. 276,155.

Mr. Brush was the first in this country to make the broad invention as stated above. He is entitled to the fruits of his invention. It is the policy of the law to reward him.

Where the Court can see that the patentee has produced an invention of real merit, it should not be unduly industrious in endeavoring to discover some statement or act of his by which, on technical grounds, his rights may be forfeited. It should rather be sedulous to protect him.

Whether or not the improvements patented by Nos. 260,653 and 276,155 are the same as the improvements covered by some of the claims of Nos. 337,299 and 266,090 it is, perhaps unnecessary to decide, for none of the claims in issue and infringed are so affected.

It seems that in his anxiety to claim his invention in every conceivable form, the patentee has involved himself in a labyrinth of descriptions and claims in which electrician and lawyer alike are quite apt to become confused.

What Mr. Brush accomplished in 1879 and 1880 can be embraced in a brief, clear and concise statement. What he actually did is the test by which his patents must be judged. He is entitled to what he invented and only this. His patents can receive no broader construction, because he described his inventions with irksome prolixity and gives to the same structure a wearisome variety of names. The nomenclaturist should not seek the reward for his labors in the Patent Office. A person is not entitled to a patent because he has invented a new word. The danger and impropriety of holding a number of claims relating to the same structure, and which can be differentiated only by the most obstruse and metaphysical distinctions seem apparent. They are calculated to embarrass the inventor and mislead the public.

Did Patents Nos. 337,299 and 266,090 expire with the Italian patent?

The Italian patent was applied for July 28, 1882, sealed August 8, 1882, and was issued for a term of three years from September 30, 1882. It expired September 30, 1885, never having been prolonged, renewed or extended. No. 337,299 was granted March 2, 1886, No. 266,090, October 17, 1882; both were applied for in June, 1881.

Having stipulated that the patent was issued for an unextended term, from September 30, 1882, and that the translation appearing in the record is a correct one, the complainant is not in a position to argue that the patent was either extended as to time or limited as to its terms. Especially is this so in the absence of the Italian patent law, which is not in evidence, and of all proof tending to establish either extension or limitation.

The difficulty with the complainant's argument in this regard is twofold; first, there is no law, and, second, there are no facts upon which to base it.

Section 4887 of the Revised Statutes is as follows:

> "No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention, which has been previously patented in a foreign country, shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years."

Under this section the test of identity between the foreign and the domestic patent, as established by the Supreme Court in two recent decisions, may be stated as follows:

Is the principal invention in each; is the thing patented abroad the same in all essential particulars as the thing patented here; would the home patent be infringed by a structure made in accordance with the provisions of the foreign patent?

In cases where these questions are answered in the affirmative the United States patent falls, and it will not be saved by the fact that it contains improvements not found in the foreign patent.

Siemens vs. Sellers, 123 U. S., 276.
Com. Co. vs. Fairbanks Co., 135 U. S. 176.

Whether the expiration of a foreign patent for an improvement only will operate to overthrow a domestic patent for a broad invention, which contains also a claim covering the improvement, has not apparently been decided by the Supreme Court. The language of the Court, in *Siemens vs. Sellers, supra*, is, perhaps, comprehensive enough to cover such a contingency, but this is a question which need not now be considered.

In the *Brush-Julien case*, the Court commented upon the absence of expert testimony relating to the Italian patent. No similar observation can, with propriety, be made regarding the present record. It would indicate a lamentable want of appreciation on the part of the Court to ask for additional instruction and advice. Eight experts of greater or less prominence and attainments have testified upon this subject. Three of these, called by the defendants, have expressed the opinion that the divisions of the Italian patent describe everything claimed in the United States patents granted to Mr. Brush and that the inventions covered by the two patents, No, 337,299 and No. 266,090, are literally described aud substantially claimed in the Italian patent.

On the other hand five electricians, including the patentee himself, have testified that the Italian patent relates to inventions wholly different and proceeds upon totally dissimilar lines. In short, that it is but a progressive step in the Plantè method, its object being to aid the process of electrical disintegration of the plates in the electrolyte, and not to supersede that process by placing the active material mechanically upon the plates prior to immersion in the battery fluid.

The mere fact these gentlemen of conceded ability and learning, whose motive is to enlighten the Court and who were all sworn to tell the truth, differ so radically regarding the meaning of the Italian patent is of itself suggestive.

The defendants plead the defense of forfeiture. They must prove it by a preponderance of evidence. And yet upon the question of the identity of the patents in question there is a sharp difference of opinion among those who are most entitled to speak upon the subject. Is there not room for the assertion that the defendants have failed to sustain the burden in this behalf?

When this question was presented in the *Brush-Julien case* the mind of the Court was in doubt, and now, having re-read the Italian patent in the light of the new testimony, it is still in doubt, but inclining more strongly to the opinion that the complainant's contention is correct. The Court is not prepared to hold, therefore, that the Italian patent is for the same inventions as those covered by the two patents in question.

The principal reasons which led the Court to adopt this view may be epitomized as follows:

First.—The language of the Italian patent is entirely different from that of the patents in suit. The drawings are different.

Some of the divisions of the Italian patent are unquestionably dissimilar and some concededly relate to the Plantè process. The broad statement relating to the primary coating of the supports with active material is not found in the Italian patent.

Second.—The inventor's statement of his intent and purpose in taking the foreign patent and his reasons for not attempting to patent the invention of No. 337,299 abroad.

This testimony is corroborated by his notes made at the time he was perfecting the inventions patented abroad. When these notes are placed side by side with corresponding portions of the Italian patent it will be seen that they are substantially similar. Mr. Brush testifies that the portion quoted describes the invention of Division D of the Italian patent.

Brush's Notes, March 7, 1882.

"About three weeks ago I conceived the idea of preparing secondary battery plates by compressing partially oxidized precipitated metallic lead, in the form of a fine powder, with great pressure, whereby I expect to get a solid metallic plate coherent and malleable. . . .

Now by using very finely granulated or precipitated lead, and slightly oxidizing superficially each particle, spontaneously by exposure to the air, or otherwise. and then compressing the metal, I will get a lead plate having minute seams throughout its substance filled with oxide of lead. This will very greatly facilitate the oxidation of the plate in the process of 'forming' in the battery. It will probably be found advantageous to coat a sheet of ordinary rolled lead on one or both sides with this peculiar fissured metal, so that the rapid oxidation in the battery will be arrested by the rolled metal when the prepared metal is all oxidized."

Division D, Italian Patent.

"In this division I shall treat a secondary battery element, wherein before treatment by a 'forming' process, either the entire body thereof, or only the coating or covering of a suitable core or body, consists of a mass, composed of metallic lead and lead oxide, in an intimately mixed condition, pressed or united together into a compact and firmly coherent mass.

In constructing this mass I take metallic lead in a pulverized, granulated, precipitated, or other finely divided state, and allow the surface of the lead particles to become oxidized, either by exposure to the air, or by any suitable artificial oxidizing process or application. . . .

I now subject the mixture to heavy pressure, hydraulic or otherwise, whereby its particles are united and consolidated into a compact and firmly coherent mass. The mass thus formed consists of metallic lead, having minute veins of oxide of lead everywhere ramifying and extending through it; and these veins of lead-oxide within and throughout the mass greatly facilitate the penetration of the electrical action in 'forming' the plates for operative use in secondary batteries."

The notes of March, 1882, seem to describe the invention of Division D; they certainly do not describe the invention of No. 337,299.

Third.—United States patents, other than those in question, were issued to Mr. Brush for the divisions of the Italian patent, evidently including Division D. At that time, therefore, neither the inventor, nor the Patent Office officials thought these inventions, or any of them, were the same as No. 337,299. Furthermore, the attention of the officials was particularly called to the foreign patents.

The opinion of the United States officials seems to have been entertained also by those of Italy, France and England.

Faure's invention was well-known abroad and yet the patents issued to Brush with no objection, apparently, from any source that they interfered with Faure.

Fourth.—The fact that a sharp distinction is drawn in No. 337,299 between the inventor's and Plantè's method. Mr. Brush claims his secondary battery element "as contradistinguished from a plate or element having the active material produced by the disintegrating action of electricity as in the well-known Plantè process."

There is nothing of this in the Italian patent. On the other hand the inventor clearly intimates that the plates of Division D are to be formed by the Plantè process.

Fifth.—The vast superiority of the electrodes of the United States patents in question over those made in accordance with the directions of the Italian patent, as demonstrated by the experiments of the complainant's experts.

A careful reading of Division D in the light of the testimony has convinced the Court that some, at least, of these experimental plates are made in conformity with the formula of that division. None of them are like the plates of No. 337,299.

Sixth.—The Italian patent is capable of a narrow construction which differentiates it from the patents in suit.

When to the statements of the patent itself is added the testimony of the inventor that he intended to limit the patent in all its branches to a coating formed by the action of the electric current and that he did not intend it to cover a coating placed on the plates mechanically before they are subjected to electrical action, there seems to be every reason why the narrower construction should be adopted.

Seventh.—The fact that the element of the Italian patent is produced by heavy pressure, hydraulic or otherwise, whereby the particles of lead and lead oxide are compacted into a firmly coherent mass having minute veins of oxide of lead everywhere ramifying through it.

There is nothing resembling this in the United States patents in suit,

Eighth.—The "mass" described in the Italian patent is malleable and capable of being made into strips or wires and manipulated so as to form any style of element.

Neither the active material of No. 337.299 nor the completed plate of that patent is capable of such treatment.

Ninth.—No. 337,299 is designed to cover Mr. Brush's inventions made in the summer of 1879 and in the summer and autumn of 1880.

Brush vs. Julien, supra, 687;
Accumulator vs. Julien, supra, 129–131.

Bearing this in mind it is quite clear that the discoveries of these years alone are insufficient to support the Italian patent. Something more is required. What Mr. Brush did in 1879 and 1880 is not described in the Italian patent. What he did in 1882 is described there.

The foregoing are some of the reasons which have induced the Court to overrule the defense of forfeiture; in fact, the more the Italian patent is studied the more settled becomes the conviction that it is not for the same invention as No. 337,299.

Apply the test suggested in *Commercial Manufacturing Company vs. Fairbanks Company*, 135 U.S., 176, 194. If a person in this country, after the issue of No. 337,299, were to commence the manufacture of secondary batteries by the precise processes described in the Italian patent, would the courts refuse the injunction to restrain their use on the ground that they do not infringe the claims of the United States patents?

It is thought, upon the conflicting testimony here presented, an intelligent court would feel compelled to deny an injunction on the ground that infringement was not proved, or at least, that the question was involved in such uncertainty

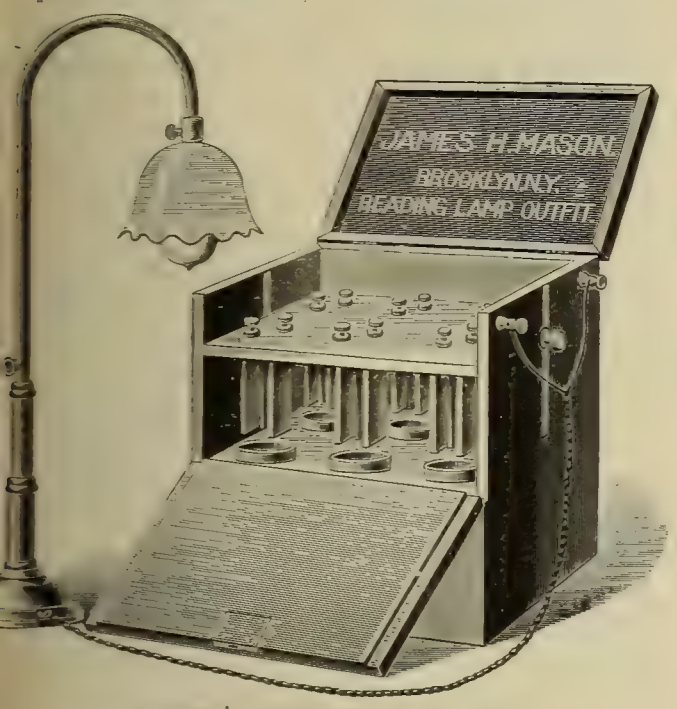
Continued on page 472.

READING LAMP OUTFIT.

One of the most convenient reading lamp outfits that has ever been gotten up is that illustrated herewith. Mr. James H. Mason, the well-known electrician and dealer in electrical goods, 87 *World* Building, New York, is the designer and manufacturer of this apparatus, and it is safe to say that there will be a large demand for it.

This outfit is far superior to the student lamp, or any other sort of lamp, and gas is simply "not in it,"—to use a slang phrase—as compared with this electric light outfit.

The illustration shows very clearly the details of the outfit, and it is hardly necessary to give any explanation of the same.



MASON'S READING LAMP OUTFIT.

As will be seen, the elements are attached to the under side of a movable board, which is capable of being raised or lowered at will. The zincs are by this means lifted out of the liquid or lowered into it as necessity requires. There is a lid at the side of the box which, when open, gives easy access to the parts of the battery, and when the box is entirely closed it is compact and portable. It is, besides, well and neatly made.

The lamp is a portable one and can be raised or lowered as desired and placed in any position. The light rays are concentrated on the desk, or book pages, and are of sufficient intensity to enable one to read or write without any fatigue to the eyes.

This is an excellent hot-weather reading outfit, as there is practically no heat developed by the light. Mr. Mason's idea is a good one, and no doubt the outfits will meet with a large sale.

FOREIGN NOTE OF INTEREST.

In a recent numer of *La Lumière Electrique* a description is given of the manner in which some small incandescent lamps, made by M. Trouvé, are used to replace the gas and petroleum lamps previously employed in the St. Petersburg Observatory as a source of light in connection with the Adie magnetograph. The necessary current is obtained from Jablochkoff accumulators, and special care has been taken to prevent the magnetic effect of the current disturbing the magnetmeters. The advantages of employing incandescent lamps in this connection are briefly as follows: The curves on the photographic paper are clearer, more uniform, and more sharply defined, consequently they permit of more precision. The substitution of electricity for gas or petroleum causes the troubles due to rise of temperature of the room to disappear. The arrangement is also more economical, and less troublesome to keep in order.

The commercial efficiency of a generator is determined by dividing the electric energy in the external circuit by the mechanical energy required to turn the armature.

THE EXHIBITION AT THE MONTREAL CONVENTION.

In a circular from Mr. James I. Gulick, Chairman of the Committee on Exhibits of the National Electric Light Association, concerning space in the exhibition to be held in conjunction with the meeting of the association in Montreal next September, that gentleman says:

There being no power in the exhibition building, it had been originally intended to erect a power plant adjoining the same, but, owing to the expensive character of the undertaking, the idea has been abandoned by the committee and the supplying of power is left to the exhibitors individually.

The Chairman of the Committee on Exhibits will be glad to furnish information and give such aid as lies in his power toward making arrangements for obtaining the same.

McGill University, at Montreal, through Prof. H. T. Bovey, kindly offers several hundred horse power at cost of operating expenses.

For small powers, such as for motor, or other work, it is expected that an arrangement can be made for obtaining the same from the plant of the Windsor Hotel, adjoining the exhibition building.

An entrance fee of 25 cents will be charged, but complimentary tickets will be issued at the request of the exhibitors.

Arragements have been made for the admission of all goods in bond, and the exhibition building will be constituted a temporary bonded warehouse, duty to be paid only in case of sale.

Ample space adjoining the building has been secured for the storage of packing cases without charge.

BOSTON'S NEW FIRE ALARM SYSTEM.

Boston has commenced making changes in its fire alarm department which will, when completed, give the city as perfect an alarm service as can be found anywhere. The rapid growth of the suburban districts and the constantly increasing additons of force and apparatus to the fire department made some change necessary, as the method of signaling continually grew more complicated. The new system will be arranged so that nothing but actual fire alarms will be recorded in an engine house, the test signals, etc., being separated from them at headquarters. The work of preparing a new switchboard, relays, repeaters, etc., at fire alarm headquarters has already begun, and will be pushed rapidly forward, so the entire new system can go into effect simultaneously with the appearance of the new running card, now being constructed under the personal supervision of Chief Engineer Webber. Once in position it will be very easily removed when the transfer of the alarm department is made to the new fire headquarters.

THE TELEPHONE.

The telephone cable already laid beneath the streets of Berlin, is estimated to meet the requirements of 30,000 subscribers. At present there are 15,000.

The annual meeting of the stockholders of the Tropical American Telephone Company will be held at the company's office, Long Branch. N. J., July 29.

The New York and New Jersey Telephone Company on May 1, last, had 8,770 stations of which 1,100 are of metallic circuits. The company operates 6,400 miles of underground wire and 15,000 miles of overhead wire, and is now erecting a new building, corner of Throop avenue and Decatur street, Brooklyn, and also one in Jersey City, corner of Erie and Bay streets. The former building is about finished and the latter will be occupied early in the Spring of next year. The territory of the company embraces Long Island, Staten Island and Bergen, Essex, Hudson, Middlesex, Monmouth, Morris, Passaic, Somerset and Union counties, New Jersey. Mr. W. D. Sargent is Vice-President and General Manager, and is also President of the National Telephone Association.

TESTS FOR WIRE LEAKAGE.

Wiring may have two kinds of leakage. One may take place between the two leads, and the other between one or both leads and earth. In order to test them for the first case, the wires from the testing instrument are attached to one lead. If no deflection occurs, they are in good order in this respect. To test for earth, one wire from the galvanometer is connected to each lead successively, and the other wire is attached to a water or gas-pipe, preferably by means of a solder, when again no deflection will take place, if the insulation is good. If, when testing for "earth" all the fittings and other apparatus being placed in one circuit, no deflection occurs, the insulation may be regarded as perfect. If deflection does occur, the number of degrees must be noted, and the makers' table referred to, which was furnished with the instrument. It must be seen whether, from the number of lamps installed, the leakage is in excess of that which would be permissible, the margin allowed being greater as the number of lamps is larger. Should the insulation be below the mark, the faulty place or places must be sought for by disconnecting various portions of the system and testing them separately. When the system is tested for earth, the lamps should be turned on; but, when tested for short circuit, the lamps must be turned off, or, better still, their switches left turned on and the lamps removed from their holders; since in the latter case the lamp leads and fittings will be included in the test. Also any apparatus, usually placed between the leads, must be put out of the circuit by a switch or otherwise. To give an idea of the manner in which the deflections are made to indicate desired results, let it be supposed that, when a test is taken over the whole installation, the result is that the needle does not move, then everything is perfectly satisfactory, and, if twenty lamps are employed upon the circuit, a worse result must not be shown. For 100 lamps a deflection of five degrees might be permitted, and for 200 lamps perhaps fifteen; but the actual value of the readings will naturally depend on the sensibility of the galvanometer and the number of cells employed for the test.

A correspondent of a New York daily paper, in an article a few days ago on the subject of the execution of criminals, sets forth the advantages of prussic acid over the electric method. "The public," he says, "has gone crazy on the subject of having everthing done by electricity, and it will apparently listen to nothing else." There is a good deal of truth in this statement, and it is because the public have learned what a valuable agent electricity is that it has gone "crazy" over it. But the public is not "crazy," it is simply enthusiastic over electricity and its wide range of usefulness. The correspondent is evidently not in touch with the times; when he does catch the infection he will be as enthusiastic as the rest of humanity.

To obtain the ratio of conversion in a converter, divide the primary E. M. F., by the E. M. F. of the secondary circuit. Thus, for example with a primary current of 1,000 volts and 50 volt lamps in parallel on the secondary, the ratio of conversion is $1{,}000 \div 50 = 20$.

THE ELECTRICAL AGE

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IN FAVOR OF BRUSH.

Five year's litigation over the storage battery patents in this country was settled July 23 by Judge Coxe in the United States Circuit Court, who filed a decision sustaining the patents of Mr. Charles F. Brush. The case thus decided was of the Brush Electric Company against the Electrical Accumulator Company. A few years ago the Julien Electric Company began to run storage battery cars on the Fourth avenue line in this city, and was sued for infringement by the Electrical Accumulator and the Brush Electric Companies and the latter corporation also brought an action against the Accumulator Company. The Consolidated Electric Storage Company afterwards succeeded the Julien Electric Company and purchased the exclusive license throughout the United States for the Brush storage battery patents, and the cause against the Electrical Accumulator Company was pushed to a final decision with the result stated. The effect of the decision will be to give the Brush Electric Company the monopoly in the manufacture of storage batteries having a mechanically applied coating of active material. In his decision Judge Coxe says: "Mr. Brush was the first in this country to make the broad invention. He is entitled to the fruits of his invention. It is the policy of the law to reward him." These patents, of which the Consolidated Electric Storage Company are the licensees, have yet twelve years to run. It was stated by the superintendent of the Fourth avenue line that the operation of the storage battery cars on that line would be resumed at once.

It is very rarely that a new enterprise meets with such a hearty reception and encouragement at the hands of the business community as has Street Railway News—the railway department of the Electrical Age. The unsolicited complimentary letters we are continually receiving show without question that our enterprise is much appreciated, and it is an extreme pleasure to us to devote our energies in the interest of those who know and appreciate a good thing when they see it. The street railway fraternity is composed of men without peers in the matter of energy and enterprise, and they are glad to welcome a weekly paper that will thoroughly and impartially represent their interests. That is the mission of Street Railway News, and the new paper will continue to grow and improve as time passes by. There is one thing our readers should remember, and that is that Street Railway News is in the field to lead and not to be led. This means tremendous energy; but we have it in every form. Street Railway News was born under the most favorable auspices, speaking from a journalistic point of view. It had everything in its favor; its circulation was already established before it was born, and this is a fact that our friends should remember and consider. By combining Street Railway News with the Electrical Age the former at once reaped the benefit of the nine-year circulation of the latter. No uphill work was necessary to establish a circulation for the new venture; it adjusted itself to the existing conditions without the least friction, and now it is on the high road to success. The Street Railway News is the first and only weekly publication in the interests of street railways, and has a very large and guaranteed circulation.

We print on another page of this issue an article on the value of patents, from the pen of Mr. Thomas J. Fay, which is well worth very careful reading and consideration. The subject is treated in a very clear manner and many interesting questions are raised. There are probably some who will not entirely agree with Mr. Fay in his arguments, but none can doubt that there is much truth back of them. The first proposition he lays down is, unfortunately, too true. If the validity of a patent has not been tested in a court of law it is likely to be looked upon with suspicion by capitalists, if it ever reaches the threshold of the stage of a financial venture. This condition of things is virtually equivalent to saying that a patent is no good, as it does not protect the inventor. Very frequently this is the case, and many inventors have paid dearly in consequence. Now the question naturally arises "what good is a patent if it does not protect the inventor in the enjoyment of the benefits accruing from the use of his invention?" Why does the government accept the inventor's fees if it gives him practically nothing in return? In the commercial world such a proceeding would be considered extremely unbusinesslike, and yet this is practically what the government does. The definition of the word patent indicates its nature, but how inconsistent it is with the facts in most cases. The inventor expects to receive the protection of the government in the enjoyment of the fruits of his patent, but instead of that the moment his invention becomes the basis of a business enterprise he is assailed by infringers, or is otherwise beset with difficulties, and he is compelled to resort to the courts. There is, no doubt, much room for improvement in the patent system, and Mr. Fay's article reveals many facts that are ordinarily overlooked, and which in their nature are incongruities. It would be interesting to hear from others on the subject. The question is an important one, and in the interest of inventors in general, we would like to have the subject thoroughly ventilated.

The past two weeks have been remarkable ones for the number of electrical suits either closed or begun. First on the list was the decision, on July 14, of the case of the Edison Electric Light Company against the United States Electric Lighting Company, in favor of the former; then came the decision of Judge Coxe in the accumulator litigation in favor of Chas. F. Brush and against the Electrical Accumulator Company. The suits instituted are those of Chas. G. Perkins against the Edison General Electric Company, and E. Baker Welch against Mr. Edison personally. In the first case the basis of the suit is the alleged infringement of Perkins' patents on circuit breakers by the Edison General Electric Company, and in the other E. Baker Welch sues the great inventor for $250,000 for alleged breach of contract. It may strike many people as remarkable that these events should transpire in so short a period of time, and the fact that two suits have been brought against the successful parties in the lamp suit, so soon after the decision of the court, is another cause for remark. Electrical cases are keeping the legal machinery busy these days. In our Legal column on another page in this issue will be found the brief facts in the two latter cases. The Edison lamp decision was printed in full in our last issue, and the Accumulator decision in full will be found elsewhere in this issue.

A most distinguished audience listened to the lecture of Lord Rayleigh at the Faraday Centenary in London, on June 16, last, and the exercises were a fit commemoration of the work of this great man. The name of Michael Faraday is probably more intimately connected with the development of electrical science than that of any other investigator. It was he, who, in 1831, made the great discovery of magneto-electric induction, which plays so important a part in the affairs of man in this generation. His work in the electrical field was extensive and varied, and his name will be spoken until the end of time. It was a fitting tribute to his memory that the first man in England, the Prince of Wales, should preside over the exercises on this occasion.

One of the most important things to be accomplished in constructing an electric circuit which is to use the ground as the return is to secure a perfect and reliable connection with the ground. Gas pipes, water pipes, etc., are commonly used, and once in a while metal plates are buried in the ground in damp places. The main thing is to find moisture. Once in a while we hear of some original ideas in electrical development, but none, so far, equals the one of a gentleman in a western city who filled a beer vat with earth in order to secure a perfect contact with the ground. He was surprised to find that his theory did not work well in practice.

On one of the largest railroads in the United States arrangements have been made to heat some of its special trains by electricity. The trains are now lighted by electricity, and after heating them by the same means it will only remain to supply electro-motive power for its propulsion to score the greatest electrical triumph of the day. Ten years ago the prediction that railroad trains would be lighted, heated and moved by electricity would have been laughed at, but how near we have reached the full realization of that state of affairs!

THE VALUE OF PATENTS.

BY THOMAS J. FAY.

At no time like the present has there been so many striking examples of the uselessness of a patent. At the present day a patent not tested by a court of law is looked upon by financiers with suspicion, and an inventor who is unfortunate enough to have an untested patent upon his hands will have great difficulty in disposing of it for cash, and a stock remuneration is a slow method, if it becomes valuable at all. When one secures a patent from this government on an invention, he will, in all probability, labor under the impression that he is protected from infringements. However, the prevailing opinion is that there is no assurance of protection in a patent; that a patent assumes no value until it has successfully passed through a siege in the court. If such is a fact, then the patent office does not fill its functions, nor does an inventor get what he pays for. The object in securing a patent on an invention is to get protection from competition, and it is analogous to our protective tariff system, which protects the home-trader from foreign competition.

An infringer on a patent is like a smuggler. On the one hand the infringer gets the same benefit as the inventor without paying for the cost of the invention, and on the other the smuggler gets the same advantages as the importer, without paying duty.

Now as the U. S. government protects traders from smugglers, both by preventing smuggling and punishing smugglers, why should the inventor who has paid for protection not get the same benefit?

A patent, in order to be of value, does not always depend upon the value of the invention itself as a commodity, but, to a very great extent, it is dependent upon the amount of the protection offered by the government, and it is not often that an invention is so valuable that it would pay for both a patent and a test by the court.

The patent office states that the inventor, upon securing a patent, has the sole right to dispose of the invention at his will, and that it is protected for a specified time. A commodity actually protected as specified would recompense the inventor; but, if the protection is uncertain and the patent liable to involve one in a costly litigation, the value of the patented commodity is much depreciated, and financiers would be very backward about risking their money.

There is one other point worthy of consideration, which I will try to illustrate. If a recognized dealer agrees to furnish commodities, no matter in what form, and he accepts the consideration, it is generally understood that, in the event the dealer as aforesaid fails to comply, he is liable for all damages incurred on account of his negligence or failure to deliver. Does this state of affairs not exist when the U. S. government accepts pay for protection of a commodity, which protection the government duly agrees to give when a patent is issued to an inventor? If such is the case, the legal holders of a patent can by law request the government to reimburse him the amount of his loss, if he is so unfortunate as to hold a patent which has been construed by the court to be an infringement on another patent, also issued from the U. S. patent office. It is evident that both holders paid their required sums in good faith, and the patent office offered both protection, and accepted in consideration the amount required by law.

It is my impression that a patent should offer to the holder absolute and irrevocable protection. And that the patent office, and not the holder, should be held responsible for conflicting claims allowed.

HOW THE LAMP DECISION IS REGARDED.

Touching the decision in the Edison Lamp Case the following opinion will be read with interest:

Mr. Franklin L. Pope, consulting electrical engineer, expert, etc., 15 Wall street, says: "While I am unable in many respects to concur, either in the the logic or the conclusions of the learned court, I do coincide in that of a certain well-known legal gentleman, who once remarked that in cases of this kind the unsuccessful party might take either of two courses, *viz.*: he might go round to a 'sample-room' in the rear of the court house, fill up with bad whiskey and swear at the judge, or he might appeal. But inasmuch as these remedies are in their nature not concurrent, and the incandesent lamp case has been or is to be appealed, it would be manifestly improper during the interim to pursue the alternative course."

Mr. F. W. Jones, electrician and assistant general manager of the Postal Telegraph Company, says: "Your request for my views on the decision of Judge Wallace in the Edison lamp case, invites me into assuming a position of great delicacy, between parties with horns locked in a serious legal contest. The published arguments of learned counsel on each side and the decision of a very painstaking and learned judge, seem to be sufficient without my comment in view of the intelligence of your readers. I may state, however, that I had learned or read but very little about the efforts of any one except Edison in the development of the incandescent lamp and during the years 1880 and 1881 I was very frequently at the laboratory of Edison in Menlo Park, and he there explained to me many of the details of various ideas he had to produce a commercially practicable lamp. I was greatly impressed with the wonderful intelligence and great labor bestowed by him on the subject, as I imagined at an enormous outlay of money, and when his lamp with the fibrous filament was developed and his scheme of subdivision shown, I had no other thought but that it was the legitimate child of Edison's fertile brain. As I understand the case goes to a higher court I will not presume to say more than that he has richly earned the laurels should they be his rightfully to wear.

THE STATUS OF THE EDISON LAMP CASE.

On July 22, Judge Wallace granted an order suspending the writ of injunction obtained by the Edison Electric Light Company against the United States Electric Lighting Company. The latter company is allowed to sell lamps to those who buy its dynamos, and it makes a statement that the number of lamps it sells a day amounts to 1,000. The United States Company is required to give a bond of $50,000, and in the meantime the accounting for past damages will go on by Commissioner Shields, Commissioner of the Court. It is expected that it will require several months to complete the accounting.

NEW BOOKS, CATALOGUES, ETC.

PRIMARY BATTERIES, by Henry S. Carhart, A. M., Professor of Physics in the University of Michigan. Pages, 183. Illustrations, 67. Allyn & Bacon, Boston. Price $1.50.

This is the first low-price work devoted exclusively to batteries that has been put on the market. It is well printed and illustrated and deals with the subject to date. The division of the work is logical, and each chapter is illustrated by the best types of the class of cells forming it. Batteries used as standards for testing purposes are dealt with more fully than those of less universal use, adapting the book to a place in every laboratory. The chapters and their scope are as follows: "Introduction," definitions of battery and descriptions of Volta's and the dry pile; "The Simple Voltaic Cell," phenomena and theory of the voltaic element with experiments on polarization; "Potential and Electromotive Force," seven pages devoted to a logical analysis of the relation of E. M. F. to difference of potential; "Closed Circuit Batteries", "Open Circuit Batteries," descriptions of nearly every form of primary battery known, with their chemical reactions; "Batteries Without a Depolarizer," "Standards of Electromotive Force," "Miscellaneous Batteries," "Battery Tests," "Grouping of Cells" and "Thermal Relations". The chapters on standards of electromotive force and battery tests will be found to contain much matter not generally known, and will be invaluable as an outline guide for laboratory purposes. The student will find the book just what he needs in this line.

MECHANICAL ENGINEER'S REFERENCE BOOK, FOR MACHINE AND BOILER CONSTRUCTION, is the title of a valuable book written by Nelson Foley, assisted by Thomas Pray, Jr. Price, $13.00.

It contains 51 plates and numerous illustrations, specially drawn and engraved for this work. The size of the pages is 11x15 inches. The book contains the latest and best matter of the engineering world in regard to compound engine design, boilers and accessories, and it contains an enormous amount of data. Electricity, dynamos and electric lighting receive liberal treatment, and valuable tables and formulæ are given in connection with these subjects. This work is the most comprehensive and valuable we have ever seen; it completely covers the entire field of mechanics in its broadest sense.

These and all other books on electrical subjects can be obtained at the office of the ELECTRICAL AGE, *World* Building, New York.

The Electrical Supply Company, 102–104 Michigan avenue, Chicago, has just issued a neat circular of ten pages, setting forth the advantages of the Stanley transformers, for which it is sole Western agent.

The C. & C. Electric Motor Company, 402–404 Greenwich street, New York, has just published a 55-page brochure entitled "The Transmission of Electric Power." Beside containing a large number of illustrations of C. & C. motors and diagrams of their efficiency, it contains a variety of forms of contracts for motors and for electric power, and a method of determining electric motor rates.

Mr. D. Thomson, brother of Prof. Elihu Thomson, of the Thomson-Houston Electric Company, is now manager and chief electrician of the Hamilton Electric Light and Power Company, Hamilton, Ont. Mr. Thomson intends to increase the facilities of his company by erecting a large building near the water front, and also intends to further develop the incandescent system. The company has at present over 300 arc lamps in use and about half of the business houses in the city use the incandescent light, on the Westinghouse system.

The Fort Wayne Electric Company of Fort Wayne, Ind., has advised Prof. Bovey, of McGill University, Montreal, that it will present to that institution an electric light plant on the Wood system, consisting of dynamo and arc lamps. Mr. A. J. Corriveau, president of the Canadian Electrical Construction, Manufacturing and Supply Company, and W. J. Morrison of the Ft. Wayne Electric Company were instrumental in securing this plant for the University. Mr. Corriveau was also the means of securing a similar gift for the same institution from the Thomson-Houston Company of Boston.

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and doubt as to justify the court in withholding the writ.

It may as well be admitted that this defense does not appeal strongly to the conscience of a court of equity. The statute creates it, and in all cases where the facts are clear the statute must be implicitly followed. But no one can examine the course of judicial decision upon the subject without being impressed with the facts that the courts have sought to construe it liberally, and have seldom, except in the plainest cases, permitted it to defeat a valuable patent.

Believing that Mr. Brush is entitled under our law to protection for a meritorious invention the court should not, unless fully convinced that the facts warrant such a course, destroy his patents upon grounds which do not go to the merits of the invention, and which, for want of a more accurate word, may be termed *technical.*

Why a meritorious inventor, who is a citizen of this republic, should lose his rights at home because he has tried to protect them abroad is, on principle, not easy to comprehend.

It is said that the expiration of the Italian patent threw the invention into public domain. So it did into the domain of the Italian public, but if Mr. Brush had taken no patent in Italy the Italian public could have practiced the invention from the moment it became known there. Had he taken no foreign patents his invention would have been thrown into the public domain of every land but this. In this country his inventions would have been protected for seventeen years, outside of this country they could have been used with perfect impunity. The inventor applied for his patent here long before he applied abroad, but through the delay of the patent office the foreign patents were issued first.

Assuming the inventions to be similar, the inventor has been guilty of no fault, the American public has lost no rights, and yet, under the provisions of this statute, which it is thought was never intended to apply to a case like this, a valuable monopoly is destroyed.

These observations are, perhaps, only germane to the present inquiry, as they tend to emphasize the suggestion already made, that in dealing with a defense where, as in this case, the disaster following the inventor's acts is so out of proportion with the fault, if fault it be, the Court should proceed with the utmost caution, and, where the evidence is not clear, give to the inventor the benefit of the doubt. If convinced that he did not intend to patent the invention abroad, the Court should not by construction broaden the language of the foreign patent so as to destroy the domestic patent, when that language is capable of a construction which permits the domestic patent to live.

The question of how to dispose of No. 337,298 is, in view of complainant's position regarding it, more puzzling than ever. The rule which obtains in this Circuit, requiring a disclaimer of invalid claims as a condition of a decree, has always seemed an arbitrary one. It certainly seems inequitable that the Court, at *nisi prius*, should compel the patentee to renounce forever a claim which may be held valid upon appeal. It is possible that this rule may be modified by the Circuit Court of Appeals.

In view of this contingency and of the extraordinary and distinguishing circumstances surrounding this case the Court has concluded, if the complainant upon reflection still desires to assume the responsibility of retaining two patents for the same invention, not to require a surrender or disclaimer of No. 337,298 as a condition of a decree. It is thought, however, that pending an appeal it should be deposited with the clerk to await the further order of the Court.

An accounting having been waived, it follows that on filing a disclaimer of claims eleven and thirteen of patent No. 337,299, the complainant is entitled to a decree upon claims one, two, three, six, seven and twelve of this patent, and upon claims seven and fourteen of No. 266,090, for an injunction, but without costs.

NEW ELECTRIC ROAD.

A new electric road is now being built from Thirty-ninth street, Brooklyn, to Nineteenth avenue, then down the avenue to the ocean. The new lines projected in South Brooklyn will very soon cover the entire territory from the present city limit to the ocean. All the farming region is rapidly being transformed into streets and avenues and building is going on rapidly.

LEGAL.

Mr. Charles G. Perkins, of Hartford, Conn., on July 23, filed a bill of complaint in the United States Circuit Court against the Edison General Electric Company, for damages for the infringement of a patent which is claimed by him. Mr. Perkins says that in 1881 he was the inventor of an improvement in circuit breakers for electric lighting. On the 4th of February, in that year, he filed his application for a patent and one month later he assigned his right, title and interest in the patent to the United States Electric Lighting Company. In September, 1881, letters patent on this invention were granted to this company. On July 15, 1885, the patents were re-assigned to him by the United States Electric Lighting Company, and since that time, although he has notified it that he is the owner of the patent, the Edison Company has manufactured, used and sold a large number of circuit breakers, which is an infringement of his patent.

A press despatch from Boston, on July 24, states that in the case of E. Baker Welch against Thomas A. Edison to recover $250,000 damages for alleged breach of contract, now pending in the United States Circuit Court, Judge Nelson, on the petition of the defendant, has ordered that the plaintiff shall produce certain letters within thirty days and also file a bill of particulars, settling on what patents, inventions, instruments, and improvements he claims to have an interest. He is also ordered to state what inventions he has requested the defendant to transfer to him in which he says he has an interest. The plaintiff bases his claim upon an alleged contract made with the defendant in 1869, by which he agreed to give him one-half interest in a patent upon which he was then experimenting, and upon all future inventions which he might make. The consideration for this alleged transfer of valuable rights was various loans of money which the plaintiff says he made to the young inventor, who was then in the employ of the Western Union Company as an operator, to help him along in his experiments. Mr. Edison, in his answer, denies the alleged contract, and says that he paid to plaintiff any sums which were paid him by giving his notes. He also says that the instruments upon which he was then at work failed to be available. The case has been pending in court since 1883. The order of Judge Nelson is regarded as favorable to Mr. Edison.

FOR HANDY REFERENCE.

It is customary in treatises on electricity to give a list of substances which become positively and negatively electrified when rubbed together. Such tables are incomplete, inasmuch as a slight modification in physical condition will affect the result. For instance, if two like pieces of glass be rubbed together, no change in electrical condition will be perceived, but if the surface of one of the pieces be roughened it will become negatively electrified, while the polished glass becomes positively charged. Difference in temperature of two pieces of the same substance, also produces a difference of electrical condition.

One ampere of current passing through a solution of sulphate of copper will deposit 18.35 grains of copper per hour.

In mixing sulphuric acid with water, the acid should be added to the water, and not the water to the acid. In the latter case great heat is evolved which is liable to spatter and break the jar.

Light can be generated by electricity, and electricity can be generated by light.

Heat reduces the electrical resistance of carbon; hence, the resistance of incandescent electric lamps is greater when cold than when hot.

A circular mil (which is now generally used as the unit of area when considering the cross-section of electrical conductors) is the area of a circle having a diameter $\frac{1}{1000}$ of an inch.

The absolute value of an ohm is not known. but in 1884, all electricians agreed to consider it, for ten years, as equal to the resistance of a column of pure mercury one square millimeter in section and 106 centimeters long, at the temperature of melting ice.

The "mho" is the practical unit of conductivity of electric wires, and was proposed by Sir William Thomson. It is the reciprocal of resistance, and the idea is expressed in the spelling of the word, being the reverse of "ohm."

WESTERN NOTES.

Among the many places where the Regan Vapor Engine, described in our issue of July 18, is used for running dynamos, may be mentioned L. J. Wing Company, 126 Liberty street, New York and the Detroit Motor Company, Omaha, Neb., the latter using a four horse-power engine. A number of plants in San Francisco, Cal., are also using these machines. They can be run by either natural gas or illuminating gas. Thomas Kane & Company, 137–139 Wabash avenue, Chicago, Ill., the makers, are also manufacturers of the Racine automatic oil-burning outfits, using either kerosene or crude oil. With the latter fuel a special boiler is used, in which steam is raised by using petroleum instead of coal. This is an automatic cut-off high speed engine of high grade and is well adapted for running dynamos.

The Western Isolated Lighting Department of the Thomson-Houston Electric Company recently made the following sales: Dornberg, Glick & Horner of the *Leader*, corner of Adams and State streets, Chicago, one 14,000-watt incandescent dynamo, one one-horse-power motor and a fan motor; E. Rothschilds & Bros., 203 Monroe street, Chicago, one 17,500 watt 10-ampere arc light dynamo; Wakefield Rattan Company, Robey street and Blue Island avenue, Chicago, one 400-light incandescent plant; the University of Illinois, Champaign, Ill., one 10,000 watt-alternating current dynamo and appurtenances for use in the electrical laboratory.

The Electric Merchandise Company, 11 Adams street, Chicago, has again demonstrated its enterprise by securing the sole agency for Pratt's portable register, for street car use. So well understood are the merits of this device, that the company has been flooded with orders since obtaining the agency.

The contract for the electric light plant for the Masonic Temple in Chicago, which will be one of the largest isolated plants in the world, has been awarded to the Western Isolated Lighting Department of the Thomson-Houston Electric Company. The generating plant will consist of six 80,000 watt generators and between 7,000 and 8,000 lights will be wired.

The Nowotny Electric Company, 30 East 5th street, Cincinnati, O., is meeting with excellent success with its small electric lamp outfit described in the advertisement on another page. This outfit is an interesting one for amateurs and experimental purposes and parties wishing anything in this line would do well by communicating with the Nowotny Company. It is a live concern and does all it promises. Its stock embraces everything that is novel and practical in the electrical field.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOM 7–12, "WORLD" BUILDING,
NEW YORK, JULY 25, 1891.

The Empire China Works, Greenpoint, L. I., are getting out a new price list.

Among the callers at the ELECTRICAL AGE office last week was Col. T. W. Anderson, of Austin, Texas.

The Chrome Steel Works, 649-667 Kent avenue, Brooklyn, are making a special grade of steel for electric light plants.

J. H. Bunnell & Co., 76 Cortlandt street, announce that the Burnley Dry Battery people propose to protect their rights and prosecute all infringers and have already begun legal action with that end in view.

Mr. James H. Mason, the well-known manufacturing electrician of Brooklyn, has taken an office in the *World* Building, New York. His customers will appreciate this move, as it will be more convenient for them when they desire to consult him. Mr. Mason will carry samples of all the goods he manufactures.

On July 18, Corporation Council Clark rendered an opinion to the New York Board of Electrical Control, to the effect that the resolution passed by the Board some weeks ago, abrogating a contract with the Consolidated Subway Company and forfeiting its bond, was inoperative and void, inasmuch as the Board had no power to pass it.

"The Duty and Reward of Loyalty," is the title of an extremely interesting and well thought out address delivered by Lieut. Allen R. Foote at Takoma Park, D. C., July 4, last. Every American citizen should read it; it inspires patriotism.

The Woodbridge & Turner Engineering Company, 47 *Times* Building, is constructing four miles of electric road for the Portland Street Railway Company, Portland, Me. It is doing all the construction work, and the Thomson-Houston system will be used. J. A. Grant & Co., 8 Oliver street, Boston, will place McIntosh & Seymour engines in the power station.

E. T. Copeland & Co., 136 Liberty street, this city, has recently contracted to put a steam plant in the Hotel Savoy, Fifty-ninth street and Fifth avenue, this city. The plant will consist of four Ball engines, aggregating 350 horse power. The company is also putting one 100 horse power Ball engine in the Hebrew Institute, East Broadway, and one 35 horse power Ball engine in Bennett, Sloane & Co.'s coffee house, 100 Hudson street, this city.

Parmly, Mitchell & Co., of 18 Cortlandt street, report that their business is better than the season warrants. They have this week sold out their entire outfit of line wire to equip a central station in northern New York, besides cross arms, pins, insulators, etc. They have in their office specifications for a large arc and incandescent South American plant on which they are estimating, and have no doubt that they will shortly ship the plant, including all details, from turbines to the last lamp. Mr. Mitchell is on an extended trip and is sending orders in daily.

Mr. Harry L. Banks has connected himself with the Hunt Engineering Company, of 238 Washington street, Brooklyn, as its New England agent. This company always manages to secure the best material, both in its goods and in the men that handle them, but it needs an extra congratulation on this latest accession to its motive force.

Mr. J. M. Brown, of J. M. Brown & Co., the large firm of railroad contractors, Room 77, No. 115 Broadway, is expected to return shortly from a successful business trip through the South. This firm has the Montgomery, Tuscaloosa and Memphis railway about half constructed. The road will be 125 miles in length when completed. The firm expects to close three other large contracts soon.

We have received from the Okonite Company (limited) a fine wall clock with a 9-inch face. Around the frame the name of the company and its well-known trade mark are prominently displayed in raised gold letters. It is a happy idea, and every time one looks to see what time it is he is reminded that the Okonite Company is at the head of time always.

During one of his visits to the ELECTRICAL AGE the past week, Mr. Louis Walsh, of the firm of Taylor & Walsh, produced a number of orders for its new fibrous batteries, among which was one for 1,000 cells. The Hunt Engineering Company, 238 Washington street, Brooklyn, has secured the exclusive agency for Long Island of the new fibrous battery made by Taylor & Walsh. These batteries, although on the market but a short time, are having an immense sale.

Mr. E. T. Lynch, Jr., Consulting Electrical Engineer, 120 Broadway, this city, has contracted with the Chattanooga Electrical Railway Company for the following additions to its plant: One 250 H. P. Armington & Sims engine, two 72x16-in. W. & W. boilers, two 80-kilowatt Edison generators and five miles of pole construction; and an electric coal cutting and electric lighting plant upon the Kanawha river, West Virginia, consisting of five coal cutting machines, two engines, two 80-kilowatt generators, two 20-ton locomotives, six stationary motors, all overhead construction and a complete lighting plant for the village and mines; also a water power generating plant at Sheridan, Va., consisting of two 50-inch Leffel water-wheels, for which the selection of the electrical equipment has not yet been made.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	10 000
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co.(N.Y.)	1,000,000	2500	3 00
American Private T'phone (N. Y.).	50,000	100 00	98 00
American Telegraph and Cable.	14,000,000	100 00	80 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co. (N. Y.)	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	180 00
Bell Telephone 7's	2,000,000		*112
Boston Electric Light.	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1,000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N.Y.)	500,000	20 00	10 00
City of London Elec. Lt. Co. (Ltd.)	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co. (N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's.	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80,000		par
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's.	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	9 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*92
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)	89,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	476 00
Edison Elec. Ill. Convt. Certs	70,000		+
Edison General	14,000,000	100 00	104 00
Elec. Sup. & Con. Co. (N. Y.)	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Equitable G. & E. Co. (Utica)	4,000		+
Erie Telephone	4,800,000	100 00	45 00
Essick Printing Tel.	5,000,000	100 00	45 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		par
Fort Wayne Elec. Co.	4,000,000	25 00	11 75
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*105
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7.500,000	100 00	15 00
Laclede Gas, pref.	2,500,000	100 00	40 00
Laclede Gas 5s.	10,000,000		*74
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light.	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		par
Metropolitan Phonograph.	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	75 00
Morristown L. H. & P. 5s (N. J.)	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust.	9,000,000	100 00	17 25
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	49 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	93 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio.	50,000		par
North American Phonograph.	6,600,000	100 00	
North New York, Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6's Manitoba.	50,000		par
Postal Telegraph.	10,000,000	100 00	30 00
Passaic, Electric Light.	15,000	100 00	92 00
Paterson, Electric Light.	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston.	200,000	25 00	25 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's.	150,000		*90
Rockaway Beach Elec. Light.	50,000	100 00	65 00
Rockaway Elec. Lt. Co. 6's.	75,000		par
Russell Electric Co. (Boston)	300.000	5 00	5 00
Saratoga Gas and Elec. Light 6s	300,000		*86
Saginaw E. L. & P. Co. 6's Mich.	50,000		par
San Diego Gas & Elec. Co. 6's Cal.	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation., N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Swan Incandescent.	800,000	100 00	5 00
Standard Ug'd Cable Co.	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	39 50
Thomson-Houston Pref.	4,000,000	25 00	24 50
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's.	100.000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.)	1,370,000	100 00	
United Elec. Light and Power.	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	30 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's.	150,000		par
Utica Elec. Light Co. 6's.	150,000		par
Vine Street Motor Co. 6's (Colo.)	100,000		par
Welsbach Inc. Gas.	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	80 25
Westinghouse Electric Co.	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			10 50
Yonkers, L. & P.	50,000	100 00	92 00

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

*Per cent. †Registered Stock.

FINANCIAL.

This is the regular bargain time in all classes of electric stocks. The midsummer dividends have been paid, all the coupons cut off and either cashed or laid away as so much cash money in safe shape, and, while resting and enjoying the recuperating season every one seems ready to sell and but few to purchase. Both bonds and stocks,

paying all the way from 5 to 10 per cent.; can be had in small lots at less than par, and beside this there are quite a number of companies owning specialties which have passed the test of fire, been introduced and require capital for the fall and winter business assured to them. These include owners of patents and manufacturers of arc lamps for incandescent circuits, arc lamps which require trimming only once in 24 hours' burning or say six times a month, self setting and regulating electric clocks, perfect in time, lasting a generation with one winding, setting and regulating; an electric underground street railway perfected system; engineering bonds or stock with contracts for construction signed; patents perfected and granted for standard goods, such as sockets, switches, rosettes, etc., etc., the money from the sale being intended to purchase raw material, manufacture and sell large sure fall trade, perfect electric railway signal in full working order; method of replacing the burnt-out carbon filament in all kinds of incandescent lamps, rendering them equal to new for a few cents; a permanent life office position at remunerative salary and present dividend of 10 per cent. per year for an investment of a few thousand dollars. Blocks of shares in large corporations, such as car companies with established and increasing business; syndicates for the consolidation of several established corporations under one management, the money being required to fund existing liabilities into a single security and save the expenses of several offices with all their accessories, and last, on the top, is scattering lots of stock in young companies who are illuminating seaside resorts. These are speculative to the extent that while they may be purchased at half their value and sold before the close of the season at the location they serve, at fancy prices or a sporting profit, the last purchaser will no doubt have to carry them to the next season, but in a few years they are able to reach par and be found in the hands of the bondholders. The goods are all open for your inspection and if, perchance, either suits your fancy or purse, they are at your command. We note Judge Wallace denied the Edison motion for immediate restraining of the United States Electric Lighting Company in the manufacture and sale of incandescent lamps but ordered the filing of a good and sufficient indemnity bond in the sum of $50,000, which is eminently correct and within precedent. There is a well-known quantity called public policy, however, and in its behalf I do hope the Edison managers will exercise great leniency to the few small manufacturers and also be generous in their royalty charges or indemnity bond demands. The cash totals will not foot up large while the public misfortune will. Contracts have been made and are being carried out in many small places where it would be most inconvenient to change quickly, nor will the plant serve an Edison lamp. Time and commercial aptitude will, no doubt, rectify all troubles and all interests be content. I do love one thing in this connection and that is the tenacity with which Tom. Edison has stuck to his first promulgated assertion, that the only proper method of electric illumination was his underground low tension incandescent system as in ordinary use from the Pearl street station, and I don't think he ever wavered in his belief but once, and that as a witness in the case of the arc lamp on 25th street and Broadway, from its inception to date. Charley Brush took the same solid stand with his high tension arc overhead system. Whether either was the actual father of the system or not I don't know; but I don't believe either one has changed the principle one iota since the first public or commercial lamp was lit, or ever will, and further I have reason to know that every investor who has loyally followed them is rich and happy, as all good investors should be.

While it is quite impossible to live in sufficiently close contact with promotors of electrical capitalization to ascertain either the volume created or the percentage which proves successful, an approximation can be compiled occasionally which is near enough for all general purposes, leaving specific amounts to be called when required for exchange of named securities. For June we hear of twenty-five central stations being incorporated with a capital of over $3,000,000. Nearly twenty were for the purpose of construction, supply and manufacturing, representing sixteen and one-half millions, including a gigantic Chicago affair, seventeen street railroads with over four and a half millions. We have now over 1,750 central stations in the United States and 150 in Canada; nearly 1,000 gas companies, one-third of which are adopting electricity in connection with their regular business. The day is not far in the future when all street cars will be under electrical influence. We hear of some new storage battery nearly every week and have not given up the hope that some fortunate man will discover one which will do all that Faure or Brush fondly believed theirs would.

The decision of Judge Coxe in favor of Charles F. Brush in the contest over the discovery of the storage battery and the ownership of the basis patent, interests the public at large more than the electrical investors, for the reason that comparatively few shareholders are even indirectly involved; neither has the battery been used to any great extent, necessitating an accounting. From the day Mons. Faure exhibited his battery at 446 Strand, about ten years ago, down to date, the storage battery has not proved a commercial success. Excessive weight, loss of electrical energy, time required to charge for short service returned, and danger of short circuiting, have been the main causes of non-appreciations by companies who otherwise would have been large customers. The great loss has been sustained by a very few capitalists and their loss in the battery has been so bountifully covered by their gains in other electrical directions that it is not felt. A few of us who expected to reap grand wealth from it were sufferers. Should the decision be sustained by the Court of last resort, while there will be no chance to recoup, there will be a possibility that the battery in its present state may be introduced more effectively in a great many industries. Litigation over some of the discoveries may be incorporated into the Brush battery, and lead us nearer to *the storage battery* which must come, and which will prove a financially successful undertaking beyond any of its predecessors. Keep a few shekels where you can use them, and when the announcement is made in the ELECTRICAL AGE that the time and battery has arrived and offers you the chance to invest, shovel them in and reap your reward.

NEW INCORPORATIONS.

JULY 13.—The Berkeley & Lorin Water and Light Company, San Francisco, Cal.; capital stock $250,000; to purchase, lease and sell water, water rights, light and power privileges and franchises. Incorporators, W. L. Sheldon, William F. Martin and J. A. Mallon, all of San Francisco.

JULY 18.—Artelectro Company of Cleveland, O. (incorporated in West Virginia); capital stock, $1,000,000; to manufacture and sell electrical devices of all kinds. Incorporators, N. S. Amstuz, George Hoyt and C. W. Foot, all of Cleveland.

JULY 1.—The Edison Light and Power Company, San Francisco; capital stock, $3,000,000. The new company has taken poseession of the plant and other property of the California Electric Light Company, used in the central station for lighting the city. Mr. George H. Roe, of the California Company, says the new company will begin at once the construction of the new central station. The wires will all be placed under ground.

JULY 20.—The United States Bulletin Company of New York City, (incorporated in West Virginia): capital stock $200,000; to manufacture, sell, rent or license others to deal in electric bulletin appliances for reporting base ball games and other sports. Incorporators: M. D. Compton, Newark, N. J., J. N. White. Tottenville, N. Y., A. H. White, Redbank, N. J., O. S. Woodruff, Newark, N. J., and J. Fred. Glashy, Elizabeth, N. J.

JULY 20.—Fairmont Development Company, Fairmont W. Va.; capital stock, $600,000; to construct and operate electric gas and water plants. Incorporators: O. S. McKinney, C. L. Smith, C. W. Amett, J. E. Watson and S. L. Watson, all of Fairmont, W. Va.

JULY 18. The Light, Heat & Power Co., New Albany, Ind.; capital stock $50,000; to supply electricity for light and power purposes in Floyd and Clark counties. Incorporators: Marcus Ruthenburg, John S. Briggs and Otto Hoffman.

JULY 17.—Merchants Electric Light Company, Leavenworth, Kan.; capital stock $50,000; to supply electric light. Incorporators: J. H. E. Wiegant, W. B. Walker, E. Michael of Leavenworth, Kan.

JULY 20.—The Cutter Electrical & Manufacturing Company, Camden, N. J.: capital stock $100,000; for the manufacture of chemical, electrical and mechanical devices, novelties and appliances. Incorporators, H. B. Cutter, E. Cobbe, E. M. Dobelbower, all of Philadelphia, Pa.

BUSINESS NOTES.

L. J. Wing & Co., 126 Liberty street, this city, is handling the Ryan Gas Engine, which we described in our issue of July 18, with considerable success. These engines are just the thing to run dynamos in small insolated plants, and they are simple, durable and economical. See L. J. Wing & Co.'s advertisement for further particulars.

Among the recent shipments of the Ball Engine Company, Erie, Pa., we find the following: Johnson Company, Johnstown, Pa., three 150 H. P. engines., one 300 H.P. Cross Compound engine; Allentown Rapid Transit Company, Allentown, Pa., two 125 H. P. engines; Lebanon Street Railway Company, Lebanon, Pa., one 50 H. P. Tandem Compound engine; Edison General Electric Company, New York City, one 80 H. P. engine; E. T. Copeland & Co., New York City, three 80 H. P. engines, one 25 H. P. engine; Schuylkill Electric Railway Company, Pottsville, Pa., one 125 H. P. engine; Durham Electric Light Company, Durham, N. C., one 80 H. P. engine and boiler; Amsterdam & Rockton Street Railway Company, Amsterdam, N. Y., one 100 H. P. Tandem Compound engine; Corvallis Electric Railway Company, Corvallis, Wash., one 150 H.P. Tandem Compound engine; Olean Electric Light Company, Olean, N. Y., one 150 H. P. Tandem Compound engine; Boston & Great Falls Electric Light and Power Co., Great Falls, Mont., one 150 H.P. engine; Northwestern Electrical Supply Company, Tacoma, Wash., one 25 H.P. engine; Reading & Southwestern Street Railway Co., Reading, Pa., two 125 H. P. engine; Key West Gas & Electric Light Co., Key West, Fla., one 150 H.P. Tandem Compound engine, one 100 H.P. Tandem Compound engine, one 60 H.P. Tandem Compound engine, two 150 H. P. boilers, 300 H. P. Wheeler condenser, 300 H.P. Davidson air and circulating pump, 300 H. P. Davidson boiler feed pump, 300 H. P. Korting injector, etc.; Trenton Lamp Company, Trenton, N. J., one 35 H. P. engine.

The Van Wagner Electric Company, 414 North Third street, Harrisburg, Pa., the only house in Central Pennsylvania exclusively devoted to the electrical trade, reports an ever increasing business. This firm deals in everything electrical and makes a specialty of fine house electric construction work. As it deals with no one manufacturer, the patrons of the company have a choice of apparatus seldom combined in one firm. Everything is of first-class workmanship, as a rigid inspection is given to all mechanism before being placed on the market.

A new book on Telephones, their Construction and Fitting, will shortly be issued by E. & F. N. Spon, 12 Cortlandt street, N. Y. It will be a Practical Treatise on the Fitting up and Maintenance of Telephones and the Auxiliary Apparatus, by F. C. Allsop. Illustrated by numerous engravings, all of which are fully described in the text. The price will be $2.00, postage prepaid.

STREET RAILWAY NEWS

A WEEKLY RECORD OF THE STREET RAILWAYS OF THE WORLD.

ELECTRIC MERCHANDISE CO.,

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The Only Company Dealing in

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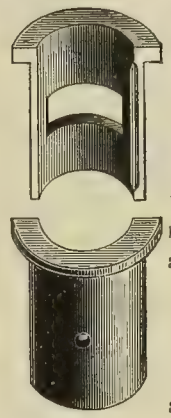
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THE NEW PROCESS RAWHIDE CO.,

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Pat. Mar. 19, 1889. THE OLD STYLE.

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ELECTRIC RAILWAY SYSTEM.

Less Coal Consumption per Passenger Carried than any Other System.

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ESTABLISHED 1881.

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INVITE THE ATTENTION OF

PROMOTERS OF ELECTRIC RAILWAY ENTERPRISES

TO THEIR SUPERIOR FACILITIES FOR THE CONSTRUCTION OF

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AND FOR THEIR ADAPTATION TO THE VARIOUS SCHEMES OF ELECTRIC PROPULSION.

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INDIA RUBBER AND GUTTA PERCHA INSULATING CO.

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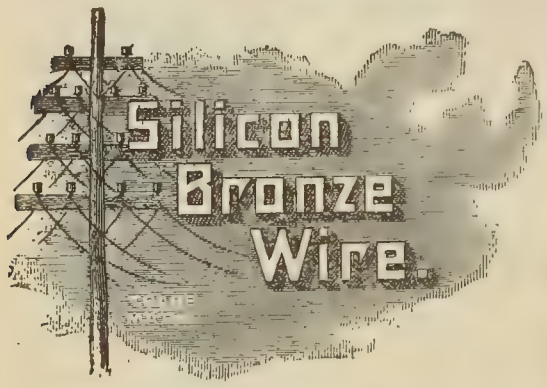
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This Company having adopted the long car for traffic on its most populous lines, is now able to dispose of a portion of its Box and Open Cars.

Roads in want can be promptly supplied at advantageous prices.

We invite correspondence, but believe an examination of our stock by a representative of parties in want, would be to their advantage.

HENRY F. WOODS,
Purchasing Agent.

Why read stale news in the monthlies when you can get it fresh and crisp regularly every week in

"STREET RAILWAY NEWS,"

The only Weekly Street Railway Paper.

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Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity, Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting, Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

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NEW YORK AUGUST 1, 1891.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

J. B. TALTAVALL, *President*, T. R. TALTAVALL, *Sec. and Treas.*
W. T. HUNT, *Vice-President*, E. V. CAVELL, *General Manager.*

ADDRESS ALL COMMUNICATIONS TO
RAILWAY DEPARTMENT ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
Telephone, 2361 Cortlandt. NEW YORK.
Cable Address (All Cables) "ELECTAGE."

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OUR FINANCIAL DEPARTMENT.

With this issue of ELECTRICAL AGE we commence a serial financial article devoted exclusively to the interests of investors in street railways and securities connected with them. We trust this initial paragraph will continue in our own and successors hands until every segregated community of one thousand people in the United States has been supplied with a satisfactory method of street car propulsion and the investment shall return a reasonable dividend on cost and maintenance. Money put into horse or mule flesh can be made to return a greater per cent. in many other ways than by hauling a street car over a route which has been proven to use up the animal in a very few years; money represented by drivers' wages will pay a community better if those who now handle the whip and line are given a silent motor, quickly responsive to the touch of a crank or lever acting on a cable or electric current; the thoughts must revert to cause and effect—cost and result—and will surely lead to a saving of salary and its investment in the like business of its winner. By this means the profession will be looked up to and sought after as honorable instead of a make shift for a few years at most. The ratio of purely mechanical propulsion to animal is increasnig rapidly for street car business; we may expect in a very few years—certainly not to exceed ten—to find a horse line in a large city attract as much attention as one of the old lumbering 'busses does now on Broadway as it is hauled through New York on its way to some summer resort. As money and financial brains are plenty in the corporations, and 1891 slipping away without witnessing the completion of the cable road we desire, personally, to be written down as among those who hope that the electric art will advance, and its mechanical obstructions overcome to such an extent that 1892 will witness both the Broadway and Third avenue street cars carried along by electricity, and at a greater income to the investor than by any other means.

END OF DETROIT'S STREET RAILWAY WAR.

The street railway question in Detroit, which for some time past has been the cause of considerable feeling between the operating companies and the citizens, is now likely to be settled. A dispatch from Detroit announces that the entire street railway system of that place has been bought by a New York and Boston syndicate, and that the war will probably end when the property passes into the new hands.

The feeling among the citizens at one time bordered on excitement, and mass meetings were held to express the sentiments of the community with reference to franchises granted the street railway companies. It was claimed that the ordinances recently passed by the City Council gave the car companies unlimited privileges, and this was the cause of the ill-feeling. The objectionable ordinance, however, was vetoed by the Mayor, and its advocates in the council lacked sufficient numerical strength to override the veto.

The change of ownership of the lines, it is said, will take effect at once, and it is reported that electric power will be substituted for the faithful but inefficient horse.

It will be interesting to watch the development of Detroit's street car system under the new order of things. The electric system should work well there, as all the conditions are favorable; the streets are wide and the country is level.

A REMARKABLE CABLE ROAD.

In order to justify the use of the adjective "remarkable" in connection with a cable street railroad, the road so referred to must possess some feature or features which no other cable line possesses. Such a road is that recently opened in Brooklyn, on Montague street. The Montague street line might properly be called the "gilt edged" line, for the reason that its patrons are composed largely of bankers and well-to-do citizens. But what makes this line remarkable is the fact that it is the shortest cable line in existence, being only 2,500 feet long, actual measurement—not quite half a mile. It runs from the landing of the ferry from Wall street, New York, to the City Hall, Brooklyn, at which point connection is made with the various surface lines running in every direction and the elevated roads.

Montague street runs through the centre of the fashionable down-town section of Brooklyn and the equipment of the line is in keeping with the surroundings. This road possesses several mechanical features which are of general interest to street railway managers, particularly of the cable class. Some new devices are being tried on this road for the first time and their performance is being carefully watched by all interested.

Take it all in all, the Montague street cable road in a most interesting one to those who have no interest in it except as a means of transportation along the route, which is a difficult one to walk on account of the steep grade. The cars are elegantly fitted up, inside and out, and it is a pleasure to ride on them.

No doubt the enterprise of the promoters of this line will be thoroughly appreciated by those who patronize it, and the attractive features of the cars will induce others to ride who would otherwise walk.

There is a probability that the storage battery cars will soon again be running on the Fourth avenue line in this city. On July 23, Judge Coxe, of the United States Circuit Court, decided the suit of the Brush Electric Company against the Electrical Accumulator Company in favor of Mr. Brush. The termination of the suit removes all of the obstacles heretofore standing in the way of using storage batteries for street car traction. The Fourth avenue cars were well patronized and they were handsome in appearance. The New York people would undoubtedly like to see more of them.

SHORTEST CABLE ROAD IN THE WORLD.

On July 20, Brooklyn's first cable railroad was put into successful operation. The road, which runs down Montague street, from the City Hall to Wall street ferry, is a remarkable one in several respects. In the first place, it is the shortest cable road in existence, and it represents, in every particular, the highest degree of development in cable road construction and equipment.

The line is owned by the Brooklyn Heights Railway Company and is exactly 2,500 feet long —140 feet less than half a mile. For nearly one quarter of the distance there is a grade of about 10 per cent., at the bottom of which is located the landing of the ferry to Wall street, New York.

The cars, which are of the vestibule type, are of the most elegant design and are equipped with all of the latest improvements. They are painted in black, with gold lettering; all the metal work on the car body is of bronze, and the interior decorations are highly artistic. The cars, of which there are five, were made by the Lewis & Fowler Manufacturing Company. Each car is equipped with a brake patented by Mr. Brady, of Brooklyn, which is said to be very simple and effective. It is a combination wheel and track brake, and is so arranged that in case of accident, and the brake does not hold the wheels firm enough, by giving the brake handle an extra turn the brake acts on the track as well as the wheel, and wedges the wheel. It is, therefore, impossible for the car to move when the brake is applied to the track. Indeed, it is said that if a car is going down hill at full speed and the brake is applied to the track, the car may be stopped immediately. This brake insures absolute safety on grades, particularly in wet weather or when the tracks are slippery from any cause.



MONTAGUE STREET CABLE RAILWAY, BROOKLYN, N. Y.

Cable railway men all over the country are watching the performance of the Montague street line with very much interest, for the reason that the new improved solid steel lock cable is being given the first practical test. This cable was made by the Trenton Iron Company, Trenton, N. J., and in many important respects differs from the ordinary style of cable. The heart is made of solid steel wire, instead of hemp as is ordinarily used, and the outer covering is so made that it is claimed to be impossible to fray it. The strands are interlocked, and it is said to be impossible to dislodge any one of them. Each one is "locked" by the one immediately next.

The cable is 9,100 feet long and 1⅛ inches in diameter, and the system is that of Robert Gillam. The diameter of the return sheaves is 12 feet.

The power house of the road is situated on State street, opposite Willow place, and the cable runs through a conduit under State street to Hicks and down Hicks to Montague, the distance from the house to Montague street being 1,300 feet.

The power is supplied by one Cooper Corliss engine, built by C. & G. Cooper & Co., Mt. Vernon, Ohio. It is of the compound condensing type, with cylinder 18x30x42 in size and of 450 H. P. The diameter of the fly-wheel is 20 feet and the wheel weighs 28 tons.

The engine runs at 56 revolutions a minute, which gives a speed of eight miles an hour to the cable. Twelve miles is the speed intended to be maintained when everything is in thorough working condition, to attain which the engine will make 68 revolutions.

The transmission machinery was made by the Walker Manufacturing Company, of Cleveland, O., and embraces the latest improvements. There are four grooves on the face of the sheave, and they are made so that they will slip on the face of the sheave instead of the cable slipping in the groove. By this arrangement all chafing of the cable is prevented. Connection between the engine shaft and the transmission machinery is made by means of a clutch.

The tension on the cable is regulated automatically by an automatic tightener made by the Walker Manufacturing Company, and it acts instantly there is any variation in the tension.

The entire engine plant is erected with every provision for continuous running. Automatic oilers are used throughout, so that it is possible to keep every and all parts properly lubricated without stopping the engine. The engine was put in by Mr. Chas. E. Kline, Erecting Engineer for C. & G. Cooper & Co. Mr. Kline has erected engines for this company in 32 states.

The steam generating plant consists of two National water tube boilers, made by the National Water Tube Boiler Company, New Brunswick, N. J. They are of 250 H. P. each, and are giving the best of satisfaction. These boilers are rapid steamers and render excellent service.

Another noteworthy feature of this plant is the fact that the cable is welded electrically, by a Thomson welder, made especially for this work. This is the first cable that was ever welded by electricity. In the engine room at the power house the welding apparatus is located. It consists of one 35 H. P. Westinghouse Junior engine, connected by belt with a Thomson-Houston generator—separately excited—and the welding machine. The weld is only 1-16 of an inch long, and is accomplished in 37 seconds.

In conversation with Mr. A. Rodgers, the superintendent, some interesting facts were learned with reference to hand splicing and welding of cables. It takes 55 minutes to cut and splice a cable by hand; a weld can be made by electricity in 37 seconds, but it takes about an hour for the welded parts to cool down, consequently there is no apparent saving as regards time, but it is said that when more experience has been had with the welder, this time can be cut down. The electric weld, however, is neat and substantial.

In conclusion it will be of interest to summarize the chief features of this remarkable road, viz.:

1. It is the shortest cable road in existence;
2. It is the first road to use the improved lock cable, from which much is expected; and
3. It is the first road to weld its cable by electricity.

Since the engine started on opening day the cars have been running with great regularity, on schedule time, and without any hitch whatever.

The officers of the company are: President, Daniel F. Lewis; Vice-President, John E. Searles, Jr.; Treasurer, George S. Studwell; Secretary, Edward Johnson; Superintendent, A. Rodgers, to whom we are indebted for courtesies.

The illustration given herewith is from a photograph taken by our special artist. The view is up the grade from the ferry house.

BUFFALO NOTES.

The Niagara street electric cars have entered on their fourth week, and the service has steadily improved as the men become more proficient in handling the cars. Everything has worked smoothly from the first, and mishaps have been few and of a minor character. Last Saturday the electrics commenced running all night, and more frequently than the horse cars, which have heretofore been put on from midnight until morning. The improvement is greatly appreciated by the public, who found much fault with the all-night service previous to this change.

The day service on this line is also much better. Although the electric cars are more numerous and have almost twice the carrying capacity of the old horse-cars, they are crowded at certain hours of the day, and their experience seems to indicate that it is extremely difficult to maintain a rapid transit schedule with large cars when overloaded, the stops are so frequent and of such long duration that the time lost cannot readily be made up in short runs at high speed. The remedy is, without doubt, more cars. The railway company is working toward this end as fast as circumstances will permit.

Many a nickel is lost from the "passenger" who walks rather than board an overcrowded car, as well as from those who ride but reach their destination before the conductor can get through the car to collect their fares.

RAPID TRANSIT PLAN.

On July 22, the Rapid Transit Commissioners selected an East side route for the proposed rapid transit system in New York City. It extends from Fourteenth street to One Hundred and Thirty-fourth street at the Harlem river.

This line will be a counterpart of that proposed on the West side of the city, and will, like it, be an underground viaduct. It will connect with the Broadway underground line, and will run up Fourth and Park avenues to Forty-second street, thus rendering access to the Grand Central Station easy. It then proceeds to Ninty-sixth street, where the end of the tunnel will be located. At that point the road will change to the viaduct system.

Surveys of the territory have been ordered in the annexed district, in order to enable the commissioners to intelligently map out a line for that section.

J. J. Murray & Co., of New York, the contractors who built the electric road in Lawrence, Mass., expect to put the road in operation next week.

THE BROADWAY CABLE ROAD.

The great undertaking of changing the horse car line on Broadway, New York, to a cable line is progressing as fast as circumstances will permit. To accomplish the task with as little interruption as possible to the enormous traffic on that great thoroughfare is a feat which requires the greatest engineering skill.

Work is being carried on simultaneously in different sections, and with the improved appliances it is progressing with comparative rapidity.

The undertaking, on account of its magnitude and cost presents some very interesting features. Operations were begun on the cable road construction on May 18, last, and there are now nearly 3,000 men employed in the work of transformation. The length of road is ten miles.

The condition of the work at the present time is as follows: From 58th to 51st street, the rails are laid, and the street repaved; from 50th to 43d street, the work is about completed; between 43d and 23d streets work is progressing rapidly, and from Bowling Green to Rector street, in lower Broadway, the rails are laid, and some repairing has been done.

The rails are of steel, of the grooved girder type and weigh 92 pounds to the yard. They were furnished by the Johnson Company, Johnstown, Pa. This company also supplied the slot rails. At intervals of 4 feet 6 inches, the rails are supported on cast iron flange yokes, about two feet long on top and two feet high. The cable conduit passes through the centre of these yokes, and is constructed of $\frac{3}{16}$ inch steel plates. The yokes are set on concrete foundations.

In some places blasting was necessary during the work of preparing the cable road bed. By the exercise of great skill and the use of special appliances the blasting operations were carried on during the daytime without any interruption whatever to the traffic on the crowded thoroughfare.

Other sections of the construction work are now being opened, and the work will progress as fast as the material is supplied.



CONSTRUCTION OF CABLE LINE, BROADWAY, N. Y.—VIEW OPPOSITE GILSEY HOUSE.



CABLE CONSTRUCTION, BROADWAY, N. Y.—VIEW OPPOSITE RECTOR STREET.

Major G. W. McNulty is the chief engineer of the work, and Mr. John D. Crimmins is the contractor.

The two accompanying views of the construction work were taken by our special artist. The first one shows the condition of the work in upper Broadway, almost opposite the Gilsey House, and the second view represents the progress being made in the neighborhood of Rector street, lower Broadway.

FINANCIAL DEPARTMENT.

Through Messrs. Waller, Cook & Wagner, 15 Wall street, a syndicate of New York and Boston capitalists has concluded the purchase of Detroit's eighty-odd miles of street railroads and propose to convert the whole as fast as possible into electric roads. There should be no trouble in securing, at a reasonable rate of interest, sufficient money to make the change. Five millions of dollars are the figures stated for the purchase, and $2,000,000 more is estimated to be the requirement. I hope to see this stock listed on the New York Stock Exchange before snow flies; both the industry and the public demand it. By the way, there is one line of electric street railroad wanted which no capitalist has yet applied for, and, to judge from the wearied appearance of all except delivery messengers along the line, would require a conductor at each end of the car to make change. I refer to the new street line to connect ostensibly the Stock and Produce Exchange, passing directly through the curb brokers' offices, affording closer and more speedy connection between them. The plungers need but one glance at New street to boom this road.

While the general tone of Wall street is decidedly bearish, yet there is no really legitimate reason why it should be so; crops will be moving shortly and a turn for the better may then be looked for.

GEO. B. ELLERY.

STREET RAILWAY QUOTATIONS.

The following are the latest prices for street railway securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany Street Railway Co. (N. Y.)	$750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Atlantic Ave. Ry. Bkln	2,000,000	100 00	102 00
Birmingham Ry & Elec.Co.,6's (Ala)	1,500,000		par
Brooklyn City R.R.	6,000,000	10 00	15 50
Brooklyn City R. R. 5's	6,000,000		*104
Benton Belfontaine (St. L.)	324,000	100 00	100 00
Benton Belfontaine 7's (St. L.)	50,000		*102
Broadway & 7th Ave. (N.Y.)	2,100,000	100 00	305 00
Bleeker St. & Fulton Ferry (N.Y.)	900,000	100 00	26 00
Broadway & Newburg (O.)	1,000,000	100 00	110 00
Brooklyn St. R.R. (O)	310,000	100 00	125 00
City Elec. St. R.R. 6's (Ark.)	200,000		par
Citizens (St. L.)	1,500,000	100 00	105 00
Cass Ave. Fair. (St. L.)	300,000	50 00	49 00
Chicago City (Ill.)	6,000,000	100 00	325 00
Chicago Passenger (Ill.)	1,000,000	100 00	96 00
Central Park N. & E. R.	1,800,000	100 00	125 00
Cleveland Cable (O.)	2,000,000	100 00	25 00
Cleveland Cable Pref. (O.)	2,000,000	100 00	105 00
City R.R. (San Fran.)	800,900	100 00	100 00
California St. (San Fran.)	1,000,000	100 00	109 00
Cincinnati, (O.)	5,775,000	50 00	109 00
Cincinnati, (O.) 7's	300,000		*102
Charleston City, (S. C.)	100,000	50 00	65 00
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Dry Dock, E. By. & Bat. (N.Y.)	1,200,000	100 00	138 00
Dry Dock, E. By. & Bat., 7's, (N.Y.)	840,000		*106
Eighth Ave. (N.Y.)	1,600,000	100 00	250 00
East Cleveland, (Ill.)	2,000,000	50 00	85 00
Ferries & Cliff House, (Cal.)	2,500,000	100 00	42 00
Ferries & Cliff House, (Cal.) 6's	650,000		*108
Germantown, (Pa.)	1,500,000	50 00	95 00
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Louisville St. Ry. (Ky.)	5,000,000	100 00	20 00
Louisville St. Ry. Pref. (Ky.)	1,000,000	100 00	70 00
Montague St. Ry., B'klyn	150,000	100 00	100 00
Missouri, (Mo.)	2,500,000	100 00	250 00
Mound City, (Mo.)	1,000,000	100 00	200 00
Market St. (San Fran.) 6's	3,600,000		*123
Mount Auburn Cable, (O.)	300,000	100 00	50 00
Mount Adams & E. Park	1,400,000	50 00	107 00
Northern Central, (St. L.)	200,000	100 00	105 00
North Beach, (Cal.)	1,000,000	100 00	53 00
People's St. R. R. (St. L.)	1,000,000	50 00	75 00
People's St. R. R. (Pa.)	1,500,000	25 00	40 00
Pawtucket, (R. I.)	270,000	100 00	92 00
Phila. City	1,000,000	50 00	146 00
Short El. Ry. Co. (Clev.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co.	16,000		†
St. Louis Ry. (Mo.)	1,000,000	50 00	75 00
St. Louis Cable, (Mo.)	1,000,000	100 00	15 00
St. Louis Cable, 5's	1,500,000		*101
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Vine St. Motor Co. (Colo.) 6's	100,000		par
West End St. Ry. (Boston)	3,000,000	50 00	79 00
West End St. Ry. (Boston) Pref	6,650,000	50 00	83 00
West End St. Ry. Boston	4,500,000	100 00	66 00
Winston-Salem Elec. St. R R. (N C.)	250,000	100 00	75 00

As very few street railway securities are dealt in on the Stock Exchange, the above prices are mostly approximate, but will be found very near the mark.

*Per cent. †Registered Stock.

TROLLEY INSULATORS.*

We illustrate on this page a number of trolley insulators adapted to use with either cross suspen-

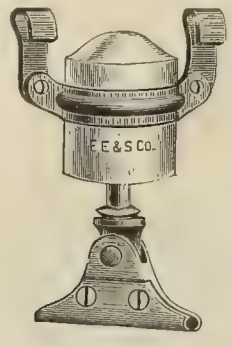


FIG. 1.

sion or bracket line, which are of new design and particularly well adapted for the purposes for which they are intended.

In Fig. 1 is represented a trolley insulator adapted for cross suspension work. The insulator itself is composed of the Syracuse porcelain which is peculiarly tough and has the highest tensile strength obtainable in this class of goods.

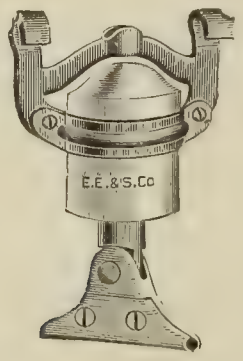


FIG. 2.

The hanger is an aluminum bronze casting which fits into the porcelain insulator and is clamped firmly around it by two screws which hold the two parts of the hanger together. The insulator is thus easily adjustable to the wire and after being hooked over the span or cross suspension wire the points are easily bent down with a pair of pliers so as to clamp the insulators in place.

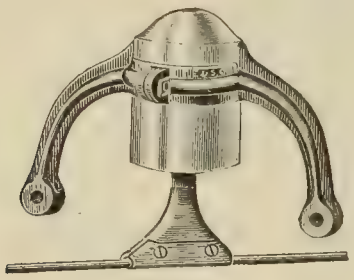


FIG. 3.

The stud running up into the end of the insulator from the bottom side, to which is hinged the ear which clamps the trolley wire is enlarged on the upper end and the interior of the porcelain so shaped that a quarter turn locks the stud into the insulator. The space around the stud is then filled with lead, which fastens it permanently. The ear, as the illustration shows, is hinged at the bottom so as to allow the "creeping" of the wire, which

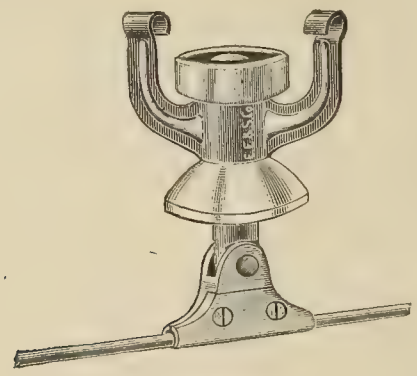


FIG. 4.

invariably occurs, to take place without breaking off the stud, which would be liable to occur if the hinged joint was omitted.

Fig. 2 illustrates another style of the same insulator except that the hanger is so arranged that when once hooked in place it is clamped into position so that it cannot slip sideways on the span wire, which obviates the necessity of turning the hooks down with the pliers. Fig. 1, however, is handier for repair work where the span wire is stretched tight across the street, whereas with No.

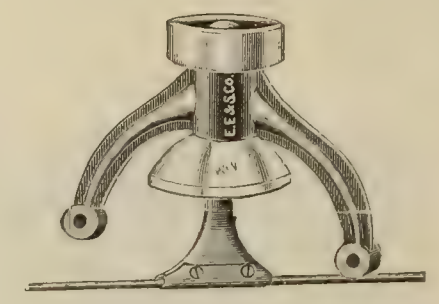


FIG. 5.

2 it is necessary to have the wire somewhat slack in order to adjust the hanger in place.

Fig. 3 illustrates a centre curve insulator which is practically the same as the other two insulators except that there is no joint between the ear and the stud, which is made unnecessary from the fact that the pull on the span wire comes directly opposite the wire. This insulator is also made so as to be adapted for the pull-off by replacing one-

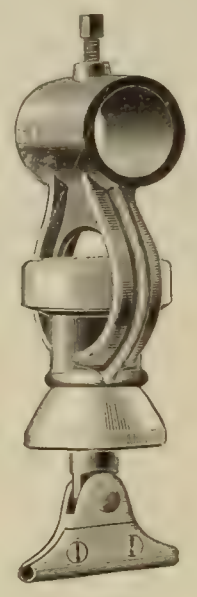


FIG. 6.

half of the yoke by a simple strap, leaving but one part of the yoke to which the wire is fastened.

Besides this style pull-off, a little gooseneck pull-off is also manufactured for use where it is preferred.

Figs. 4 and 5 illustrate a different style of cross suspension and centre curve trolley insulator which is made up of two pieces of porcelain instead of a

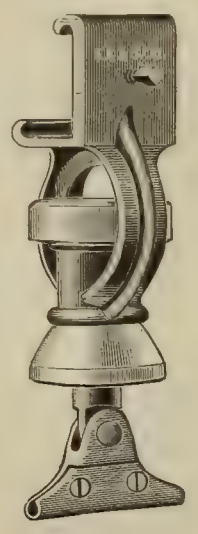


FIG. 7.

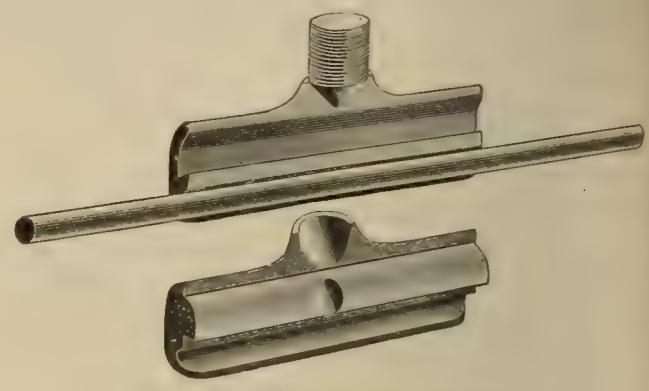
single piece, as is the case in Figs. 1, 2 and 3. This insulator is somewhat heavier than the first three and has been used with the most satisfactory results in the construction of some fifty miles of street railway.

Figs. 6 and 7 illustrate two styles of insulation for bracket lines, the first adapted for use with a bracket or extension arm composed of iron pipe, and the second for an angle iron bracket. It is a well-known fact that glass and porcelain are the best insulators obtainable, but the use of glass is hardly safe on account of its being so brittle. The porcelain, such as is used in this insulator, however, will stand the worst kind of hard usage and no complaint has yet been made of these insulators breaking or chipping. In cases of changes or repair work these insulators could be quickly adjusted in place of the other styles of insulators which they replace.

*The Electric Engineering and Supply Co., Syracuse, N. Y.

THE "CHICAGO" TROLLEY CLAMP.*

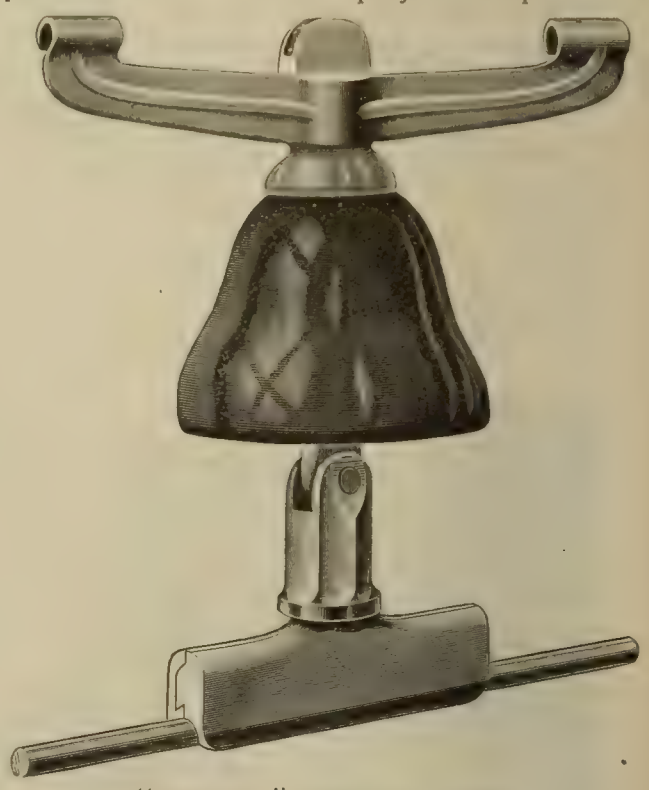
While many meritorious trolley wire clamps have appeared on the market since the first electric railway raised the necessity for such an appliance, it has remained for Mr. John S. Gustin, purchasing agent for the Electric Merchandise Company, Chicago, after long and earnest study, to



"CHICAGO" TROLLEY CLAMP.

devise a perfect clamp. The result of Mr. Gustin's efforts are embodied in the "Chicago" Trolley Clamp, a cut of which we give, and which has been put to the severest tests, under strains such as those with which it would meet in actual service.

The clamp is formed in three distinct parts, two sections with opposing lips, one of which is provided with a threaded projection upon which



"CHICAGO" TROLLEY CLAMP.

the clamping nut is screwed; the other by a dog enclosed by the protruding lower rim of the nut. Through the lower portion of these opposing sections, a groove is formed to contain the trolley wire, the size of which does not call for different construction of the clamp. With this clamp an absolutely reliable support is provided for the trolley wire, while at the same time, its simple mechanism makes its adjustment an easy task of a minute's time. The clamp is equally efficient whatever may be the style of insulator used in connection therewith.

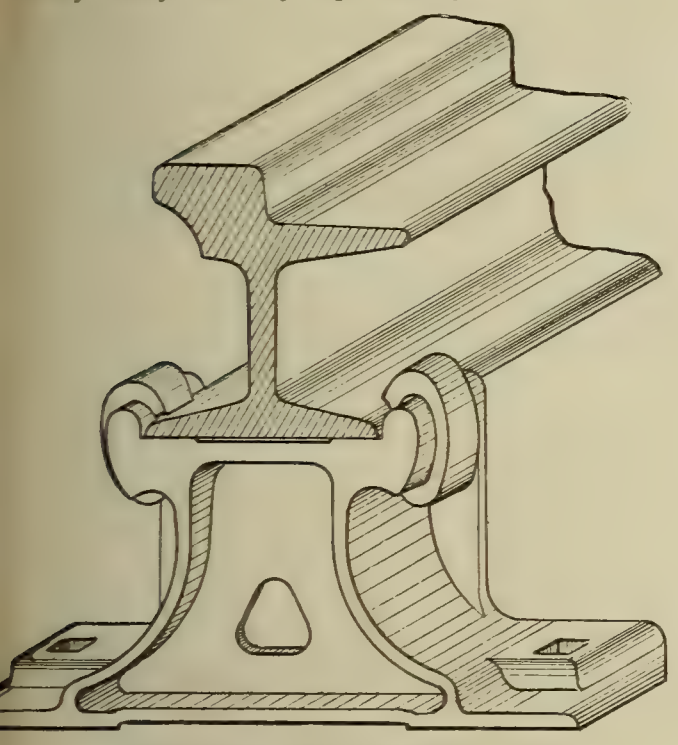
The Steel Tubular Car Company, of Buffalo, seem to be having a nice little exposé in the family. We have nothing to do in the personal merits of the case or similar ones, but we fail to see any good substantial reason why any one who has sufficient intelligence to accumulate enough money to invest in the shares of a joint stock corporation should lose it in such investments. It is

* The Electric Merchandise Company, Chicago.

getting altogether too common for comfort to read almost for the first time of an invention or scheme in the police reports, while at the same moment inducements of a legitimate and generally known enterprise seek requisite commercial aid in vain. This loss could easily be saved by an interview with any one of hundreds of disinterested people whose opinion could be paid for, the same as a lawyer's or doctor's, if you so desire; but who would quickly set you straight, with the reason for the change.

CHAIR FOR STREET RAILWAY TRACK.*

The accompanying illustration conveys a very good idea of this chair, which is very strong, and which has a large bearing surface upon the ties. It will be noticed that neither bolts nor rivets are used, and that the rail is fastened to the chair very firmly and very expeditously.



CHAIR FOR STREET RAILWAY TRACK.

A good point in favor of this device is that the rails can be removed while the track is being repaired without disturbing either the chairs or the road bed. They are made for all patterns of rail, both Girder and Tee.

THE WEEKS' RECORD OF STREET RAILWAY NOTES.

CALIFORNIA.

OAKLAND.—Trial trips were made over the new Fruit Vale Road, July 14. The cars are all large and roomy and are drawn by horses, which will soon be superseded by electricity. E. C. Sessions expects to extend the road to Alameda shortly.

It is reported that necessary steps for letting contracts for constructing the cross-town lines of the Consolidated Electric Road, will be taken shortly. Secretary Hunt thinks they are almost ready to commence work. Mr. Hunt says it is the intention of the Consolidated Company to buy the Berkeley road after building the cross-town lines.

PASADENA.—It is reported that A. J. Painter, of the Painter Street Railway line, has invented a machine for running cars with naphtha. Several satisfactory experiments have been made, and it is thought that the new motive power will replace the present power used on that line.

SACRAMENTO.—Thinking that horse-cars have the appearance of rusticity, this city stipulates in its ordinance granting the right-of-way to the street railroad, that neither horses or mules shall be used in propelling the cars. The people here do not wish to be behind the age.

SANTA ROSA.—J. W. Warboys, of the new street railway company, says that the proper committees were instructed at the last meeting of the company to purchase equipment material at once.

CONNECTICUT.

NORWICH.—The Norwich Horse Railway Company is using the Burnham & Duggan railway appliance track chair, and appears to be well pleased with it.

GEORGIA.

COLUMBUS.—The contract for the complete equipment of the North Side Electric Railway, has been given to E. T. Lynch, Jr., of New York.

ILLINOIS.

CHICAGO.—A number of property owners on State street have filed a bill of injunction to restrain the construction of the Alley "L" between Wabash and State streets, and between Congress and Twelfth streets. It is alleged that the road was incorporated as a surface road, and strenuous efforts are being made to keep the company from building an elevated structure.

DANVILLE.—President F. W. Penwell, of the Danville Gas, Electric Light and Street Railway Company, reports that the building of the new electric line will be carried forward as rapidly as possible. The road is to be completed to the new fair grounds by September 1.

JOLIET.—Electric cars are now running between this place and Lockport.

It is understood that a factory for the construction of street cars will be established here.

INDIANA.

GREENCASTLE.—On account of the erection of a freight depot by the Vandalia line, the street railway company has been compelled to abandon its track leading to the Vandalia depot. It is proposed to extend the track down Carthage avenue. It is said that unfriendly legislation has crippled the operation of the street railway line here, and if a franchise to extend down Carthage avenue is not granted, the company will tear up its tracks and sue the city for damages.

INDIANAPOLIS.—It is rumored here that the Edison Company and the Citizens' Street Railway Company are working together; the one to obtain a city lighting contract and a contract to furnish the Citizens' Company with power, and the other to obtain an extensive franchise.

MARION.—The Marion Electric Street Railway Company ran its first car July 14. The road was scarcely ready for traffic, but the car was run to comply with the terms of the company's franchise. Efforts are being made to complete the road as soon as possible.

KANSAS.

SALINA.—The contract for the construction of the Salina Electric Railway has been given to the United States Equipment and Construction Company. Mr. Laurence, the agent for the company, went to St. Louis, July 16 for rail and track men. The road is to be built of 40 lb. steel rails. There will be five 22-feet cars, having a carrying capacity of 30 passengers. They will be lighted by electricity, the brakes operated by electricity, and will be also heated by electricity. Twenty H.P. motors will be used on the cars Mr. Laurence thinks it will require about 70 days to complete the work.

MASSACHUSETTS.

BEVERLEY.—It is reported that Beverley is to lose its storage battery cars.

BOSTON.—The new rapid transit commission has got into working order.

CHELSEA.—On July 12 the East Middlesex horse railroad used its new double track from Pine Banks, Malden, to Mt. Vernon street, Wyoming, for the first time. The addition of these new tracks considerably shortens the trip between Melrose Highlands and Chelsea,

FITCHBURG.—The new street railroad opened for traffic July 22.

GLOUCESTER.—The Street Railway Company, which is laying its tracks and putting in heavier rails, expects to run to East Gloucester, by electricity, by August 1. It received a 100 H. P. Rae dynamo July 18.

HUNTINGTON.—The majority of the stockholders of the new street car line are somewhat surprised at the success of the experiment. It was not supposed that the road would pay, but it was a success from the start.

LAWRENCE.—The Merrimack Valley Street Railway Company has purchased ten new cars from the Newburyport Car Mfg. Company, of Newburyport. The cars will be equipped for electric traction.

Superintendent Morton, of the new electric railway, expects to have cars running by August 1. The line to Andover will not be completed until the system here is finished. Mr. J. E. Oakes, of Walton, has been engaged as chief engineer, and G. B. Austin will have charge of the motors.

MARBLEHEAD.—The Naumkeag Electric Street Railway Company has secured permission to erect poles and wires. It expects to have the road running by the single trolley system by August 15.

NEWTON.—The Garden Street Railway Company has been granted permission to construct lines on Walnut, Homer, Centre, Willow, Summer and Station streets, to Newton Centre. The road must be completed and in operation by January 21, 1892.

WORCESTER.—The Worcester, Leicester & Spencer Electric Railroad has just received nine new motor cars.

The new track chair, recently placed upon the market by the Burnham & Duggan Railway Appliance Company, of Boston (and of which an illustrated description appears elsewhere in this issue), has been adopted by the Worcester, Leicester & Spencer Railroad.

MICHIGAN.

BAY CITY.—It is understood that the Union Street Railway Company will substitute electricity for horse power on the Mackinaw street line.

ISHPEMING.—During the first twelve hours after the opening of the books for subscriptions for the stock of the proposed Ishpeming and Negaunee Street Railway, $12,700 were subscribed by citizens of Ishpeming. There is scarcely any doubt but the full amount required will be forthcoming quickly.

SAGINAW.—The Street Railway Company is double tracking its line on North Washington avenue, near Potter street.

The Saginaw and Union Street Railway Company is to erect a $6,000 brick building for storage purposes.

MINNESOTA.

DULUTH.—Manager Chase and Superintendent Wardell, of the Street Railway Company, desire to substitute sixty-pound T rails for the present forty-five pound material.

MINNEAPOLIS.—The Minneapolis Street Railway Company is to erect a two-story frame pavilion to cost nearly $10,000, and to make extensive alterations to its car house, corner of Bloomington avenue and Thirty-second street.

Second Assistant Postmaster General B. F. Stone has notified the local authorities that the plan for inter-urban electrical mail service has been found satisfactory, and that the inter-urban line has been declared a postal route from August 1. Superintendent Perkins will have everything ready by the date set. Twelve cars will carry the mails at first and the number will be increased when needed.

The growth of the business of the Minneapolis and St. Paul Street Railway Company has been such that an auditor's department has been created and John F. Calderwood appointed to the position of auditor.

MISSOURI.

ST. LOUIS.—Three electric roads are to be constructed to and beyond the suburbs during the next year.

MONTANA.

ANACONDA.—The Electric Street Railway is extending its lines from Ninth avenue toward Black Eagle Falls.

HELENA.—It is expected that the Electric Company will build an electric street car line here this fall.

NEBRASKA.

LARAMIE.—A street railway company has been organized here, which has petitioned the council for a franchise.

NEW HAMPSHIRE.

DOVER.—A new 85 H. P. generator is being set up in the power house of the Union Street Railway Company. This will make the total capacity of the station 300 H. P.

NEW JERSEY.

ASBURY PARK.—A. A. Taylor, of New York, has secured the contract for rebuilding the power station of the Sea Shore Electric Railway Company, which was destroyed by fire a short time ago. The new station is to be entirely of brick.

ELIZABETH.—On July 6 a consolidation was effected between the Rapid Transit Street Railway Company and the Clinton & Newark Railway Company, both of Newark.

JERSEY CITY.—A storage battery motor made a trial trip on the West Side Avenue Line, July 13. The trip is said to have been successful, the car ascending and descending grades with comparative ease.

NEW YORK.

BROOKLYN.—In the suit of Gustav M. Carroll against the Union Elevated Railroad Company for damages caused by the erection of a station before his place of business, 10 Sands street, the plaintiff was awarded $16,750. It was claimed that the station injured his business as a cigar manufacturer. C. William Stenzel, a neighbor of Carroll, was awarded $11,250 in a like suit.

JAMESTOWN.—The Jamestown Street Railway on July 18, received eight electric motors to be used on its Lakewood route.

NEW YORK CITY.—Mr. M. K. Bowen, formerly superintendent of the Kansas City Cable Railway, is now manager of the New York office of the Short Electric Railway Company, seventh floor, *World* Building, New York. Mr. Bowen's experience in railway circles will be of advantage in his new position. Mr. C. C. Curtiss, the general agent of the company, is here aiding in the establishment of the new headquarters and is very sanguine of success.

Eugene T. Lynch, Jr., consulting electrical engineer, 120 Broadway, recently closed some very large contracts in the South. Among them may be mentioned the construction of the Raleigh Springs Railway, Memphis, Tenn., consisting of ten miles of roadway, on which 56 lb. T rails are to be used; all grading, bridges, paving, ties, turnouts, overhead trolley work, boilers, engines, eight 16-feet motor cars and complete station equipment; North Side Railway, Columbus, Ga., three miles—40 lb. T rails, all construction both for track and overhead, four 16-feet motor cars, with a complete steam and electrical generating plant; Chattanooga Land, Coal, Iron and Railway Company, three miles 56 lb. T. rails and overhead equipment and three 16-feet motor cars with Edison motors; Chattanooga and North Side Street Railway, three and one-half miles, 56 lb. T rails, overhead construction and a complete station equipment as follows: two 14x13 inch Armington & Sims engines, two 16x66 inch Walsh & Weidener boilers, two 80 H. P. T.-H. electrical generators and four 16-feet motor cars having two T.-H. single reduction motors to each car. The last two roads run across the new bridge over the Tennessee River. Mr. Lynch has just completed the construction of the Maplewood Railway at Nashville, contracting for everything necessary to make the road complete and is now working upon a complete trolley system at Roanoke, Va.

On July 23 the law firm of Waller, Cook & Wagner of No. 15 Wall St., representing a Boston and New York syndicate, purchased the entire Detroit Street Railway system, paying upward of $5,000,000. The change of ownership will take place at once. It is said the motive power will be changed from horse to electricity.

ROCHESTER.—George Van Schuyver has commenced an action to recover $10,000 from the street railway company for damages received from a car on June 15. On that date during a street parade an electric car ran into a crowd, killing one and injuring several persons, among whom was the plaintiff. It is alleged the accident was caused by negligence of the company's employés.

SCHENECTADY.—It is rumored that the Schenectady Electric Railway Company will extend its lines from the old Pierson toll-gate as far as Cady's Corners and back to Mohawkville and Mt. Pleasant to Kruesi avenue, forming a belt line.

TROY.—The Watervliet Turnpike and Railway Company has replaced its cable under Congress street bridge, so that power is now conveyed to the east side of the river when the draw is open. Since the first cable was broken by ice last spring, cars have been operated by the overhead trolley system across the bridge, necessitating a complete stoppage whenever the draw was open, as the circuit was completely cut off. The new cable will make the circuit continuous.

* Burnham & Duggan Railway Appliance Company, 70 Kilby street, Boston

NORTH CAROLINA.

Raleigh.—Superintendent Lewis expects to have the street railway system completed and running by August 15.

OHIO.

Braddock.—The electric street car line was open for traffic July 20.

Niles.—An electric street railroad is to be built between this place and Mineral Ridge.

Toledo.—The street car strike here which was begun July 15, was settled July 19, at a conference of the companies, a committee of strikers and the Mayor. There was a compromise in the rates of wages demanded by the men.

Youngstown,—It is said that the building of the street railway from Leavittsburg through Warren, Niles and Girard to meet a branch of the Youngstown line is assured. When the road is completed it will form a street railway nearly 25 miles long, extending from Leavittsburg to Hazelton.

PENNSYLVANIA.

Harrisburg.—A meeting of ministers and officers of the various churches held July 16, resulted in a long petition to the directors of the East Harrisburg Passenger Railway Company, requesting them to stop the running of cars on Sunday.

McKeesport.—It is expected that the first of the two tracks of the White Electric Traction line will be completed from Duquesne to Riverton bridge by July 28.

Philadelphia.—It is reported that a syndicate has been formed to construct a cable road along Arch street from Second street to Spring Garden street bridge and electric cars will be used from that point west to Belmont avenue. The present line is operated by horse and mule power by the Hestonville Company.

Pittsburg.—Property owners on Woods Run and McClure avenue, Allegheny City, are endeavoring to restrain the Pittsburg, Allegheny and Manchester Traction Company from laying a "Y" on those thoroughfares.

Wilkesbarre.—An electric railway syndicate has ordered 18 new cars, which are to be equipped with the latest improved Short electric motors.

TENNESSEE.

Chattanooga.—The Chattanooga Electric Railway Company is to increase its power plant by the addition of one 250 H.P. Armington & Sims engine, two 72x16 inch W. & W. boilers and two 80-kilowatt Edison generators.

The Chattanooga Land, Coal, Iron and Railway Company and the North Side Street Railway Company have contracted with E. T. Lynch, Jr. of New York for the construction and complete equipment of these roads. The first named road, which is to be three miles in length, will use Edison motors and the latter, three and a half miles long, Thomson-Houston motors and generators.

Memphis.—The Raleigh Springs Electric Railway to be constructed by E. T. Lynch, Jr., of New York, will cover ten miles of roadway. The road is to use the trolley system.

TEXAS.

Waxahachie.—The new street car line here will probably be operated by electricity.

WASHINGTON.

Spokane Falls.—The officers of the Spokane Street Railway Company expect to have their line transformed from cable to the electric system in a very short time. All arrangements have been completed.

Tacoma.—The cable of the Tacoma Street Railway Motor Company was put on the wheels at the power house and spliced, July 16.

Statistics.

Dover, N. H.—On June 30 the street railroad carried 9,000 passengers, the receipts for the day being $666.37. This is the largest day's business in the history of the road. The receipts for June were $4776.95, a gain of 40 per cent. over the month of May.

Harrisburg, Pa.—The report of the Harrisburg City Railway Company for the year is as follows: The capital stock of the company, $125,000 in 5,000 shares; cost of roadbed and equipment, $166,963.93; value of real estate, exclusive of roadway, $30,000; number of passengers carried during the past ten months were 757,013; amount of money on hand is $232,103. The treasurer, Mr. Rudolph F. Kelker, and clerk, Mr. W. A. Kelker, have resigned. We have not been informed as to who will fill these positions.

Rutland, Vt.—The Rutland Street Railway Company has done a good business the past year. The company's annual statement shows an increase of passenger receipts of $100 more than the year previous. The live stock of the company was somewhat increased in numbers, causing an additional expense of $700. The first bond paid since the company began operations was one for $1,000 during the year just ended. The officers of the company consider its financial condition better than ever before.

Track Extensions.

Concord, N. H.—The Street Railway Company is to extend its tracks to the western section of the city, and will use electricity as a motive power.

Lynn, Mass.—It is expected that the Lynn and Boston Street Railway Company will connect its route with the West End Road within three months. This will directly connect the southerly part of Boston with Salem by means of electric cars. The West End is to furnish the motive power.

Oakland, Cal.—The Sessions-Vandercook Electric Railway Company, has contracted for the construction of nearly 1,000 feet of double track on 8th street, from Broadway to 18th street, East Oakland. From there one track will go up 4th avenue, and the other will continue along 18th street.

Pittsburg, Pa,—The Greenfield Avenue Railway Company has been granted the right to lay tracks on Sylvan avenue, and the Swissvale and Wilkenson Street Railway Company the right to lay tracks on Forwood street.

An ordinance has been passed granting the Pittsburg, Allegheny & Manchester Street Railway Company the right to construct a single track to its line along Duquesne and 5th streets from the 6th street bridge and along Liberty street from 5th street to its terminus on Liberty street.

Franchises.

Dayton, Ohio.—An ordinance has been passed to extend the time during which the Dayton Street Railway shall be authorized to operate its line for a further term of fifty years. It provides that when the company changes its motive force to electrical and cable power, it shall extend its lines from the east corporation line to the west corporation line, and shall run all of its cars regularly over the entire road.

Oakland, Cal.—Felix Chappellet, William E. Ames, H. B. M. Miller, V. W. Gaskill and Herman de Laguna have petitioned the Board of Supervisors for a franchise for a street railroad from Hayward to San Jose. The above-mentioned parties have formed a co-partnership for the purpose of obtaining right-of-ways and franchises for constructing, equipping, running, maintaining and operating lines of street railroads from Haywards through Decoto, Alvaredo, Centreville and Warm Springs to the boundary line of Alameda county. The road will be cable or electric. There are to be two routes to Warm Springs, from which point to San Jose there will be but one line.

Pelham, N. Y.—A franchise has been granted to the Westchester Electric Railroad Company to run an electric line between City Island and Yonkers, via Mount Vernon. A short line will also be operated from Pelham Park to New Rochelle and Glen Island. Congressman Stahlnecker is at the head of the project.

Casualties.

Cleveland, O.—A collision occurred July 15 at the Crawford Road switch, between two motor cars, by which one motor man was nearly killed and the other badly bruised. The accident is supposed to have been caused by one of the motor men not complying with the rules of the road, with reference to the meeting and passing of cars at sidings. Both cars were badly wrecked.

Eau Claire, Wis.—On July 19, while a 12-year-old boy was trying to accustom his horse to the new electric cars, he was thrown from his horse under the wheels of the rapidly moving car, which crushed him to death. The gripman reversed the current immediately, but not in time to save the boy. The gripman went insane from the shock.

Elizabeth, N. J.—On July 21, as a car of the Elizabeth Street Railway was passing over a manhole an explosion of gas dashed the big iron cover of the manhole against the bottom of the car, lifting it from the rails and pitching all the passengers from their seats. The car was slightly damaged.

Jersey City, N. J.—On July 19 a 15-year-old boy fell over the dashboard and under the wheels of a street car. His right leg was cut off at the knee. The driver of the car, when arrested for assault, claimed that the boy fell from the car in a fit.

New York, N. Y.—A Third avenue street car ran over a gentleman, aged 44, at Seventy-ninth street and Third avenue, July 22, injuring him to such an extent that he died shortly after his removal to his home at 178 East Seventy-ninth street.

Pittsburg, Pa.—While a seven-year-old negro was following a negro brass band a Central traction car ran over and almost instantly killed him. Shortly before it occurred an old man was knocked down and rendered insensible by a Birmingham car.

Decatur, Ill.—While a rapidly-moving car was rounding a curve here, July 23, it jumped the track, throwing a lady, a resident of Elgin, Ill., under the wheels, killing her instantly. Several others were severely injured.

Cambridgeport, Mass.—On July 23 a gentleman's leg was badly crushed by his falling beneath an electric car on Main street. The injured member was amputated.

Mortgages.

Anaconda, Mont.—A bond for $50,000 has been filed by the Metropolitan Electric Railway Company, as security for compliance with the regulations set forth by the county pertaining to the right-of-way granted to the company.

Incorporations.

Chicago, Ill.—The North Western Street Car Company was incorporated July 16 to operate street cars in Chicago, The capital is $100.000. Incorporators: Charles Seegers, Frank Wilke, W. Houssen and others.

On July 18, the Chicago & Evanston Electric Railway Company was incorporated to build and operate a street railway. The capital stock is $500,000. The company is to secure a franchise to construct a double track electric road on the trolley system, to extend through the villages of Evanston, South Evanston and Rogers Park and to connect with the Lincoln Avenue Cable, Chicago. The incorporators are J. L. Cochran, DeLancey H. Louderback, Frank S. Gorton and Alexander Clark.

Pasadena, Cal.—On July 10, the Pasadena and Mt. Wilson Railway Company was incorporated to erect an electric road up Mt. Wilson, 6,000 feet high. The length of the line will be nearly 9 miles, and will cost fully half a million of dollars.

Springfield, Ill.—On July 17 the Harrison Street & Des Plaines River Electric Railway Company filed articles of incorporation. The capital stock is $112,500. It is proposed to construct a street railway in Chicago. The incorporators, who also formed the first Board of Directors are: E. L. Steward, S. G. Swysher, G. Grant Stewart, B. Phister and H. H. Ingham.

Election of Officers.

Boston, Mass.—Ex. Governor Ames, Frederick Ayer, and J. T. A. Clark have been elected to the Executive Committee of the Atlanta Consolidated Street Railway Company.

Newark, N. J.—At a meeting of the stockholders of the Newark and Rapid Transit Street Railroad, held July 18, the following directors were chosen for the ensuing year: Thomas C. Barr, E. J. Moore, E. E. Denniston, Richard W. Clay, A. Q. Keasbey, Andrew La Massena, Jr., Henry Congar, E. B. Gaddis and John N. Akerman. Mr. Akerman, the superintendent, takes the place made vacant by the death of A. L. Dennis. The old officers were re-elected. By a resolution the directors were given full power in the consolidation matter.

Rutland, Vt.—The annual meeting of the stockholders of the Rutland Street Railway Company, July 15, resulted in the election of the following Board of Directors: John W. Cramton, George T. Chaffee, N. K. Chaffee, John A. Sheldon, P. M. Meldon, S. M. Willson, Egbert C. Tuttle, T. W. Moloney and M. McKeogh. Following the election of the directors Mr. Cramton was elected president, N. K. Chaffee, treasurer, M. McKeogh superintendent and S. M, Williams clerk for the ensuing year.

Duluth, Minn.—At the annual meeting of the Duluth Street Railway Company, July 21, the old officers were re-elected excepting Thomas B. Wilson, who was replaced by Luther Medenhall as vice-president. A. S. Chase will be retained as manager until August 1, when he will retire.

Personal.

Mr. Harris, who has charge of the construction of the Electric Street Railway, reached Danville, Va., July 20, and will commence work at once. He expects to have cars running in about three weeks.

Eugene O'Rourke of La Salle, Ill., has patented a baggage arrangement for the top of electric cars. The baggage is lifted to the roof by electricity and held there by the new contrivance.

Mr. A. L. Millard, of the Edison General Electric Company, was in La Salle, Ill., July 19 to test the new Edison generator of the street railway company.

Mr. Louis P. Hall of Baltimore, Md., general manager of the Raleigh Street Railway, and Mr. John C. George, also of Baltimore, are in Raleigh N. C., pushing the construction of the Raleigh Street Railway system to completion.

Supt. Sharpe of the Street Railway, St. Paul, Minn., has resigned to accept a lucrative position with the New York Construction Company. Mr. Heild, who has been acting as superintendent of electrical construction, will succeed him as superintendent.

Mr. Wm. Robinson, General Manager of the Robinson Radial Car Truck Co. is in St. Louis.

Mr. Charles L. Pullman is at the Lafayette Hotel, Cape May, N. J.

Mr. Wm. White, president of the Dry Dock road (N. Y.), is summering at the Delaware Water Gap.

Mr. A. A. Folsom, president of the Tripp Manufacturing Co., of Boston, is at the Profile House, White Mountains.

Mr. O. T. Crosby, General Manager of the railway department of the Thomson-Houston Co. was in town last week.

Mr. Tom L. Johnson, president of the Brooklyn Street Railway Co. of Brooklyn, O., was registered at Young's Hotel, Boston, last week.

Major H. C. Evans was met in Young's Hotel, Boston, last week.

Elmer O. Evans, the Major's first lieutenant, was recently in Buffalo. While there he was taken quite sick with a bad attack of dysentery, but, in spite of being threatened with typhoid, we are glad to say he pulled up all right, "slightly disfigured," it is true, but "still in the ring." (Some men are hard to kill.)

Mr. Louis P. Hall has assumed the duties of his office as manager of the Raleigh (N. C.) Electric Street Railway.

Mr. W. J. Clark of the railway department of the Thomson-Houston Electric Company, started on a trip West on July 25 in the interest of his company. He will put in some energetic work in the electric railway field, and no doubt he will make many converts to electricity. During

a recent business trip to San Francisco Mr. Clark was generously interviewed by the reporter of one of the daily papers, and in a very clear and able manner he told the Californians a good many facts about electricity that they did not know before.

INCREASE OF CAPITAL.

CHICAGO, Ill.—The capital stock of the Chicago City Railway Company has been increased from $6,000,000 to $7,000,000, to meet the additional expenses of the road incurred by improvements, which include the construction of a number of new cars and large extensions to the road.

GRAND RAPIDS, Mich.—The Valley Street and Cable Railway Company is to increase its capital from $600,000 to $2,000,000.

BUSINESS NOTE.

William Wharton, Jr. & Co., of Philadelphia, holds the exclusive contract for the construction of the Third Avenue Cable Line in New York City. The contract calls for eight miles of double track. The cable road construction is completed from 100th to 116th street, and in a few days operations will be begun at the upper end of the the Bowery.

STILL THEY COME.

MR. E. V. CAVELL,

Gen. Mgr. Railway Dept. ELECTRICAL AGE.

Dear Sir:—It affords me pleasure to note the tremendous improvement in your paper. It is the most complete paper published.

In my past fifteen years' experience in the electric field I can say with confidence that it must be without an equal in the field.

Yours truly,

F. R. CHINNOCK.

N. Y. State Agent, E.G.E.C.

Mr. W. A. Stadelman, manager and chief engineer of the Equitable Engineering and Construction Company, Philadelphia, Pa., writes:

"Being a weekly publication, you should certainly be able to supply your readers with fresh news, which will be very much a chestnut by the time the regular monthly street railway journals come to hand. I wish you every success with your new department."

C. A. Benton, manager of the railway department of the Detroit Electrical Works, Detroit, Mich., writes:

"There is no doubt in my mind that you have made a step in the right direction. The electrical railway field is one in which you are most competent to produce good results, and I predict for your STREET RAILWAY NEWS unqualified success."

Mr. J. A. J. Shultz, president of the Shultz Belting Company, St. Louis, Mo., writes:

"I think the street railway news given weekly in the ELECTRICAL AGE is as good as it is new."

SIMPLEX ELECTRICAL COMPANY,
BOSTON, July 23, 1891.

E. V. CAVELL, Esq.,
General Manager, STREET RAILWAY NEWS.

My Dear Sir:—In these days of rushing, I am glad to see that the ELECTRICAL AGE is fully abreast of the times.

Your departure in making a special "Railway Department" commends itself as sound policy. It will be appreciated by both your reading and advertising friends.

Wishing you largest success, I am,

Yours very respectfully,
A. F. MASON,
Gen'l M'gr Simplex Electrical Company.

DELAWARE & HUDSON COMPANY.

For the information of those who have never visited the Canadian metropolis, but who are intending to go to the Montreal meeting, it may be stated that the shortest and most interesting line between Montreal and New York is the Delaware & Hudson Railroad. Parties from the West can go to Schenectady or to Albany, connecting at either point with the "D. & H." road, and see something of Saratoga, Lake George, Lake Champlain and the marvelous scenery of the Adirondack Mountains. The "D. & H." stands at the head in the number and importance of the summer resorts along its line, and in the number of summer tourists carried in its trains.

Arrangements should be made to include a stop at the Hotel Champlain on the west shore of Lake Champlain, three miles south of Plattsburgh, which, architecturally and in beauty of location of surroundings, is perhaps the finest affair of its kind in the world.

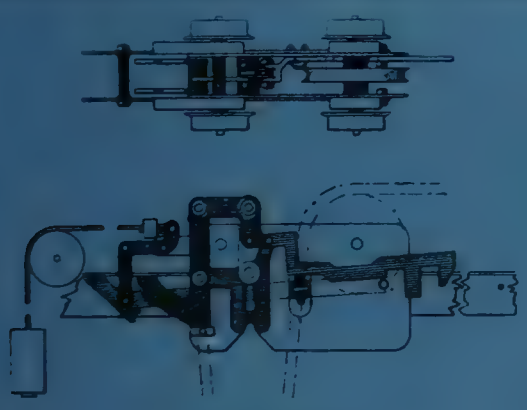
Mr. J. W. Burdick, general passenger agent of the Delaware & Hudson Railroad, Albany, N. Y., will be glad to send by mail an illustrated guide of the line, upon receipt of six cents in stamps, to cover postage.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued July 21, 1891.

456,148. Trolley. James E. Kinney, John H. Brown and Charles G. Wade, Chicago, Ill.; Brown said Wade assignor to Kinney and Brown. Filed Oct. 20, 1890.

The combination, with an arm having pivoted connection with the jaws and provided with notches on opposite sides of a lug carried upon it, of a stop against which the lug is brought to arrest the forward movement of the trolley, and a stop provided upon the frame of the trolley, whereby when the forward movement of the trolley is arrested the



456,148—TROLLEY.

pivoted bar will be brought into engagement with the two stops to hold the jaws separated, while the trolley is at the same time held in position.

456,195. Brake for Street Cars. John M. Gropp, Wilmington, Del. Filed Apr. 13, 1891.

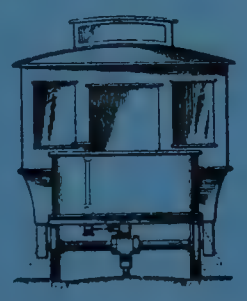
In combination with a car axle or other axial support connected with the car, a brake, consisting of a body formed with a boxing, provided with a bit, and adapted to be oscillated with respect to its axle or support.

456,250. Insulated Contact for Electric Switches. Ocron S. Platt, Bridgeport, Conn. Filed June 4, 1890.

In an electric switch, the combination of a contact bar having a lip, contacts for the bar, a porcelain insulator having a slot, a brush mounted on the insulator, and the filling affixing the insulator in place.

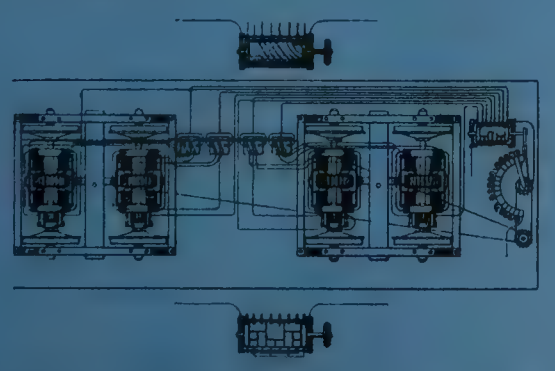
456,252. Connector and Support for Trolley-Wires. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Oct. 29, 1890.

In combination with a sectional trolley-wire for underrunning trolleys, an insulating connector comprising a metal frame provided with a trolley bearing surface and with conductor attaching devices above the trolley bearing surface and having insulation between the conductor sections and frame.



456,195—BRAKE FOR STREET CARS.

456,434. Crossing for Conduit Railways. Edward Samuel, Philadelphia, Pa., assignor to William Wharton, Jr., and Company, incorporated, same place. Filed Mar. 9, 1889.

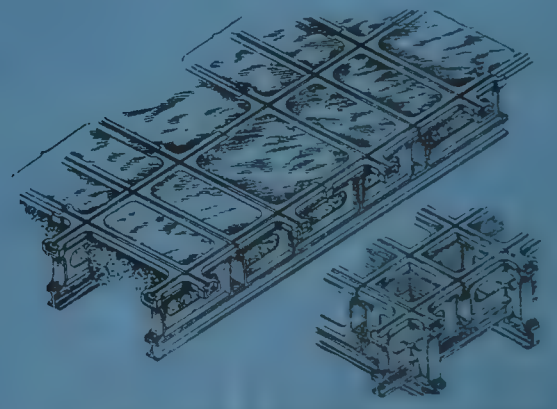


456,254—SWITCH FOR ELECTRIC CAR MOTORS.

The combination, in a crossing for a conduit railway system, of the crossing-castings extending from side to side of the cross track and forming the slot of the conduit, foundation beams or girders located transversely to the line of the conduit track, and supports or frames interposed between the foundation beams or girders and the crossing-castings, whereby the castings are rigidly united to the foundation beams or girders.

456,513. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed July 14, 1885. Divided and this application filed Oct. 10, 1889.

The combination of an electric conductor extending along an electric railway, an electrically propelled vehicle, a frame supported by the vehicle and laterally movable, and an intermediate contact device supported thereby and independently of the conductor, but maintaining a traveling connection therewith and having a self-sustaining free swiveling movement about a vertical axis.



456,434—CROSSING FOR CONDUIT RAILWAYS.

456,514. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Original application filed Sept. 23, 1886. Divided and this application filed Sept. 27, 1890.

The combination, in an electrical railway, of a main line and branch, each of which is provided with a positive and a negative conductor, and in which the positive conductors of the main line and branch are directly connected and electrically united without the employment of a switch, and in which the negative conductors are electrically connected and provided with a switch at their point of juncture.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued July 21, 1891.

456,172. Method of Measuring Electrical Currents. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Original application filed Oct. 19, 1887. Divided and this application filed May 27, 1889.

Evaporating a liquid by the heat generated by an electric current and noting the amount of evaporation to ascertain the amount of current that has passed through the heat generator.

456,182. Electric Lock. Abraham S. Wiley, Detroit, Mich. Filed Apr. 9, 1891.

In a safe or vault, the combination, with one or more locking bolts, of one or more electro-magnets adapted when the electric circuit is closed through the same to move the bolts into or out from their locked or bolted position, and a dog adapted to prevent the unbolting movement of the bolts, and means adapted to disengage the dog prior to unbolting the door.

456,219. Electro-Therapeutic Apparatus. Edgar Grauert, New York, N. Y., assignor to Emil Gramm, same place. Filed July 16, 1890.

A battery having as an element a compressed plate of chloride of silver.

456,253. Operating Mechanism for Current Regulators. Sidney H. Short, Cleveland, O. Filed Mar. 10, 1891.

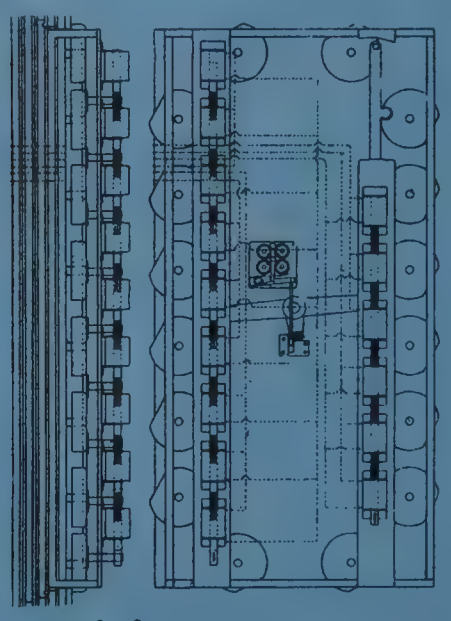
In combination with the current-regulator, operating

mechanism comprising two wheels and an intermediate chain, each wheel being provided with a web of non-conducting material.

456,254. Switch for Electric-Car Motors. Sidney H. Short, Cleveland, O. Filed Apr. 7, 1891.

In combination with the wheel-base of a car and four or more propelling motors, the rheostatic and commutating switches, the commutating switch being adapted to connect the motors in series, in multiple series, and in parallel, and the rheostatic switch being arranged in a portion of the supply circuit common to the motors.

456,271. Flexible Conduit for Electric Conductors. Charles H. Herrick, Winchester, assignor of two-thirds to Herbert H. Brooks, Cambridge, and Alfred A. Brooks, Boston, Mass. Filed Apr. 17, 1891.



456,182—ELECTRIC LOCK.

A flexible conduit for electrical conductors, composed of a spiral lining, a protective wrapping applied to cover the line of separation between the turns of the spiral of the lining, and an inclosing envelope.

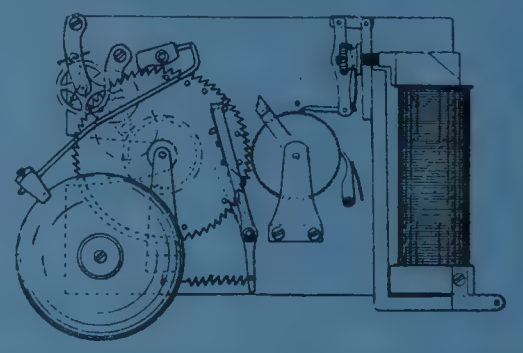
456,280. Rheostat. John Van Vleck, New York, N. Y., assignor to Luther Stieringer, same place. Filed Jan. 19, 1891.

The combination, in a rheostat, two series of contacts, each series connected by resistances, and a switch arm or device co-operating with both series of contacts and arranged to throw a resistance of one series into circuit by movement of the switch one step, and then to throw a resistance of the other series by movement of the switch a second step.

456,325. Secondary Electric Clock Movement. Benedikt Haberthür, Breitenbach, Switzerland, assignor of one-half to Pius Saner, same place. Filed Nov. 8, 1890.

ELECTRICAL PATENTS—Continued.

In an electric clock, the combination, with a hand propelling mechanism and electro-magnetic means for driving it, of a striking mechanism, a motor-spring therefor, and mechanical means in connection with the hand-propelling mechanism for rewinding the spring.



456,325—SECONDARY ELECTRIC CLOCK MOVEMENT.

456,327. Cut-out for Electric Lamps. Walter F. Smith, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed Apr. 24, 1891.

An electric lamp having a filament holder provided with fusible terminal feet and a switch adapted to contact therewith.



456,327—CUT-OUT FOR ELECTRIC LAMP.

456,376. Conduit for Electric Cables. Maurice Delafor, Paris, France, assignor to Jacob Fréres & Co., same place. Filed Aug. 15, 1890.

A conduit of suitable insulating material having a removable cover, the joint between the cover and conduit following a broken line, whereby tightness of the conduit is assured, the conduit being also provided with a series of insulators, each having a groove, an insulating neck, flanges and a lower support or foot attached to the body of the conduit.

456,493. Double-Contact Switch. Thomas H. Lovell, Cleveland, O. Filed Dec. 2, 1890.

In a double-contact switch, a fixed plate mounted upon a movable insulated spindle, having longitudinal movement in bearings at either end, and an operating pin in combination with spring electrodes mounted on either side of the spindle and provided with recesses adapted to receive and secure the rounded extremities of the plate.

456,507. Magnetic Separator. Henry G. Fiske, New York, N. Y., assignor to John D. Cheever, same place. Filed Mar. 26, 1891.

The process of separating magnetic particles from associated impurities by feeding the mass through the field of a moving series of magnets at a speed different from that of the magnets, and subjecting the mass while traversing the field to continued reversals of polarity, the movement of the mass being in opposition to a current of fluid.



456,540—METHOD OF WELDING BY ELECTRICITY.

456,540. Method of Welding by Electricity. John H. Bassler, Myerstown, Pa. Filed Aug. 16, 1888.

The method of welding together heavy plates of metal by means of electricity, consisting in first coating the meeting edges of the plates with carbon, then placing those edges close together, then sending simultaneously one current of electricity transversely through the joint from the upper surface of the plates and another current transversely through the joint from the lower surface of the plates, and moving the plates longitudinally with relation to the direction of the currents.

456,541. Method of and Apparatus for Electric Welding. S. Lloyd Wiegand, Philadelphia, Pa. Filed Dec. 9, 1889.

The method of uniting parts of structural metal work by inserting progressively a fillet of metal of such small cross-section as to become pliable and plastic under temperature, and transmitting through such fillet two or more distinct electrical currents which divide and pass through the separate surfaces opposed to the fillet and applying pressure to the fillet to insure contact.

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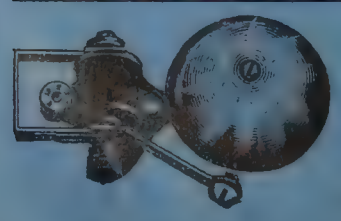
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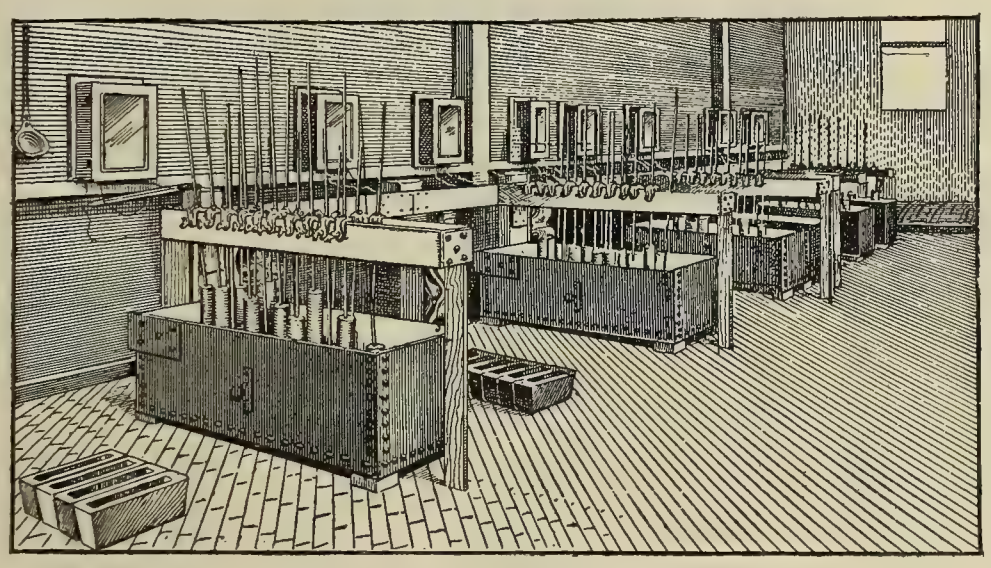
Vol. IX. NEW YORK, AUGUST 8, 1891. No. 32.

PRODUCTION OF ALUMINUM.

In our issue of July 4, we gave an interesting and extensive account of the Pittsburg Reduction Company's plant, at Pittsburg, Pa., and described in considerable detail the process of manufacturing aluminum as operated by that company.

The process of the production of aluminum is as interesting as it is peculiar, and is a perfect parallel to the electrolytic deposition of metals from an aqueous solution of their salts.

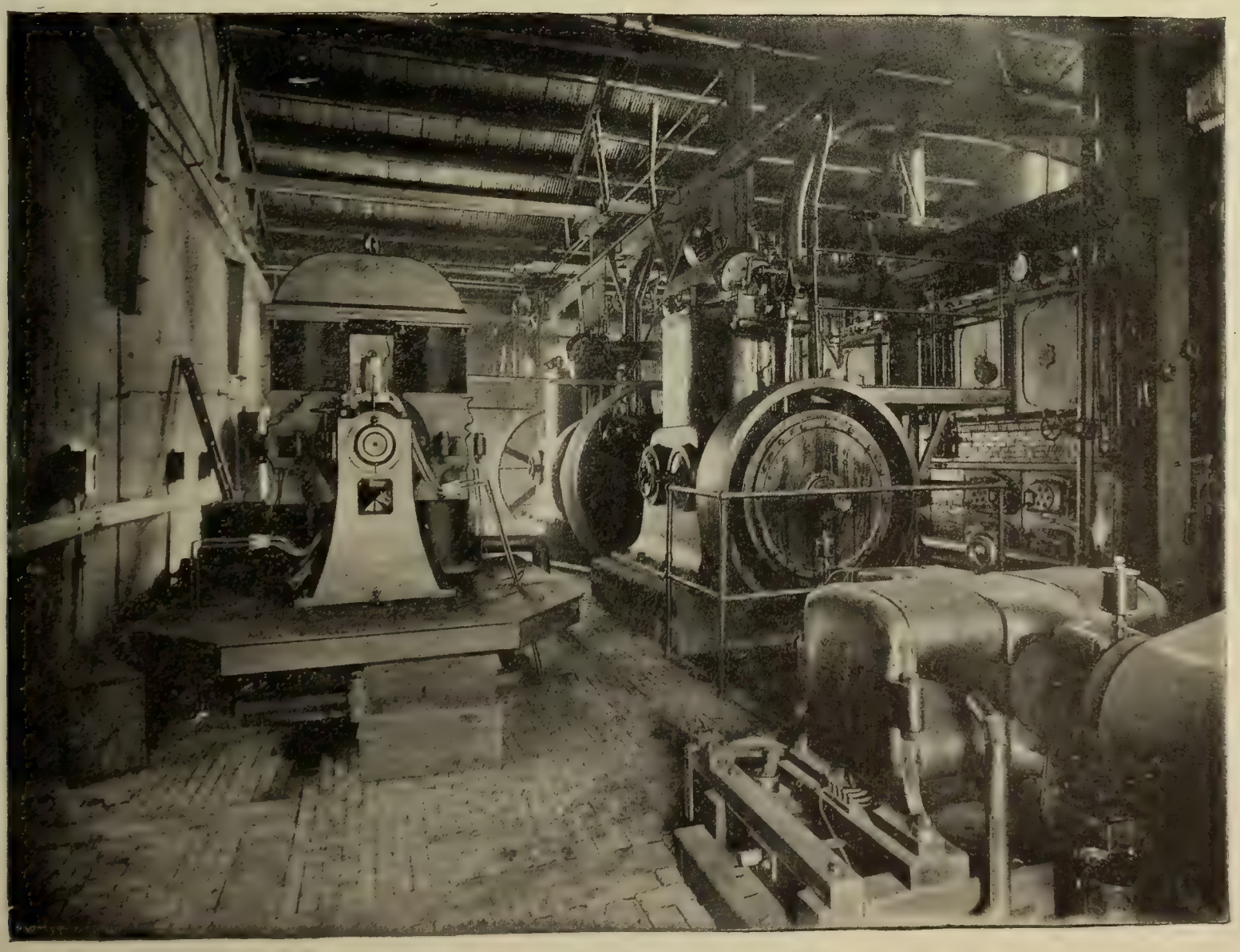
The Pittsburg Reduction Company's commercial success is dependent in a great measure on their ability to run the plant continuously for a long time. Recognizing the single-acting principle of the Westinghouse engine, as best suited for their purpose, they have installed two Westinghouse high-duty compound engines of 200 H. P. each, which drive two Westinghouse shunt-wound dynamos in multiple arc, each generating 2,500 amperes of current of 50 volts pressure; also, one Westinghouse Standard 125 H P. engine, driving two Westinghouse shunt-wound dynamos in multiple arc, each generating 1,000 amperes of current of 25 volts pressure.



ALUMINUM REDUCING BATHS, PITTSBURG REDUCTION CO.

In the short time that this company has been organized a four months' run has not been uncommon and it is quite probable that the machinery will be called upon in the near future to run for a year without a stop.

Our illustration is a view of the interior of the company's power-room from a photograph.



POWER ROOM OF THE PITTSBURG REDUCTION CO.

ELECTRIC WELDING.—Pieces of such metals and alloys as wrought iron, silver, copper, brass, lead, tin, zinc, bronze, German silver, platinum, gold, aluminum, and even cast iron, are not only welded to each other by the electric process, but different metals can be welded one to another in many combinations, extending the applications of the process to the attainment of results heretofore impossible in metal-working. Solid iron or steel bars three inches thick are welded perfectly. The time consumed in making the weld of this size is from 100 to 120 seconds.

Dr. D. C. Jackson of Chicago, has been elected professor of electrical engineering in the Wisconsin University.

GAS MACHINES FOR SMALL ISOLATED PLANTS.

The many improvements in the construction of gas engines during the past few years have been the cause of an increased number of isolated electric light plants. There are so many objections to the use of a steam engine about a residence for running dynamos that many who prefer electric lights have been compelled to resort to other methods of illumination. The advent of improved orms of gas engines made isolated electric lighting possible in many districts where nothing but gas was used, but the apparatus we describe and illustrate herewith will enlarge the field of usefulness of this form of engine, as people can have electric light plants where no gas mains exist, by manufacturing the gas on the premises, easily, cheaply, and with safety.

The scope of the outlet created by this apparatus for electric lighting will be seen when it is said that each individual can manufacture his own gas cheaper than he can be supplied by the gas companies, and the farmer, the merchant, the suburban and country resident, and the mechanic are made independent of light and heat corporations.

Phelps and Dingle of Passaic, N. J., the manufacturers of these domestic gas generators, have made so many developments since they introduced the machine about two years ago, that the latest improved gas machine would not be recognized as having any connection with the original.

The Domestic Gas Machine is simply a gas works on a very small scale, based on a correct principle of making gas.

It is as impossible to explode the machine as it is an ordinary parlor stove. It is claimed to be the only machine made that can be set out in the open ground away from any building, and without any cover withstand all the changes of a severe climate, from the coldest winter weather to the hottest July day, storms, rain and wind, without interruption giving a constant and steady flow at all times.

The uniform quality of the gas made by this machine renders it peculiarly adapted for use in the running of gas engines, making it practicable to install, at little expense, efficient combination electric light and gas plants in establishments located beyond the reach of gas and electric light mains.

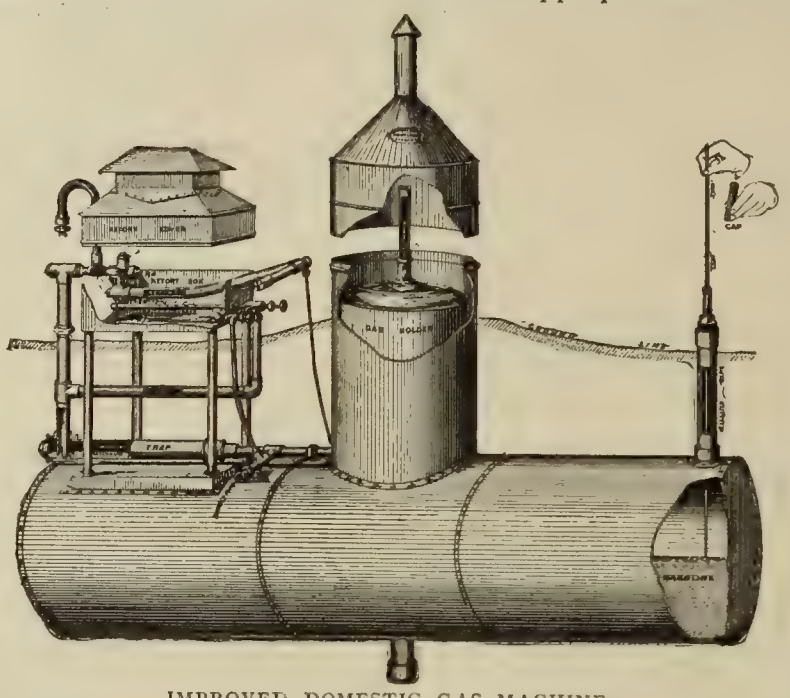
The improved machine is shown in full in Fig. 1, with some portions of the casing cut away so as to show as far as possible the important parts of the machine. The improvements consist mainly in simplifying the working parts of the machine, the elimination of all of the more delicate parts which require more or less care and attention from time to time, and the building of the whole machine in a more compact and substantial form, heavier and better material being used; and last but not least, the introduction of features which make it entirely automatic and self-acting, by the most simple construction imaginable. When the machine is once filled with gasoline and started it will run for months without being touched again. This is a feature in gas machines which was never claimed before and which the manufacturers of the old style machine never considered possible.

The simplicity and cheapness of the little machine, the ease with which it could be installed, and the little care that it required all added to its popularity, and now it is nightly furnishing light and power for hundreds of homes, stores, factories, hotels, churches, etc.

As will be seen from our second illustration, which shows the machine located in the grounds of a country residence, no part of it is placed in the house.

Besides being used for supplying gas engines for electric lighting, the gas may be utilized for any purpose for which any illuminating gas is made.

Messrs Phelps and Dingle's offices are at 45 Dey Street, New York, where they have an efficient and courteous staff of attendants.



IMPROVED DOMESTIC GAS MACHINE.



VIEW OF MACHINE ON GROUNDS OF A COUNTRY RESIDENCE.

THE FARADAY CENTENARY.

A brilliant audience assembled on Wednesday afternoon, June 17, at the Royal Institution, London, to hear Lord Rayleigh deliver the first of the two lectures appointed in honor of the centenary of the birth of Michael Faraday, the second of which is to be given by Prof. Dewar. The Prince of Wales, president, was in the chair and there were also present many of the most distinguished people in England. In opening the ceremonies the Prince of Wales made a few appropriate remarks, after which he introduced Lord Rayleigh.

Lord Rayleigh, who was received with cheers, said that the man whose name and work they were celebrating was identified in a remarkable degree with the history of the institution. If they could not take credit for his birth, in other respects they could hardly claim too much. During a connection of fifty-four years, Faraday found there his opportunity and for a large part of the time his home. The simple story of his life must be known to most who heard him. Fired by contact with the genius of Davy, he volunteered his services in the laboratory of the institution. Davy, struck with the enthusiasm of the youth, gave him the desired opportunity and as had been said, secured in Faraday not the least of his discoveries. The early promise was indeed amply fulfilled and for a long period of years, by his discoveries in chemistry and electricity, Faraday maintained the renown of the Royal Institution and the honor of England in the eyes of the civilized world. He should not attempt in the time at his disposal to trace in any detail the steps of that wonderful career. The task had already been performed by able hands. In their own "Proceedings" they had a vivid sketch from the pen of one whose absence that day was a matter of lively regret. Dr. Tyndall was a personal friend, had seen Faraday at work and enjoyed opportunities of watching the action of his mind in face of a new idea. All that he could aim at was to recall, in a fragmentary manner, some of Faraday's great achievements and if possible to estimate the position they held in contemporary science. Whether they had regard to fundamental scientific import, or to practical results, the first place must undoubtedly be assigned to the great discovery of the induction of electrical currents. He proposed first to show the experiment in something like its original form and then to pass on to some variations with illustrations from the behavior of a model, whose mechanical properties were analogous. He was afraid that these elementary experiments would tax the patience of many who heard him, but it was one of the difficulties of his task that Faraday's discoveries were so fundamental as to have become familiar to all serious students of physics. Lord Rayleigh then illustrated the discovery, by such methods as were open to Faraday, without calling in aid the more elaborate resources of modern science. But with all his skill, Faraday did not light upon the truth without great delay and difficulty. In December, 1824, he had attempted to obtain an electric current by means of a magnet, and on three occasions he had made elaborate, but unsuccessful attempts to produce a current in one wire by means of a current in another wire, or by a magnet. He still persevered and on the 29th of August, 1831, he obtained the first evidence that an electric current could induce another in a different circuit. On September 23d he wrote to his friend, R. Phillips: "I am busy just now again on electromagnetism and think I have got hold of a good thing, but can't say. It may be a weed instead of a fish that, after all my labor, I may at last pull up." It proved a very big fish indeed. Lord Rayleigh then by a series of experiments with models, indicated, as he said, with substantial accuracy, all the phenomena of electric induction. He also illustrated the operation of Prof. Clerk Maxwell's differential gearing, and of Huggins' gearing and observed that it was a remarkable achievement of modern mathematics, that all the results of these different experiments could be represented by the same equation. By a series of interesting experiments he illustrated the propagation of energy across intervening space by means of dielectric rings and explained the decomposition of water by electricity, which could not be effected solely by a single Daniell cell, but could be done with the aid of self-induction. Faraday had always felt great uneasiness as to the soundness of contemporary views and always experienced a fear of being mislead by words. Having proved the complete identity of the electricity in lighting with that in the voltaic cell, he abandoned the term "pole" for "electrode" and considered the expression "electric fluid" a dangerous one. It was, indeed a term which, as Maxwell observed, ought to be banished to the region of newspaper paragraphs. Diamagnetism was another subject for the researches of Faraday which had been more fully developed by Sir William Thomson. Lord Rayleigh then illustrated by some beautiful experiments the magnet-

ization of a ray of light, the full significance of which, not fully understood by Faraday, was realized to a great extent by Sir W. Thomson. His observations in acoustics were also of great value. Faraday had made one singular remark as to a particular formation of waves generated under the action of wind, which he had himself, after patient observation for half an hour or three-quarters of an hour, verified at a French watering place. He was disposed to doubt whether anybody else save Faraday and himself had ever noticed that phenomenon. But it was one thing to have discovered and quite another to have verified the discovery once made. The philosopher had also made a number of minor observations of great value and he was reminded of one by a recent lamentable accident caused by the breaking of a paraffin lamp. Faraday had shown a method of holding the breath for a prolonged time by means of successive deep inspirations and expirations, which, if practiced, might have proved of saving worth on that sad occasion. The question had often been discussed what effect on Faraday's career would have been produced if he had been subjected to a mathematical training. They must all feel that they would not have wished him to be other than he was; but if the question must be discussed it would have to be admitted that, by such a training he would have been placed in more thorough *rapport* with his scientific contemporaries. But mathematical training and mathematical capacity were different things and it did not follow that Faraday had not a mathematical mind. In Prof. Clerk Maxwell's opinion Faraday had mathematical powers of a very high order, from which, if he had devoted himself to that science, valuable and fertile methods might have been discovered by him.

Sir W. Thomson, in moving a vote of thanks to Lord Rayleigh for his address, said that the Royal Institution was, during the last part of Faraday's life and during the whole of his scientific career, his home. The splendid results of Faraday's labors contributed in no small degree to the scientific glory of the nineteenth century and helped to made it one of the most prolific periods in the world's history. Faraday was throughout animated solely by the love of knowledge. He freely gave his discoveries to mankind, and left it to others to turn them to practical and profitable account.

The motion was seconded and carried unanimously.

Among those present were the following from the United States: Professors J. P. Cooke, Dana and Simon Newcomb. A letter was read from Dr. Tyndall, in which the writer expressed his great regret at his inability to be present on account of ill health and said that as Faraday receded from him in time his character became to his mind more and more beautiful.

THE ELECTRICAL CENSUS.

Upon the recommendation of Mr. Allen R. Foote, Hon. Robert P. Porter has appointed Horatio A. Foster, special expert agent for the collection of statistics relating to the electrical industries for the State of New York. In making the appointment, it is the intention of the Census Office to complete the work for the State of New York and to publish the results in a special bulletin at the earliest practicable date. It will therefore be the good fortune of this State, not only to have the benefit of the publication in advance of all other States, but also the honor of being first in the series of bulletins to give the results of the Electrical Census of the United States. For these reasons the Census Office and all interested in this department of its work are extremely anxious to have the report for New York complete and accurate in every detail. It is especially desirable that every person in the State in any way interested in the electrical industries, shall cordially co-operate with Mr. Foster in facilitating his work and furthering the general interests involved.

Mr. Foster will visit every electric central station, electric railroad and the more important isolated plants in the State and assist their superintendents in correctly filling the official schedule. All schedules that have been sent to Washington are put into his hands for correction and verification.

A very great service will be rendered by each superintendent if he will earnestly endeavor to assist in completing the work, so far as his station is concerned, in the shortest possible time consistent with accuracy.

To assist in saving time it is suggested that each superintendent should have a correct memorandum for Mr. Foster, covering the following details:

1. Average number of poles per mile.
2. Kind of wood.
3. Number of poles, part wood and part iron.
4. Total length of conductors on poles.
5. Total length of conductors on housetops.
6. Total length of conductors on bridges.
7. Total number of service connections.
8. Number of service connections on each alternating current main.
9. Total cost of all aerial conductors.
10. Total annual cost of maintaining all aerial conductors.

Mr. Foster will give each company due notice of the date when he will call for the purpose of finishing up its schedule, and will give all the assistance that may be necessary.

It is the opinion, without exception, of all who know Mr. Foster personally, that no other person is as well fitted as he is, in all particulars, for the work he is to undertake.

GAIFFE MILLIAMPERE-METER.

The Milliampere-Meter illustrated below is known as the Gaiffe, and is manufactured by G. Gaiffe's Sons, Paris, France.

This meter is intended for electro-therapeutical work where accurate and delicate measurements are a necessity. The reading is from zero to 250 milliamperes, giving a range sufficient to cover the needs of the general practitioner.



GAIFFE MILLIAMPERE-METER.

The Law Telephone Company, 85 John street, New York, are the American agents of the Gaiffe Company, and the meters are used in connection with the Bailey Current Regulator and from 30 to 60 cells of Law Battery; the regulator and meter doing away with the cumbersome and complicated cell selector or switchboard, which up to a few years ago was generally used, but which was relegated to the lumber room when meter and regulator were put on the market.

DEAD-BEAT AMPERE METER.

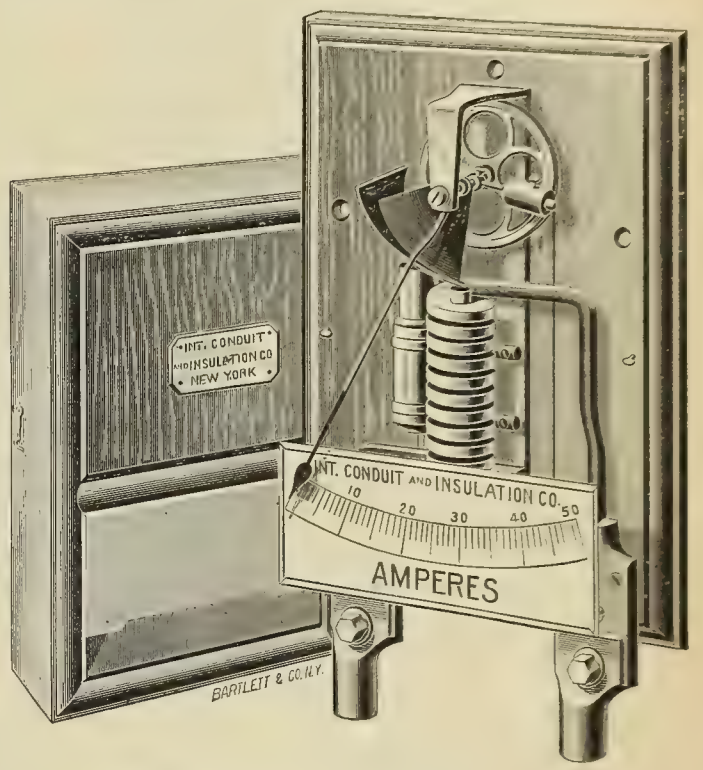
The advantages of the dead-beat principle in electrical measuring instruments in these days of time and labor-saving devices are many. The electrical engineer in measuring currents naturally desires an instrument that will perform its functions accurately and quickly.

A reliable dead-beat ampere meter has been long looked for by electricians, and such an instrument has at last been brought out.

The Interior Conduit and Insulation Company, 42 and 44 Broad street, New York, is just placing on the market the Johnson Dead-Beat Ampere Meter, of which we give herewith an excellent illustration.

This is said to be the only absolute dead-beat ampere meter in the market. A dash-pot of peculiar construction is applied to the company's already well-known ampere meter with the result of a remarkably effective instrument.

In the form of dash-pot referred to, air washing of the piston is the only friction imposed; the friction, therefore, becomes a practically constant



JOHNSON'S DEAD-BEAT AMPERE METER.

quantity, rendering the instrument an accurate indicator under all conditions of time, place and use.

Violent changes of current are instantly indicated, and noted with as ready facility, as are gradual changes in the ordinary forms of ampere meters. The instrument is therefore peculiarly adapted to use in connection with motors and power stations.

As the metal of the two interlocking pistons is never in actual contact, no disarrangement is possible, and nothing exists to impair the delicacy of operation so essential to accurate work, or to retard the return of the needle to zero.

The needle being actuated by an electro magnet, and its armature being always in a strong magnetic field, is not influenced by currents in its vicinity.

The extremely low resistance of the coil also merits attention; a 25 ampere instrument, for instance, measuring only .005 of an ohm.

The instruments are low in cost, and they can be supplied mounted on slate bases or in any special form to order.

The company makes these instruments in five sizes, with capacities ranging from 10 amperes to 200.

"Peltier Effect" is the name applied to a phenomenon discovered in 1834 by Peltier. He found that if a current of electricity from a battery be passed through a junction of dissimilar metals the junction is either heated or cooled, according to the direction of the current.

THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY, AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

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THE ELECTRICAL CENSUS.

The electrical census has begun to assume a tangible form, and the practical work is about to be commenced. Mr. Horatio A. Foster, a gentleman well known in electrical circles, has been appointed special expert-agent by Superintendent Porter, of the census bureau, for the collection of statistics relating to the electrical industries in New York State.

New York State is a good one in which to begin this important work and, apart from the honor of being the first on the long list of States to make its electrical census report, the result will be of the utmost importance to all interested in electrical affairs It is a work of large magnitude, but under the system and direction of the gentleman named it will probably be completed within a reasonable time. The report, no doubt, will be watched for with a great deal of interest by all connected with the electrical trade, and it is hoped that those persons who will be called upon to furnish the facts will do so in the fullest manner possible.

While the New York report will be important in itself, its value will amount to little without similar statistics from all of the other States. The electrical census must cover the entire country to be complete, and it is hoped that the same thing will be done with reference to the other States as has been done in New York.

Congress cannot perform a greater duty than to appropriate ample funds for the carrying on and completion of this most valuable work.

A correspondent asks, "What is the generally accepted theory of the relations of electricity to heat?" Our knowledge on this subject, of course, is not positive, but according to the best evidence at the present time, electricity and heat are different kinds of molecular motion, and the transmission of either from the source of generation to a distant point is accomplished by interposing between the generator and the distant point a material substance selected with especial reference to facility of propagation of the motion. The substance used to connect the two points is known as the conductor. For electrical transmission the conductor is composed of a metallic wire, usually of copper or iron. As the electric action is transmitted along the conductor, heat is generated in the wire, and heat, therefore, must be regarded as a legitimate part of the work done, whether it is useful or otherwise. The heat developed in a conductor is always in direct proportion to the electric resistance of the conductor. Thus if heat is the form of work we desire to obtain from an electric current, or if we desire to obtain light, we increase the resistance at the point where we wish to use the heat or light. In other classes of work, however, the suppression of the heat, or keeping it down as low as possible, is of the utmost importance. This is done in conductors, by lessening their resistance; in other words by increasing their mass or diameter. There can be no expenditure of electrical energy without a simultaneous development of heat, and it is also assumed that there can be no expenditure of heat without a corresponding development of electricity. Joule made a specialty of the study of this branch of electrical science, and determined accurately the relations between the electric current and heat. From his investigations he deduced a law which is known as Joule's Law, and which is as follows: The heat developed in a conductor by an electric current passing through it varies as the conductor's resistance, the square of the current's strength, and the time the current lasts.

Cincinnati wants to put its electric wires underground—a very commendable ambition. She will have the benefit of the experience of other cities in which wires are laid underground, and need not make experiments to find out what is already known. A variety of systems is in operation in New York City, and no doubt Cincinnati's electrical expert, who is now in the East studying the underground conduit systems, will derive considerable valuable knowledge on the subject.

A correspondent of a New York daily paper thinks it is about time to get a better word than "Electrocute"—meaning electrical execution. The problem, he says, is to find a word "terse in form, correct in composition and precise in meaning, which will convey the idea 'to administer electricity so as to cause death.'" He suggests "electrothnate," "electrophony," "electro-mor-sion," "electrize," "thanatelectrize" and "cat-electrize." No doubt it will be a great relief to the victim to know that he is going to die by a process that has a correct name. The word "electrocute" is about as barbarous as the killing process.

The Chautauqua *Herald*, in an intense effort to show its admiration for Mr. Edison, referred to that gentleman as the "lizard of Menlo Park." Mr. Edison has had many honors and titles conferred upon him, but the one above quoted is the most unique of all.

Gas engines seem to be growing in favor for the purpose of driving dynamos for small isolated electric light plants, and much attention has been given to the subject of late. Such use of the gas engine opens up a large field for development. Most people expect to see domestic electric lighting in a small way a success some day, and that it will be convenient, cheap and reliable. It would seem that the use of a gas engine on the premises is a long step forward in this direction. Of course, not every one can afford to maintain an electric plant of this character. There are many, however, who can and who would not hesitate to introduce the electric light in their houses were the subject presented to them in the proper manner. A country residence lighted by electricity is something we never hear of, but it is quite feasible. It is possible, even if there is no gas within a hundred miles of the place. The gas can be manufactured on the premises by a gas machine, and the gas engine would thus be supplied with its power, and would be independent of street gas mains.

THE MAGNETIC CLUB'S DINNER.

On July 29, the Magnetic Club, of this city, held its midsummer meeting at Clifton, S. I., where an elegant dinner was served at the hotel. There were about 80 persons present and the usual good cheer, for which the club is celebrated, prevailed in greater abundance than ever.

After dinner, speech making and musical and vocal exercises were indulged in.

Superintendent Humstone, of the Western Union Telegraph Company, very generously placed the company's cable steamer "Western Union" at the disposal of the members.

The steamer left her dock at the foot of Dey street at 3:30 P. M. and a good crowd went down on her. A delightful trip was made toward Sandy Hook, after which a landing was made at the quarantine dock, near the hotel where the meeting was held.

Many members who could not take the "Western Union" came down later by the regular routes and all came back to the city together on the "Western Union," after the festivities were over.

The guest of the club was Mr. Erastus Wiman, who made a few appropriate remarks. He dwelt with considerable emphasis on the vast importance of the telegraph in the world to-day, and complimented telegraph operators as a class as the most intelligent and honest body of employés to be found anywhere. He represented in glowing terms the greatness of America, which he said was due to a great extent to the telegraph.

He referred to the wonderful changes wrought during the last 50 years, all due to our ability to instantaneously communicate with distant points.

He did not forget to say a good word for Canada, of which country he is a native. When he referred to America, he said he meant Canada, too.

His remarks were well received, and he received a hearty applause.

The meeting was a highly successful and enjoyable one.

THE KELL'S SYSTEM OF ELECTRICAL DENTISTRY.

When the electric motor became a practical commercial product, it was quickly recognized by surgeons and dentists as a means of driving their tools, cheaper and more easily controlled than the cumbersome apparatus at their disposal before. From the absence of small and handy power machinery, laborious hand tools had to be depended upon, but electricity made things easier and more rapid. Every dentist who desires success is aware that he must keep abreast of the times and the profession knows and adopt every thing that will aid it Nearly all the apparatus of this kind used by dentists have proven satisfactory, so much so that electrical devices have been specially designed for their use. One of these we illustrate and describe herewith.

Our illustrations show the Kell's system of applying electricity to dentists' use as developed by the S. S. White Dental Manufacturing Company, Chestnut street, corner 12th, Philadelphia. The system comprises an electric motor, with a magnetic clutch device for stop motion, a pedal switch for controlling the direction of the current and a variable resistance to vary the current.

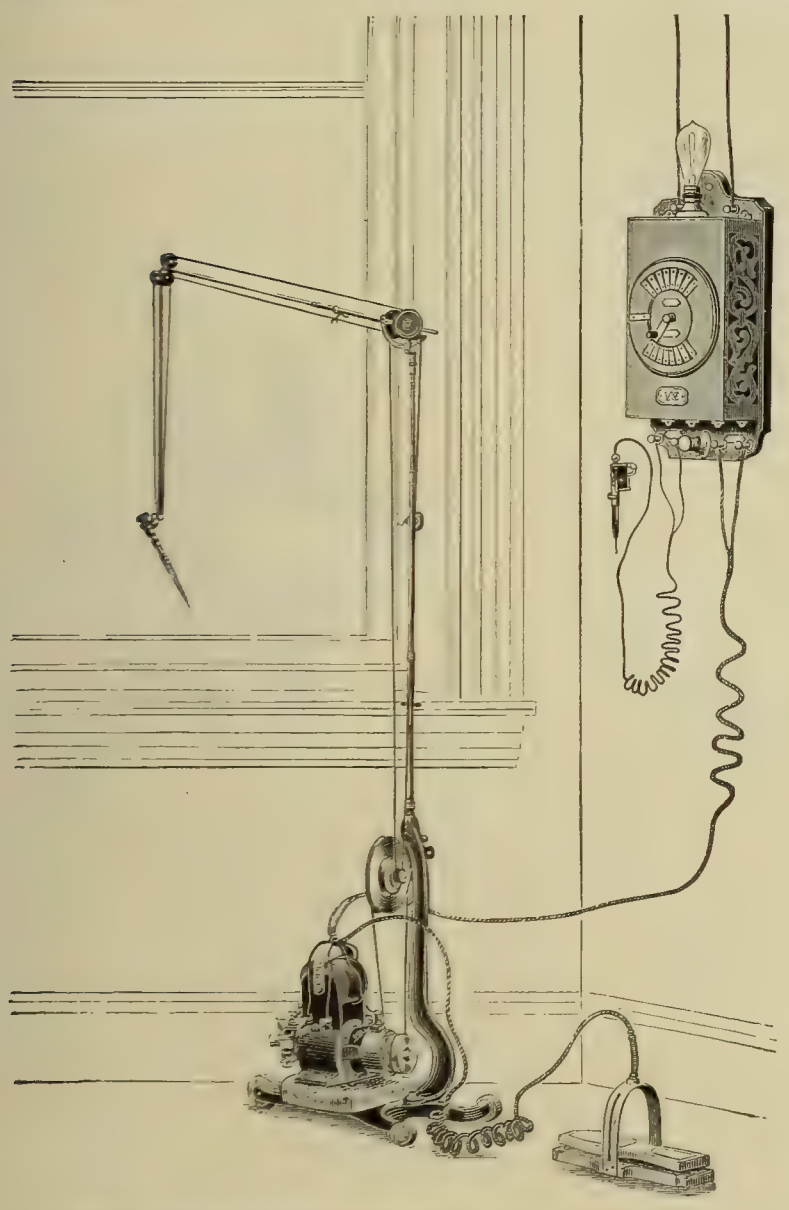
The machine shown in the cut is the Rhodes motor, which gives great power at a low rate of speed. Other motors can be used if required. The stop motion is a coned clutch operated by a spring and a magnet.

In the pedal switch, pressing the heel directs the current to the motor; pressing the toe cuts it off from the motor and sends it to the magnet.

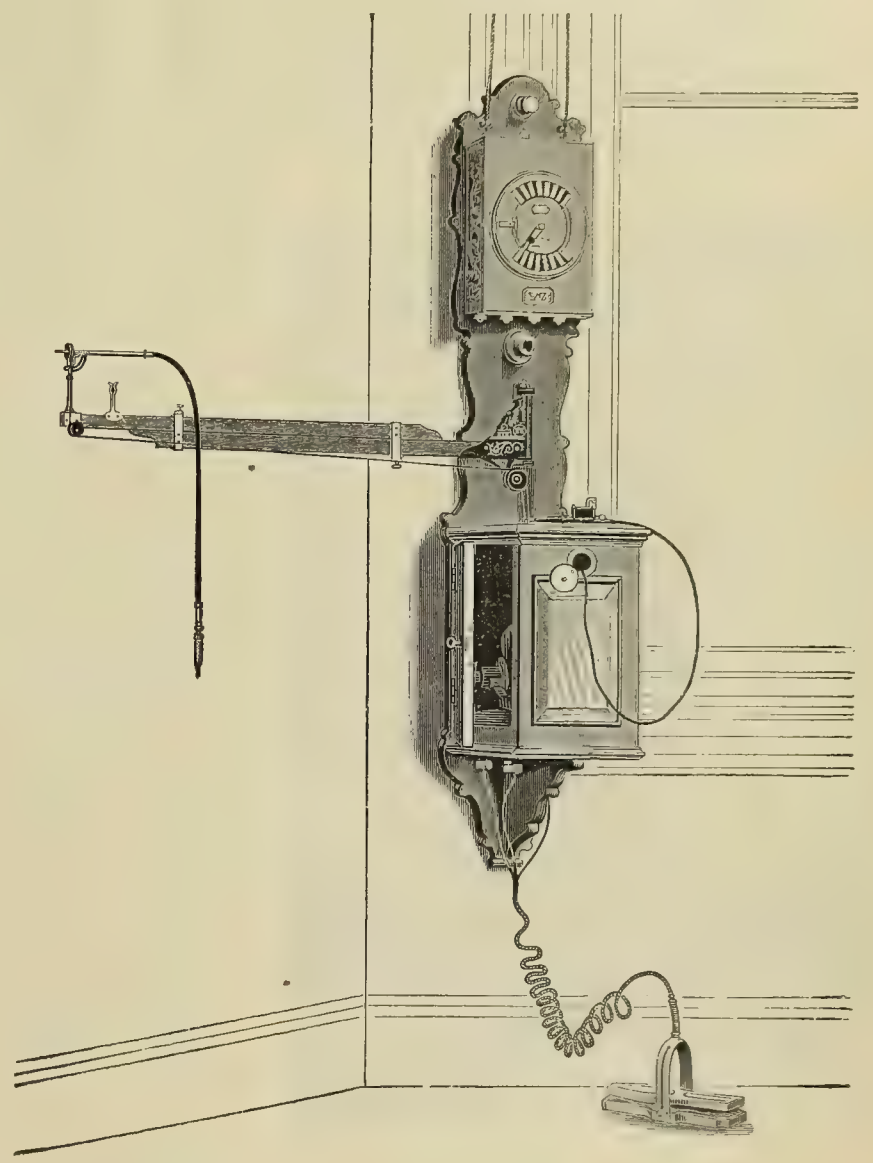
By means of the variable resistance boxes, shown against the wall in the illustrations, the speed of the single pulley engine head is maintained from 1,600 to 3,200 revolutions per minute, but in the New Cord engine, because of its variable pulleys, the speed can be regulated from 900 revolutions to considerably above 3,200 per minute. The motor can be fed from an Edison incandescent light wire of 110 volts potential.

One cut shows a 50 candle-power incandescent lamp on the top of the resistance box, to be used to modify the current for a dental mallet and a mouth lamp.

The motor may be also used to run the lathe in the dentist's laboratory or for any other small power work, if so desired.



DENTAL SURGERY APPARATUS ON THE KELL'S SYSTEM.



ANOTHER STYLE OF DENTAL SURGERY APPARATUS.

ELECTRO-PLATING DYNAMOS.

From the difficulty in getting a constant current from galvanic batteries the dynamo has largely taken its place in electro-deposition of metals. The magnitude of operations capable of being carried on by means of the current obtainable from batteries is limited, because the current is not constant in the best makes. All the objections to the use of a battery are overcome by the use of a dynamo and the time and labor wasted in setting up and keeping the cells in working order are put to other and possibly better uses.

The current from a dynamo, properly constructed and driven, is constant, varying only with the speed at which it is driven, or with the resistance of the bath. When placing a number of articles to be plated in the vats at the same time, a larger quantity of current is needed; but, as increasing the number of articles gives more paths for the current and lessens the resistance of the vat, there is less resistance to be overcome in the external circuit, consequently there is more current as the E. M. F. remains constant.

The volume of current obtainable from a dynamo constructed especially for electro-plating purposes is very large, with a potential arranged just high enough to deposit the metal in good condition.

When the machine is shunt wound, the strength of the current is, within a certain limit, self-regulated by the work to be done in the outer circuit. The shunt dynamo is not as liable to be reversed by the "back action" from the vat as the "series" or "compound" wound machine, and although a little more expensive than the "series" for a given output, it is the best to use. As each metal requires a different output there can be no general rule for selecting a dynamo, the choice being made according to the work to be done.

NOTES ON THE MONTREAL CONVENTION.

The floor space available for the exhibition of electrical appliances at the Montreal convention, is five times greater than that of any preceding convention and yet the applications for space have been in excess of that available.

It is hoped that the Governor-General of Canada, will attend the opening of the exhibition, and with his own hand start the power machinery in motion.

Plans will be made for music afternoons and evenings, special features in decoration will be carried out and the Canadian members of the Committee on Exhibits promise great interest from their countrymen and a very large attendance. In view of the many new and pleasant features which will be had at Montreal, a very large number of the members of the association propose to attend the convention with their families and already the hotels of Montreal are flooded with applications for quarters.

CINCINNATI NOTES.

The city has an expert in the East examining the various conduit systems with a view to the establishment of a general system here whereby all wires may be placed under ground. There were two or three large fires lately, during the progress of which the net-work of wires seriously interfered with the work of the firemen and this has seemingly strengthened the determination to relegate the wires to mother earth.

The work of the Edison Electric Light Company on its new plant and the laying of conduits, goes steadily on and is now unrestrained by injunctions, etc. The public eagerly awaits the opening of this enterprise for business, hoping its advent may release it from the extortions to which it now submits.

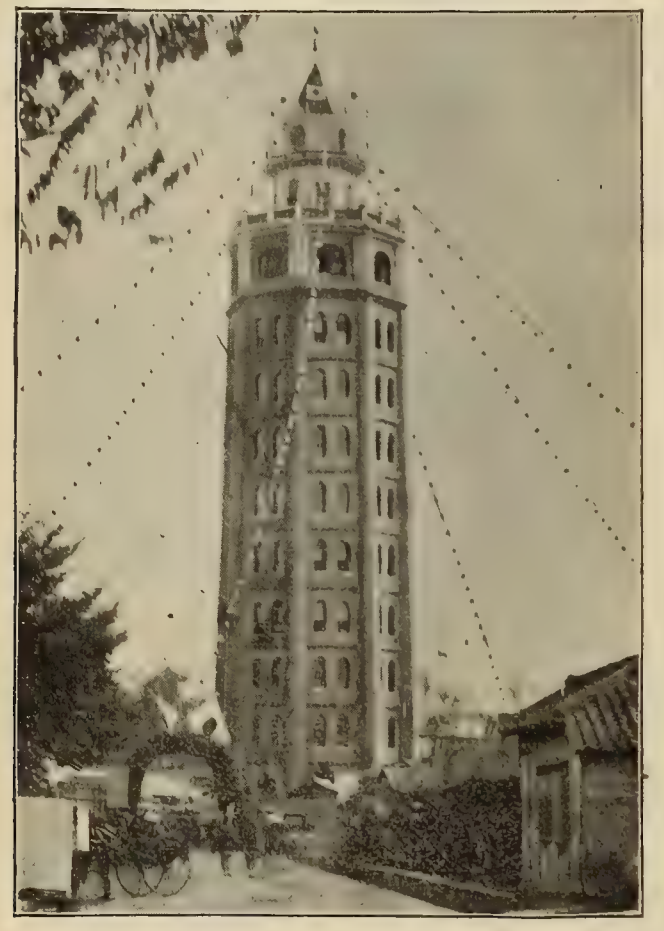
All books on electrical subjects can be purchased at the Electrical Age office.

ELECTRICAL AFFAIRS IN JAPAN.

We have, on various occasions, referred to the rapid industrial progress being made in Japan, and of the extensive and growing uses of electricity in its various branches, for almost every purpose. The telegraph is an old institution there as compared with the later electrical inventions; the telephone is an indispensible convenience to the people of Tokio, and the use of electric light and power is rapidly increasing.

In our issue of April 25, last, we gave two views and a description of the telephone exchange in Tokio, Japan. Herewith we give a view of a structure in Tokio, in which electricity plays an important part.

The illustration is made from a photograph forwarded to us by our Tokio correspondent, and represents a new brick observation tower erected in Tokio. The building is octagonal in shape and 220 feet high. The top is reached by an electric elevator operated by a 10 H. P. Sprague motor, and on the top of the structure are two 3,000 c. p. arc lights, which diffuse a brilliant light over a large area of ground in the vicinity of the tower, and can be seen for many miles in all directions.



OBSERVATION TOWER, TOKIO, JAPAN.

From the top of the tower nearly the entire city of Tokio is visible, and the view is a grand one.

The Japanese government has given an order for 6 knots of shore end and 25 knots deep sea cable to be laid in Japanese waters. The work of laying, etc., will be done by native engineers, but the cable itself will be imported from London.

The new parliament buildings, which are now in course of erection, will when completed, be lighted by electricity. It will be remembered that the former building was destroyed by fire nearly two years ago, and it was claimed that the fire was started by the electric light current, but evidence was strong against the theory.

Mr. S. Katogi expects to put an electric car in operation in Tokio soon, and will adopt either the Sprague (Edison) or Thomson-Houston system.

The difficulty in Champaign, Ill., between the Western Union Telegraph Company and the City Council, on account of the right granted by the council to the Incandescent Electric Light Company to use the poles of the telegraph company, has been settled in favor of the Western Union. The electric light company will put up its own poles.

CORRESPONDENCE.

THE VALUE OF INVENTIONS AND PATENTS.

Editor Electrical Age:

A contributor in your last issue opens an article thus: "At no time like the present has there been so many striking examples of the uselessness of a patent." He then modifies this sweeping statement by holding that any given patent must be first tested by the courts, or financiers will look upon it with suspicion.

A patent on an invention corresponds in a general sense to a title to real estate. If the real estate is practically worthless the title is similarly unsalable. Again, if the title is defective, the real estate, although of enormous value in itself, becomes practically unsalable. No one wishes to touch it with a defective title.

It is similar with a patent and the invention it is supposed to cover. If an inventor has an invention worth in itself a million dollars, the patent may be worth nothing if the claims are not properly drawn; but if the claims are well worded to cover accurately the gist of the invention, he need not fear but that within the seventeen years of the life of his patent he may make a profit entirely satisfactory. He owns that which is valuable, and his success, I venture to say, depends only upon his ability to show its value to financiers. They have not, in the past, and therefore will probably not in the future, neglect an opportunity simply because they fear litigation on account of infringers. On the other hand, it has been often customary for such purchasers of patents to delight in infringers, because, in the first place, they are the basis of one of the best proofs of the value of the invention, and because, in the second place, royalties for every device made must be paid upon favorable decision.

On the other hand, the court records show that among the smaller inventions infringers are scarce. Since the owner of the patent may be counted upon to sue infringers, the latter do not care to risk the costs of a patent suit on account of the comparative smallness of the total profit which may reasonably be expected. The word "patent" on the article is sufficient to deter financiers from infringing.

In the case, however, of inventions worth millions of dollars, there have always been infringers, and it is safe to say that there always will be, on the principle that many men covet that which has millions in it.

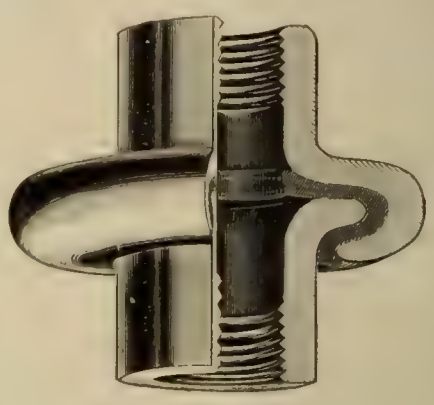
Attention is now invited to the last paragraph of the article alluded to. It would be practically impossible for the Patent Office to give absolute and irrevocable protection. The general law of the country is that any party has a right through the courts to test the ownership of any property. Let us follow briefly a case. The Patent Office examines an application, and after prosecution of the same, certain claims are finally allowed. The invention is found to be novel. The Office has done all this work to the best of its ability. It has greater facilities than any Patent Office in other countries. The court records show even after the hard fighting of opposing parties, who bring up all the evidence both great and small, that only one out of thousands of patents are pronounced void. This shows that the Patent Office does good work; but it cannot be expected to give as satisfactory evidence as to the patentability of the invention as may be obtained by a patent suit where, often, the best attorneys and experts of the country on both sides spend months in taking testimony, searching the past state of the art, arguing before a proper judge and dwelling upon each little point until finally settled satisfactorily to both parties.

If any given financier is satisfied with the value of the invention and backs out for fear of the cost of litigation, I say to the inventor, go to another financier, and to another, until one or more are found who, like those, for instance, in the case of the recent lamp patent or vestibule car, are willing to run some risk and take some trouble with the hope of becoming rewarded in the end. There are numerous instances, I knowing one personally, where rights to the Bell telephone patent were offered for a whole State for a mere trifle in the early history of the telephone, and rejected. Present regrets and sorrow are the result.

Edward P. Thompson.

THE PRIOR INSULATING JOINT.

Those who are engaged in the electrical construction business are quick to appreciate and adopt any improvement in their line that is put before them. An improved insulating joint for chandeliers where both gas and electricity are used, is illustrated in this issue, and is of special interest to those who make the wiring of stores and houses a speciality. This perfection of insulating joints was designed, and is being put upon the market by Matthew Prior of Watertown, Mass. It is made of bright brass in two castings, insulated from each other by the best insulating fibre, put in under a pressure of several tons, and firmly held in place, thereby rendering the joint perfectly tight and secure from all action of gas or atmosphere. The joint is made in all the standard sizes, have no screws to twist, break off, or cause short circuits, and is as strong as a solid casting. As proof of the worth of this joint it has the approval of the Electrical Department of the Boston Fire Underwriter's Union. Mr. Prior is prepared to fill all orders promptly, and sectional samples, as well as all information can be obtained by sending to him at Box 2,649, Boston, and mentioning this paper.



INSULATING JOINT.

Heat of the Arc Light.—Many persons imagine that the electric light gives no heat, and are much puzzled when told that the electric arc is the highest temperature known at the present day. It is perfectly true that the arc light is cool for illuminating purposes, for the actual mass raised to so high a temperature is extremely small for the enormous amount of light given out. It must also be borne in mind that arc lamps give off noxious nitrogenous fumes which are very noticeable in confined situations. Incandescent lamps emit absolutely no fumes, since they are hermetically sealed in glass globes. On the other hand, they produce a considerable quantity of heat, but far less than gas, or oil lamps, light for light; and, difficult as it may be to believe, wax candles give more heat, light for light than either of the latter-named illuminants.

The resistance offered by the human body to the passage of electric currents lies chiefly in the skin. The blood and nerves are probably the best conducting media in the body, and owing to the saline fluids they contain the muscles offer a fair conducting path. In a healthy condition the body offers a resistance of from 4,000 to 5,000 ohms. Certain diseased conditions of the body cause great variation in its resistance.

"ANTI-RUBBER" COMPOSITION.

Mr. A. T. Smith, electrician, 6 W. 14th street, this city, has brought out a valuable composition for the purpose of covering battery jars of all kinds, particularly dry battery cells and those made of glass. It is pliable, elastic, water and acid proof and possesses excellent insulating qualities.

The composition is placed around the cell in a semi-plastic state and adheres firmly to the material of the jar. Owing to its elastic nature it affords an excellent protection to the cell against breakage and in case the cell should become fractured through any extraordinary cause, the composition itself, being water and acid proof, practically takes the place of the cell.

In addition to this valuable feature, another is worth special mention. The use of this composition on jars renders the matter of packing for shipment a very easy task. They can be packed without any other protective material around them and shipped any distance without danger of breakage. This means less bulky packages and less cost for labor, material and freight.

The composition is called Smith's "Anti-Rubber," and can be manufactured very cheaply. Manufacturers of dry batteries will be particularly interested in this material, and they would do well to consult Mr. Smith in regard to it.

Owing to its many advantages and its varied application, it will, no doubt, meet with a very large sale.

Water will not remain on its surface; it rolls off, leaving no trace of moisture, whatever, behind.

LEGAL.

Two executions aggregating $83,580 were, on July 28, issued against the North American Underground Telegraph and Electric Company, formerly of 43 Broadway, New York in favor of Louis May. No property could be found, however, on which to levy. The company was organized some years ago to develop the Johnstone underground conduit system, but it met with no encouragement. The capital of the company was $5,000,000.

An attachment for $15,000 has been issued against the Easton Electric Company, late of 45 Broadway, this city, on promissory notes of that company in favor of Samuel Rowland. The notes were indorsed by P. Minturn Smith, late president of the company, and W. D. Perry, vice-president. The company was organized in 1889, with a capital of $1,000,000.

An interesting case was decided a few days ago by the Court in Wilmington, Del. The Western Union Telegraph Company sought to prevent the Postal Telegraph Company from using the telephone for receiving and transmitting telegraphic dispatches, claiming that, by virtue of a contract between the Western Union and the National Bell Telephone Company (now the American Bell Telephone Company), the former had the exclusive right to such use of the telephone. Judge Wales decided that inasmuch as the Telephone Company is a common carrier, it must serve all persons alike, impartially, and without unreasonable discrimination, and ordered that a writ of mandamus be awarded. The case will be appealed to the Supreme Court.

The importance of the electrical exhibition at the World's Exposition in Chicago may be judged from the fact that already over two-thirds of the entire space in the building to be devoted to the electrical department has been engaged. The remaining third will not wait long to be secured. The only thing to be feared is that there will not be enough space to satisfy all. To properly represent the electrical interests of this great country at the fair will require a very large space, and it is hoped that all will be accommodated.

NEW PUBLICATIONS.

The latest addition to electrical journalism is *Electricity*, which made its first appearance on July 22. Its home office is in Chicago, but the publishers state that it is intended to make it as much an eastern paper as a western, and for that purpose will maintain an editorial staff in New York. As regards the paper, it is handsome in appearance, and its typography is of a high class. The title of the paper is striking in its simplicity, and the combination of colors on the cover is very pleasing to the eye. It is the purpose of the publishers to devote particular attention to the popular exposition of electrical progress. They will not sacrifice technical discussions, however, their object being to produce a paper that will interest the uninitiated as well as the most technical expert in electrical matters. Mr. W. H. Temple is president of the company; J. W. Dickerson editor, and Irving Washington, business manager, at Chicago. Mr. George H. Guy is the New York editor and C. McL. Paine, New York manager. *Electricity* starts out full of hope, and we trust its ambitions may be realized, and that it will find plenty of "plain sailing" in these days of hustling and hard competition.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
ROOM 7–12, "WORLD" BUILDING,
NEW YORK, Aug. 1, 1891.

Mr. Charles W. Madden, late of the Empire City Electric Company, 15 and 17 Dey street, this city, has been appointed assistant general manager of the Metropolitan Telegraph and Telephone Company. He held this position a few years ago.

Mr. W. T. McGahey, of Elkton, Va., accompanied by his son, was in town last week purchasing machinery for their new engine shops. McGahey Bros. are now very busy erecting a complete machine shop at the above-named place.

The following contracts have been secured by Mr. Joseph Harris, contracting agent of the Shaver Corporation, 207 Broadway, this city: One from house to stable at the summer residence of Mr. Edward McClintock, distance being 1,000 feet; one for the Union Trust Company, Broadway and Wall street, to run from the fifth to first floor; one for Richard Webber, 120th street and Third avenue, to run from his market to the poultry department, a distance of 700 feet; also a line from J. B. Olsen's, 606 East 135th street, to 172 Willis avenue, Mr. Harris' residence, a distance of 1,200 feet. This line is ready for inspection at any time. Mr. Harris is also under way with a bank system of fifteen lines in the Chelsea Jute Mills in Greenpoint, and another system of the same kind for eleven lines in Bloomingdale's, 59th street and Third avenue. The company is erecting a sample line in the Roosevelt Avenue Watch Factory, Jersey City, and one in Clark's thread mills, Newark, N. J. The company has a number of lines in constant operation in Harlem, among which is one for Richard Webber, 120th street and Third avenue, to 122d street and Madison avenue, a distance of 5,000 feet; E. E. Lyons, 125th street and Madison avenue, to 126th street and Lexington avenue; Hulberg, 125th street and 8th avenue, to Hamilton stables; Weisbacker, 125th street near 8th avenue, to house 125th street 9th avenue, and Washington Storage Warehouse, 124th street and 8th avenue.

Mr. Thomas J. Fay is the manager of the Maine Electrical Improvement Co., with headquarters at 136 Liberty street, New York. The company is constantly producing new specialties, several of which will shortly be ready for the market. His latest device is a unique lightning arrester, which is constructed on new lines. It is automatic in its action and effective in operation. Mr. Fay has already sold several hundred of these arresters, which have been on the market but a short time.

The New York Insulated Wire Co., 649–651 Broadway, New York, of which R. E. Gallaher is secretary and J. W. Godfrey general manager, has been experimenting on an interior conduit system for some years, and lately completed the system under most agreeable auspices, a number of large orders being at once placed for the installation of the conduit in some of the largest buildings in the country, the installations including a complete line of safety devices, junction and distributing boxes, joints and elbows. The system of conduits is made from solid materials, said to be positively non-inflammable and water-proof. It is not artificially built up in strata, thus avoiding leakage. It is also somewhat pliable. The interior of the tubes are perfectly smooth and even throughout, and will not impede the introduction of wires and cables. A piece shown your representative was somewhat like a hard rubber tube. It is claimed that it can be sold cheaper than any other material now in the market. The company has just issued a handsome pamphlet, illustrating and describing the system.

The Safety Electric Light Company, of Boston, has made another trip over the N. Y. & N. E. Railroad with the car lighted by electricity by the company's system. The company desires to make a specialty of lighting railroad cars. We illustrated, a short time ago, a car lighted by this system, which was run over the N. Y. & N. E. R. R. from Boston to New York.

Mr. James P. Gallagher, the big contractor for installing conduits in New York, was in to see us last week.

The Engineering Equipment Company, Central Building, West, Liberty and Washington streets, with headquarters in Boston under the supervision of Mr. F. A. Magee, is having unusual progress in its business at both ends, particularly in its specialties in the street railway line. It has the sole agency of Anderson's trolleys, line material, etc., which are conceded to be equal to the best in the market. Its Kellogg poles sell at sight; the Underwood cotton leather belts were popular goods before it secured control of them, but as they are now receiving proper attention, some big sales are reported weekly. The company is now taking some very satisfactory orders for Habirshaw insulated wires and cables for the electric light, railway and general use.

J. Van Vleck, chief electrician of the Edison Illuminating Co., 432 Fifth avenue, called at the ELECTRICAL AGE office during the past week.

Collins & Co., makers of Ball ore separators have moved their New York offices from 45 to 29 Broadway.

The Desant Electric Signal Company, has moved to 29 Broadway.

Mr. Paul G. Burton of Albany, has opened headquarters at 464 Broadway, for a general line of electrical supplies. He will be able to give his customers practical help as he has had a practical education at Cornell University, and has done considerable electrical work since. He has already secured several important contracts.

Mr. E. R. Knowles, C. E., E. E., on August 4, severed his connection with the law and patent office of Mr. C. E. Webb, 181 Broadway, this city, to accept the position of chief electrician for the

Schuyler Electric Co., Middletown, Conn. Mr. Knowles was at one time the electrical expert and superintendent for one of the most enterprising companies then in the business, and during his connection with this concern and prior thereto, he invented and patented many valuable improvements in storage batteries, some of which are now in general use. A low tension current dynamo nvented by Mr. Knowles is in quite extensive use at the present time in electric lighting and for charging storage batteries, and it has the reputation of being equal to machines of any other make. Among the many patents granted to Mr. Knowles are some for arc light dynamo regulators, switches and rheostats. The Schuyler Electric Company are to be congratulated in securing the services of so eminent an electrical expert as Mr. Knowles, and it was only after extraordinary inducements were held out that Mr. Knowles decided to accept the offer. He will, in his new position, supervise the manufacture and development of the Schuyler Company's specialties, for which it has a reputation. The company is well-known through the extensive use of the Schuyler system of arc lighting, and it produces some of the principal apparatus now used in electric light and street railway work. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co.	350,000	100 00	10 000
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co.(N.Y.)	1,000,000	2500	3 00
American Private T'phone (N. Y.)..	50,000	100 00	98 00
American Telegraph and Cable....	14,000,000	100 00	80 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit....	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co. (N. Y.)	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	178 00
Bell Telephone 7's	2,000,000		*112
Boston Electric Light.	1,500,000	100 00	85 00
Brooklyn Edison Electric Light....	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brunswick Elec. L. & P.	50,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.).	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s....	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N.Y.).	500,000	20 00	10 00
City of London Elec. Lt. Co. (Ltd.).	500,000	250 00	250 00
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)...	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	7 00
Cons. Gas & E.L.Co. of West Co.6's.	250,000		par
Cons. Gas & E. Co. Batavia, 6's....	80.000		par
Cons. Gas Co. Batavia, (N. Y.)	100.000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)...	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's..	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	9 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)...	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., (Phila.)..	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	96 75
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Equitable G. & E. Co. (Utica).	4,000		†
Erie Telephone	4,800,000	100 00	47 50
Essick Printing Tel.	5,000,000	100 00	45 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)..	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)...	100,000		par
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co.	4,000,000	25 00	11 75
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.).	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*103
Hunt Engineering Co. (Brooklyn)..	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited.	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7 500,000	100 00	12 50
Laclede Gas, pref.	2,500,000	100 00	40 00
Laclede Gas 5s.	10,000,000		*74
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s....	50,000		par
Little Rock Edison E. L. & P. 6's...	30,000		par
Littleton Water & E. L. Co. 6's....	75,000		par
Livingston E. Lt. Co. (Mont.) 6s..	30 000		*99
Long Branch Electric Light..	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.)..	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)..	60,000		par
Metropolitan Phonograph.	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	75 00
Morristown L. H. & P. 5s (N. J.)...	25,000		*90
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust.	9,000,000	100 00	15 00
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	49 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock...	2,535,000	100 00	93 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt...	100,000		†
N. Y. Phonograph Co	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150.000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio..	50,000		par
North American Phonograph.	6,600,000	100 00	
North New York, Lighting	150,000	100 00	10 00
Northern Elec. L. & P. (Phila.).	200,000	10 00	
Northwest Elec. Co. 6's Manitoba..	50,000		par
Postal Telegraph.	10,000,000	100 00	30 00
Passaic, Electric Light.	15,000	100 00	92 00
Paterson, Electric Light.	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)....	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co....	8,000		†
Pettingell Andrews Co. Boston..	200,000	25 00	25 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	60 00
Richmond L. H. & P. 5's.	150,000		*90
Rockaway Beach Elec. Light.	50,000	100 00	65 00
Rockaway Elec. Lt. Co. 6's.	75,000		par
Russell Electric Co. (Boston).	300.000	5 00	5 00
Saratoga Gas and Elec. Light 6s...	300,000		*86
Saginaw E. L. & P. Co. 6's Mich....	50,000		par
San Diego Gas & Elec. Co. 6's Cal..	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y..	100.000	100 00	
Shaver Corporation., N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Swan Incandescent.	800.000	100 00	5 00
Standard Ug'd Cable Co	1,000.000	100 00	95 00
Staten Island L. H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y)...	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	40 00
Thomson-Houston Pref.	4,000,000	25 00	24 50
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers 6's.	100.000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100.000		par
Tucker Elec. Const. Co. (N. Y.)....	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.)...	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.).	1,370,000	100 00	
United Elec. Light and Power.	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370.000	100 00	
United States Elec. Co	1,500,000	100 00	30 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000.000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250.000	5 00	6 00
Utica Elec. & Gas Co. 6's.	150,000		par
Utica Elec. Light Co. 6's.	150,000		par
Vine Street Motor Co. 6's (Colo.)....	100,000		par
Welsbach Inc. Gas.	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	78 75
Westinghouse Electric Co.	7,000,000	50 00	12 00
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			15 50
Yonkers, L. & P.	50,000	100 00	92 00

*Per cent. †Registered Stock.

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

I say! What a day they are having in the Argentine Republic! Gold up to 400 and English bank checks 30 per cent. discount! Business throughout the country paralyzed and no signs of recovery in sight! Did none of our youngsters of twenty years ago learn in New street how to manage matters sufficiently to lead the poor people out of the swamp they are in? Portugal is no better off. Gold has disappeared from Lisbon. Spain nearly as deep in the soup. Why stand ye all the day idle between the rear exits of the Stock Exchange and the Edison Building, fishing with dry sucked egg shells, when your advice and experience would be so valuable and your opportunities so abundant in either of the above localities?

It is reported that a special meeting of the National Lead Trust will be held on August 27, with a view to reorganization and incorporation under the laws of New Jersey with a capital of $30,000,000, of which $15,000,000 will be preferred cumulative 7 per cent. stock. It will also be on the cards to issue $3,000,000 debenture bonds bearing 6 per cent. interest, part of which will be used to retire certain mortgages on real estate and reimburse the trustees, the balance to carry on the legitimate business of the Trust. This is one of the few industries from which the public can derive great benefit through the intervention of capital and at the same time shareholders reap a large reward from their investment.

NEW INCORPORATIONS.

July 17.—The Gaston Electric Manufacturing Company, Sparta, Ill.; capital, $125,000; for the manufacture and sale of all kinds of electrical and other machinery and apparatus. Incorporators, J. E. Gaston, D. B. Barker and R. H. Rosborough.

July 17.—The Columbian Electrical Works of Chicago, Ill.; capital, $3,000,000; for the manufacture, sale and use of all classes of electrical apparatus. Incorporators, Samuel L. Moore, Louis S. Day and John Irvine.

July 28.—Appleton Edison Electric Company, Appleton, Wis., capital stock $100,000; to conduct a general electrical business. Incorporators: A. L. Smith, C. A. Beveridge and F. G. Kurtz.

July 28.—Chicago Electric Manufacturing Company, Chicago, Ill., capital stock $10,000; for developing and selling electrical devices, appliances and machinery. Incorporators: J. D. Claghorn, H. B. Hallock and C. P. Chapman.

Fottrell Insulated Wire Company, Philadelphia, Pa., capital stock $200,000; to manufacture insulated wire and cables, insulating materials and compounds and electrical appliances. Incorporators: John R. White, Charles Barclay, J. B. Colahan, Jr., all of Philadelphia, Pa.

NEW CATALOGUES.

The Straight Line Engine Company, 218 Geddes street, Syracuse, N. Y., has just published a catalogue of 31 pages fully describing their Straight Line Engines. Views of sectional parts of the engine are given, and their working described in detail. These machines have been on the market for a number of years, giving good satisfaction wherever used.

The Interior Conduit and Insulation Company 42 and 44 Broad street, this city, has just issued its illustrated catalogue and price list No. 4, of interior conduits and special electric light, heat and power appliances for use in connection therewith. The catalogue is handsomely gotten up, and the illustrations are excellent ones of the apparatus manufactured and handled by the company.

In our last issue the price of "The Mechanical Engineers' Reference Book," by Nelson Foley, assisted by Thomas Pray, Jr., was erroneously given as $13.00. The retail price is $25.00. Copies of this work and all others on electrical subjects can be obtained at the Electrical Age Office.

BUSINESS NOTES.

F. R. Chinnock, State Agent of the Edison General Electric Co., has been awarded the contract for lighting the new steamer "Thousand Island," plying between Clayton and Ogdensburg, N. Y. The contract calls for a 50 incandescent light dynamo and a 4,000 c. p. search light. E. T. Copeland & Co., 116 Liberty street, New York, will furnish one 8 H. P. engine for driving purposes.

The Peninsula Electric Light Company of Detroit, Mich., has bought out the Brush Company in that city. The price reported to have been paid is $1,100,000 in cash. The Peninsula Company is the old Edison Company rehabilitated. The latter company was bought by the Jenney Electric Light Company of Fort Wayne, Ind., and reorganized under the name of the Peninsula Electric Light Company some months ago.



A WEEKLY RECORD OF THE STREET RAILWAYS OF THE WORLD.

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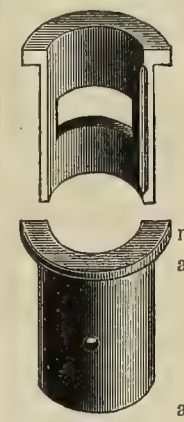
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For Electric Light, Electric Railways, Motors, Telegraph and Telephone use.

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Blue Vitriol.

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NEW YORK AUGUST 8, 1891.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

J. B. TALTAVALL, *President*, T. R. TALTAVALL, *Sec. and Treas*
W. T. HUNT, *Vice-President*, E. V. CAVELL, *General Manager*.

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DIFFICULTIES IN CABLE CONSTRUCTION.

The work of converting the horse railway on Broadway to the cable system is being rapidly pushed forward, but few people can have even a remote idea as to the stupendous amount of labor required to effect such a transformation.

Being the main artery of the city as it is, Broadway—or rather underground Broadway—is a complete mass of pipes; no less than seven of the gas companies run their main pipes through (or under) that busy thoroughfare—those of the Croton water system, the main cables of the Western Union Telegraph Company and its pneumatic tubes, to say nothing of the underground wires and cables of the electric light and telephone companies, the pipes of the heating companies—all combine to form a snarl difficult, indeed, to so arrange that a conduit could be cut through them for the operation of a cable line.

If facilities are at hand for the easy location of a wondrous mass of pipes and cables like this, the problems to be solved at the outset lose fully one-half of their terrors, but when one considers that many of these pipes (notably the water pipes) were laid twenty-five or thirty years ago, and then only in the most irregular and hap-hazard fashion, and that only exploratory excavations would locate most of them, it is evident that the difficulties of constructing a cable road under such circumstances must be stupendous. Yet one by one these obstructions are being removed, these difficulties overcome, and when finished the Broadway cable railway promises to prove itself one of the best constructed in the country.

GOOD RECORD FOR THE TROLLEY SYSTEM.

A fairly complete list of accidents which have occurred at different times, and which have been charged to the operation of the trolley system, was recently published in a Buffalo paper, but, after making a very careful digest of the same, we certainly find that none of them tend to substantiate the wild statements of those opposed to such a system, allegedly on account of its danger to life and limb.

The list goes to confirm what THE STREET RAILWAY NEWS has always held, viz.: That no human being has ever lost his life by shock from the trolley-wire. As far as the scaring of horses is concerned, that is liable to occur from any number of causes; true, a highly nervous horse will frequently take fright at the sight of a vehicle moving without any apparent motive power, simply because the sight is strange to him, but we venture the belief that the electrically propelled car has never yet scared as many horses as a peddler walking in the road with a big pack on his back—(there is nothing on earth to equal that sight as a horse-scarer.)

A number of accidents—none of them of a very serious nature, however—have occurred through the carelessness of the motorneer in running his car up too close to a wagon ahead of it, or in not being sufficiently careful in making crossings. Delays by reason of derailed cars have been caused a number of times, but no more so than by the usual blockades incidental to crowded streets.

Taking the record as a whole, it speaks volumes for the trolley system, and such a record, carefully compiled as was the one to which we refer, should convince even skeptics that there is no real danger in the trolley system.

ELECTRICITY GOOD ENOUGH FOR THEM.

President Thomas Lowry, of the St. Paul and Minneapolis Electric Railroad, says the improvements made by his company in the two cities during the past fifteen months have cost $6,000,000. There are between 225 and 230 miles of electric railway, about evenly divided between the two places.

Speaking of the alleged "deadly wire" accidents, about which the daily press of the country love to dilate on, Mr. Lowry says the whole matter sifted down amounts to this: The passengers in an electric car are not in danger in a thunderstorm; the car will not burn up, and if a motor burns out no one is loser but the company.

EXCELLENT RETURNS.

We are informed that the current gross receipts of the West End Street Railway of the Hub reach in round figures $5,000,000, and the operating expenses, inclusive, $4,000,000, leaving a net profit for dividends and reserve fund of $1,000,000. This, if correct, is a happy state of affairs for the shareholders, especially as the income must increase with the mileage and population and the expenses decrease. President Whitney contemplates introducing double decked cars. These will be a great luxury to sight-seers, and they respond nobly. By no possible accident can a tourist see a large city to better advantage than from a ride through it on top of a street car, and it pays all around, the shareholder getting in money what the public has in accommodation.

THEY WANT TO BE PROTECTED.

The Fire Commissioners of Buffalo are insisting that the Common Council shall compel the street car company to protect its insulated mains, which are placed on the arms of the centre poles on Niagara street, with guard wires in the same manner as the trolley wires are protected. They apprehend that the fire alarm apparatus will suffer in case their wires come in contact with the mains.

Since the last issue of STREET RAILWAY NEWS, its Directories have been decidedly improved upon, and these improvements will continue until they are perfect.

CAR VENTILATORS.*

The accompanying illustration shows a new method of ventilation for street cars, as recently applied to a number of cars in Brooklyn, N. Y.

The trouble and inefficiency of the old style turn-over sashes is well known. When open, there is a constant liability to cold draughts from side winds—the dust that lodges on the roof is blown in, soiling the car and often causing the lamps to smoke, and sometimes extinguishing them. The sashes when left open soon get covered with dust and then look shabby, and passengers are always grumbling about the unpleasant odors through the lack of change of air. The sashes are also inaccessible to short-legged conductors.

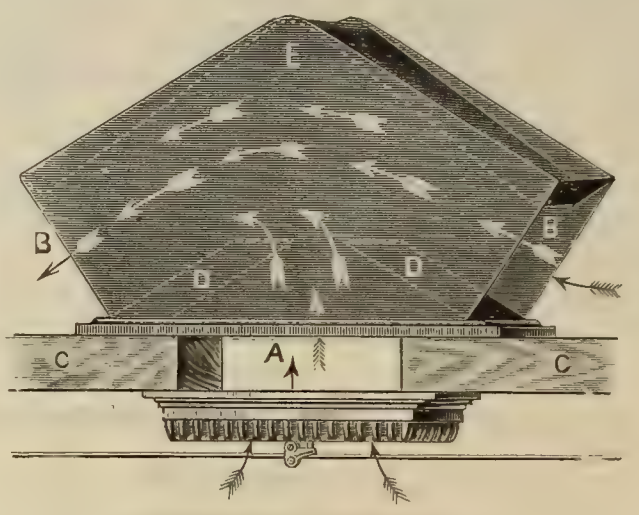
In the method illustrated, each alternate sash is removed and the remainder fixed. Outside of the opening is placed a Eureka or a self-reversing automatic ventilator which prevents any inward draught of cold air, and whichever way the wind blows the draught is outward. Inside are placed convex registers, nine inches long and seven inches high.

The improvement is common-sense and popular with everyone, and especially so with conductors, as the operation is so simple and easy that they become interested in it. It is applicable to all cars and is already in extensive use on steam railroads.

To maintain the action of the inlets the impure air which rises to the clear story is drawn out by self-reversing exhaust ventilators placed on the outside of the clear story. To the registers inside (opposite the ventilators), is attached a continuous rod worked from the end of the car. This is plainly shown in the illustration. The lever has an index which shows the exact position of the register valves.

By this arrangement the conductor is ten times more likely to attend to the adjustment of the registers (which regulate the temperature) than he is when he has to go to each register separately, as he does it unobserved and without annoying the passengers. If the heating appliances are of sufficient power for all occasions the temperature may be regulated to any degree required.

The company manufactures two systems of ventilation. In one the supply of air comes in cleaned from dirt and without draughts on each side of the car through double screens. The inner screen has apertures about one-hundredth of an inch square. The injectors have two wings outside, one of which is opened outward about three inches down the front of the car. The rear wing is closed tight. These are operated and adjusted by handles and set screws. The air is forced in by the movement of the car and passes down into a



CREAMER CAR VENTILATOR.

covered conduit on the sides of the car inclosing the heater pipes. The fresh air is thus warmed and comes up through small registers near the floor, the valves of which may be regulated by a small handle at the side of the car within easy reach of the passenger.

The other system is the same except that the air is admitted through transom monogram registers, or drop panels, perforated end plates or drop sashes in the doors. The self-reversing exhaust ventilator for the clear story is by far the most powerful ever made, and as now constructed is perfectly noiseless at all times. The only attention it requires is to see that the deflectors are put in properly at the start and that they always work free as air.

The latter ventilator has been applied to forty cars on the Long Island Railroad and twelve cars on the Brooklyn Bridge.

*William G. Creamer & Co., New York.

DETROIT STREET RAILWAY NOTES.

At last, after many years of "horse power," Detroit is about to have rapid transit. Ex-Governor Waller, of Connecticut, and two or three other prominent capitalists from eastern cities have purchased the property of the Detroit City Railway Co., including several branches. Electric cars will take the place of all horse cars as soon as the change can be made. The price paid, as near as can be learned, is about $4,500,000.

Among those that rejoice at the sale of the Detroit street railways, are several gentlemen interested in the Detroit Electric Battery Co., who want to give their storage battery a trial. The company has bought a Shawhan motor and had a car overhauled and refurnished at the Pullman Car Works. It is stated that the street railway companies refused to have anything to do with the car, or to allow it to be tested on their rails. Fortunately for them the railway have passed into other hands, and an effort will be made to secure the desired permission from ex-Governor Waller and his associates who have purchased the roads. They have spared no expense in fitting up the car and it is a handsome little palace on wheels. The car will be lighted with five 32 c. p. electric lamps.

A new storage battery car, constructed by the Standard Electric Co., of this city, was given a test a few days ago and gave general satisfaction. The car was run over a bar of railroad iron placed on the track, and the jump was made without damage to either the car or the cells. The battery is the Logan cell, consisting of lead molds filled with red lead. Those who are interested in the car are satisfied that it will solve the question of rapid transit for Detroit, and become the accepted motor. Another trial will be had in a short time on the tracks of one of the street railroads.

INTERIOR VIEW OF CAR SHOWING CREAMER VENTILATOR.

NEW CARS.

The Minneapolis Street Railway Company a few days ago put on the rails twenty new cars from the works of the Northern Car Company, at Robbinsdale. In general appearance they are like those made by the Jones Company, Troy, N. Y., and the Laclede Car Company, St. Louis, Mo.

The length of the new cars is 18 feet, and the interior is handsomely finished in light woods. The cars are upholstered in the best manner possible, and at each end are two plate glass mirrors.

The interior of the cars is illuminated by electric lights, and the platforms will be lighted in a similar manner. The car bodies are of a bright orange color, and the decorations and finishing are very artistically wrought.

A new feature has been introduced on these cars which will be appreciated. The steps are made of wire, so that all dirt and moisture will pass through and not accumulate, as is common on the ordinary solid step.

TROLLEY-WIRE HANGER.*

An excellent trolley-wire hanger, is briefly described and illustrated below.

This hanger possesses some novel features in its construction. As seen in Fig. 2 the upright part of the wire clip is imbedded in the substance of the insulator, and the rivet which holds the iron head to the insulator passes through the

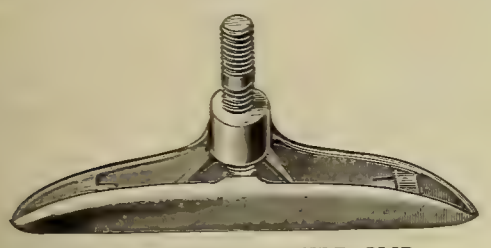


FIG. 3—TROLLEY WIRE CLIP.

imbedded end which is formed in the shape of a ring or washer. The rivet is insulated from the metallic parts by proper insulating material.

By this method of construction there is no danger whatever of the trolley-wire being dropped from the insulator, and this is an important consideration when it is remembered that falling trolley-wires never fail to cause alarm, and a stampede among those who happen to be near. With the wire-hanger under consideration accidents are avoided.

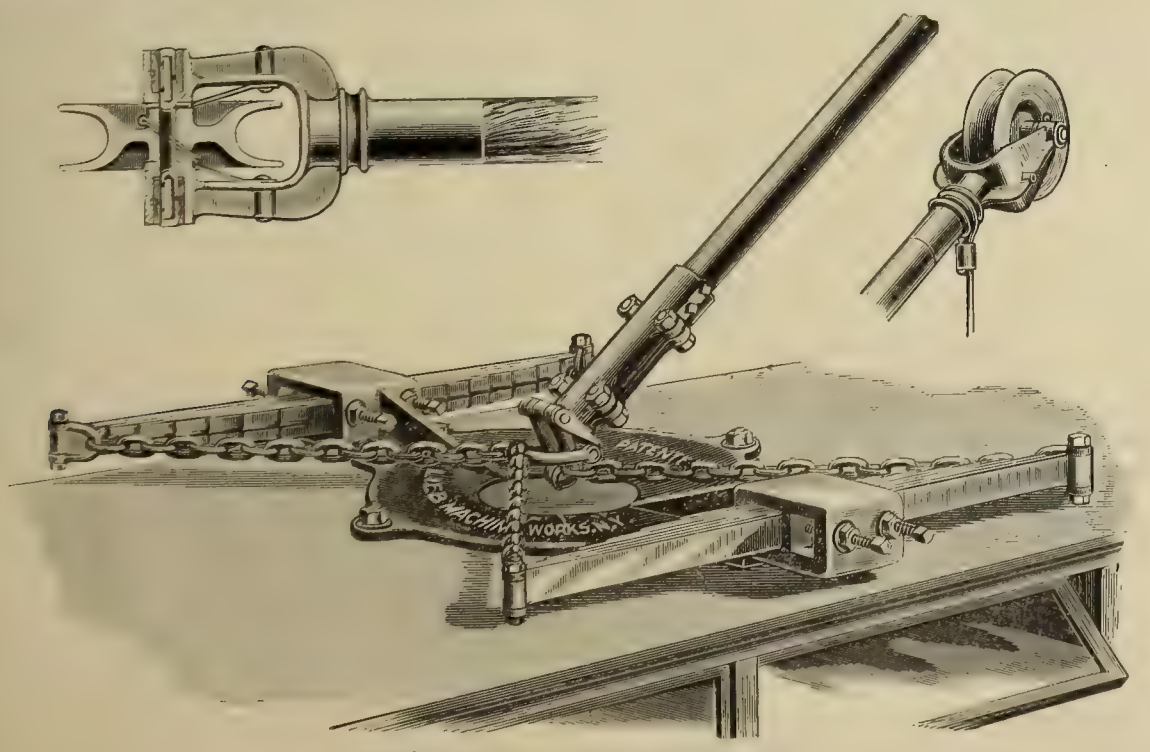
The clip itself is of novel design. The two jaws are forced together by means of a tapering screw, and the grip on the trolly-wire can be made very strong. Any size wire up to No. 4 will fit the clip, it being adjustable by means of the tapering screw.

In placing the hanger the insulator is first screwed to the trolley-wire and then put in place on the span wire.

There is no possibility, by this construction, of the jaws of the clamp becoming loose as the insulator itself must be turned before the clamp can be opened, and this necessitates detaching the insulator from the span wire. Fig. 1 shows the insulator complete and in position: Fig 2 shows the internal construction of the insulator, and Fig. 3 shows the clip.

TROLLEY-POLE AND STAND.†

A simple and durable trolley-stand and pole for electric cars has been brought out, illustrations of which we give herewith.



LIEB'S TROLLEY POLE AND STAND.

One of the objects desired in the design of this stand and pole was to secure an even pressure on the trolley-wire, at whatever angle the trolley pole might be disposed. This was successfully accomplished by using two wagon springs the ends of which are connected with the base of the trolley-pole by chains as shown in the accompanying figure. The use of springs in this manner secures an even pressure on the wire regardless of the variations in level.

The wheel and fork of the trolley are made of bronze, and the wheel-shaft is hollow and packed with felt, which is saturated with oil for the purpose of lubricating the interior of the bearing, the oil passing through holes drilled in the shaft for the purpose.

Strip washers riveted to the fork communicate the current to the latter. The conductor is enclosed in the interior of the pole, which is of wood, and the pole base is so constructed that the pole may be readily detached from the base.

An important improvement has been introduced in this trolley-shaft. The shaft is so constructed that it turns with the trolley-wheel in its bearings. This construction is claimed by the inventor to be a most desirable one, as the shaft changes its position with reference to the line of wear, as with the trolley.

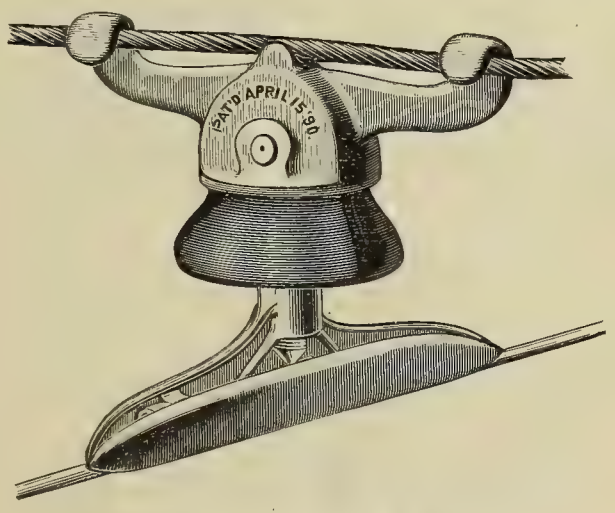


FIG. 1—TROLLEY WIRE HANGER.

Some idea of the flexibility of this apparatus may be had from the fact that the trolley will pass under any structure as low as five inches from the top of the car, and it is suitable for any overhead system.

The Brooklyn and Jamaica Electric Railway is now using twenty of these trolleys and reports good satisfaction. One of the trolleys on this road has run about 8,000 miles and is still in use, and doing good work. Other electric roads are using them with satisfactory results.

STORAGE BATTERY PLATES.*

In looking up the history of electrical development one is surprised to find how frequently commercial success has been achieved through small details.

Think of what has been done for electric railroading by the carbon brush and the under contact trolley. May we not hope that even storage batteries may win a better reputation through the improvement of one or more details?

It is said that seventy-five per cent. of the street cars in the United States are in cities where overhead wires cannot be used. Then why do they not use storage batteries? Such advantages as they possess ought to sweep the street railway field.

Each car is an independent unit.



SECTION OF STORAGE BATTERY PLATE.

The car can be run over any track in a city; that is, they are not limited to the road that is wired.

No unsightly street construction, with attendant danger.

No stoppage from ice on the wires.

No troubles with the telephone systems.

No people killed, or buildings set on fire by dead wires.

No loss of power from bad insulation on the line.

No loss of efficiency as the result of increasing or diminishing the number of cars on the line.

Ability to start all the cars at once, if necessary, without stopping the engine.

No danger to the motors from lightning.

No flashing on the rails or wires.

No danger to power station or building from lightning.

Absolutely safe potential, 220 volts being used instead of 500 or more on overhead.

No changes in roadbed are necessary on the introduction of storage batteries on old roads.

Less sparking at the brushes and less wear on commutators. This is a fact well demonstrated by practice, and can probably be accounted for by the difference in the nature of the current

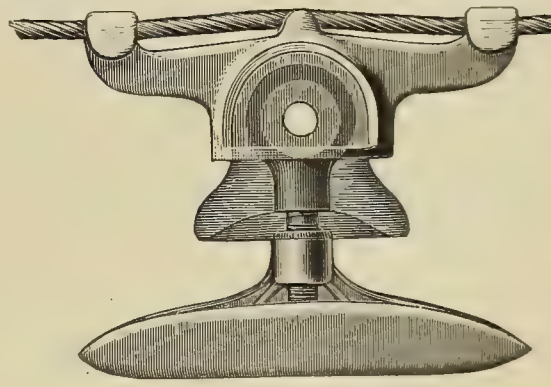


FIG. 2—INTERNAL CONSTRUCTION OF TROLLEY-WIRE HANGER.

drawn from a storage battery and that supplied by a dynamo. The storage battery current is positively continuous, while the dynamo current is a pulsating one, and its pulsations greatly increase the self-induction in the armature.

The storage battery has had a hard time, but it has not been proved a failure, as many people suppose, and there is considerable progress being made just now toward demonstrating that it is not.

The inventors of the storage battery, plates from which are shown in the accompanying illustrations, claim that they have succeeded in perfecting a battery in which the active material cannot fall out and the plates cannot buckle. The accompanying figure shows a section of the plate made by this company.

The plates are insulated from each other by plugs of a new insulating material, and of such shape that there is no chance for the plates to buckle. For railway work a high rate of delivery is an absolute essential, so that the battery can respond to the excessive demands for current which are made upon it without a great fall of

*Charles A. Lieb, New York.
†Lieb Machine Works, New York.

*Lloyd and Paxton, New York.

potential, and a consequent falling off of the speed, and the manufacturers claim that by using their plates and more of them, with a larger number of perforations and greater mechanical perfection, a rate of discharge can be attained that has never yet been equalled in a commercial battery. Their 150-ampere hour cell can be discharged continuously at 50 amperes, for three hours, with a fall of potential not greater than 10 per cent., or it can be discharged for one hour at 100 amperes and 10 per cent. fall.

STREET RAILWAY QUOTATIONS.

The following are the latest prices for street railway securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

Names of Companies.	Capital.	Par.	Price.
Albany Street Railway Co. (N. Y.)	$750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Atlantic Ave. Ry. Bkln	2,000,000	100 00	102 00
Birmingham Ry & Elec.Co.,6's (Ala)	1,500,000		par
Brooklyn City R.R.	6,000,000	10 00	15 50
Brooklyn City R. R. 5's	6,000,000		*104
Benton Belfontaine (St. L.)	324,000	100 00	100 00
Benton Belfontaine 7's (St. L.)	50,000		*102
Broadway & 7th Ave. (N.Y.)	2,100,000	100 00	305 00
Bleeker St. & Fulton Ferry (N.Y.)	900,000	100 00	26 00
Broadway & Newburg (O)	1,000,000	100 00	110 00
Brooklyn St. R.R. (O)	310,000	100 00	125 00
City Elec. St. R.R. 6's (Ark)	200,000		par
Citizens (St. L.)	1,500,000	100 00	105 00
Cass Ave. Fair. (St. L.)	300,000	50 00	49 00
Chicago City (Ill.)	6,000,000	100 00	305 00
Chicago Passenger (Ill.)	1,000,000	100 00	96 00
Chicago Passenger (Ill.) 6's	400,000		*105
Central Park N. & E. R.	1 800,000	100 00	125 00
Cleveland Cable (O)	2,000,000	100 00	25 00
Cleveland Cable Pref. (O)	2,000,000	100 00	105 00
City R.R. (San Fran.)	800,000	100 00	100 00
California St. (San Fran)	1,000,000	100 00	109 00
Cincinnati, (O.)	5,775,000	50 00	109 00
Cincinnati, (O.) 7's	300,000		*102
Charleston City, (S. C.)	100,000	50 00	65 00
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Dry Dock, E. By. & Bat. (N.Y.)	1,200,000	100 00	138 00
Dry Dock, E. By. & Bat., 7's, (N.Y.)	840,000		*106
Eighth Ave. (N.Y.)	1,600,000	100 00	250 00
East Cleveland, (Ill.)	2,000,000	50 00	85 00
Ferries & Cliff House, (Cal.)	2,500,000	100 00	42 00
Ferries & Cliff House, (Cal.) 6's	650,000		*108
Germantown, (Pa.)	1,500,000	50 00	95 00
Gloucester St. Ry. Co. (Mass)	60,000	100 00	95 00
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Lehigh Ave. (Phila.)	1,000,000	50 00	66 00
Louisville St. Ry. (Ky.)	5,000,000	100 00	20 00
Louisville St. Ry. Pref. (Ky.)	1,000,000	100 00	70 00
Montague St. Ry., B'klyn	150,000	100 00	100 00
Missouri, (Mo.)	2,500,000	100 00	250 00
Mound City, (Mo.)	1,000,000	100 00	200 00
Market St. (San Fran.) 6's	3,600,000		*123
Mount Auburn Cable, (O.)	300,000	100 00	50 00
Mount Adams & E. Park	1,400,000	50 00	107 00
Northern Central, (St. L.)	200,000	100 00	105 00
North Beach, (Cal.)	1,000,000	100 00	53 00
North Chicago City R.R.	500,000	100 00	
North Chicago Street R. R.	5,000,000	100 00	156 00
People's St. R. R. (St. L.)	1,000,000	50 00	75 00
People's St. R. R. (Pa.)	1,500,000	25 00	41 00
Pawtucket, (R. I.)	270,000	100 00	92 00
Phila. City	1,000,000	50 00	143 00
Ridge Ave. (Phila.)	750,000	50 00	215 00
Short El. Ry. Co. (Clev.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co.	16,000		†
St. Louis Ry. (Mo.)	1,000,000	50 00	75 00
St. Louis Cable, (Mo.)	1,000,000	100 00	15 00
St. Louis Cable, 5's	1,500,000		*101
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Vine St. Motor Co. (Colo.) 6's	100,000		par
West Chicago Street R. R.	10,000,000	100 00	119 00
West End St. Ry. (Boston)	2,000,000	50 00	64 00
West End St. Ry. (Boston) Pref.	6,400,000	50 00	81 50
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00

*Per cent. †Registered Stock.

As very few street railway securities are dealt in on the Stock Exchange, the above prices are mostly approximate, but will be found very near the mark.

THE WEEKS' RECORD OF STREET RAILWAY NOTES

CALIFORNIA.

SAN JOSE.—On July 22, the First street Electric Railway received two 26 ft. open trailer cars.

ILLINOIS.

CHAMPAIGN.—The Western Union Telegraph Company threatened to close its city office if the City Council did not compel the Champaign and Urbana Electric Railway Company to erect poles of its own, and stop using the telegraph company's poles. The Western Union Company's request was granted.

CHICAGO.—The Homewood, South Harvey and Harvey Dummy Electric Railway Company, will begin construction work at once.

KANKAKEE.—The Electric Street Railway Company received a number of cars July 19, and started the road into active operation at once.

On July 19, the Kankakee Electric Street Railway Company began running cars. The line is over four miles in length.

INDIANA.

INDIANAPOLIS.—The Citizen's Company expects to have its Irvington line in operation by August 10.

The North Indianapolis Street Car Line ran its first car over a portion of the road July 20. The entire track will be constructed in a short time, when the stringing of trolley wire will be commenced.

KENTUCKY.

LEXINGTON.—The Belt Electric Company has stopped the use of its line by the Kentucky Union Railroad, as it received no compensation for the same.

PADUCAH.—A street railway company here, desiring to control the transportation of a theatrical troupe to and from the Opera House situated on the railway line, backed the troupe to secure its patronage. The theatrical venture collapsed leaving the actors and singers destitute, and they now threaten to sue the street railway company for unpaid wages.

MASSACHUSETTS.

BOSTON.—The Street Railway employés are organizing to secure better wages and fewer hours of labor. It is said that nearly 3,000 joined the Federal Labor Union inside of two days time.

The Governor and Council have approved an appropriation of $2,500 to defray the expenses of the rapid transit commission to Europe.

HOLYOKE.—The street railway company's new building on Canal street, is nearly finished. Besides containing sufficient space for keeping the cars, a large waiting room and the general offices of the company will be located in it.

LEOMINSTER.—On July 22, the new horse car line was formally opened.

NEW BEDFORD.—It is said that the Union Street Railway Company will take up its tracks on Summer street, and run its cars from Cannonville to Fair Haven by electricity.

WORCESTER.—The electric street railway company and the electric light company have made arrangements by which the railway company is to provide two 80 H. P., Westinghouse generators, set the poles and string the wire, and the electric light company is to place the generators in its building, in Faraday street, to take care of them and furnish power to run them. By this arrangement the electric light company will furnish power for the railway to the lake.

MICHIGAN.

OWOSSO.—The councilmen are fighting the granting of an electric railway franchise because the streets are narrow.

MISSOURI.

JOPLIN.—The Electric Street Railway Company is erecting poles for its trolley wires on South Main street and laying rails from the Gulf Road south.

KANSAS CITY.—A transfer system has been arranged between the Kansas City Cable Company and the Interstate Consolidated Railway Company.

MONTANA.

BUTTE.—On July 22, Supt. Woolston, of the Butte Consolidated Street Railway Company, and a gripman in his employ were arrested for endeavoring to run a car through a crowded street while a procession was passing.

NEBRASKA.

LINCOLN.—The Lincoln Street Railway Company and the Lincoln Electric Railway Company, have filed with the Secretary of State, articles of agreement for the consolidation of the two systems. The capital stock is $2,000,000, and consists of 1,500 shares of common and 5,000 shares of preferred stock. A cumulative dividend of 7 per cent. is guaranteed on the preferred stock. The Consolidated Company issued to the old Electric Company *pro rata* $200,000 of preferred and $200,000 of common stock. The stock of the other company remains in force as stock of the Consolidated Company, the names being identical. The unissued stock is to remain in the treasury of the company, to be used only to acquire additional property and pay for paving. All rights acquired under the separate franchises are retained. The document is signed by J. D. McFarland, C. J. Ernst and J. W. Deweese, for the Street Railway Company, and by C. J. Ernst, J. D. McFarland, J. W. Deweese, F. W. Little, Joseph Sampson, Charles A. Clark and John C. French, for the Electric Railway Company.

NEW HAMPSHIRE.

DOVER.—Over $40,000 worth of stock in the Union Street Railway Company, was bought by the residents of this place. The capital stock of the company is but $50,000.

NEW JERSEY.

JERSEY CITY.—Track on the Montgomery street line will be relaid during this month. Heavier rails and new ties will be used.

NEWARK.—The strike of the employés of the Rapid Transit Railway Company ended July 29.

On July 27 a number of motor men and conductors struck for an increase of twenty cents a day. They had been receiving $1.80 for eight trips or thirteen hours.

NEW YORK.

LOCKPORT—The Lockport Street Railway Company has contracted with the Westinghouse Electric Construction Company for an electric plant.

On July 27 the Westinghouse Electric Construction Company purchased the property of the Lockport Street Railway Company and will change the motive power to electricity as rapidly as possible.

NEW YORK.—The Rapid Transit Commissioners are still actively engaged studying the engineers' plans for the West Side route.

SARATOGA.—The electric street railway formally opened July 22.

OHIO.

CINCINNATI.—The work of transforming the Pendleton or East End line into an electric railway is nearly completed.

It is understood that the 8th street route will soon adopt electricity.

From present indications it looks as if it would be another year before the Avondale line is completed.

The Mt. Auburn Electric line recently received a number of new open cars.

The mule line to Newport, Ky., will soon give way to electricity. It is said that another line is to be constructed between the two cities as soon as the new bridge is completed.

The Norwood Electric Road was completed on July 4. The through electric service will be completed about September 1, or as soon as the Mt. Adams Incline, which is being rebuilt, is finished.

COLUMBUS.—On July 24 the horse car system on High street was converted to the electric system. Electric power will be used on other streets as soon as the necessary changes can be made.

PORTSMOUTH.—The street railway has suspended operations.

ONTARIO.

TORONTO.—It is said that Ex-Alderman McDonald, who recently endeavored to enjoin the city from giving a street railway franchise to the Kiely-Everett syndicate, alleging that some of the aldermen had been bribed to grant a franchise to that company, claims that he has received a consideration more than sufficient to cover the costs incurred in his action, on the strength of which he promised to drop the action entirely. Mr. McDonald says, as he was not asked to keep the matter secret, he feels at liberty to make it public.

PENNSYLVANIA.

CONNELLSVILLE.—Work on the new electric street railway from Leisenring to Connellsville has been commenced.

PHILADELPHIA.—The construction of the Northeastern Elevated Railroad will be begun the latter part of August. Engineers have been at work completing plans and surveying the line since Mayor Stuart signed the ordinance. The motive power has not yet been decided, but the majority of the directors favor electricity.

SAYRE.—Work has now been commenced on the electric railway.

WILLIAMSPORT.—An 100 H. P. generator was installed in the Lycoming Electric Light Company's station, July 28, to furnish power for the electric cars.

RHODE ISLAND.

PROVIDENCE.—The Union Railroad Company began work on its trolley system to Pawtuxet, July 28.

TEXAS.

BONHAM,—Construction work has been begun on the electric street railway. It is expected that the road will be in operation by the first of September.

UTAH.

OGDEN.—It is expected that the new electric railway will be in operation by September 1. The power house, a two-story brick building 116x66 feet, will be completed by August 15. The line will consist of ten miles of track.

WASHINGTON.

SEATTLE.—The discussion with regard to an electric railway between this city and Tacoma, has resulted in the formation of the Seattle White River Valley Electric Railway Company; capital stock, $1,500,000. It is understood that the company will file articles of incorporation at once. Among the capitalists connected with the enterprise are the following: L. H. Griffith, J. H. Dengstorff, Julius Mees, Terence O'Brien, B. F. Shaubut, T. M. Alvord, W. W. Corbett, Patrick Hayes, D. A. Neeley, William Cochrane and C. H. French.

SPOKANE FALLS.—The Electric Street Railway Company received four new 29 ft. cars, July 19. The cars were constructed by the J. G. Brill Company, Philadelphia, and each is equipped with two 15 H. P. Edison motors, and will be lighted with 16 c. p. incandescent lamps.

TACOMA.—It is said the property owners will make an effort to disfranchise the Tacoma Railway Motor Company, which has had tracks laid on certain streets for over a year without running cars.

WISCONSIN.

MILWAUKEE.—The Milwaukee City Railway Company has consolidated with the Pfister Dummy Steam Railway Company.

The new street railway company, Georgetown, Ky., has declared a semi-annual dividend of 4 per cent.

The Braddock and Turtle Creek Street Railway Company, McKeesport, Pa., will increase its capital from $100,000 to $150,000; the increase to be used to extend the road to Keating.

NEW ROADS.

Des Plaines, Ill., is to be connected with Chicago by an electric road. A company was organized in Chicago on July 28, for the purpose of constructing such a road, with a capital stock of $250,000. The name of the road is Norwood Park and Maine Electric Railway. The incorporators are, Freeman J. Short, Martin E. Cole, Russell O. Dunning and Andrew Dunning.

Ashland, Schuylkill county, Pa., is to be connected with Centralia, Columbia county, Pa., by an electric line. On July 27, the Ashland and Centralia Electric Railway Company was organized, with a capital of $20,000, for the purpose of constructing a road between the two points named. The incorporators are, John E. Reilly, D. S. Marshall, M. T. Donohue, all of Ashland, Schuylkill Co., Pa.

Moorewood, Westmoreland Co., Pa., is to be connected by an electric road with Mt. Pleasant Township. The Mt. Pleasant Electric Street Railway Co., has been organized for the purpose, with a capital stock of $50,000; and the following named gentlemen are the incorporators: W. D.

Mullen, T. S. Tintsman, and R. H. Goodman, Mt. Pleasant, Westmoreland Co., Pa. Daniel J. Gordon is president.

An electric road is to be built from Allegheny City to Reveree Township, Allegheny Co., Pa., by the Spring Hill Street Railway Company which was organized July 27, with a capital stock of $12,000. The incorporators of the company are, William C. Haslage, Dr. Nicholas Schenkel and John M. Goehring. The incorporators constitute the first board of directors. Thomas Einstein is president.

BLOOMINGTON, Ill.—A representative of the Thomson-Houston Electric Company has been here consulting with a number of capitalists, with a view of installing a second street railway plant in this city,

CHICAGO, Ill.—Many of the contracts for the construction of the North side electric road have been let, and active work will begin about September 15. The road is to be built by the Love Electric Traction Company. The officers of the company are as follows: P. C. Hanford, president, John A. Roche, vice-president, John G. Shortall, treasurer, Albert G. Wheeler, secretary and general manager, and Prof. J. P. Barrett, the city electrician, electrical engineer.

DENVER, Col.—It is proposed to construct an electric line from the marble quarry of Gunnison county, to a connection with the Rio Grande road.

INDIANAPOLIS, Ind.—The route of the North Indianapolis Street Car Line has now been decided upon.

SOUTH HADLEY, Mass.—The citizens are trying to induce the Holyoke Street Railway Company to run its cars through this place.

SUTTER CREEK, Cal.—The Amador Railway and Light Company will build an electric road from Ione to Jackson *via* Sutter Creek. Lewis Glass, the general manager of the Edison Electric Company, is now looking over the ground in the interest of his company.

WHITENSVILLE, Mass.—There is a strong movement here to establish an electric railway to connect this town with Manchauga, East Douglas, Douglas, Glenwood and Uxbridge. Over $50,000 have already been subscribed for the road between Manchauga and East Douglas.

LEGAL.

CHICAGO, Ill.—On July 24, Judge Tuley, in a lengthy opinion, decided against the State street property owners, who sought to enjoin the construction of the Alley "L" Road. between Wabash avenue and State street, and from 12th to Congress street. It was claimed that the company had violated the ordinance by not complying with the specifications as laid down therein, and thus trespassed upon the complainant's property. Judge Tuley in summing up said the evidence showed that the defendant had kept itself strictly within the requirements of the ordinance.

INDIANAPOLIS, Ind.—On July 24, Judge Woods refused to appoint a receiver for the Broad Ripple Street Railway Company, and denied the Edison Electric Light Company's right to a bill in equity. Judge Woods said that the charges in the Edison Company's bill were unfounded, as there was a perfect understanding between the two companies from the beginning of their business to the end.

NEW YORK, N. Y.—On July 29, Judge Barrett of the Supreme Court, Chambers, dissolved the temporary injunction restraining the Broadway and Seventh Avenue Cable Company from running its cables across the tracks of the Sixth Avenue Railroad Company, at 34th street and Sixth avenue.

OMAHA, Neb.—The Capital Heights Street Railway and the Lincoln City Electric Railway Companies, have sued the Sheedy estate for damages claimed to have been caused by a temporary injunction procured by Mr. Sheedy before his death, restraining them from constructing tracks on streets adjoining his property. The injunction has been dissolved, and the companies are trying to recover damages on the bond given by Mr. Sheedy.

WORCESTER, Mass.—The Worcester Consolidated Street Railway Company has sued Benjamin F. Boyden for five cents which Mr. Boyden had refused to pay as he held a transfer check from the South Worcester to the Main street line of the company. The suit is brought for the purpose of ascertaining whether or not the company has the right to enforce its regulations regarding the use of transfer checks, which Mr. Boyden had violated by letting a number of cars pass before taking one to his destination.

FINANCIAL.

DETROIT, Mich.—On July 24 last the mortgage between the Grand River Street Railway Company and G. M. Hendrie and W. C. McMillan, given December 27, 1889, was filed in the City Clerk's office. Bonds were given to the amount of $250,000, which were secured by a mortgage for a like amount. The bonds run for ten years and were issued to defray the expenses of constructing and operating the road. The mortgage for $1,000,000 given by the City Railway Company to W. K. Muir and Sydney D. Miller on the same date, was also filed with the City Clerk, July 24.

NEWARK, N. J.—It is said that the amount paid for the Rapid Transit Street Railway by the Newark Passenger Railway Company was $1,000,000.

TRACK EXTENSIONS.

BOSTON, Mass.—The West End Street Railway Company is continuing its electric tracks from Washington street to the ferry.

INDIANAPOLIS, Ind.—The Fort Wayne Street Railway Company is constructing an extension to the east end of the city.

MANCHESTER, Va.—The Hull street car line is to be extended to Forest Hill.

MARBLEHEAD, Mass.—The street railway company will extend its tracks to Devereux and Riverhead Beaches, and use electricity as the motive power.

OAKLAND, Cal.—Hoskins, inventor of the Hoskins motor, says he will extend his road to Piedmont and Alameda. He is now building a road from San Jose to Alum Rock.

SALT LAKE CITY, Utah.—The Rapid Transit Street Railway Company has asked for the privilege of constructing and operating a street railway from its present terminus to the city limits.

SAN FRANCISCO, Cal.—The San Francisco and San Mateo Railway Company has petitioned for a franchise to extend its tracks.

WEST BAY CITY, Mich.—The electric street railway is to lay new street rails on its Salzburg extension.

INCORPORATIONS.

BOULDER, Col.—A company has been formed to construct and operate a street railway from this place to Owen's Lake; capital stock $200,000.

CHICAGO, Ill.—The Electric Light, Street Railway and Power Company, of Creal Springs, Williamson county, this State, was incorporated July 24, with a capital stock of $6,000. Incorporators, W. Debolt, C. L. Ostrich and W. S. Carroll.

DANVILLE, Ill.—On July 23, the Citizens' Gas and Electric Railway Company was incorporated with a capital stock of $100,000. Incorporators, J. R. Kendall, W. Beckwith, C. H. Beckwith and H. W. Moorehouse.

DAYTON, O.—The White Line Street Railroad Company has been incorporated with a capital of $300,000.

FALL RIVER, Mass.—On July 22, the Tiverton and Seaconnet Street Railway Company was incorporated with a capital stock of $200,000, at $100 a share. The line will run from Cook Pond to Tiverton, and thence to Wind Mill Hill in Little Compton and to the Seaconnet House. The incorporators are authorized to condemn lands, both public and private. The incorporators are Daniel T. Church, Nathaniel B. Church, Henry A. Church, B. Franklin, ex-Lieut. Governor Henry T. Sisson and Congressman Oscar Lapham.

HARRISBURG, Pa.—The Gettysburg Electric Railway Company was incorporated July 28, with a capital stock of $100,000, to build a railway from the centre of the city to the famous battle field. The length of the road will be nearly five miles.

PIERRE, S. D.—The Hot Springs Street Railway Company has been incorporated with a capital stock of $50,000. Incorporators: Edward Calhoun, Edward Petty, Sylvester A. Calhoun, Charles D. Fargo and Philander Ferguson.

STERLING, Ill.—The Jamison Street Railroad Company has been incorporated with a capital stock of $50,000. Incorporators: Charles Jamison, Edward C. Underwood and James McCune.

WORCESTER, Mass.—The Worcester and Shrewsbury Street Railway Company has filed articles of incorporation, with a capital stock of $20,000, divided into 200 shares of $100 each. The length of the street railway proposed will be a little less than a mile, and its gauge 4 feet 8½ inches. The incorporators are C. S. Turner, George A. Stevens, George Sumner, Henry Y. Simpson, Charles A. Cleveland, J. C. Speirs, Milton P. Higgins, A. H. Sampson, Julien F. Bigelow, Irving E. Bigelow, Horace H. Bigelow, Josiah H. Clarke, Arthur O. Young and James M. Drennan, all of Worcester, and Lambert Bigelow, of Shrewsbury. The following are to act as a board of directors for the present: Charles S. Turner, James M. Drennan, H. Bigelow, Irving E. Bigelow, Josiah H. Clarke, George A. Stevens and Lambert Bigelow.

YOUNGSTOWN, O.—On July 25, the Youngstown Street Railway Company was incorporated to build and operate street railroads by horse, cable, electric or other power, and to furnish power and light, capital $500,000. Incorporators: W. J. Crawford, J. H. Dempsey, L. M. Snyder and Harrison N. McGraw.

STATISTICS.

BROOKLYN, N. Y.—The gross earnings of the Brooklyn, Bath and West End Railroad Company for the last quarter were $27,117.63, the expenses $20,594.67, net earnings $6,522.96, fixed charges $8,763.93, deficit $2,240.97, cash on hand $5,670 27; profit and loss deficiency $14,259.23. For the corresponding quarter of last year the earnings were $28,437.15, deficit $6,046,33.

NEW YORK, N. Y.—The last quarterly report of the Harlem Bridge and Fordham Railway Company is as follows: Gross earnings from operation $49,846.19, operating expenses $47,546.75, net earnings from operation $2,299.44 other income $3,750. Gross income from all sources $2,336.94, fixed charges $3,377.12, deficit $1,140.18, cash on hand $2,203.71, profit and loss surplus, $7,896.12. For the corresponding quarter of last year the earnings were $48,303.56, and the net income $1,145.80.

PHILADELPHIA, Pa.—The Ridge Avenue Passenger Railway Company carried 7,423,642 passengers during the past year; expenses were $215,835.07 and the total receipts were $368,014.99; the dividends aggregating $150,000. The 13th and 15th streets line carried 9,594,008 during the year. The receipts were 483,001.99 and the expenses $280,056.68. The dividends amounted to $170,000.

BROOKLYN, N. Y.—The quarterly report of the Brooklyn City and Newtown Railroad Company, ending June 30 last, is as follows: Gross earnings, $113,306.39; expenses, $82,973.12; net earnings, $30,333.27; other income, $225; gross income, $30,558.27; fixed charges, $18,957.42; cash on hand, $27,860.42; profit and loss, surplus, $81,217.23. Its corresponding quarterly report of last year shows: Net earnings, $109,846; net income, $15.422.89.

CASUALTIES.

AMESBURY, Mass.—On July 23 two cars on the Black Rocks and Salisbury Beach Electric Road collided with some force, severely injuring one passenger, a lady.

BROOKLYN, N. Y.—On July 28, during a heavy storm lightning struck the trolley-wire of the Brooklyn and Coney Island Electric Railroad, destroying the insulation to such an extent that the wire was grounded by the rain. The accident caused the stoppage of five cars for nearly three hours.

ELIZABETH, N. J.—A two-year-old child fell out of the window of a horse car July 27, but was only slightly hurt

QUINCY, Mass.—On July 23 an electric car on the Quincy and Boston road struck an express wagon at the corner of Copeland and West streets, killing a nine-year-old boy and injuring the driver.

ELECTION OF OFFICERS.

CHICAGO, Ill.—At a meeting of the shareholders of the Homewood, South Harvey & Harvey Dummy Electric Railway Company, July 23, W. C. McClintock was elected president, J. Hartman, vice-president, and F. M. Bangs, secretary and treasurer.

HARTFORD, Conn.—At the annual meeting of the Hartford and Wethersfield Horse Railroad Company, July 29, the stockholders re-elected the old Board of Directors as follows: James D. Goodwin, Atwood Collins, S. G. Dunham, E. S. Goodrich, Daniel R. Howe and Charles L. Lincoln. E. S. Goodrich was re-elected president and D. R. Howe secretary and treasurer.

FRANCHISES

NEWTON, Mass.—The Garden City Electric Street Railway Company has secured a franchise to build a single track road from Newtonville to Newton Centre. Cars will be operated by the storage battery system.

READING, Pa.—The City Passenger Railway Company has been granted a franchise to erect poles and string wires to run its road by the trolley system, over a number of streets.

SAN FRANCISCO, Cal.—The Market Street Railway Cable Company has asked for a franchise to extend its system.

SHREVEPORT, La.—The Shreveport Electric Railway and Motive Power Company, has been granted the right-of-ways over the principal streets of the city for 30 years.

SIOUX CITY, Iowa.—D. T. Hedges is after a franchise for a street railway here.

PERSONAL.

Major H. C. Evans of the Johnson Co. is in Nantucket.

We are glad to report the convalescence of Elmer O. Evans, who was quite sick last week. (We said some men are pretty hard to kill).

Mr. F. L. Perry, associate editor of the *Westen Electrician* of Chicago made the ELECTRICAL AGE office a very pleasant visit during the past week. We understand that Mr. Perry is now located in New York for an indefinite length of time.

Mr. C. A. Yeamans, President of the Woronoco Street Railway Co., of Westfield, Mass., was in New York during the past week.

Mr. D. W. Higgins, President of the National Electric Tramway and Lighting Co., of Victoria, B. C., was in town last week, and while here decided to use stationary registers on his road and placed an order for the same with the Railway Register Mfg. Co.

Mr. D. C. Robinson, President of the Elmira and Horseheads Railroad, was a visitor in New York last week.

Mr. J. T. Rogers (designated by Major Harry Evans as the "Pooh Bah" of the Binghamton Street Railway Co.), of Binghamton, N. Y., was in town last week.

Leland Gamble, formerly secretary of the Oakland and Barkeley Rapid Transit Company, but at present engaged in lighting the city of Mexico with electricity, was recently in Oakland, Cal., on a visit.

Julius Meyer, Chief Engineer of the Milwaukee Electric Railway system, accompanied by a few members of the Milwaukee City Council, was lately in Minneapolis inspecting the electric street railway systems.

Mr. Thomas Hodge, a director of the Gloucester (Mass.), railway, has resigned and severed his connection with the company by selling his stock.

Mr. W. E. Van Brunt, Manager of the Peoples' Street Railway Company, of St. Joseph, Mo., is in St. Paul and Minneapolis investigating the use of petroleum as a fuel for steam plants, with a view of using it, if found satisfactory, in his power house.

Mr. F. R. Chinnock, State Agent of the Edison General Electric Co., who now makes Utica his headquarters, was in town during the past week and paid us a very pleasant visit. Mr. Chinnock is very well known among the electrical fraternity, as well as by street railway men, and his genial manner, coupled with the thorough knowledge of the business he looks after, has won for him friends without number.

The Broadway and Newburg Street Railway Company, Cleveland, O., intends to extend its lines, and to put in 50 new car equipments.

SOUNDNESS OF STREET RAILWAY SECURITIES AS INVESTMENTS.

The battle royal, between labor and the representatives of capital on the 27th of July, at Newark, was one which, as a precedent, will go far to form the investor's estimate of electric street car securities. In all classes of business a certain portion of the profits are discounted for unforseen contingencies. Life insurance, no doubt, has approached nearer perfection in this respect than any other calculation, but the most competent mathematicians of the world labored long to reach the result. Electric propulsion is new; the actual cost of construction and maintenance is yet to be ascertained; favorable circumstances do not exist; courageous capital is fighting all the elements, known and unknown, and obliged to use unskilled labor, for, with the exception of the few electricians who superintend the construction, the great mass of employés have had time to learn comparatively nothing beyond turning a contact wheel, or placing a trolley pole in position. A short circuit, a moderate leak, a metallic contact, or any one of a hundred trifling incidents would be too much for the average trainman's electrical knowledge. It is altogether too previous to dictate to capital and reminds one of the confiscation of green apples. Young investors in looking over the field for a safe deposit in which their wealth may increase with a satisfactory degree of certainty and a greater volume than the old channels, should examine closely the financial growth of street railways, or as our English cousins call them—Trams. With the evolution from horse through cable to electricity, money which at first was hard to secure for the purpose has become educated to a point at which its holders are capable of judging in a measure of the feasibility and earning power, almost as soon as the scheme is presented. In 1886, a short five years ago, we only had five or six electric roads in operation, with about forty cars; to-day there are nearly 400 electric roads in operation or under contract. The rates for passenger service have not, and for some years, will not change, while operating expenses have been, or will be reduced at least 50 per cent. We have all become accustomed to five cent car fare and pay it without question; now the logical result, all other things being equal, would be that dividends should be credited with the major part of that 50 per cent. Stock dividends will be quite the order of the times, the cash being used to extend the service. Old investors have neither the time nor the desire to unlearn the lessons of years; let them plod along in the old rut. Fresh vigorous ideas are required in the new order of things; money alone is worse than useless. Energy, tireless application, constant and watchful attendance to the splendid growth of street passenger accommodation during recent years will result in comfort and increased dividends to investors.

New electric surface roads in and about New York are fast assuming financial importance; every few days we find the cars filled with happy people speeding along fresh paths to ocean's beach or country pleasure resorts, where quiet farms alone were visible last season. The nimble nickels will soon reach the bank and part of them remain for investors, while the great bulk will have enabled labor to enjoy its outing. These securities must increase in value rapidly.

BUSINESS NOTES.

The U. S. Electric Railway Company, 10 Wall street, New York, has just closed contracts with the Oswego street Railway Company, Oswego, N. Y., and Worcester Consolidated street Railway Co., Worcester, Mass. The Westinghouse system will be used on both roads. Mr. Lemuel W. Serrell of this firm is in the West at present looking after other contracts.

Mr. L. R. Millen of L. R. Millen & Co., New York, is in the south and expects to return by the middle of August. This firm is the largest railroad lumber dealers in the United States, its capacity being estimated at ninety million feet per year. The present members of the firm are L. R. Millen, L. Johnson and R. H. Bewick. This firm has also an office in Savanah, Ga., with two additional members, Mr. Wm. B. Stillwell and W. R. Bewick.

The Edison General Electric Company has sold thirteen car equipments in Grand Rapids, Mich. The road at Menominee, Mich., constructed on the Edison system, is about completed.

A company has been organized in Pittsburg, Pa., to equip electric and cable street railways with the underground systems under patents granted to John J. Miller of that city. The name of the company is the Pittsburg Underground Electric Construction Company; officers, C. D. Robbins, president, a prominent Washington county merchant, D. J. Rex, a manufacturer of Pittsburg, secretary and treasurer; C. F. Shoemaker, E. A. Mann, F. J. Sterling and John J. Miller, of the Robbins Electric Company, and inventor of the underground system, comprise the directory. The capital stock, $300,000; $96,000 paid in. The inventions cover complete street railway systems, comprising motors, underground trolley, rail and roadbed.

The Electric Railway Specialty Company, 29 Broadway, is out with a number of superior new specialties, as usual. It has a complete new truck ready for the market that is said to revolutionize street railway travel. Other specialties for the improvement of line material and track work will be pushed shortly. It has other surprises to startle the trade with, which will at the same time interest it very much.

The Edison General Electric Company has sold a 250 H. P. generator for railway purposes in Ottumwa, Ia.; also two 275 H. P. generators in Louisville, Ky.

The Westinghouse Company has sold four car equipments at Vincennes, Ind.

Detroit has granted a franchise for an electric road, and specifications are being prepared for a 200-car outfit. Mr. Ferguson and ex-Governor Waller of Massachusetts are the interested parties.

Mr. H. A. Everett, of Cleveland, O., has obtained a franchise for an electric road in Toronto, Ont., and will proceed to draw specifications for the same at once.

The Thomson-Houston Electric road in Columbus, O., is now in operation.

All who have seen the Murnane Underground Conduit system, on exhibition in room 48, *World* building, New York, are unanimous in saying that it is without doubt the solution of the street electric railway traction problem.

A project for the construction of an electric railway from Aosta to Pre Saint Didier, on the borders of France and Switzerland, has been laid before the Italian Minister of public works. The distance is between 20 and 30 miles and if completed it will be the longest electric road in Europe.

A car on the Niagara street line, Buffalo, has been equipped with Edison single reduction motors. Its performance is being watched with considerable interest by electrical engineers, as well as by the street railway people.

The following copy of a letter with reference to the Peckham Radial Truck explains itself:

OFFICE OF THE RAPID TRANSIT STREET RAILWAY CO.
OF THE CITY OF NEWARK, N. J.
GENERAL OFFICE, 275 WASHINGTON STREET.

NEWARK, N. J., July 16, 1891.

E. PECKHAM, Esq.,
President, Kingston, N. Y.

Dear Sir:—We have now had the Radial Gear No. 4 Truck your company made for us in active service for nearly three months under Car 29, and in reply to your inquiry have to say, that it has fulfilled all our expectations, and is equal to all your representations.

It is superior to all other trucks that we have in our service. It is strong and rigid, but also flexible and easy to ride upon.

A special merit of the truck is the relief it gives the car body from the oscillation which is so noticeable in other trucks. Another feature of merit is the ease with which wheels can be taken out and replaced, with much less trouble and expense than in the ordinary trucks.

I cheerfully endorse your claims for its efficiency.

Yours truly,

(Signed) SAMUEL SCHOCH,
Gen. Supt.

HE THINKS WELL OF IT.

James F. Peavey, president of the Sioux City Street Railway Company, Sioux City, writes:

"I have carefully looked it (STREET RAILWAY NEWS) over, and wish to compliment you upon the interesting matter contained therein, and would be glad to have you add our company to the list of subscribers."

DELAWARE & HUDSON COMPANY.

For the information of those who have never visited the Canadian metropolis, but who are intending to go to the Montreal meeting, it may be stated that the shortest and most interesting line between Montreal and New York is the Delaware & Hudson Railroad. Parties from the West can go to Schenectady or to Albany, connecting at either point with the "D. & H." road, and see something of Saratoga, Lake George, Lake Champlain and the marvelous scenery of the Adirondack Mountains. The "D. & H." stands at the head in the number and importance of the summer resorts along its line, and in the number of summer tourists carried in its trains.

Arrangements should be made to include a stop at the Hotel Champlain on the west shore of Lake Champlain, three miles south of Plattsburgh, which, architecturally and in beauty of location of surroundings, is perhaps the finest affair of its kind in the world.

Mr. J. W. Burdick, general passenger agent of the Delaware & Hudson Railroad, Albany, N. Y., will be glad to send by mail an illustrated guide of the line, upon receipt of six cents in stamps, to cover postage.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued July 28, 1891.

456,543. Tramway-Switch. Charles Beach, Albany, N. Y. Filed Jan. 8, 1891.

The combination of a pivoted, switch-block a plate having a loop on its under side and a cross-bar connected at one end to the free end of the switch-block and at its other end to the free end of the shifting-block and supported in the loop of the plate with longitudinal guide bars for the shoes, and vertically-movable presser-bars with shoes.

456,762. Car-Starter. Patrick Flood, Albany, N. Y. Filed Feb. 20, 1891.

A starter-dog pivotally secured to a spring-controlled slide-bar, means for swinging it to and from engagement with the ground, and a draw-bar movably connected with the slide-bar and controlled in its movements by the slide-bar-controlling springs.

456,818. Railway. William S. Herrington, San Francisco, Cal., assignor to himself and Frank E. Jones and John D. De Fries, same place. Filed April 4, 1890.

An underground tunnel comprising a frame constructed of uprights, bases, ties and braces, a casing forming a lining for the frame and provided at its top with a continuous slot widened at curves, and two parallel rails secured to short ties on the frame and within the casing.

456,864. Car-Body. John Turner, New York, N. Y., assignor of two-thirds to John Wimmer and Henry J. Muhlfeld, both of same place. Filed March 24, 1891.

A cable, electric, or horse car having its seats arranged longitudinally and provided with longitudinally-grooved pillars carried by the side frame and supporting the roof, trusses having their ends secured to the pillars and supporting the roof at the centre, window-sashes sliding upwardly between the pillars, with permanent or fixed window-sashes between the upper portion of the pillars and cap-plates closing the space between the back of the seats and the side of the car.

456,866. Brake for Elevated Railway Carriages. John N. Valley, Jersey City, N. J. Filed Feb. 20, 1891.

A brake-shoe having bent ends forming guides for preventing undue play, and a lever for throwing it.

456,867. Elevated Railway Carriage. John N. Valley, Jersey City, N. J. Filed Feb. 20, 1891.

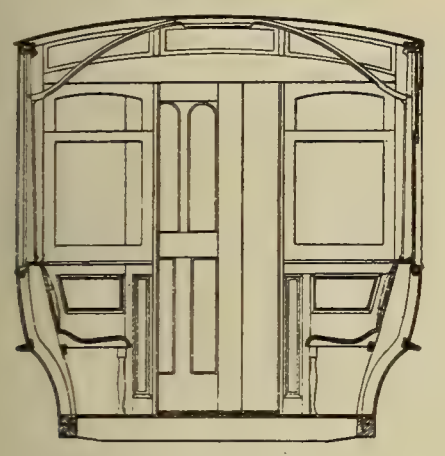
A wheeled carriage for elevated railways having upwardly-extending spaced sides or legs adapted to encircle a suspended track and formed integrally or continued from side to side and forming bearings for the wheels at the upper end.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued July 28, 1891.

456,558. Electrodes for Secondary Batteries. Otis C. Flick, Brooklyn, assignor to the Wellington Manufacturing Company, New York, N. Y. Filed Jan. 3, 1887. Renewed March 7, 1889.

The method of making electrodes for secondary batteries, consisting in casting or placing pure metallic lead into apertures, cavities, or recesses or upon the surface of a plate composed of a metal or alloy that is not affected injuriously



456,864—CAR BODY.

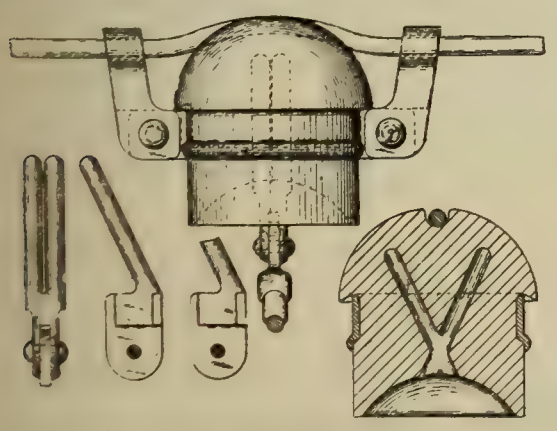
by the exciting-liquid of the battery, then converting the pure metallic lead into a carbonate of lead or other salt or oxide of lead, and then converting the converted pure metallic lead into lead of a spongy or granular nature while held in the cavities or apertures or upon the surface of the plate.

456,574. Span-wire Insulator. Walter S. Jarboe, William P. Seibert, and John White, Allegheny, Pa. Filed Nov. 28, 1890.

A span-wire insulator consisting of a block of insulating material having pins entering transversely therein and connected at their outer ends to form a connection from which the trolley-wire is suspended.

456,593. Regulation of Dynamos Driven by Compressed Air. Victor Popp, Paris, France, assignor to the Popp Compressed Air and Electric Power Company, Limited. Filed April 7, 1888. Patented in France, Belgium and Italy.

A compressed-air motor driving a dynamo having a pipe which directs the exhaust of the motor against the dynamo, whereby it may be cooled by the direct action of the exhaust air.



456,574—SPAN WIRE INSULATOR.

456,598. Electric-Arc Lamp. Francois L. Sautter, Paris, France, assignor to Sautter, Harle & Co., same place. Filed Dec. 18, 1890. Patented in France and England.

An electro motor for regulating the relative positions of the electrodes, a make and break lever in the circuit of the motor, and a device for controlling the position of the lever, consisting of a wire or piece of material sensitive to the heat or light of the arc, and adapted to move the lever.

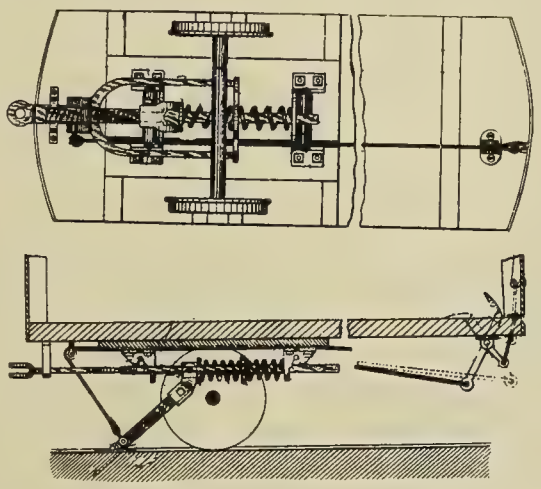
456,600. Span-Wire Insulator. William P. Seibert, Allegheny, Pa., assignor of two-thirds to Walter S. Jarboe and John White, same place. Filed Dec. 13, 1890.

An electric insulator formed of an outer casing having a series of teeth or projections formed around its mouth and an insulating-block with which the teeth engage.

456,611. Cable-Head for Electric Wires. Upton H. Balsley, Philadelphia, Pa. Filed Jan. 12, 1891.

A terminal head for electric cables, consisting of a box into which one end of the cable passes, a frame at the top of the box above the end of the cable, one portion of which is inclosed within the box and the other portion exposed on the outside of the box, and permanent electrical connections through the frame, terminating upon the outside of the box for connections with external wires and terminating at the inside of the box for connection with the wires of the cable, whereby the exposed end of the cable within the box is entirely sealed against atmospheric changes.

456,612. Electro-Motive-Force Regulator. Edward M. Bentley, Boston, Mass. Filed Oct. 21, 1890.



456,762—CAR STARTER.

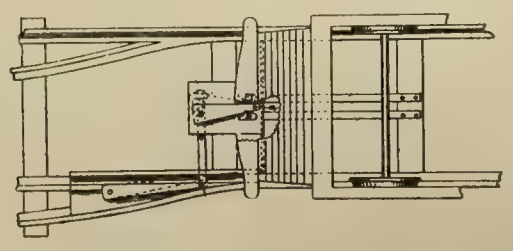
The method of regulating electric generators or motors by dividing them into two sources of electro-motive force and completing the circuit of each source through a variable portion of the other source.

456,622. Magnetic Separator. David E. Lain, Yonkers, N. Y. Filed Aug. 2, 1890.

In a battery of magnets for a magnetic separator, the combination of a hollow cone of magnetic metal, two spiral rows of projections of magnetic metal from the external surface of the cone to form the cores for the electro-magnets, windings of insulated electrical conductors for each of the cores, and a continuous spiral pole for each of the two rows of cores.

456,683. Attachment for Poles for Electric Wires. Edmond Verstraete, St. Louis, Mo. Filed July 7, 1890.

An insulating cap fitted on the end of a pole with an insulating-ring below the insulating cap, and a metallic cap having wire-supporting knobs fitted over the insulating-cap and ring.



456,543—TRAMWAY SWITCH.

456,684. Electric Gas-Lighter. Adolph Wunderlich, Cleveland, Ohio. Filed April 7, 1890.

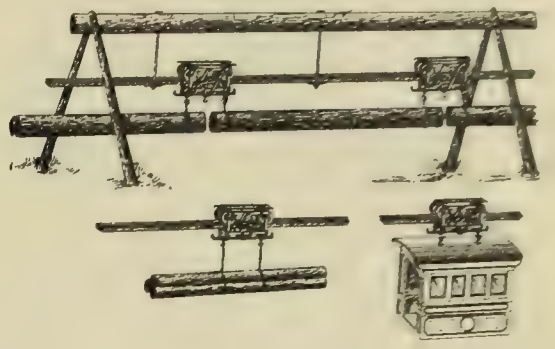
Electro-magnets energized by a single electric circuit with an armature fastened to a stem connected to a valve controlling the flow of gas and a cam operating the stem, valve, and armature.

456,685. Automatic Electric Gas-Lighter. Adolph Wunderlich, Cleveland, Ohio. Filed Dec. 5, 1890.

An armature connected with a valve with two pairs of electro-magnets arranged to act on the armature one pair to open and the other to close the valve, and a [illegible] spring to hold it open or closed.

456,718. Coin-Controlled Electrical Apparatus. Theodore L. Brooks, Port Bryon, N. Y. Filed May 19, 1890.

Multiple independent coin-slots, each having a chute, a swinging contact-plate, a spring contact-finger attached to



456,867—ELEVATED RAILWAY CARRIAGE.

the plate for each chute, provided with a hook upon its free end, an insulating-block secured upon the plate, and contact-screws through the block, adapted to engage with the contact spring-fingers by the swinging of the plate.

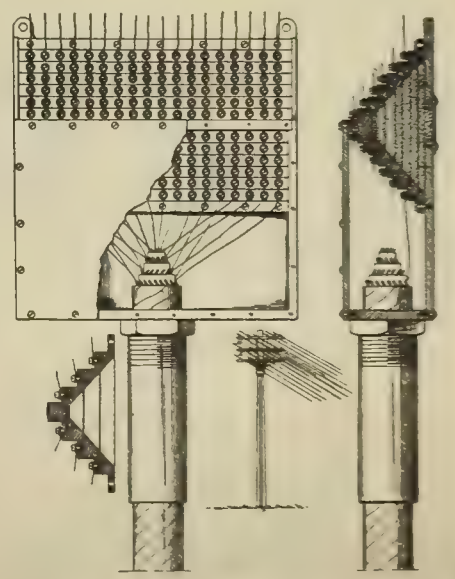
456,746. Medical Induction Coil. Henry A. Voelkner, Detroit, Mich. Filed Jan. 28, 1891.

Two current-breakers of different rapidity, and a switch by means of which either current-breaker may be placed independently, or both in series in the primary circuit.

456,803. Annunciator. William C. Dillman, Brooklyn, assignor to Owen Walsh, New York, N. Y. Filed May 6, 1891.

An annunciator for speaking-tubes consisting of a swinging-leaf arranged at the mouth of the tube and carrying a mouth-piece, a catch to hold the leaf in a raised position, means for releasing the catch, and an electric bell arranged in a circuit which is closed by the dropping of the leaf.

456,804. Alternating-Current Motor. Michael



456,611—CABLE HEAD FOR ELECTRIC WIRES.

Von Dolivo-Dobrowolsky, Berlin, Germany, assignor to the Allgemeine Elektricitäts-Gesellschaft, same place. Filed Dec. 23, 1890.

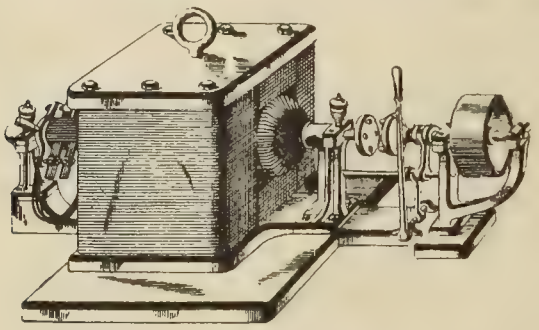
A number of conductor-bars passing through the field magnet and insulated therefrom, means for conductively connecting all the bars together at one end, electric circuits, the terminals whereof are connected to the other ends of the bars, and means for exciting in the circuits differential phase alternating currents.

456,817. Electric-Circuit-Changing Apparatus. Hammond V. Hayes, Cambridge, assignor to The American Bell Telephone Company, Boston, Mass. Filed Feb. 3, 1891.

ELECTRICAL PATENTS—Continued.

An instrument hung or journaled on bars constituting terminals of an electrical circuit and adapted to be placed in one position when employed and in another when unemployed, combined with an electric-circuit-changing switch controlling the connection of the instrument with the circuit having fixed and movable elements, the fixed elements being the projecting ends of the bars which constitute the circuit-terminals, one or both of the bar ends having in their circumferential surface a non-conducting section, and the movable elements consisting of contact-springs fixed to the instrument and constituting the terminals, the free ends of the springs being in pressure-contact with the circumferential surface of the fixed elements and adapted to rest on their conducting sections when the instrument is in its resting position and to revolve about the same and to make contact with the conducting portion when the instrument is moved to its working position.

456,827. Clutch. William H. Johnson, Brooklyn, N. Y. Filed April 1, 1891.



456,827—CLUTCH FOR DYNAMO ELECTRIC MACHINES.

In a clutch mechanism for a dynamo-electric machine the combination of clutch-shafts provided with a collar, a rod also having a collar, and having its end bearings in the standards of the machine, two forked arms, a transverse rod and a handle-lever.

456,835. Electric Condenser-Regulator. James McBride, Brooklyn, N. Y. Filed Sept. 24, 1890.

A thermostat located within the escape or waste pipe of a condenser, electro-magnetic apparatus controlled by the thermostat, a three-way valve controlling a fluid under pressure and itself controlled by the electro-magnetic apparatus, a motor actuated by the fluid under pressure, and a valve in the cold-water supply pipe of the condenser controlled by the motor.

456,836. Railway Signaling Device. William Newcomb, Johnsonville, N. Y. Filed Dec. 20, 1890.

In a railway signalling device, the combination with a semaphore-blade secured on a sectional revoluble hub containing springs adapted to sustain the weight of a semaphore-blade, a bracket-plate on which the hub is secured, a post supporting the bracket-plate, a battery, circuit-wires normally in open circuit, an electro-magnet on the bracket-plate below the hub, and an armature-bar supported by a weak spring and pivoted at one end to vibrate between the magnet and hub and adapted to detachably hold the hub when the magnet is dormant,

456,843. Secondary Battery. Henry Pieper, Liege, Belgium. Filed Oct. 17, 1888. Patented in Belgium and England.

The method of increasing the capacity of primary and secondary batteries and effecting their depolarization by maintaining within the battery-fluid gases in solution under pressure.

456,859. Electric-Light Crane. Charles H. Shank, Armourdale, Kas. Filed Jan. 10, 1891.

A hollow crane having a slot therein extending from top to bottom, through which a lamp-supporting device may travel.

456,865. Show-Stand. John W. Tyler, Dayton, Ohio. Filed March 12, 1891.

A show-stand comprising the combination with a shelf, a shaft or rod, and motor therefor, of a segmental circuit-closing device, the moving member of which is connected to and operated by the motor, and electric lamps of various colors connected in groups to the several segments of the circuit-closer so that each group successively may be thrown into and out of circuit.

456,888. System of Electrical Distribution. Morris Feilbogen, New York, N. Y., assignor to Gustav Lindenthal, Pittsburg, Pa. Filed Sept. 22, 1890.

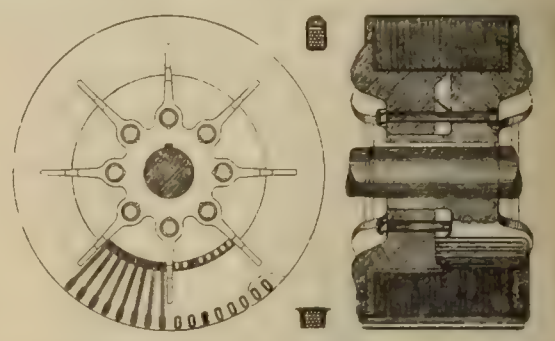
The combination with a constant electric generator and an inductorium or a series of the same, of a series of circuit-breakers having their brushes connected with the primary coils of the inductoriums, a series of break-levers by which the circuit breakers are regulated, a driving-shaft having a pulley connected with the motor by which the dynamo is driven, and a series of pulleys connected with the pulleys of the disrupters or circuit breakers by means of suitable bands.

456,889. Electric-Circuit Breaker for Secondary Generators. Morris Feilbogen, New York, N. Y., assignor to Gustav Lindenthal, Pittsburg, Pa. Filed Sept. 22, 1890.

In a circuit-breaker or disrupter, the combination of a disc constructed of insulating material carrying a series of segments in electrical connection with its shaft, a brush secured to an insulated seat, a weighted brake-lever having a curved spring-plate bearing against the periphery of the disc, a hollow coil having its terminals in the main circuit, and a movable core secured to the brake-lever and setting in the coil, whereby the lever is operated as a brake to control the movement of the disrupter.

456,908. Electric Hoisting-Machine. George H. Reynolds, New York, N. Y., assignor to the American Electric Elevator Company, same place. Filed Dec. 27, 1890.

In a hoisting apparatus, the combination, with a series of contacts and a rheostat in an electrical circuit, a switch arranged to traverse the contacts, and an electric motor adapted to receive a greater or less electro-motive force there-



456,925—ARMATURE FOR MOTORS AND GENERATORS.

through, of a worm driven from the shaft of the motor, a worm-wheel meshing with the worm and carrying frictional contact-surfaces, a central shaft upon which the worm-wheel is fixed, having one end threaded, a winding-drum having frictional surfaces to correspond with those on the worm-wheel, and a sleeve carried loosely upon the central shaft, a hand-wheel working upon the screw of the shaft, and a clamp for joining the hand-wheel to the sleeve, so that they may move together laterally and revolve together or independently.

456,925. Armature for Motors and Generators. Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 27, 1891.

An iron-clad-armature having longitudinal holes or perforations near its periphery, or surface coils wound through and partly filling the holes, and a wedge or wedges of insulating material driven into the holes so as to compress the coils and bind them within.

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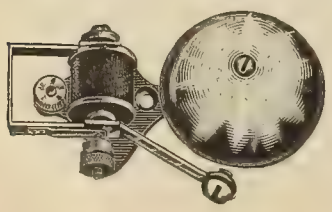
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WEEKLY.

Vol. IX. NEW YORK, AUGUST 15, 1891. No. 33.

PELTON WATER MOTORS.

The subject of water power and its utilization for useful purposes has received very great attention from engineers of late years, and since the application of electricity for light and power purposes they have given it more attention than ever before. The result of this has been to create a demand for an efficient water motor.

It is conceded that nothing is so convenient, and under all ordinary circumstances so cheap as a water motor. One of the most efficient machines of this class yet put upon the market is that made by the Pelton Water Wheel Company, of San Francisco, illustrations of which we give herewith.

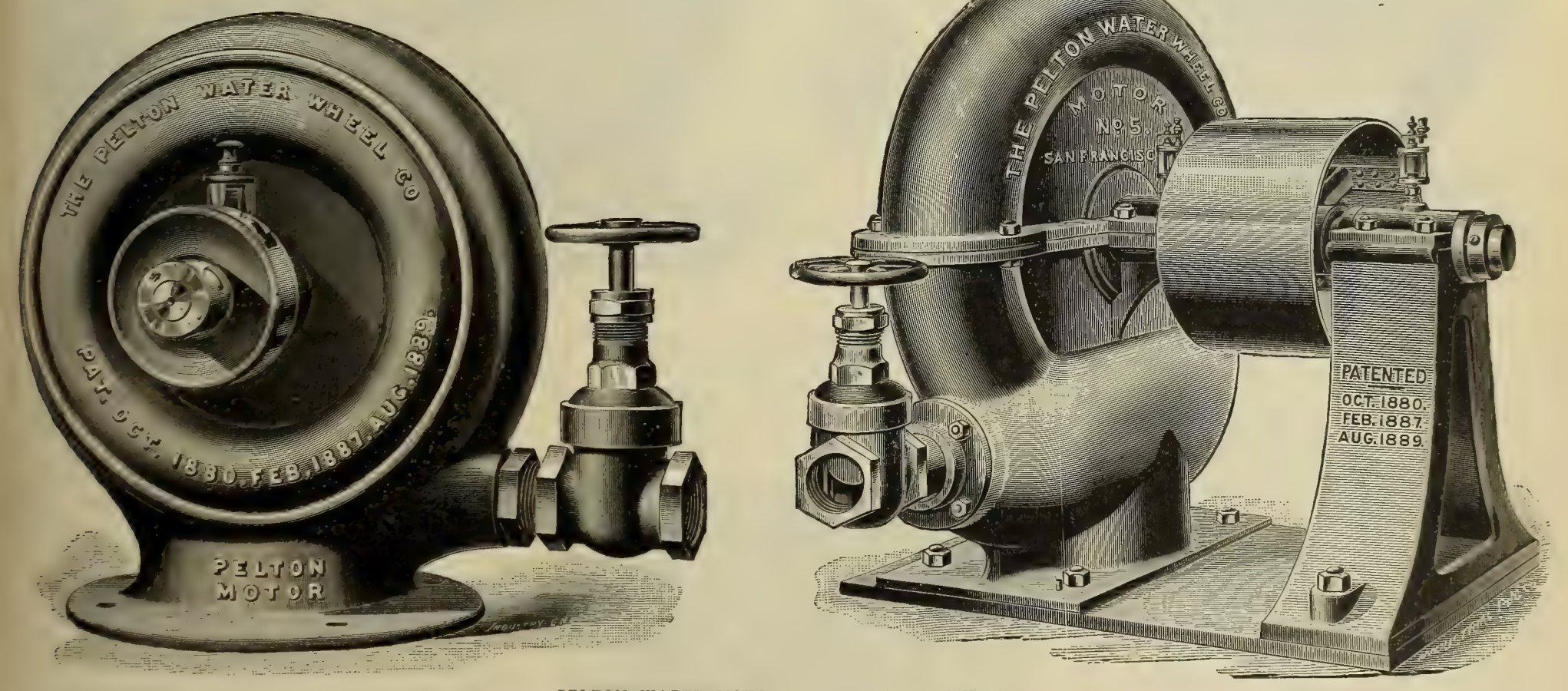
The Pelton motor is said to be superior to all others as regards strength, durability, economy of water, in fact in all that constitutes a high-class water motor. It is warranted to do a given amount of work under the same conditions, with at least 50 per cent. less water than any other motor now on the market, and also to run any number of years without repair, or even without any other attention than the lubricationof journals; to be always in order ready for instant service, and good for any demand that may be made upon it within the limits of its capacity.

Motors Nos. 2, 3 and 4 are especially adapted for running dynamos, and a large number of them are now being used in this way.

When the head admits and the power is not wanted for any other purpose, both wheel and dynamo can be mounted upon a cast iron bedplate, and the shafting connected by coupling. Where the power is wanted for other use through the day time, a belt connecting with shafting pulley is used.

The wheel of motor No. 2 is 12 inches in diameter and weighs 75 pounds; the pulley is 4 inches in diameter by 4 inch face.

Motor No. 4 weighs 300 pounds and has a pulley of 6 inches diameter by 4½ inch face. Our illustrations give two views of motor No. 4, one with the wheel enclosed and the other with the cover removed. The latter also shows the buckets of the wheel.



PELTON WATER MOTORS—SIZES NOS. 2 AND 5.

Motor No. 5 weighs 650 pounds and has a 24 inch wheel with pulley 8 inches in diameter by 8½ inch face.

All the above motors are for ordinary service up to a head of 250 feet or pressure of 108 pounds. For heads in excess of this, heavier machines are used.

The main office of the Pelton Water Wheel Company is at 121 and 123 Main street, San Francisco, Cal., and the New York office at 143 Liberty street.

THE CARE OF ACCUMULATOR PLANTS.

All conductors in the accumulator room should be so placed that if the insulation wears off by the action of the acid and of the fumes, short circuits will be impossible. The leads may be carried on porcelain insulators and every wire should be kept apart in all cases.

Never add concentrated acid to the cells, as the grids will soon become rotten, if this is done.

Never test a cell for E. M. F. by "flashing," which means taking a short wire, pressing one end on the positive strip of a cell and rapidly touching the negative strip, in this way producing a flash, if the cell has life. It is the old method of testing which soon spoils the cells, if frequently resorted to, and no scientific result is obtained. The proper way to test is with a lamp or voltmeter.

When the plates are sulphated, the internal resistance of the cells is greater and consequently, the E. M. F. for daily use is much lower. Their capacity, also, is less. Charging continued until boiling occurs, without further observation, may result in erroneous conclusions, for, clearly the less the capacity of the plates, the sooner will the phenomenon occur and everything is supposed to be in good order; whereas a serious fault may really exist, for the plates may be in bad condition or much paste lost, or many cells dead. The boiling in the latter case arises from the charging current being too great, since much counter E. M. F. has been removed. Again, it may happen that no amount of charging causes the cells to boil, indicating that nearly all the paste has fallen from the plates.

If at any time, the plates of a fully-charged cell are removed from the electrolyte, then, on making up the cell again, the specific gravity of the liquid put in should be the same as it was before. If acid of a lower specific gravity is used,

no amount of charging will appreciably raise it, because the plates being chiefly composed of PbO_2 when charged, there is little or no $PbSO_4$ which can be converted to PbO_2. Consequently, but a very slight further chemical action can take place in the electrolyte.

MAGNETIC SEPARATOR.

Among the machines shown at the recent meeting of the Royal Agricultural Society at Doncaster, says the London *Electrical Review*, and entered as a new implement, was the magnetic separator of Atkinson & Elliott. This machine is intended to remove bolts, nuts, nails, horseshoes, etc., from bones, oil cake or minerals, before they are passed into disintegrating machines, as the presence of these foreign bodies is very detrimental to the machines. The chief difficulties that had to be overcome in designing this machine were the large size and irregular shapes of the material to be treated, the fact, also, that the iron, particularly in bones, is frequently entangled in the bones, so that merely passing the substance *once* over or on to a magnet was not found sufficient to ensure the absolutely certain removal of the foreign substance. These points have been satisfactorily overcome by the use of a hollow truncated cone with ten internal magnets of alternately opposite polarity. The cone revolves on outside runners driven by friction only, which is found ample for the purpose.

Into the back end the bones are fed by a chute, and, falling to the bottom, are rolled over and over again, so that as they gradually travel forward—in about 10 or 15 complete revolutions—to the front they pass 100 to 150 times over the magnets. In the upper part, or the barrel, is a fixed tray, into which the iron is carried and collected. Each magnet in turn, as it comes to the bottom, is magnetized, and remains so till it reaches the top where it becomes demagnetized and the iron is detached.

This process is carried out by a commutating ring on the back of the machine, and the arrangement (shown in diagram 2) is such that each coil has one end permanently connected to one pole of the dynamo, and the other ends are in turn connected during one half a revolution to the other pole. Thus the magnets receive current in parallel. Before cutting a coil out of circuit it is short-circuited through a resistance, and by this means no sparking of any consequence occurs.

The machine has proved itself a very practical success, and the value of the repeated revolutions over the magnets has been demonstrated by repeated trials. The power required to excite the magnets is about 600 watts for the largest size capable of dealing with 4 tons of bones per hour.

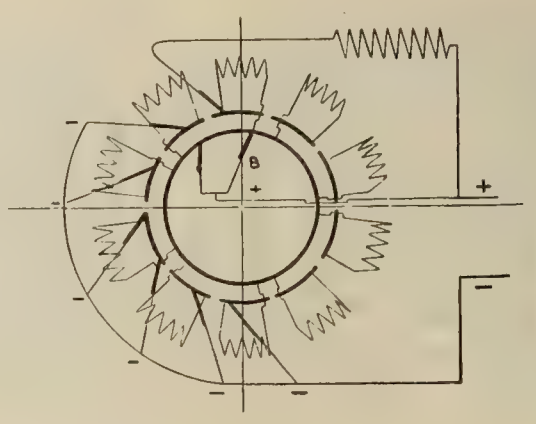


FIG. 2—MAGNET POLES, NORTH AND SOUTH POLES ALTERNATELY; B, BRUSHES.

A NEW MECHANICAL TELEPHONE.

A new mechanical telephone called "The Phonodisk" has recently been invented by Mr. Henry B. Thompson, of Pittsburg, Pa.

In its construction Mr. Thompson has abandoned the flexible diaphragm, and technically considered, the instrument has no diaphragm at all. He uses compressed air in such a novel way as to completely insulate the instrument from the wall on which it is hung, thus rendering it possible to use the telephone on elevated roads, bridges, mills and other situations where the vibration of machinery, etc., are imparted to the structure.

Another improvement consists of a supporting bracket, constructed with a ball socket adjustment, making "The Phonodisk" a self-contained instrument which can be placed in any position, so that the line wire may be run in the most convenient way. This bracket contains a cam-switch, which is both "damper" and "ground," shutting off the instrument as effectually as an electrical switch.

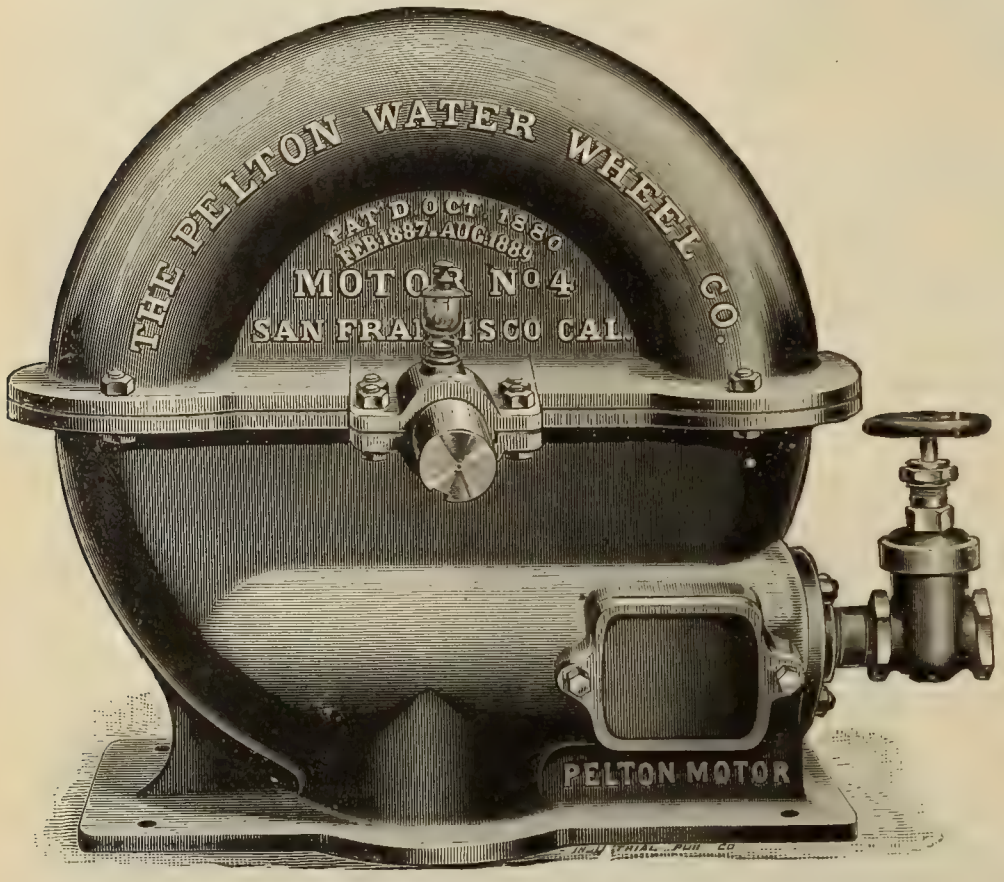
Another feature is the "telescopic centrator," which acts exclusively as a transmitter.

The receiver is practically the entire covering of the instrument, which can be removed while the telephone is in use.

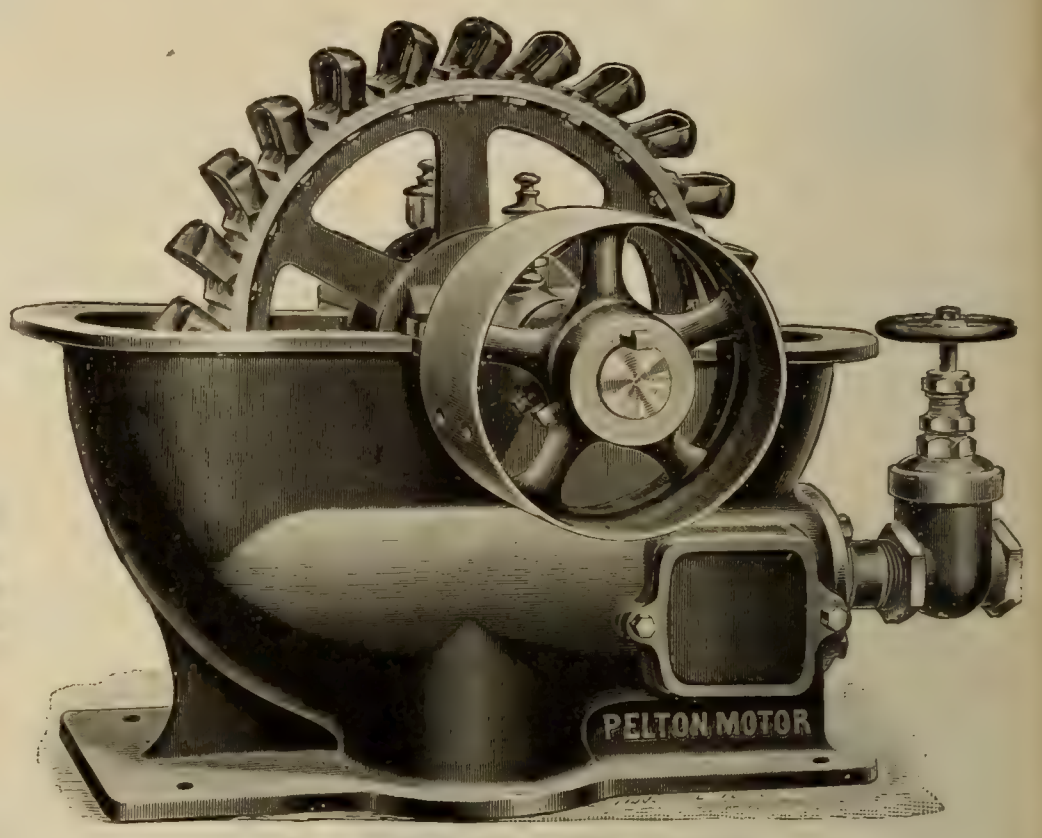
The wire used for "The Phonodisk" is an ordinary steel cable wire, without fibrous core, varnish or other treatment. The effects of vibration and the insulation and supports for the cable are properly and completely provided for.

The instrument is said to work with remarkable clearness and there is no chance for injury or over strain; there are no sensitive adjustments to the line wire, and in every way the instrument is said to be a practical invention. They are beautifully finished in hard wood, and compare favorably with the finest workmanship on electrical apparatus.

The inventor of "The Phonodisk" claims that the foundation of the success in this instrument lies in the abandonment of the flexible diaphragm, and the substituting of a construction far in advance of any preconceived notions in the field of natural philosophy.



PELTON NO. 4 MOTOR.



NO. 4 MOTOR WITH COVER REMOVED.

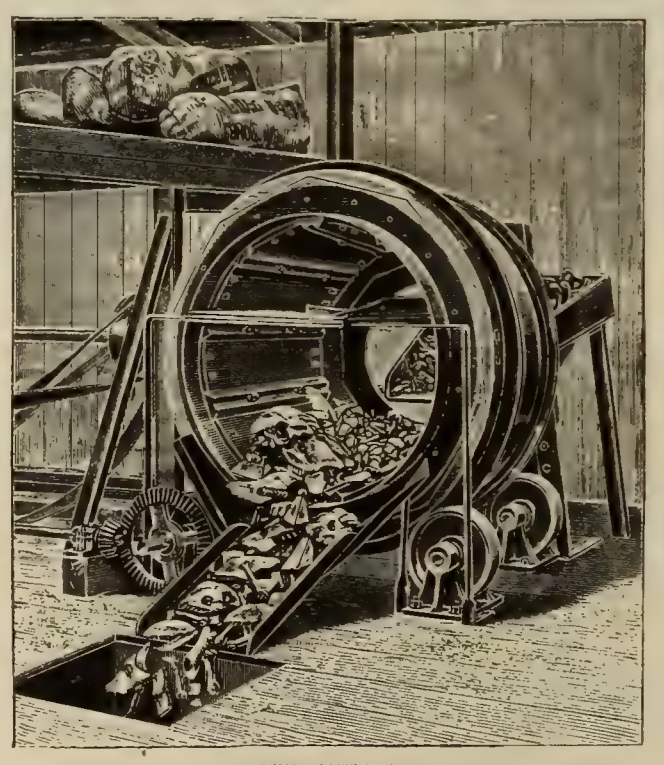


FIG. 1—MAGNETIC SEPARATOR.

Mr. Thompson has also abandoned the use of boards and other devices to increase sound, and has introduced instead certain combinations of aluminum and aluminum iron, and elastic supporting discs of wood with surprising results.

INSULATION RESISTANCE.

The *Electrician*, of London, gives the following simple formula for determining the insulation resistance between a dynamo circuit and its frame:—

$$R = \frac{E - \epsilon}{\epsilon} \times r.$$

where R = insulation resistance in ohms, E = the terminal E.M.F. of the machine, ϵ = the sum of the volts observed betweeu the positive brush and the frame, and between the negative brush and the frame, and r = the resistance of the voltmeter, which must be very high.

ALTERNATING CURRENT MOTOR.*

The alternating current motor of Messrs. Hutin and Leblanc, which has recently been presented to the French scientific societies by M. Leblanc, belongs to the class of motors with a revolving magnetic field.

It consists in principle of a system of fixed inductors constituting the magnetic field and a movable armature closed upon itself moving inside the revolving field produced by the fixed inductors.

The special characteristic of M. Leblanc's motor lies in the mode in which the revolving field is produced. In his first experiments, M. Ferraris produced this field by realizing for the first time currents with multiple phases, and using two distinct circuits traversed by alternating currents interlagging one another for a quarter f each period, and supplied by one armature. This method required four wires, or at least three, if one common return wire was used.

Various attempts have been made to produce revolving magnetic fields by utilizing the simple alternating current supplied by the ordinary distributions, the electric generator being connected with the electric motor which it feeds by two wires only, forming a simple circuit traversed by a periodic current.

The problem consists in subdividing this single current into two others, which have be-

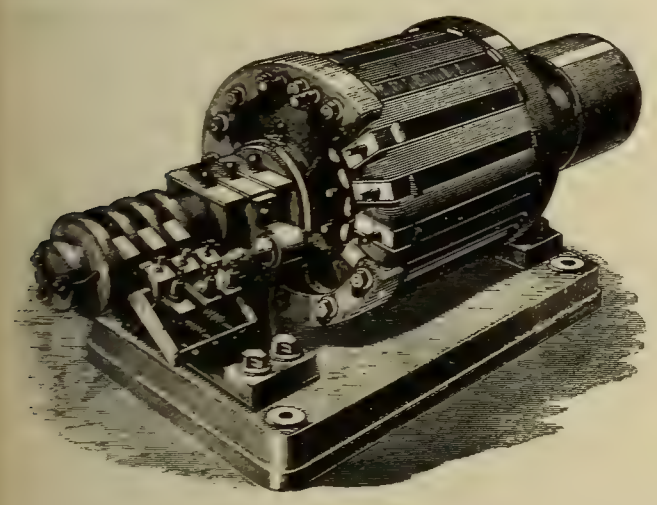


FIG. 1—LEBLANC'S MOTOR.

tween them a lag of about a quarter of a period, and thus they play the part of a periodic alternating current with multiple phases. Many solutions have been suggested.

The most convenient and the most practical method of obtaining the result sought, is, without doubt, the employment of the condensers as proposed and realized for the first time with a view to their application to alternating current motors, by M. Maurice Leblanc.

We know, in fact, that by introducing a condenser into a circuit presenting self-induction, the apparent coefficient of self-induction of the whole is diminished, as well as the lag of the current passing through the self-induction coil and the condenser, with regard to the electromotive force producing this current. It is this property which is applied in M. Leblanc's motor. The inductive system of this motor is formed of a ring bearing 16 projections of laminated iron radiating from the inner part of a fixed drum and forming a cylindrical hollow in which is placed the armature. On the polar projections are placed 16 bobbins; they are numbered successively 1, 2, 3, ... 14, 15, 16. These 16 bobbins form two distinct groups; those bearing uneven numbers form the circuit, A, and those bearing even numbers the circuit, B. The eight bobbins of circuit A are connected together, four in series, and form two circuits connected directly in derivation on the wire coming from the generator. The eight bobbins forming circuit B are connected in series and also arranged in derivation on the generator, by introducing a condenser of suitable

London Electrical Review.

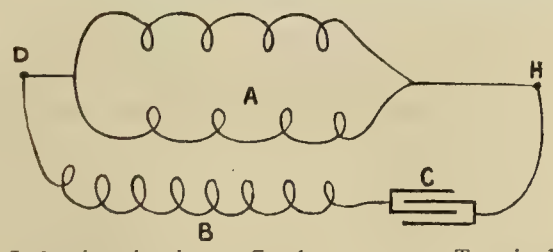
capacity. Under these conditions, the derivations formed by the two circuits, A and B, are traversed by periodic currents having between them a lag of a quarter of a period, thus satisfying the conditions necessary to the production of a revolving magnetic field, although the generator furnishes a single current only. Fig. 1 shows the



JAMES H. MASON.

coupling of these 16 inductive coils. Of course, in the machine with a revolving field produced by 16 bobbins, the complete rotation of the field is really effected only at the rate of one-fourth of a revolution in a period, a complete revolution occupying four periods. M. Leblanc's machine is therefore a 16 pole machine.

The movable circuit consists of two polygona windings, crossing one another, and each containing eight bobbins. The spirals of these bobbins are fastened into 16 slots cut in a cylindrical drum formed of sheets of iron cut out and laid one upon another. The 16 induced coils form two distinct circuits (fig. 3), each containing eight bobbins connected in series. Their extremities are connected with three collecting rings, one ring being common to two circuits; three brushes rub on these rings, these brushes being connected with two rhoestats, R, R′, worked by hand, which enable a variable resistance to be introduced into



A, B, Inductive circuits; C, Condenser; D, H, Terminals of the motor connected with the alternator.

FIG. 2.—COUPLING OF THE INDUCTORS OF ALTERNATING CURRENT MOTOR.

each circuit. At starting, this resistance should be made considerable, so as to increase the motive torque. When the speed is increased, the resistances introduced into each of the induced circuits is gradually diminished, until the moment when the resistance in the rheostat becomes nil, the amatures being short-circuited. The motor then turns at its normal maximum speed.

The machine had been calculated to produce 15,000 watts with a frequency of 120 periods per second, but the generator used did not allow of a frequency of more than 83 periods per second, or of an available power of more than 8,000 watts, the corresponding electrical efficiency being 89 per cent. The corresponding industrial efficiency could not be determined for want of a wattmeter, or some other instrument that would allow of the power supplied being measured with some exactness.

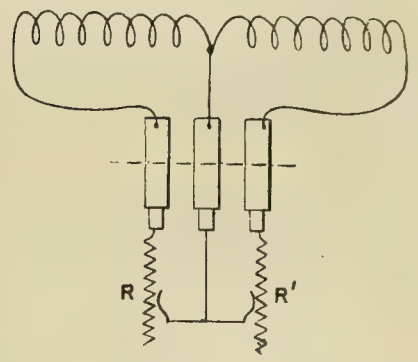
BIOGRAPHICAL SKETCHES.

The subject of this sketch, James H. Mason, well-known in the electrical trade, through the famous Mason Primary Battery, was born in London, England, June 24, 1864, and is therefore now a little more than 27 years of age.

In early childhood he showed a bent for mechanics, and at the age of ten years he entered a shop where electrical and mathematical instruments were made, as errand boy. In four months, his employers perceiving that there was in him the making of a good mechanic, put him to work at a bench to learn the business.

He afterwards entered the service of the Metropolitan Telephone Construction and Maintenance Company, and before he was 18 years of age, was considered as good a mechanic as any one in the service, and it was not long before the manager of the company recognized young Mason's ability and took special interest in him. Unfortunately the company, through litigation was compelled to shut down, and this threw Mason out of a position with the others. In a few days however, he obtained employment with the London and Globe Telephone Company, with which concern he remained a year and a half, the last eight months of his service being in the capacity of superintendent and assistant electrician.

This company, too, went under, involved in litigation, and Mason was again thrown out of employment, but with a strong will he started out again in life under different conditions and amid radically different surroundings. It was at this time that Mr. Mason, who had from childhood yearned to come to America, gratified his ambition. On Feb. 13, 1885, he set his foot for the first time upon the land of the free.



R, R′, Rheostats.

FIG. 3.—COUPLING OF THE ARMATURES.

His experience in the telephone service in London served him well, and it was but a short time after his arrival in this country, that he obtained a position in the service of the Metropolitan Telegraph and Telephone Company of this city.

He remained in the employ of this company two or three months, and one day accidentally met on the street Mr. A. W. Rose, the late manager of the Metropolitan Telephone Company of London, who introduced him (Mason) to Waite & Bartlett, the manufacturers of medical batteries, on 23d street, this city. Mr. Mason obtained a position with this firm, and was engaged on experimental work. He sometime afterwards, with commendable ambition, branched out for himself and located in Brooklyn. He started out in general electric wiring and construction business, at the same time making what is now better known as the Mason Primary Battery.

In regard to this battery it will be of interest to state that Mr. Mason, when 18 years of age, had in use at his home in London seven six-candle power electric lamps burning, supplied by current from a battery which was practically the parent of the present Mason battery. This is given to show the long experience Mr. Mason has had in primary battery work. He began his electrical experiments when but 14 years of age, and at the age of ten years, while at work in the shop first mentioned, he discovered that burning two gas

Continued on page 503.

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"TOUCHED THE MOTOR—DIED."

This was the heading given an account in one of the New York dailies on August 5 of a peculiar accident which happened in a saloon on Grand street, this city, the previous afternoon.

There was an electric motor in the saloon for the purpose of keeping the air in the stuffy place cool. It was faithfully performing its duty on the afternoon mentioned when the bartender, in reaching over it to get a box of cigars, suddenly fell over, and died in a few moments. At once the cry of "electricity did it" was raised and everybody present in the saloon swore that the unfortunate man touched the motor and received a shock which killed him. The doctors who were called in shook their heads doubtfully when the electric theory was suggested, and on the very face of the case it was evident that the man could not by any possible means have been killed by electric shock. But that made no difference. It was a grand opportunity for certain of the New York dailies to give electricity a blast on general principles, so they appeared next day with most absurd accounts of the accident and charging everything dreadful to electricity. The improbability that electricity had any direct connection with the man's death was so obvious that these journals in their effort to twist the facts as much as possible against the "deadly wire," succeeded in spoiling their nice story. It was thoroughly overdone.

An autopsy showed that the man had died of uræmic convulsions, and that electricity had nothing to do with his death.

This case reminds us of that of a son of "ould Ireland" in Buffalo who became blind, and told his friends that the trolley cars had caused it.

Electricity was equally responsible for the injury in both cases.

GUARANTEEING ACCUMULATORS.

An English contemporary states that the Electric Construction Corporation (London) is about to put into practice a system of guaranteeing or maintaining its accumulators. The plan will be in the nature of insurance, and for a certain rate the company will guarantee the battery to do the work for which it was designed and installed, and maintain it. The company proposes to employ a force of inspectors, whose duty it shall be to inspect periodically the various plants so insured and keep them in good condition.

In this connection it will be of interest to refer to the practice in the United States. A plan very similar to the one outlined above, is now in operation here.

The Accumulator Company during the first years of its existence guaranteed the life of its accumulators for two years, and also guaranteed a recovery of 80 per cent. of the current with which they were charged. For various reasons the giving of guarantees was stopped, and now the company has in operation a system of periodical inspection of the plates which seems to work well. Parties purchasing an accumulator plant for lighting purposes, may insure the plates of their batteries by paying annually a certain percentage on the original cost of the plant and the company in consideration of the amount so paid will send an inspector around periodically to look over the cells and replace any defective plates with new ones. This plan, it is said, is satisfactory both to the company and the owner of the plant; the latter knows just about how much the plant costs to maintain, and the company has the satisfaction of knowing that the cells are properly taken care of and their reputation maintained.

Accumulators when properly used and taken care of deteriorate not more than five per cent. per annum, and in very many cases not as much as two per cent.; in fact, we understand that several plants after being in constant use for over two years, have not cost anything for repairs. A plant, therefore, costing originally $500, with proper care would cost not more than $25 a year to maintain—an insignificant sum indeed.

When used at their normal rate, the life of the plates is much longer than when used at their maximum capacity. All the accumulator needs is intelligent use and care. When it receives these the difficulties frequently experienced disappear almost entirely, and a greater appreciation of its advantages are the natural result.

The insurance plan is a good one, and no doubt our English friends will find it out after giving it a fair trial.

ELECTRICITY "NOT IN IT."

On the night of August 6th, an Italian, his wife and daughter, living on East 42d street, this city, were very seriously burned by the explosion of an oil lamp in their rooms. All three were covered with the burning fluid, and the house was also fired. The fire department, however, readily suppressed the fire, and the victims of the lamp explosion were taken to the hospital. The next day a young Bohemian, the keeper of a saloon on 73d street, accompanied by another man went into the cellar with a lighted candle to locate a leak in the gas pipe. The result of their curiosity was an explosion of the penned-up gas, and the two investigators were unceremoniously projected from the cellar to the other side of the street, badly burned.

The daily papers made no more than a passing reference to these casualties, giving only the bare facts, but we venture to say that had any one of the victims referred to accidentally touched an electric wire and received a shock, the newspapers would have treated the affair in a quite different manner.

When men go with a lighted candle into a cellar filled with explosive gas, and so long as the deadly kerosene lamp continues to do its awful work, electricity stands no show whatever as a means of exterminating the human race.

We simply call attention to these facts to show the inconsistency of the daily press. They speak for themselves.

A few days ago an exhibition was given in Boston before a few interested gentlemen of a process of forging and tempering metals by electricity. This application of electricity is a logical consequence of the welding process, and no doubt, if it proves to be entirely successful it will find a large field of application. It should at least be a great time-saving process of working metals.

In less than one month the Montreal Convention of the National Electric Light Association will have practically become a thing of the past, and the victories will be won. Montreal is now uppermost in the minds of those in the trade who intend to have exhibits at the convention, and the exhibition feature of the meeting will be worthy of the extraordinary occasion. It will be a rare opportunity to foster the development of the electrical trade between the two countries, and it is interesting to note that the American dealers appreciate that fact.

The burning of the electric light station at St. George, S. I., on August 3, and the consequent deprivation of several independent communities of lights is not without its lessons. The water supply was insufficient and the station was soon ruined by the flames. In small communities where the town water supply is liable to be deficient extra precautions should be taken by the managers of electric light stations against the possibility of fire. Such a station can be destroyed very much easier than it can be built; therefore, every means should be taken to prevent its destruction.

OBITUARY.

WILLOUGHBY SMITH.

Mr. Willoughby Smith, a well-known English electrical engineer, died at Eastbourne, England, July 26 last, at the age of 63.

Mr. Smith was prominently identified with submarine cable manufacture and development, and was engaged in this service from 1848 up to the time of his death. He took a prominent part in the laying of many of the most important cables.

Continued from page 501.

jets together gave a light of great intensity. This discovery was put into practical use throughout the shop after that, and to-day the very same thing is protected by a patent in anothers favor.

Mr. Mason's reputation in the electrical trade in this country in late years, has been constantly increasing. His dealings have always been characterized by honesty and fairness, and although recently he has met with some discouraging reverses in business, he continues to keep to the front in his line, undaunted and with a strong will to urge him along in life's battle.

Personally, Mr. Mason is a quiet, unassuming gentleman, and is possessed of sterling qualities of character. He is a good mechanic and a thorough theoretical man, and there is not an electrical instrument that he cannot make. He is well thought of by his employés, as may be judged from an incident that occurred lately. During a recent business trouble all of the men in his factory agreed to work a month for nothing in order to help Mr. Mason out of his difficulties, but their generous offer was not accepted, Mr. Mason not believing in the principle of receiving something for nothing.

In conclusion it may be stated that Mr. Mason does not confine himself to the manufacturing of batteries alone; he carries on a general electrical business. He has made several improvements in electrical bells and motors, and was the first man to invent an amalgamating compound for battery zincs. In 1888 he lighted a carriage by electric light supplied by a Mason primary battery, which performance attracted a great deal of attention at the time, and won for Mr. Mason quite a little fame.

Mr. Mason has a large export trade in his battery, and there is hardly a country in the world where Mason's Primary Batteries are not found.

WHEELING'S NEW LIGHT PLANT.

The commission appointed by the city of Wheeling to inspect different systems of electric lighting, and report as to the best system for the city tc adopt, made their report to the Mayor and Council July 28. The commission visited several places where the different systems could be seen in operation, and thoroughly examined the construction and operation of the various parts of the equipment, and recommended that the contract for lighting the city should be awarded to the Jenney Electric Light and Power Company, Ft. Wayne, Ind., and also recommended that the plant should consist of six 80-light dynamos, and two Hamilton-Corliss engines, including clutch pulleys, shafting, switchboards and full equipment, and two extra armatures; the entire plant not to cost more than $85,420. The report as read was adopted by both branches of the city government, and as soon as the necessary papers are drawn up the work will be rapidly pushed.

CENTRAL STATION BURNED.

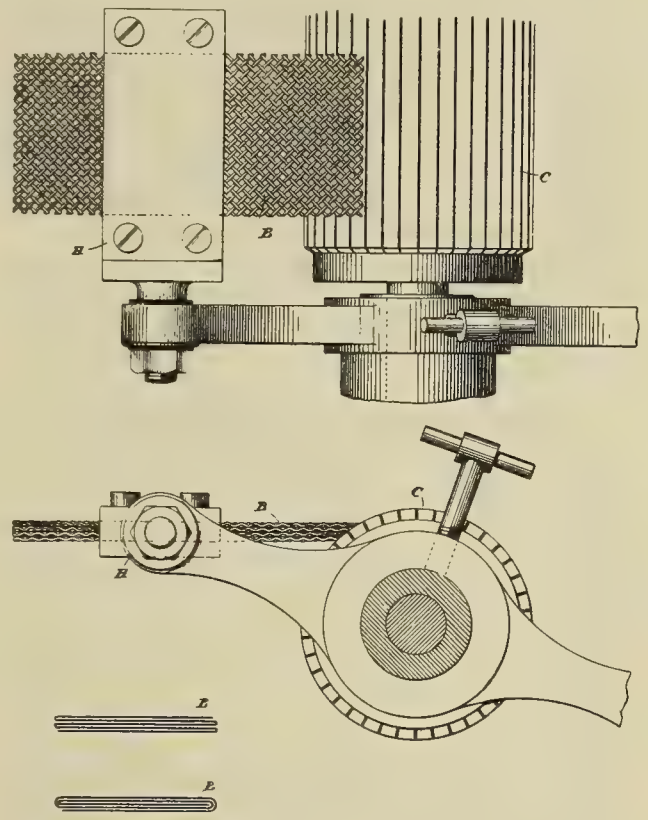
On the night of August 3 the only central station on Staten Island was distroyed by fire. The station was that of the Richmond County Light Heat and Power Company, and was located on Jay street, St. George, S. I. It was said to be the largest Westinghouse central station plant in the country, and it supplied current for the lighting of thirty-two square miles of the territory of Staten Island. The plant was built about two and a half years ago, and cost from $75,000 to $100,000. The loss is covered by insurance.

The fire started in the boiler room, and as the building was of frame construction, the fire spread with great rapidity and in four hours the whole place was in ruins.

The places left without light are West Brighton, Sailors' Snug Harbor, New Brighton, St. George, Tompkinsville, Stapleton, Clifton, Ft. Wadsworth, South Beach and a part of Port Richmond.

IMPROVED COMMUTATOR BRUSH.

After a long legal contest in interference with a patent issued Sept. 3, 1889 to F. O. Blackwell, and owned by the Thomson-Houston Electric Company, a patent has been granted to Mr. C. J. Kintner, of New York, assignee of Leonard Paget, for an improvement in commutator or contact brushes for dynamos and motors.



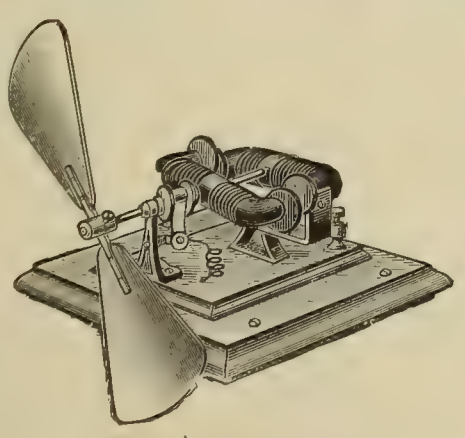
WIRE COMMUTATOR BRUSH.

In view of proposed litigation upon the carbon brush patent owned by the Thomson-Houston Company, the Paget brush assumes an important place in the art.

The brush is made of woven copper wire with the objects of reducing the sparking to a minimum and securing even wear on the face of the commutator. It is made in such a way that the ends of all the individual wires bear upon the commutator segments as the brush wears away.

The accompanying illustration gives a plan view of the brush in position, with reference to the commutator; C represents the commutator, B the wire woven brush, (the subject of this patent), and H the brush-holder.

Wire brushes are not new, but as usually constructed the individual wires are liable to cut individual grooves in the face of the commutator, wear it unevenly and to fuse, often causing serious sparking and other trouble. It is claimed for this improved brush, however, that this cannot occur, the wire fabric being of such a nature that the individual wires are held firmly in place and bear at equal angles upon the face of the commutator, and as they wear away constantly change their position thereon.



MASON'S FAN OUTFIT.

Referring to the interference above mentioned, it will be of interest to state that Dr. Paget proved priority of invention broadly to a wire gauge commutator brush as early as 1883.

It is said that the brushes are absolutely perfect in their operation, as by virtue of the multiple contact of the individual wires they cause the spark to be divided over the face of the commutator. The elastic or yielding nature of the brush makes it as nearly frictionless as possible.

FAN MOTOR OUTFIT.

The property of flexibility is one of the marvelous features of electricity. It can be utilized to accomplish, through the instrumentality of proper apparatus, results diametrically opposite in their nature. Thus, for instance, it can be used for heating purposes, and by the use of proper instruments can be made to keep us cool in the summer time. The latter result is accomplished by what are now generally known as fan motors.

The discovery of this applicability of electric power was a happy one, and the suffering from heat that has been relieved by the use of these valuable machines is incalculable.

Nothing is more grateful to the sick in warm weather than a cool breeze, which nature does not provide very lavishly in the summer time. Such a breeze, however, can be created artificially by the use of a fan motor, and in the past year or two many of these machines have been put upon the market for popular favor.

The latest one of these is shown in our illustration. It is manufactured by the well known manufacturing electrician, Mr. James H. Mason, Room 87 *World* Building, New York.

The motor shown is the No. 1 size, and is run by two No. 9 cells of Mason's primary battery. It has a two-bladed fan. The battery will keep the fan in operation for 18 hours, and the breeze created by it is sufficient to keep the temperature in a good-sized room down to a comfortable degree.

Mr. Mason is just bringing out a larger size motor and fan known as No. 2. The fan has three blades, and the breeze it creates is described as a "young cyclone." It is run by three No. 9 cells of Mason's battery.

The motor is constructed so simply that there is nothing to become deranged, and the whole outfit is remarkably cheap when the breeze it creates is considered.

One charge of solution in the battery is sufficient to run the motor and fan 18 hours, and as the cost per charge per cell is so small there is no reason why even the "poor man" should not enjoy the delights of a cooling breeze in hot weather.

THE STORAGE BATTERY CASE.

The Consolidated Electric Storage Company, of Philadelphia, is sending out circulars calling attention to the fact that the Circuit Court of the United States for the Southern District of New York has, in the case of the Brush Electric Company *vs.* the Electrical Accumulator Company decided July 23, affirmed its decision in the case of the Brush Electric Company *vs.* the Julien Electric Company, sustaining the storage battery patents of Chas. F. Brush.

It also gives notice that preliminary injunctions will be applied for against infringers, but as the policy of the company always has been to foster the storage battery industry rather than check it, it stands ready to open negotiations with parties desiring supplies.

The Consolidated Electric Storage Company is the manufacturer of the Julien battery, and is exclusive licensee for the United States of the storage battery patents of Charles F. Brush.

CORRESPONDENCE.

PRIMARY BATTERIES.

Editor Electrical Age:

Professor Carhart, in his book upon primary batteries, on page 50, gives among other reasons for preferring to use bichromate of soda to bichromate of potash, this: That it is necessary to heat the water used to the boiling point, or the bichromate will not dissolve, whereas the sodium salt will readily dissolve in cold water. This seems to me erroneous, as I am daily using the potassium bichromate and find no trouble in dissolving it without the aid of boiling water. Besides having tried bichromate of soda I found it difficult to keep in condition for use and not readily obtainable unless taken in large unbroken packages which few would wish to do. The crushing of the bichromate of potassium crystals in a mortar is entirely unnecessary. The comparative cost of the two salts can hardly be said to be in favor of the soda salt and I have found greater inconvenience in using it, partly on account of its great affinity for moisture; it cannot be left exposed in the open air without in a short time becoming very unpleasant to handle when it is to be weighed for use.

What is said about the formation of crystals in the use of the potassium salt I cannot understand, as I am never troubled with them. But this whole matter as given upon pages 50 and 51 is entirely unnecessary and antiquated, for nobody now need to use the solution the "formula" of which is given on page 51.

I will here state how all this trouble, which the professor seems to think is unavoidable, can easily be gotten over when a bichromate solution is desired:

First place a suitable amount of water in a stone jar then add your bichromate salt with little or no stirring; next add the sulphuric acid slowly with continued agitation and if the right proportions are used all the heat that will be needed to dissolve the salt will be generated. All this in our view is unnecessary, as no one is now using the formula given on page 51 unless it be for short laboratory work; certainly none of the new batteries for strong and constant work use it at all so far as I know. Better and cheaper means for suppressing polarization in batteries of the kind under consideration are available, and I confess to a tiresome feeling in having continually to read the old formula of Poggindorff, Bunsen, *et. al.*: "*Bichromate Potash or Soda Sulphuric and Water.*"

I think the chemical means for depolarizing batteries for strong and constant current are at best alone insufficient to satisfactorily accomplish the work. Mechanical means must be resorted to, as is being done with the very best results. But in this the "laboratory professors" can afford us but little assistance. Their "science" we rely upon but the practical part must be wrought out by others; and I believe it is being done.

I fully believe that even now apparatus is sufficiently perfected that it need not be considered rash to affirm that primary batteries can do any work that can be done by storage cells, and with so much less original outlay as in many plans to be more enonomical and much more readily available.

P. B.

New York, Aug. 6, 1891.

It is said that the Thomson-Houston Electric Company, of Lynn, Mass., and the Jenney Electric Light and Power Company, of Fort Wayne, Ind., have purchased large interests in the Municipal Electric Light Company, of St. Louis.

A NEW ELECTRICAL FIRM.

We have received notice of the formation of a new corporation under the title H. Ward Leonard & Co., whose principal office will be in New York City, and whose business will be that of electrical engineering generally, with special attention paid to electrical motor appliances, the transmission of power, the installation of central station lighting and power plants, the concealed wiring of large office buildings, hotels, etc., and plants in which advantages can be obtained by a combination of apparatus of various companies, such as alternating current systems, storage batteries, arc lights, etc.

A feature of the business of this concern which is entirely novel, will be the supplying of expert information regarding engineering matters, the operation of different plants and upon the best methods and system of accounts in connection with the operation of electrical plants. Such information will be supplied by correspondence at a very moderate charge per annum.

This company will be actively in business before September 1. Its offices will probably be in the Columbia Building, No. 29 Broadway, New York City.

THE VALUE OF PATENTS.

In a recent issue of the London *Journal of Gas Lighting* some very pertinent statements are made with reference to patents in general. "The British patent system," it says, "is anything but perfect; but then nobody pretends that it is. The American system is full of defects, and it is considered treasonable to hint at the existence of a single blot upon it."

The latter part of the last sentence is rather an exaggeration, for the American patent system, from an American standpoint, is acknowledged to be anything but perfect, and Americans are not afraid to express their opinions to that effect.

Referring particularly to the American system, the *Journal of Gas Lighting* says: "As a matter of fact, it is extravagantly costly to the country, if not to the patentees, and but that any excusable outlet for revenue is desired by the Federal government, the working of the patent office would be speedily overhauled. The system of prior examination, of which apologists make so much, is utterly useless, since no guarantee is attached to it, and it only causes vexatious delay in obtaining protection, besides being very expensive. Then the absence of any machinery for removing merely obstructive patents has been already remarked."

In conclusion the article says: "When a man has invented a new and improved way of doing anything, it is but right and reasonable that he should have at least the credit for the suggestion, and as much profit as the idea can bring him. But for a man to appropriate, by the complaisance of the patent office, a notion which is neither better nor worse than many others of the same class, or a device which is rather an alternative to ordinary methods than an improvement upon them, and to make this appropriation a means of tying the hands of designers who do not seek to captivate the market, but only to do their work after their own fashion, is a piece of impertinence that requires checking before it grows commoner than it is. It may be asked how the line is to be drawn in this regard between what is a distinct improvement and what is merely an alternative. But the distinction, if not easily defined, is easy to understand. If, for example, a gas engineer wishful to erect a gas holder is informed of a method whereby the work may be done at considerable saving of expense or of time, he may be willing to pay a reasonable proportion of the estimated saving for the privilege of using the new method, and will not object to it as being temporarily private property. Should he, on the other hand, propose, for his convenience to make a change in the design which is of no particular advantage in itself, he will naturally be wroth when told that some gas holder maker has appropriated the idea, and will either grant him a license to use it, for a consideration, or will graciously waive the claim upon securing the contract for the erection of the holder. This is the sort of thing that inclines people to ask whether, after all, a patent system is not of more harm than good to the public."

FORGING AND TEMPERING METALS BY ELECTRICITY.

A press dispatch from Boston states that an exhibition was given in that city on August 6 before a few gentlemen, of a process of forging and tempering by electricity of obdurate metals. One experiment was the melting into liquid form of a bar of steel an inch in diameter and twelve inches long in forty-five seconds, without the temperature of the room being raised a single degree from its normal condition.

Another thing shown was the making of a steel railroad spike. The bar is cut into the required length, the pieces passed through the electrical machine, where one end is heated, and then to a die, which shapes the head on the heated end, the point being compressed into shape without heating. Another exhibit was the forming of an auger screw, the flat bar of iron being fastened in the machine at the two ends and heated almost instantly, and then twisted into the required spiral by the automatic turn of the machine. A little machine is devised for making spherical ball bearings, such as are used for bicycles, etc.

It is stated that Krupp, the German gun maker, is negotiating for the rights of this invention for European countries.

PHILADELPHIA NOTES.

The Star Electrix Company has lately moved its establishment from Wallace street to Warner Hall, 641 Broad street, this city, and is just getting settled. The factory and salesrooms are on the top floor of the building, where there is fine light. The company, as is well known, makes specialties of Star Electrix incandescent switches, lamp sockets—both key and keyless,—and other accessories for incandescent circuits. Among the goods manufactured by this concern, which have a large sale and reputation, is the Star Electrix Ceiling Cut-Out, which is well known for the convenience with which it can be put in.

The Consolidated Electrical Storage Battery Company feels very sanguine of the success of the Julian Storage Battery, and anticipates an enormous demand for the same during the next six months. Since the decision in the accumulator case this company has received very many inquiries in regard to taking out licenses, cost of equipment, etc., and everything indicates great activity in this line.

The Novelty Electric Company, 54 North Fourth street, this city, is sole agent for the Columbia incandescent lamp for New Jersey, Delaware, Maryland, District of Columbia and Pennsylvania. The company recently received an order for 1,000 of these lamps from a large establishment as the result of tests. In addition to the lamp sales, the company carries on a large trade in general electrical supplies, and reports an active business in this line.

The Cornish Electric Bell Company has removed from 1115 to 1109 Chestnut street, just a few doors from the old stand. This company is the agent for the Western Electric Company, and carries a large line of burglar alarms, electric call bells for every purpose, batteries, general supplies, etc. Mr. J. A. Sturtevant is the manager. The company has the reputation of doing the best class of work in this line, which is all guaranteed.

ELECTRICITY AND CLAMS.

The thirteenth annual clam bake of the American Electrical Works, Providence, R. I., at the Vue De l'Eau Club, took place on August 8th, and was an unqualified success in every particular.

About 150 persons left Providence by boat at 10:30 A. M. for the scene of operations. Arriving there they found a great variety of entertainment, including foot-ball, lifting-machines, hammering the post, etc. A game of ball was also indulged in by picked teams from the New York and Boston people. Mr. C. E. Stump, of the *Street Railway Journal*, of New York, was umpire of the game, which was an extremely lively one. Mr. H. B. Cutter, of Philadelphia, acted as fielder for the New Yorkers, and succeeded in catching all the fly balls that came his way. Mr. C. E. Bibber, of Boston, did some fine playing for the Boston team, as did also Mr. Phillips, the son of Mr. Eugene F. Phillips. After great excitement, during which the official scorer and the umpire were roughly handled, as is customary on great occasions of this character, the umpire retaliated and awarded the game to the New Yorkers by a score of 9 to 0. The Boston team claimed that the score was 24 to 15 in their favor. Since the official score was badly mutilated in the skirmish, the actual result cannot be given.

At the target shooting contest W. T. Hunt, of the ELECTRICAL AGE, New York, and A. H. Alexander, of Alexander, Barney & Chapin, New York, won prizes.

At the clam bake the tables were set under a tent. Mr. Eugene F. Phillips sat at the head, with Mr. T. D. Lockwood, electrician of the Bell Telephone Company, Boston, at his right, and Governor Ladd, of Rhode Island, at his left. Mr. Phillips welcomed the guests in the name of the American Electrical Works. Mr. Lockwood acted as toast-master and distinguished himself in his usually happy manner. His sly hits and witticisms created general merriment. Governor Ladd was the first one to be called on to respond, and after a few appropriate remarks, Mr. A. J. DeCamp, of Philadelphia, made some interesting remarks on electric lighting. Sydney Smith, Esq., Mayor of Providence, next entertained the company in response to a toast, and was followed by Mr. George M. Phelps, of New York, who made a few interesting remarks in behalf of the electrical press. Mr. Ralph W. Pope, of New York, and Mr. Martin Day, of Providence, each followed with a few sentences, after which the entire freedom of the place was granted to all hands.

The crowd enjoyed themselves in various ways until sunset; they then dispersed, some going back to Providence and others returning to their respective homes.

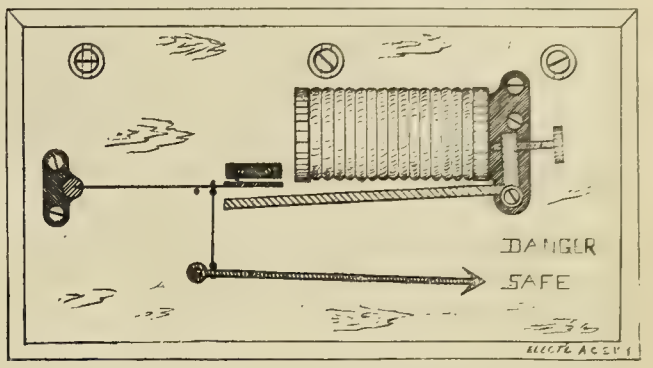
During the clam bake a neat souvenir was presented to each one present, in the shape of a pack of playing cards, on the back of each of which was a neat design and the name of the American Electrical Works.

The following is a complete list of the names of those present:

E. D. Floyd, T.-H., Boston, L. G. Banker, G. M. D. Fernald, Boston; C. E. Stump, New York; F. P. Baker, Topeka, Kas.; H. B. Cram, Boston; H. D. Sears, Lynn, Mass.; A. J. DeCamp, Philadelphia, Pa.; D. A. Harrington, Boston; P. H. Alexander, New York; W. C. Fish, Boston; E. R. Tilton, Boston; C. W. Price, New York; A. D. Blodgett, Boston; Robert Walker, New York; E. D. Moore, New York; J. H. Bates, New York; J. H. Conly, New York; J. F. Carney, New York; Jos. Taylor, Boston; E. Caldwell, New York; M. E. Clemins, Attleboro, Mass.; H. P. Stanwood, Boston; H. M. Nichols, Boston; L. W. Dillon, Attleboro, Mass.; E. E. Wood, New York; W. H. Babcock, Hartford; G. F. Porter, Philadelphia; G. L. Auston, Boston; G. M. Phelps, New York; S. L. Coles, New York; H. B. Cutter, Philadelphia; C. E. Bibber, Boston; W. W. Stadler, New York; H. Stewart, Greenville, N. J.; W. J. Johnston, New York; G. D. Stonestreet, New York; W. J. Barker, Boston; H. H. Sherman, Auburn, R. I.; J. D. Darling, Providence, R. I.; J. B. Tatums, Putnam, Conn.; O. Durfee, Fall River, Mass.; W. T. Hunt, New York; W. McGregor, Pawtucket, R. I.; E. C. Stevens, Pawtucket, R. I.; H. B. Emery, Boston; E. N. Clark, New Haven; C. J. Berkenmayer, Stamford, Conn.; V. A. Thomas, Providence, R. I.; C. A. Grant, Lowell, Mass.; G. H. Wallbridge, New York; L. Cofren, Boston; F. Murdock, Newton, Mass.; W. E. Holmes, Newton, Mass.; C. H. Herrick, Boston; F. Luther, Boston; J. C. Keefe, Syracuse, N. Y.; A. P. Seymour, Syracuse, N. Y.; F. H. Cicott, Chicago, Ill.; F. W. Harrington, New York; F. E. Brisbie, Auburn, N. Y.; N. B. Griffin, Stamford, Conn.; F. H. Bibber, Boston; F. A. Gilbert, Boston; G. H. Almon, Boston; W. E. Geer, Boston; R. W. Pope, New York; W. H. Sawyer, Providence, R. I.; E. B. Barker, New Haven, Conn.; G. W. Phillips, Norwich, Conn.; E. M. Carhart, Providence, R. I.; J. M. Hollywood, Brockton, Mass.; H. A. Cleverly, Philadelphia; H. A. Day, Boston; N. B. Denison, Nantucket, R. I.; E. W. Tyler, Boston; H. G. Wright, Providence, R. I.; N. H. Pearce, Harriswell; B. E. Locke, Pawtucket, R. I.; H. L. Greene, Riverpoint, R. I.; E. C. Hughes, Providence, R. I.; A. O. Smith, Providence, R. I.; L. H. Hart, Boston; M. W. Brown, Boston; A. D. Sayward, Providence, R.I.; G.W. Festes, Andover, Mass.; J. E. Whitney, Andover, Mass.; J. H. Craig, Boston, Mass.; R. S. Faber, New Bedford, Mass.; J. N. N. White, Providence, R. I.; W. J. Thurston, Providence, R. I.; C. A. Baldwin, Boston, Mass.; F. H. Lord, New York, N. Y.; F. H. Hopper, New York, N. Y.; W. H. Cleverly, Riverpoint, R. I.; W. M. Turner, Boston, Mass.; F. W. Crocker, Boston, Mass.; H. L. Pierce, Leominster, Mass.; J. J. Gates, Hartford, Conn.; C. G. Perkins, Hartford, Conn.; C.P. Choppell, Providence, R.I.; A. Wright, Providence, R.I.; E. Byrnes, Providence, R. I.; W. H. Vialle, Worcester, Mass.; A. Coleman, Taunton, Mass.; W. K. Wagner, New Bedford, Mass.; G. H. Darling, Providence, R. I.; H. C. Binford, Providence, R. I.; R. S. Brown, New York, N. Y.; C. C. Fry, Lynn, Mass.; E. F. Peck, Brooklyn, N. Y.; W. C. Bigelow, New Briton, Mass.; W. F. Whittemore, Leicester, Conn.; A. F. Gifford, Hopedale, Mass.; A. C. Shaw, Boston, Mass.; C. Burgher, Boston, Mass.; J. F. Barker, Lynn, Mass.; E. D. Dailey, Windsor Locks, Conn.; T. D. Lockwood, Boston, Mass.; J. M. McLaren, Boston, Mass.; Wm. Finkham, Providence, R. I.; G. B. Davis, Boston, Mass.; H. H. Fairbanks, Worcester, Mass.; W. H. Coughlin, Worcester, Mass.; H. F. Woods, Boston, Mass.; I. M. Kimball, Boston, Mass.; S. W. Leedon, Boston, Mass.; F. J. Boyton, Boston, Mass.; F. M. Gilley, Boston, Mass.; J. K. Butler, Boston, Mass.; E. M. Wilson, Pittsfield, Mass.; John Tregoning, Providence, R. I.; J. I. Drake, Providence, R. I.; J. H. Clark, Boston, Mass.; C. N. Whiting, Boston, Mass.; J. S. Keenan, Boston, Mass.; L. S. Dumoulin, Boston, Mass.; S. S. Stiness, Pawtucket, R. I.; W. S. Key, Boston, Mass.; E. R. Phillips, Providence, R. I.; H. W. Hamblin, Portland, Ore.; P. C. Ackerman, agent American Electrical Works, New York, N. Y.; M. C. Day, Providence, R. I.; F. Ridlon, Boston, Mass.; G. H. Heathcote, Providence, R. I.; W. E. Decrow, Boston, Mass.; N. W. Lillie, Boston, Mass.; C. A. Vicelle, Boston, Mass.; C. R. Remington, Jr., Providence, R. I.; F. E. Pettengill, Boston, Mass.; C. G. A. Peterson, Providence, R. I.; L. C. Halst, Providence, R. I.; A. P. Crowley, Providence, R. I.; H. C. Longstaff, Providence, R. I.; R. H. Whittier, Providence, R. I.; J. E Andrew, Pawtucket, R. I.; F. E. Smith, Somerville, Mass.; W. W. Demster, Providence, R. I.; H. G. Pettingill, Boston, Mass.; W. A. Leaman, Newton, Mass.; A. D. Wheeler, Boston, Mass.; D. K. Fales, Pawtucket, R. I.; T. R. Payson, Providence, R. I.; Otto Hoff, Providence, R. I.; G. R. Stetson, New Bedford; R. C. Broeck, Bridgewater, Mass.; W. A. Hathaway, Providence, R. I.; J. L. Lucas, Boston, Mass.; S. S. Sherman, C. B. Burleigh, Brookline, Mass.; M. P. Burbank, Whitesville, Mass.; C. Wilmot, Uxbridge, Mass.; C. H. Barney, New York; C. W. Whitney, Jr., Boston; A. C. White, Providence, R. I.; J. F. Hedge, Jr., Providence, R. I.; C. S. Smith, Providence, R. I.; H. F. Kellogg, Boston, Mass.; L. C. Whitney, New Britain, Conn.; G. A. Steere, Providence, R. I.; E. C. Perkins, Providence, R. I.; C. W. Williams, Providence, R. I.; G. W. Adams, Boston, Mass.; J. Carroll, Montreal, Canada; J. W. Poole, Boston, Mass.; C. H. Leary, Providence, R. I.; C. W. Baker, Providence, R. I.; J. B. Straw, Boston, Mass.; J. P. Felton, E. I. Garfield, W. N. Monro, E. A. Smith, A. C. Barstow, Jr., Providence, R. I.; D. A. Andrew, Boston, Mass.; J. A. C. Hamill, Bristol, R. I.; Herbert W. Ladd, Governor of Rhode Island; J. S. Reed, A. L. Rogers, Lynn, Mass.; W. B. Lewis, F. E. Chafee, Providence, R. I.: 287 in all.

A SIMPLE INSTRUMENT PROTECTOR.

Our cut represents an instrument which has stood very severe tests, and proved its ability to protect telephones, telegraph and other electrical instruments, (and persons who may be in the vicinity) against over-charges of electricity caused by lightning or contact of the wires of said instruments with electric light or electric railway wires. The protector is a small instrument (5x3½) with a single malleable ivory magnet wound with coarse wire to a very low resistance, and is placed in the circuit of the telephone, or any other electrical system. It remains quiescent until the wire or circuit becomes abnormally charged by atmospheric, electric light or other strong currents,



WOOD'S INSTRUMENT PROTECTOR.

when the magnet attracts the armature and automatically grounds or shunts the excess as long as the excessive current remains, and at the same time the indicating arrow (upon the instrument) points to "danger." When the excessive current ceases or is removed, the protector readjusts itself automatically, and restores the circuit to its normal condition; the indicating arrow will then point to or indicate "safe." Electric instruments or circuits without this protection are burned up or injured, and persons are liable to injury and death each day by electric light or other circuits, and many cases are on record of houses wholly or partially destroyed by fire originating in this way. With this protector in the circuit, no damage of any character can occur. This instrument is the invention of Mr. G. T. Woods, 109 *World* Building, New York, and is well spoken of by those who have tested it.

THE EDISON COMPANIES' CONVENTION.

The annual convention of the Association of the Edison Illuminating Companies is being held during the present week at the Murray Hill Hotel, corner Park avenue and Forty-first street, this city.

There are to be two sessions on Tuesday and Wednesday, and on Thursday the delegates will leave at 6 A. M. on a special train for Schenectady, N. Y., where the Edison Machine Works will be inspected. The party will return to New York the same evening. Those who desire to will visit the Edison Lamp Works, Harrison, N. J., and the Edison Laboratory, Orange, N. J.

The Electric Club will extend its hospitality to the out-of-town members of the convention during their stay in this city.

The meeting, no doubt, will be an exceedingly interesting one.

BALTIMORE NOTES.

The Baxter Motor Company is in elegant shape for business. It is said to have the largest works in Baltimore, which are equipped with a traveling crane run by one of the company's own motors. The company is equipping several electric railways with its system; and Baltimore is proud of the road equipped by it. The works of the company are very extensive, and Mr. Baxter is in a happy frame of mind.

Wenstrom Consolidated Dynamo & Motor Company is running its entire works by water-power, using Leffel Wheels. Five hundred horse-power is the limit now, and there is fall of water enough for 700 H. P., which can be called upon in short notice. The company has elegant large works, a large traveling crane made by Wm. Sellers of Philadelphia, run by its own motor will carry any size piece of machinery or complete truck and equipment from any part of the works to any other part.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, "WORLD" BUILDING,
NEW YORK, Aug. 8, 1891.

Mr. C. L. Cornell of the Cornell Engineering Company, 45 Broadway, this city, has gone to Dallas, Tex., to close some contracts in which he is highly interested.

The Riker Electric Motor Company, 45 and 47, York street, Brooklyn, has just sent another of its latest improved one H. P. motors to Boston. These motors, although but recently placed on the market, are giving excellent satisfaction wherever used.

Mr. W. S. Chesley has established a purchasing agency for all kind of electrical supplies, at 136 Liberty street. As a broker he will furnish electrical companies with all their wants. The idea is original with this gentleman, and he already has a number of clients.

The Manhattan Electrical Supply Cumpany, 36 Cortlandt street, manufacturers of the "Mesco" Dry Battery are doing quite a trade in this battery. It is original in its construction and maintains a standard current equal to any other dry battery in the market. Every dealer in dry form of cell should get a sample of this one before completing his stock for the Fall trade.

William Fay, General Agent of the Steuben Electric Manufacturing Company, Hornellsville, N. Y., was in the city the past week looking after the interests of his company. It is manufacturing direct and alternating generators. It also manufactures steam engines, and makes a specialty of incandescent lamps. The company's factory is right in the great glass belt and some of the finest incandescent bulbs are made in this section.

In a competitive test at Sibley College, Cornell University, of steam separators to determine the relative efficiency of each of the principal makes, the Hine Eliminator, made by the Hine Eliminator Company, of 106 Liberty street, showed an efficiency 25 per cent greater than that of six of the principal makes of separators, the quality of the steam being over 90 percent. Much credit is due the Hine Eliminator Company as it was perfectly ignorant of the fact that such a test was contemplated.

Truex & Vail, 136 Liberty street, are prepared to undertake contracts of any dimensions for light and power, and are equipped to install accumulators in the Eastern states for any number of lights. Isolated and marine plants are a hobby with them. Their swinging ball lightning arrester is having a big sale, several thousand having been placed since the firm began taking orders a short time ago. They are having a well merited trade in the Walker Ammeters, having lately given an order for 100 to the Walker Electric Company, for whom they are agents.

The Maine Electrical Improvement Company, Brunswick, Me., has been installing some large electrical systems lately. Mr. Thomas J. Fay, E. E., general manager, with offices at Electrical Exchange Building, corner of Liberty and Washington streets, personally manages all construction work—a sufficient guarantee that the work will be of the best. This company undertakes the supervision of electrical installations of every description, inclusive of provision of plans, specifications, tests and reports, complete in every detail. All that is necessary is to let the firm know an installation is wanted and it will send its experts to the place, who will furnish data of different systems, draw up contracts and arrange everything in detail with satisfaction to the purchaser.

Mr. F. D. Voorhees, the new managing salesman of the Norwich Insulated Wire Company of New York, offices 54 Cedar street, is meeting with excellent success. The business of the company has increased to such an extent that its factories in Brooklyn are not capable of putting out the stock fast enough to meet the demand, and it is seeking larger quarters. If the report is verified they will shortly have one of the best equipped factories in this country, and one very convenient to New York City. Thousands of feet of the company's cables for telephone use, have been placed in the conduits of New York and Brooklyn. Five of its 200 wire cables are now in use by the New York & New Jersey Telephone Co., and are run over the Brooklyn Bridge. It is also making a large quantity of electric light wires and cables, waterproof magnet wires, house wires, etc. The insulation resistance of its wires is spoken of in the highest terms by users.

The Hunt Engineering Company last week advertised for sale 10,000 sockets to fit T.-H. lamps. This was a special lot of sockets which this company manufactured, and it wished to dispose of them to make room for other new goods, which it is bringing out. These sockets are brand new, well made, perfect in every respect, and are guaranteed to carry five amperes of current without heating; the contact with the lamp ring being especially desirable on account of its scraping connection. All the conductors in this socket are made of Eureka tempered copper, which are held in position by Valcanized Fibre. There are a few more of these sockets left, and it is an excellent opportunity for anybody desiring first class sockets to obtain them at exceptionally low prices.

The Ongley Electric Company's System is meeting with success; the public has recognized the value of its reliable watchman's register which faithfully records the movements of a night or day watchman, and its many adjuncts, viz., Engine Stopping Device, Fire Alarm Signals, Automatic Sprinkler Protector, etc., etc. Among the latest establishments which have been equipped with this system, we may mention the Pennsylvania Railroad Yards both at Jersey City and Hoboken; Eble and Herter's Brewery, Philadelphia, Penn., the Appleton Manufacturing Company, of Brooklyn, and we learn that many other large and important concerns have just closed contracts with the Ongley Electric Company. The system is pronounced by all most reliable and thorough in all its workings. Particulars or any information may be had by applying to the Company's Office at No. 1 Broadway, New York City.

Mr. T. J. Murphy, Room 215, 136 Liberty street, this city, the well-known manufacturer of slate bases for electrical apparatus, is building up an excellent trade. Mr. Murphy's slate switchboards are to be seen in many electric light, power and railway stations, and they are fine specimens of workmanship and art. Instrument bases of slate are also extensively used, and Mr. Murphy makes a slate composition which is both water and fire-proof. It finds many uses in electrical work, where these two qualities are so highly essential. As an example of the artistic manner in which Mr. Murphy can manufacture slate goods when occasion requires, is a checker board composed of squares of different colored marbleized slate. It is a beautiful piece of work. Among the uses to which slate is put in the electrical line the following may be mentioned: Bases for transformers, fuses, resistance coils, knife switches, rheostat heads, terminal boards, washers, etc., and the goods are finished according to the uses to which they are to be put.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	10 000
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	10 00
American Electric Motor Co.(N.Y.)	1,000,000	2500	3 00
American Private T'phone (N. Y.).	50,000	100 00	98 00
American Telegraph and Cable.	14,000,000	100 00	80 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co. (N. Y.)	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	175 00
Bell Telephone 7's	2,000,000		*112
Boston Electric Light.	1,500,000	100 00	85 00
Brooklyn Edison Electric Light.	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light.	500,000	100 00	137 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brunswick Elec. L. & P.	50,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.).	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s.	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	45 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N.Y.).	500,000	20 00	10 00
City of London Elec. Lt. Co. (Ltd.).	500,000	250 00	250 00
Columbia Canal 6's (Ga.)	200,000		*102
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	4 50
Cons. Gas & E.L.Co. of West Co.6's.	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80,000		par
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's.	300,000	25 00	25 00
Detroit Electrical Works.	1,000,000	10 00	9 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600.000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	100 00
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000,000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.).	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., (Phila.).	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	100 00
Elec. Sup. & Con. Co. (N. Y.)	120,000	15 00	18 00
Elizabeth E. L. Co.	100,000	10 00	4 00
Equitable G. & E. Co. (Utica).	4,000		†
Erie Telephone	4.800,000	100 00	45 50
Essick Printing Tel.	5,000,000	100 00	45 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.).	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		par
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co.	4,000,000	25 00	11 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	25 00
Hackettstown Elec. Light (N. J.).	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.).	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*103
Hunt Engineering Co. (Brooklyn).	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited.	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	95 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7 500,000	100 00	13 50
Laclede Gas, pref	2,500,000	100 00	40 00
Laclede Gas 5s.	10,000,000		*73
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Little Rock Edison E. L. & P. 6's.	30,000		par
Littleton Water & E. L. Co. 6's.	75,000		par
Livingston E. Lt. Co. (Mont.) 6s.	30 000		*99
Long Branch Electric Light.	50,000	100 00	78 00
Manhattan E. L. Co. Ltd 5's (N.Y.).	1,000,000		par
Marysville L. & W. Co. 6's (Ohio).	60,000		par
Metropolitan Phonograph.	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	75 00
Morristown L. H. & P. 5s (N. J.).	25,000		*101
Morristown L. H. & P.	50,000	100 00	100 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust.	9,000,000	100 00	15 75
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	49 00
N. Y. and N. J. Tel. and Tel 6s.	1,500,000		par
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	93 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark Elec. Light (Schuyler)	100,000	100 00	
Newark E. L. & P. Co. 6's Ohio.	50,000		par
North American Phonograph.	6,600,000	100 00	
North New York, Lighting	150,000	100 00	10 00
Northern Elec. L. & P. (Phila.).	200,000	10 00	
Northwest Elec. Co. 6's Manitoba.	50,000		par
Postal Telegraph.	10,000,000	100 00	30 00
Passaic, Electric Light.	15,000	100 00	92 00
Paterson, Electric Light.	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton).	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston.	200,000	25 00	25 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	
Richmond L. H. & P. 5's.	150,000		
Rockaway Beach Elec. Light.	50,000	100 00	60 00
Rockaway Elec. Lt. Co. 6's	75,000		par
Russell Electric Co. (Boston).	300,000	5 00	6 00
Saratoga Gas and Elec. Light 6s.	300,000		*86
Saginaw E. L. & P. Co. 6's Mich.	50,000		par
San Diego Gas & Elec. Co. 6's Cal.	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation., N. Y.	100.000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Swan Incandescent.	800,000	100 00	5 00
Standard Ug'd Cable Co	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y).	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	39 00
Thomson-Houston Pref.	4,000,000	25 00	25 00
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's.	100,000		par
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.).	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.).	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.).	1,370,000	100 00	
United Elec. Light and Power.	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	30 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's.	150,000		par
Utica Elec. Light Co. 6's.	150,000		par
Vine Street Motor Co. 6's (Colo.).	100,000		par
Welsbach Inc. Gas.	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	79 50
Westinghouse Electric Co.	7,000,000	50 00	11 50
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			16 50
Yonkers, L. & P.	50,000	100 00	92 00

*Per cent. †Registered Stock.

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The electric lighting of the City of London is now finally settled for the next few generations, and the whole business secured by the amalgamation of all in interest and the registration on the 11th ult, of the City of London Electric Lighting Company, ltd., with a capital of $4,000,000 in $50 shares, to enter into and carry into effect the agreements with the Brush Electrical Engineering Company, ltd., the Laing, Wharton & Down Construction Syndicate, ltd., and the City of London Electric Lighting (Pioneer) Company, ltd., and to carry on in the City of London and in the district of St. Saviour's District Board of Works, the business of an electric light company in all its branches. The subscribers are Sir David L. Salomons, F. W. Reynolds, E. Lucas, Duke of Marlborough, Earl of Suffolk and Berkshire, Hon. Allan Charteris and J. B. Braithwaite, each of whom signed for one share. The number of directors is not less than three nor more than ten; to be nominated by the subscribers: Qualification $5,000; Remuneration: '91 and '92, $5,000 per year; '93, $7,500; '94, $10,000; '95, $12,500; '96 and thereafter, $15,000 per year. This may be considered as permanently settling the financial question of electric light in London, and offers a chance to American investors for a long, safe and increasing security. This company has passed successfully through all the various phases of municipal opposition and stands forth like the dome over the ELECTRICAL AGE office in full unadulterated golden purity alone, of its kind. A few shares of this stock in trust to be delivered when your young friend attains his majority will produce more than a brown stone front. As an electric investment in contradistinction to gambling this company to-day stands without a peer.

British capital occupies so firm a position in connection with American financial negotiations that a comparison of its ultimate earnings as shown by the annual accumulations of record in the various bureaus of taxes on business transactions, capital transferred by succession, donation, etc., is interesting to those of our readers who want some of it or to profit by their experience. While Italy gains yearly only £20,000,000, Prussia, £83,000,000, France, £120,000,000, Great Britain looms up with a net annual profit—books all balanced—of £180,000,000.

The fire losses to electric corporations this season are attracting attention, but the percentage of disasters in nearly, if not quite all other industries is far greater. Probably the dry goods district of New York is more carefully guarded against fire than any other area of its size, yet there are more conflagrations among those buildings than in the central electric stations scattered over the country. Among the latest we note a loss at Atlantic City which will not reach above $1,000 and will cause only momentary trouble. The destruction of the Richmond Light, Heat and Power Station at Staten Island is more serious, the loss being estimated at nearly $100,000, fully insured. I understand nearly the whole of this, with the station, could have been saved had not the water supply been cut off; if this be true it seems to me an action should lie in this direction. Minority shareholders have legal rights which majority shareholders must defend and this fire will delay dividends on the stock many moons. It will be a conundrum to earn the interest on the bonds while the station is being rebuilt; there is, however, not much danger of a default. Those maturing April 1 were paid at the Holland Trust Company.

Another screw in the coffin of the telephone patents has just been manipulated by the great undertaker—Time. The Blake transmitter having passed the existence allotted by H. majesty's patent laws departed from the realm of protection on the 20th of July and all carbon transmitters became at once public property. The telephone stocks have been a sale for some time and there is little if any doubt but those who began selling them down from 200 will continue to make money even down to 50. At present many authorities place the intrinsic value of the shares at from 125 to 150, say 137, but as a very large proportion of this are royalties which will soon cease, and in its place active, aggressive competition appear, there is but one course for the investor to meditate upon, and that is to determine his position at the funeral. Acoustic telephone lines are going up in many places where their usefulness is limited to a radius of a quarter to a half-mile, say the distance of the ordinary incandescent electric light circuit, and they are making money too. The next five years will show a grand improvement in all directions in telephonic art. No respectable residence will be considered complete without connection with a central office. It will be simply known as one of the modern improvements, and the plumber will be relegated to the lower plane of prosperous financial mortals, giving place to the wire man in his various callings. Those of our readers who get in there properly can live in the new Fifth avenue, and entertain their friends. It will be separate from ordinary construction corporations and pay better.

When the flyers nest again, in about 60 days, they may be expected to chirrup to the tune of a lively advance in both listed and unlisted electric bonds and shares. There is no good public reason why several new ones should not be active in stock exchange circles. The litigation has reached a stage where it can safely be discounted, and the natural increase in actual business fathomed, bar that unknown quantity —strikes—which adds excitement akin to gambling. As against the far off unknown, railroad, they have on the floor visible, tangible, absolute, known, electric telegraph, ticker, telephone, light, clock or time, call bell, elevator appliances: all owned by corporations represented by certificates —spot business, see?

BUSINESS NOTES.

E. T. Orne, 112 Randolph street, Chicago, has secured the contract to equip the daily *Herald* building with his speaking tube system. He will also install a hundred or more Partrick & Carter Company's New King Annunciators in the same building.

The McCreary Electrical Specialty Company, 136 Liberty street, N. Y., are preparing to bring out a big line of specialties for the Fall trade, and dealers generally throughout the world will do well to get posted here before laying in their supplies for the Fall.

On July 27 the Common Council of Grand Rapids, Mich., decided to light the city by the tower electric system, and a three-year contract for 250 lamps was awarded to the Star Iron Tower Company, of Fort Wayne, Ind., for $30,000 per year.

The business of the Electric Railway Specialty Company, of 29 Broadway, this city, has been combined with that of R. D. Nuttall Company, of Alleghany, Pa. The capital stock of the R. D. Nuttall Co. will be increased to $500,000 and the manufacturing plant materially enlarged. The company will carry a full line of general street railway supplies, in addition to its own specialties. J. F. Porter will remove to Alleghany for the purpose of giving his entire time to the business. Messrs. Carey and Moyer will travel for the company. Write for copy of its new catalogue.

The Nowotny Electric Company, 30 East Fifth street, Cincinnati, O., is manufacturing a one-fourth horse power motor for fan or other power work. It is wound for a regular incandescent current or for a 6 volt battery current. The Company manufacture a special battery that is well adapted for operating this machine. The machine can be wound to be used for electro-plating purposes. It has capacity to operate a twenty-five to thirty gallon tank of nickel solution. The same machine is wound as a dynamo for operating incandescent lamps, and general laboratory or experimental work.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued August 4, 1891.

456,940. Electro-Magnetic Cut-Out. Sylvanus H. Cobb, Hyde Park, Mass., assignor to the Electrical Safety Company, Portland, Me. Filed Nov. 29, 1890.

In a current-protector for electrical instruments, the combination of an electro-magnet acting by the movement of its armature when the magnet is energized by a current of strength sufficient to injure the instrument to be protected to establish a connection with ground, a resistance less than the resistance of the magnet and connected to the circuit, having a supplementary armature operated by the same or another electro-magnet in the circuit and not attracted except by currents stronger than those which cause the attraction of the other armature, and connections. The attraction of the supplementary armature establishes the connection of the resistance with the electro-magnet or magnets and ground, thus causing a division of the current between the resistance and the electro-magnet or magnets.

456,997. Coupling for Electric-Light Shades, Philip Levison, Chicago, Ill. Filed March 23, 1891.

A continuous expansible and contractible ring having disconnected end portions and adapted to surround and engage an electric-light socket, and having devices for attaching to a shade having an aperture, the apertured portion of the shade serving to surround the ring and hold it in engagement with the socket.

457,030. Electric Clock. Walter K. Menns and Walter J. Dudley, Everett, Mass., assignors to the Waltham Electric Clock Company, of New Hampshire. Filed March 8, 1890.

The combination of the pendulum with an impelling device and a detent, it comprising a movable member mounted on the impelling device and movable therewith, and a stationary member, the movable member having an engaging portion in the path of movement of the pendulum-rod and operated thereby to disengage the detent members, the movable detent member thereby transmitting the pressure from the impelling device to the pendulum-rod.

457,058. Electric Track-Signal. Myron W. Parrish, Detroit, Mich. Filed Aug. 8, 1890.

The combination of a track with tread-bars on the out side of the rail, extending a little above it, the ends of the tread-bars having downward and outward curves, springs supporting the bars, signals with circuit-wires leading from them and provided with the end separated bars or terminals, and spring-actuated rods provided at one end with a series of prongs for contacting with the terminals and the other end of the rods engaging the side of the tread-bars.

457,065. Armatures for Dynamos or Motors and Method of Winding the Same. Ferdinand A. Wessel, Brooklyn, assignor to the Excelsior Electric Company, New York, N. Y. Filed Nov. 15, 1889.

Drum-armatures having two sets of coils or bobbins applied in two layers to the armature wound alternately, the bobbins of each set being wound directly upon the armature on one side and over a previously-applied portion of another bobbin of the other set upon the other side.

457,072. Incandescent-Lamp Socket. Waldo

ELECTRICAL PATENTS—Continued.

C. Bryant, Bridgeport, Conn. Filed March 9, 1891.

An incandescent lamp having a rib and a socket provided with clamping-arms having inwardly-turned ends and lugs formed by striking in the metal of the arms, between which and the inwardly-turned ends the rib is engaged in use.

457,090. Rheostat. John A. Mosher, Abilene, Kan., assignor to the Mosher Arc Lamp Company, same place, Filed Nov. 5,1890.

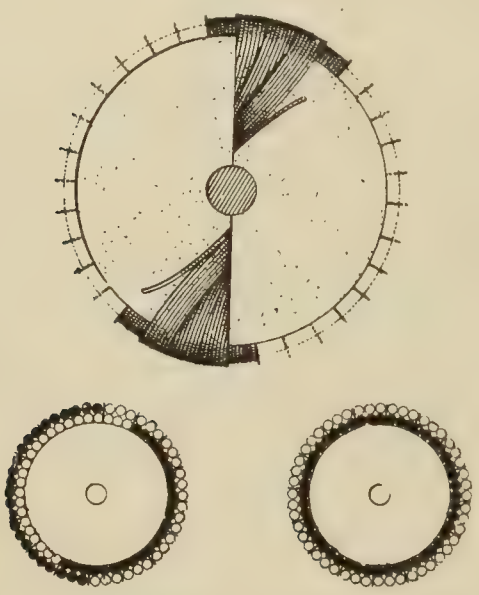
Non-combustible non-conducting discs having a central separating-bolt screw-threaded at each end and provided with nuts passing through them and carbon rods passing through openings in the discs, with adjustable clamps embracing the ends of the carbon rods and connecting them alternately in pairs, binding posts secured in the discs, having connections between their lower ends and the terminals of the carbon-rod circuit.

457,105. Electric-Conductor Support. Eben M. Boynton, West Newbury, Mass., assignor to the Boynton Bicycle Railway Company. Filed Oct. 17, 1890.

A support and protector consisting of a rail having a longitudinal groove cut through its inferior face, in which the conductor is held by lateral pressure, and a surrounding metal covering serving as a guide.

457,109. Socket for Incandescent Electric Lamps. John Criggal, Newark, N. J. Filed Jan. 3, 1891.

An incandescent electric lamp having a base with a



457,065—ARMATURE FOR DYNAMOS OR MOTORS.

double-threaded shank having metallic eyes at opposite points with a socket provided with spiral wires of the same pitch as the threads of the shank and adapted to engage the eyes on it.

457,110. Mechanical Switch for Electric Systems. Christian Dauffenbach, Milwaukee, Wis. Filed March 3, 1891.

Binding-posts for main and loop wires of a high tension electric system having spring controlled levers pivoted to the binding-posts of one set of wires and designed for contact with the binding-posts of the other set of wires and a slide-bar with a cam in opposition to the levers.

457,116. Galvanic Battery. John R. Hard, New York, N. Y. Filed Feb. 6, 1891.

A closed galvanic-cell having a gas-outlet in its closing-stopper, and a self-closing valve controlling the outlet, the valve opening outwardly.

457,127. Electric Hand-Fan. William B. Luce, Boston, Mass. Filed May 19, 1890.

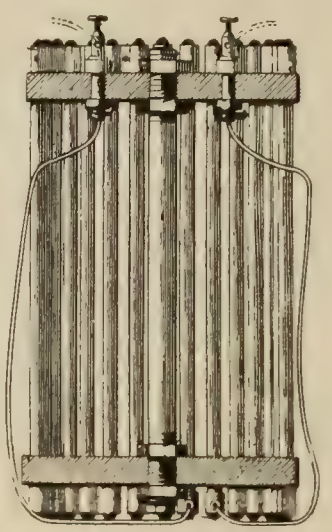
An improved electric fan comprising a handle formed to be grasped by the hand, an electric motor mounted on one end of it, and including a shaft journalled in bearings, fan-blades attached to the shaft, conductors extending from the motor through the handle, one of the conductors including a contact-spring which is normally in position to break the continuity of it, a push-knob or handle extending from the spring to the exterior of the handle whereby the user of the fan while holding the handle can close or break the circuit in which the conductors are included and thereby control the operation of the fan and flexible prolongations of the conductors outside of the handle adapted to be connected with a suitable source of electrical supply.

457,135. Railway-Signal. William C. Serrell, Bayonne, N. J. Filed May 18, 1891.

Track-rails electrically connected in sections with circuit connections from one section to a non-adjacent section containing a battery having similar poles to the same track-section and means for operating a signalling device upon the locomotive.

457,141. Electric-Arc Lamp. Xavier Wertz, New York, N. Y. Filed Dec. 5, 1889.

Contacting carbons separated by a layer of insulating material, supported in sockets attached to conducting wires, the whole enclosed in an evacuated glass globe.



457,090—RHEOSTAT.

457,151. Coupling for Electric Incandescent Lamps. Isaac J. Flagg, Clinton, Mass. Filed Mar. 13, 1891.

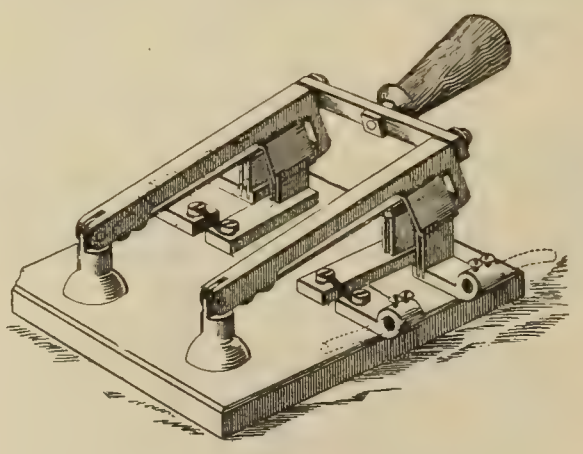
Two halves or portions of a tubular shell adapted to be connected together and each containing two electric conductors to be joined to form two paths for the current from end to end of the coupling, and insulating water or moisture proof material in which they are embedded, and insulating-coverings for the conductors entering and leaving the coupling, which are in direct contact with the insulating water and moisture proof material in which the conductors are embedded, completely protecting the conductors.

457,164, Electric Smoothing-Iron. Willis Mitchell, Malden, Mass., assignor to the Butterfield-Mitchell Electric Heating Company. Filed Nov. 21, 1890.

A smoothing-iron for tailors' and laundry use having a hollow body and removable plate with a magnet movable with the plate and having a support or supports which rest on the bottom.

457,226. Brush-Holder for Dynamo-Electric Machines. Sydney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Dec. 18, 1889.

The combination with a commutator, of a box open at its ends and pivotally supported at points between its ends, so that the holder may oscillate or incline in either direction



457,301—ELECTRIC SWITCH.

relatively to the commutator, a commutator-brush adapted to pass freely through the box, and means for causing it to bear on the commutator with a yielding pressure.

457,239. Printing-Telegraph. Henry Van Hoevenbergh, Elizabeth, N. J., assignor to the Baltimore & Ohio Telegraph Company, Baltimore, Md. Filed April 16, 1885.

In a printing-telegraph instrument, a type-wheel controlling device consisting of the combination of a scape-wheel having an anchor applied thereto, with an armature for controlling the movements of the anchor, a permanent magnet polarizing the armature, and two single-coil electro magnets for controlling its movements.

457,296. Electric-Fence-Station Device. David H. Wilson, Normal, assignor to the American Electric Fence Company, Chicago, Ill. Filed Aug. 25, 1890.

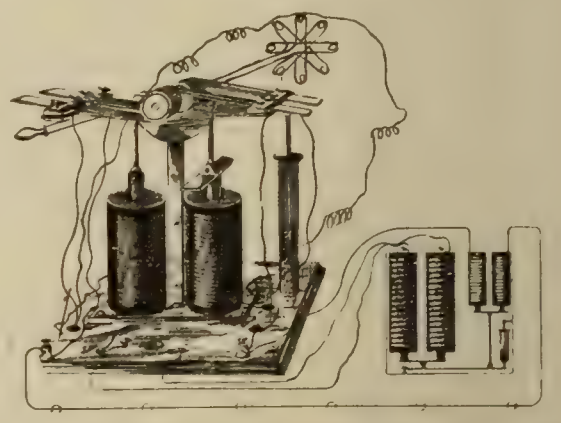
In an electrical appliance for generating and maintaining an induced current of electricity, the combination of a primary battery, a circuit-breaker, and an induction-coil contained in the circuit of the primary battery, and a condenser, one wire connecting the condenser with the circuit extending from the circuit upon one side of the circuit-breaker, and the other wires extending from the other side of the circuit-breaker, and secondary wires extending from the induction-coil, one of the wires being grounded and the other extending around the coils of a magneto-electric bell and to the fence wire, the hammer of the bell being adapted to move synchronously with the armature of the circuit-breaker.

457,300. Electric Switch. Waldo C. Bryant, Bridgeport, Conn., assignor to the Bryant Electric Company, same place. Filed April 8, 1891.

The combination, with a tilting contact-bar having a central table formed integral therewith, of a rotary vertically-movable spindle having an operating-arm, and a spring acting to hold it in contact with the table, so as to tilt the contact-bar quickly when the arm is moved past either of the pivotal points.

457,301. Electric Switch. Lewis D. Castor, Philadelphia, Pa., assignor to William H. Weston & Co., same place. Filed May 20, 1891.

Two pairs of metal clips, each pair forming a circuit-terminal and an inverted U-shaped blade whose ends are



457,330—AUTOMATIC BRUSH-SHIFTER FOR DYNAMOS.

adapted to enter the clips, respectively, completing an electric circuit through a fusible connection on the supporting-plate of one terminal, and the holder of one of the circuit-wires, the blade being connected with a spring which is secured at one end to an operating-lever, and adapted at the other end to be engaged by a shoulder on the lever.

457,327. Commutator or Contact Brush. Leonard Paget, New York, N. Y., assignor to Charles J. Kintner, same place. Filed Sept. 25, 1889.

A commutator-brush, composed of one or more layers of wire gauze or fabric having the individual wires located in lines diagonal to the axis of the commutator.

457,330. Automatic Brush-Shifter for Dynamo Electric Machines. Thomas E. Adams, Cleveland, Ohio, assignor to the Brush Electric Company. Filed Sept. 16, 1887.

In an apparatus for controlling the length of spark at the commutators of dynamo-electric generators, in which the strength of current is governed by a shunt of variable resistance around the field, the combination of a solenoid in the field-circuit adapted to carry the normal current through the field and a solenoid in the governing branch adapted to carry the maximum current in the latter, with a pivoted brush-carrier, controlled by the differential action of the solenoids, and a sliding weight for counteracting the frictional drag of the commutator upon the brushes.

11,185. Electric Elevator (Re-issue). Francis B. Perkins, Boston, Mass. Reissue filed June 24, 1891. Original dated Oct. 28, 1890.

The combination of an elevator mechanism, an electric motor to actuate the same, a starting and stopping mechanism for the elevator mechanism, a brake mechanism, and an electrically-controlled connection connecting the brake-mechanism with the starting and stopping mechanism, whereby the former is made operative by the latter so long as the circuit through the connection is maintained the electrically controlled connection being disconnected or broken as soon as the circuit is interrupted, to thereby prevent the brake mechanism from being operated by operation of the starting and stopping mechanism.



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NEW YORK AUGUST 15, 1891.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

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W. T HUNT, *Vice-President*, E. V. CAVELL, *General Manager*

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THE OLD AND THE NEW.

During a recent visit to a western city, our attention was attracted to a peculiar state of affairs which, no doubt, was rendered necessary by force of circumstances. The tracks on certain streets were used jointly by cars propelled by horses and mules, and the cable and electric systems, and it was an odd sight and one full of suggestions, to see a string of cars moving along, representing every system of street car propulsion under the sun, except steam.

A mule car preceded by an electric car, and followed by a cable car, is indeed an inspiring sight, and the juxtaposition of the mule with types of the latest improved systems of car propulsion seemed to emphasize, better than it could be done in any other way, the antiquity of the mule car. Besides this, the commingling of the various systems afforded an opportunity for the observer to compare, to a great extent, their merits. The mule and the horse were simply "not in it," to use a slang expression.

We could, by a stretch of the imagination, see in the expressions of the above-named animals, a look of discouragement and weariness, and they no doubt felt their humility keenly.

LISTING STREET RAILWAY SECURITIES ON THE STOCK EXCHANGE.

Strict banking collateral is composed only of securities realizable at a moment's notice during business hours at commercial centres. All else is speculative. Security, or stock exchanges are organized and located at the most convenient spots, where brokers can meet for the purpose of purchase and sale of listed securities. Stability is given by the rules of all exchanges, first, in the full examination of the broker; next, by the verified statement of the financial condition of the security offered for listing; and we urge, most strenuously, now that street railways have grown so enormously, and are assuming a position in the first rank of finance, that a concerted movement is in order having in view the general listing of all street railway shares and bonds, either on the New York Stock Exchange or the local exchanges scattered over the country. It means to the public that commercial examination has been exhausted and convincing proof produced of the value of the collateral and to the holders that in case money is desired for the further development of the enterprise or personal requirements, that it can be had at once for a fair consideration or brokerage at or through the exchange or any one of its members. The requirements of the committee on stocks can be had by any respectable officer of an incorporated company sufficiently advanced to be able to make good delivery of certificates, and it is due to the public that all should be listed and a portion of their stock and bonds on the market, at a price. If your company is making money, there is no reason why you should not place a price on the shares far enough above par to equalize its financial position, but you should also remember that your commercial honor is at stake and be governed accordingly.

CHANGING TO ELECTRIC POWER.

A fair idea may be had of the growing popularity of the electric railway by glancing at our "Changes of Power" column on another page. The sentiment in favor of electricity is not confined to any particular section either; it is as wide as the country itself.

The close observer will find food for thought in this column; he will see that the tide is rushing one way and that electricity is at the bottom of it all.

These simple facts, as stated in our column, bristle with suggestions and they show what a great power in this broad land electricity is.

The plain fact of the matter is, electric cars are quicker and more pleasing to ride in than the antiquated concern known as the horse car. To be sure there are a great many fine horse car lines, but the people seem to want electricity. "Give us electricity" is the universal cry.

IMPORTANCE OF REGULARITY.

The people of a lively town in Massachusetts are somewhat out of patience because the street cars are run "spasmodically." This probably means that they are irregular as to their frequence in passing over the road.

Two elements of success in any business are reliability and system. If these qualities are lacking no one can tell what to expect, and in the case of street car travel it is annoying, indeed, to be compelled to wait an unreasonable length of time for the "next car."

Regularity is a great virtue in operating a railroad of any class, and it is a satisfaction to the passenger to know that he may, with reasonable assurance, expect a car to pass a given point at a given time. Regularity inspires confidence in the management always.

AN IMPORTANT COLUMN.

Attention is called to our "Possible Purchases" column, which will be found on another page in this issue. This department of our notes column, no doubt, will be greatly appreciated by all dealers in electrical equipment, as it will serve to point in the direction in which possible sales may be effected. We believe that every first-class journal should study and anticipate the wants of its readers and customers; and that is what STREET RAILWAY NEWS is constantly doing.

OUR "Possible Purchases" column will appear as regularly as day follows night.

BUFFALO'S NEW ELECTRIC ROAD.

In our last issue we gave a description of the opening of the Niagara street electric line of the Buffalo Railway Company, Buffalo, N. Y., which was built in spite of opposition to its construction on the part of some of the residents of that thoroughfare. The ups and downs in the experience of this road have attracted much attention from outsiders, while in Buffalo itself the feeling between the opposite parties was intense at times.

All the difficulties, however, were finally overcome and the road was successfully put into operation as described. It is safe to say that those who so strongly opposed the establishment of the line will before long be warm advocates of the system.

We have come into possession of a view of one of the cars used on the Niagara street line, and an interior view of the same.

These cars are models of street car architecture and are beautiful in the extreme. They are just such cars as one would naturally expect to find running on so select a thoroughfare as Niagara street, and their interior fittings represent the highest development of decorative art.

The cars were built by the Gilbert Car Manufacturing Company, of Troy, N. Y., and are 35 feet long. They are finished inside in mahogany; the head linings are of quartered oak, decorated, and the trimmings are of bronze. The seats are finished in birch veneer and their backs are covered with carpet. There is an elegant lamp at each end of each car, also a signal lamp. Under each platform is a gong used for the purpose of signaling. In the doors and window sashes are panes of 26-ounce English crystal sheet glass, and the glass in the deck sash is handsomely decorated. Brill ratchet lever brakes are used, and the cars are equipped with radial draw-bars. Stoves and sand-boxes also form a part of the car equipment. The cars are vestibuled at each end, and make a very elegant appearance.

Edison and Thomson-Houston motors are used—about equally divided. The Edison motors are of the ordinary double-geared type, while the Thomson-Houston machines are of the single reduction type. Each motor is a 15 H. P., and the trucks used are, with two exceptions, of the Bemis make. One car is equipped with Brill maximum trucks and another with Robinson six wheel radial trucks.

We give herewith, also, an illustration of the Ball engine, which is used in supplying the power for driving the electric generators in the power house. There are six of these engines used. They are of the cross compound non-condensing type, each of 250 H. P. The sizes of the cylinders are 15 and 25 by 16.

The belting used by the Buffalo Railway Company in its power house consists of three 24-inch double belts with round corner laps, made by the well-known and reliable firm of Bicford & Francis Belting Co., 53 & 55 Exchange street, Buffalo, N. Y. Each belt is 50 feet 4 inches in length and is made of the best oak-tanned leather obtainable.

All the belts manufactured by this company are made with a short round corner lap, which it is claimed adds to the life of the belt for the reason that there are no sharp corners exposed to catch. The company makes a specialty of "B. C. & D." oak tanned leather belting.

Car 13 (not an unlucky number in this instance) of the Niagara street line is a favorite among the patrons of the line on account of its easy running. It has radial trucks and single reduction motors.



VESTIBULE CAR ON NIAGARA STREET LINE, BUFFALO.



INTERIOR OF CAR ON NIAGARA STREET LINE.

BINGHAMTON'S STREET RAILWAYS.

Binghamton, N. Y., has had such excellent street railway service since the Washington street, Asylum and Park railway, the Binghamton Central railroad and the City railway were consolidated into the Binghamton Street Railway Company, that it is now strongly agitating a consolidation between this company, the Binghamton and Port Dickinson horse railway and the Court street and East End railway, which would place about twenty-five miles of road under one management. The Binghamton street railway runs through the principal portions of the city, having for its termini Ross Park, a beautiful resort worth traveling many miles to see, the State Hospital, Glenwood and Spring Forest cemetery, the Orphans' Home, and all depots. The Binghamton and Port Dickinson road is about seven miles in length, and runs from Port Dickinson to Lestershire through the principal streets of Binghamton, and the Court street and East End road covers fully five miles of streets, including the main business avenue. During the year just ended the Binghamton street railway carried at least one million people, notwithstanding that it was greatly interrupted by rebuilding its tracks, and the city's construction of new pavements and sewers along its lines. The company is exceedingly popular with the public and the city authorities, by its ready compliance with every reasonable requirement and demand made by either. The other lines also carry a large number of passengers and are equally popular. It is said that the consolidation of these lines, and the adoption of electricity as a motive power throughout its entire length, will advance the value of the adjoining property; and both the city and the railroad companies look upon the project with favor.

FINANCIAL DEPARTMENT.

Investors in electric railway securities and apprentices intending to learn the profession of electric trainmen should understand the position and interest of each to the other. The investor with his money in hand, ready to put into the business, fills all the conditions requisite. On the other hand, as showing the present ability of the average trainman, we note that a few days ago, in the height of the busy season, Nature's electricity from the clouds failed to meet with any arrester and took possession of the circuit wires of the Coney Island railroad, destroyed the insulation, converted the water into a conductor and grounded the whole current. Two cars were stopped instanter *en route*, and some twenty nervous passengers, electrically ignorant, possibly a few inventors among them, had their choice of a tramp through a pouring rain or an hour in the cars, before help arrived. No legal cause for big damages this time, but chances are good that way soon. Journeymen trainmen should be able to repair all electrical difficulties immediately and with safety to owner, contributor and themselves. We also note that

1,400 trainmen in the employ of the West End Street Railway Company, of Boston, have enrolled themselves under the banner of the Federation of Labor. Why not, instead of this, join together and buy a lot of the companies' shares and bonds, invest $1 each per month; they will not feel this, but it gives them $16,800 interest in a business they are more familiar with than any one else the first year in lieu of signing the by-laws of a secret labor association. Agree as a company or otherwise among yourselves to keep up this investment for ten years which will give you the ownership and representation of $168,000; add to this the dividends also, and long before the end of the ten years you will at the meeting of the Board of Directors pass on your own wages, time, etc., and you will do it on the square, too. The average investor blindly places his or her money in the company and relies implicitly on the officers and men to use it to the best advantage and return the largest income which they can honestly earn.

Brooklyn electric railways as a source of income, either for permanent investors or speculators, are fast coming to the front, and we desire particularly to call attention to the Atlantic avenue company as per list our quotation. The existing facts of the earning powers may be gleaned from the following, which I quote from statistics recently published by the A. A. Ry. Co.: "There are now in the United States over 300 different roads, aggregating over 2,600 miles of track using the trolley system of electric power. These cars carried during the past year over 700,000,000 passengers without the loss of life or injury to person in any instance, so far as known, by electric current, which is about 500 volts and entirely within the safety line." Our Brooklyn readers will make no mistake on money put into this company's various collaterals. The avenue will soon assume its business of forty years ago.

The Jewell Belting Company, of Hartford, Conn., is meeting with unusual success for this season of the year. Its belts are made in a particular manner, which meets the requirements of a special department of engineering, and it is gaining very perceptibly the good will of buyers of electric light and railway companies' power stations. Among a few of the sales the company has made lately is the Jamestown (N. Y.) Electric Street Railway Co., Springfield Electric Light Co., a second order for a 48-inch double belt for the Toledo Street Railway Co., Cedar Rapids Electric Street Railway Co., Cedar Rapids, Iowa, and many others, making its orders run up to thousands of feet of belting.

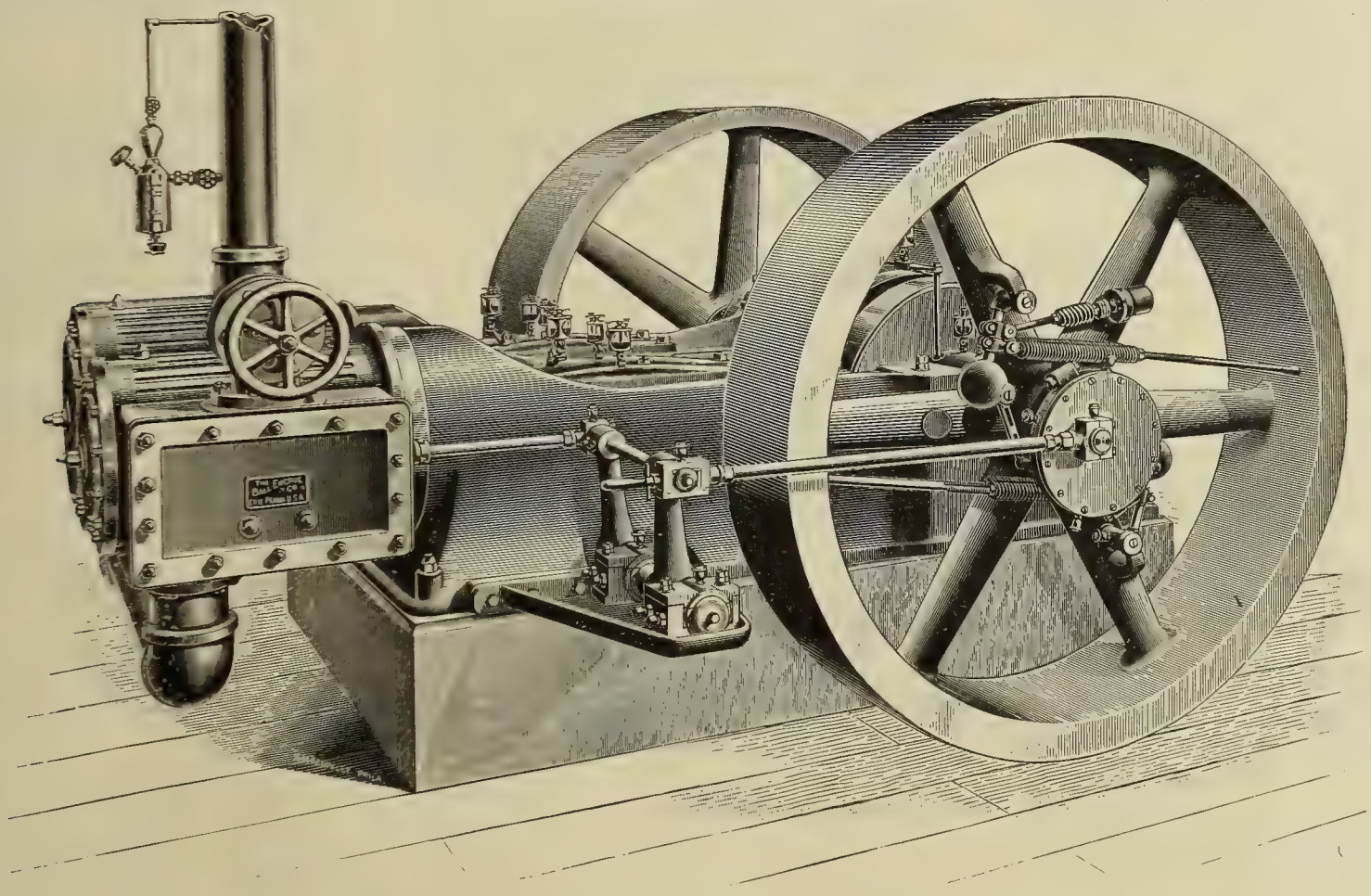
BUFFALO NOTES.

Work has been resumed on the extension of the Niagara street electric line down Main street to Seneca street, and it is expected the cars will soon be running to the latter street, which formerly was the terminus of the horse cars on this line.

The Fire Commissioners appear to have a little the worst of the argument in their controversy with the street car company over the necessity for protecting the insulated mains with guard wires, as the Council left that question open, while ordering guard wires placed over all trolley wires. Guard wires have been placed over the trolley wires on Forest avenue. The wires on this line are supported on side poles.

Ground was broken on August 4, for an electric street railway in South Tonawanda, N. Y. The contract for the construction of the road was awarded some time ago to Woodbridge & Turner of New York, who sublet the work. The girder rails to be used inside the corporation limits are to come from the Johnson Company, Johnstown, Pa., and a Buffalo firm will furnish the ties. The contract calls for the road to be in operation on December 1, next. The line is to extend to Buffalo.

When the average newspaper reporter undertakes to explain the operation of some electrical device he is quite likely to make public some unique information. One of the Buffalo dailies recently published a half column interview with an electrical engineer on the *modus operandi* of a trolley car, and managed to sandwich in what he thought might be of "timely interest" to many of its readers, the following very original account of how it worked. He said: "The electric current is conveyed through the trolley rod down the sides of the car and there is connected with two electric motors, one for motion forwards and the other for motion backwards. These motors consist of several electro-magnets, across which revolves a wheel bearing a number of coils of closely wound wire. As the current from the trolley passes through the shaft of this wheel another current flows from the coils of the wire to the electro-magnets causing the wheel to revolve in a direction opposite to that of the primary current."



BALL ENGINE IN POWER HOUSE, BUFFALO RAILWAY CO.

STREET RAILWAY QUOTATIONS.

The following are the latest prices for street railway securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Albany Street Railway Co. (N. Y.)	$750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Atlantic Ave. Ry. Bkln	1,000,000	100 00	102 00
Birmingham Ry & Elec.Co.,6's (Ala)	1,500,000		par
Brooklyn City R.R.	6,000,000	10 00	15 50
Brooklyn City R. R. 5's	6,000,000		*104
Benton Belfontaine (St. L.)	324,000	100 00	100 00
Benton Belfontaine 7's (St. L.)	50,000		*102
Broadway & 7th Ave. (N. Y.)	2,100,000	100 00	305 00
Bleecker St. & Fulton Ferry (N. Y.)	900,000	100 00	26 00
Broadway & Newburg (O)	1,000,000	100 00	110 00
Brooklyn St. R.R. (O)	310,000	100 00	125 00
City Elec. St. R.R. 6's (Ark)	200,000		par
Citizens (St. L.)	1,500,000	100 00	105 00
Cass Ave. Fair. (St. L.)	300,000	50 00	49 00
Chicago City (Ill.)	6,000,000	100 00	305 00
Chicago Passenger (Ill.)	1,000,000	100 00	96 00
Chicago Passenger (Ill.) 6's	400,000		*105
Central Park N. & E. R.	1,800,000	100 00	125 00
Cleveland Cable (O)	2,000,000	100 00	25 00
Cleveland Cable Pref. (O)	2,000,000	100 00	105 00
City R.R. (San Fran.)	800,000	100 00	100 00
California St. (San Fran)	1,000,000	100 00	169 00
Cincinnati, (O.)	5,775,000	50 00	109 00
Cincinnati, (O.) 7's	300,000		*102
Charleston City, (S. C.)	100,000	50 00	65 00
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Dry Dock, E. By. & Bat. (N.Y.)	1,200,000	100 00	138 00
Dry Dock, E. By. & Bat., 7's, (N.Y.	840,000		*106
Eighth Ave. (N.Y.)	1,600,000	100 00	250 00
East Cleveland, (Ill.)	2,000,000	50 00	85 00
Ferries & Cliff House, (Cal.)	2,500,000	100 00	42 00
Ferries & Cliff House, (Cal.) 6's	650,000		*108
Germantown, (Pa.)	1,500,000	50 00	95 00
Gloucester St. Ry. Co. (Mass)	60,000	100 00	95 00
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Lehigh Ave. (Phila.)	1,000,000	50 00	66 00
Louisville St. Ry. (Ky.)	5,000,000	100 00	20 00
Louisville St. Ry. Pref. (Ky.)	1,000,000	100 00	70 00
Montague St. Ry., B'klyn	150,000	100 00	100 00
Missouri, (Mo.)	2,500,000	100 00	250 00
Mound City, (Mo.)	1,000,000	100 00	200 00
Market St. (San Fran.) 6's	3,600,000		*123
Mount Auburn Cable, (O.)	300,000	100 00	50 00
Mount Adams & E. Park	1,400,000	50 00	107 00
Northern Central, (St. L.)	200,000	100 00	105 00
North Beach, (Cal.)	1,000,000	100 00	53 00
North Chicago City R.R.	500,000	100 00	
North Chicago Street R. R.	5,000,000	100 00	156 00
People's St. R. R. (St. L.)	1,000,000	50 00	75 00
People's St. R. R. (Pa.)	1,500,000	25 00	41 00
Pawtucket, (R. I.)	270,000	100 00	92 00
Phila. City	1,000,000	50 00	143 00
Ridge Ave. (Phila.)	750,000	50 00	215 00
Short El. Ry. Co. (Clev.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co.	16,000		†
St. Louis Ry. (Mo.)	1,000,000	50 00	75 00
St. Louis Cable, (Mo.)	1,000,000	100 00	15 00
St. Louis Cable, 5's	1,500,000		*101
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Vine St. Motor Co. (Colo.) 6's	100,000		par
West Chicago Street R. R.	10,000,000	100 00	119 00
West End St. Ry. (Boston)	2,000,000	50 00	64 00
West End St. Ry. (Boston) Pref.	6,400,000	50 00	81 50
Winston-Salem Elec. St. R.R. (N C.)	250,000	100 00	75 00

*Per cent. †Registered Stock.

As very few street railway securities are dealt in on the Stock Exchange, the above prices are mostly approximate, but will be found very near the mark.

Mr. C. E. Kline, erecting engineer of the C. and G. Cooper Co., Mt. Vernon, O., who recently installed the engine plant for the Brooklyn Heights cable road, has gone to Worcester, Mass., to erect the plant at that point for the Worcester, Leicester and Spencer electric road.

The Week's Record of Street Railway Notes

ALABAMA.

Birmingham.—The Birmingham Railway and Electric Company has ordered 24 motor and 24 trailer cars.

CALIFORNIA.

San Diego.—The sale of the property of the San Diego Street Car Company was postponed from July 31, to October 29, next.

San Francisco.—The last spike of the San Francisco and San Mateo electric road was driven July 29.

The Omnibus Cable Railway and the Market Street system are fighting over the possession of Stanyan street.

COLORADO.

Denver.—The Denver and Golden Electric Railway Company and the Denver, Apex and Western Street Railway Company are fighting over the right-of-way to Golden. Part of the line surveyed by the Denver, Apex and Western Company is claimed by the Denver and Golden Company, and the Apex Company was enjoined from occupying the ground. It is reported that both companies are employing men with Winchester rifles to protect their respective claims to the part of the road in dispute.

CONNECTICUT.

Hartford.—The Hartford and Wethersfield Horse Railroad Company is relaying part of its tracks with a hollow 4½ x 4¾ inch rail, having a concave surface on about one-half the width of the face.

DELAWARE.

Wilmington.—On August 1, the Wilmington City Passenger Railway Company made a new issue of tickets and a reduction of fare. The tickets are issued in book form, containing two tickets for each working day in the month at a cost of $1.75.

FLORIDA.

St. Augustine.—The Mayor vetoed the ordinance passed by the Council granting a franchise for a street railway.

GEORGIA.

Athens.—The Street Railway Company which had its machinery destroyed by lightning on July 15, again started into operation July 27.

ILLINOIS.

Chicago.—The West Chicago Street Railway Company is to erect a one story and basement brick power-house at 28 South Des Plaines street, to cost $50,000.

A new line of cross-town cars was put in operation on Chicago avenue, August 3.

INDIANA.

Columbus.—The Columbus and Orinoco Street Railway opened July 31.

Indianapolis.—The citizens of West Indianapolis are after a more rapid transportation system than mule cars.

Marion.—On July 31 a force of men in the employ of the Pan-Handle Railroad Company endeavored to remove a bridge being constructed by the Queen City Electric Street Railway Company over the Pan-Handle tracks, without any previous process of law. As the bridge was being erected by consent of the city authorities, the Mayor placed a large force of police on the ground, and notified the Pan-Handle officials that he would defend the bridge at all hazards.

IOWA.

Davenport.—The Tri Street Railway Company desires to sell its entire plant and system. The property is an amalgamation of the horse railways of Davenport, Moline and Rock Island, but the road at present uses the Thomson-Houston system of electricity.

Dubuque.—The Key City Motor Company has petitioned the Council to rescind its resolution ordering the railroad to extend its lines, as it is in the hands of a receiver.

Fulton.—Construction work has been begun on the new electric street railway.

Sioux City.—President Beavey, who expects the street car track on Fourth street to be relaid by August 1, says that it will have cost $50,000 by the time it is completed.

MASSACHUSETTS.

Beverley.—On July 30 the selectmen refused to grant the request of the Beverley and Danvers Storage Battery Company for permission to run its cars over the Naumkeag street railway tracks on Rantoul and Cabot streets.

The Naumkeag road is being petitioned to extend its trolley system to this place.

Danvers.—The citizens are complaining because the Beverley and Danvers street railway runs its cars spasmodically.

Leicester.—The electric street railway has been completed.

North Adams.—The Hoosac Valley Street Railway Company is compelling its conductors and motor men to wear uniforms.

Peabody.—The Naumkeag electric road made its first trip to Danvers August 3.

Springfield.—The citizens are greatly exasperated over the fact that they are compelled to pay two fares on the same routes where they formerly paid but one.

The new electric street railway has practically destroyed the use of the telephones between this place and Chicopee, but the telephone company expects to remedy the fault soon.

MAINE.

Portland.—The Stroudwater extension of the street railroad was opened August 4.

MICHIGAN.

Detroit.—It is said that during a successful test of the Healy motor, the past week. a speed of 18 miles an hour was obtained.

Jackson.—The electric street railway line is being constructed as rapidly as possible.

MINNESOTA.

Minneapolis.—The St. Anthony Park, Fair Grounds and Hamline electric line was opened to travel August 2.

MISSOURI.

Kansas City.—The Grand Avenue Street Railway Company reduced salaries, from the President down, August 1.

NEW HAMPSHIRE.

Concord.—The Board of Directors of the Concord Street Railway Company, has appointed Supt. George W. Pierce building agent of the road, and given instruction to construct the West End road as soon as permission was obtained from the city.

NEW YORK.

Brooklyn.—President Lewis of the new Montague street car line, says the traffic more than covers the expenses.

Rochester.—The Rochester Street Railway Company received a new generator July 31.

Schenectady.—The Street Railway Company has ordered road crossing frogs to the amount of $2,100 of the Johnson Company, Johnstown, Pa.

OHIO.

Cleveland.—An ordinance has been presented to the Council providing that the street railway companies pay $10 license on each car.

Steubenville.—The Street Railway Company is being reorganized.

Toledo.—It is stated that the Toledo Consolidated Street Railway Company will pay fully $23,000 in taxes to the county and city this year.

PENNSYLVANIA.

Bethlehem.—The Bethlehem and Allenton street railway is nearly completed.

Du Bois.—The electric street railway will be in operation soon.

Harrisburg.—The first electric car over Second street was run July 30.

Johnstown.—The street passenger railway made its trial trip on the Morrillville line July 31.

McKeesport.—The McKeesport Passenger Railway Company has contracted for its electric equipment and machinery, and expects to have its electric cars in service by October 1.

TENNESSEE.

Memphis.—The Citizens' Street Railway Company has just received four new cars. Sixty have been ordered for the entire system.

TEXAS.

Corsicana.—W. J. McKie, President of the Corsicana Street Railway Company, has purchased the entire property of the company for $18,000.

Possible Purchases.

Ann Arbor, Mich.—The Ann Arbor Street Railway Company is in the market for a new engine.

Beaver Falls, Pa.—The Beaver Valley Traction Company is negotiating for the purchase of the street railway.

Berkley, Va.—The Berkley Street Railway Company needs one car.

Brockton, Mass.—The Brockton Street Railway Company is contemplating making additions to its present rolling stock.

Centralia, Ill.—The Centralia and Central City Railway Company contemplates increasing its general equipment.

Charleston, S. C.—The Enterprise Railway Company desires to purchase some more cars.

Chicago, Ill.—The Chicago City Railway Company will increase its equipment to the extent of 50 cars.

Cincinnati, O.—The Pendleton, Mount Lookout and East Walnut Hill Railway Company will require two electric motor cars this fall.

Cleveland, O.—The Cleveland City Cable Railway Company will soon be in the market for grip cars to be delivered in 1892.

Detroit, Mich.—The Fort Wayne and Elmwood Railway Company will buy four cars.

Elmira, N. Y.—The Elmira and Horseheads Company will buy six more motor cars.

Fort Scott, Kan.—The Fort Scott Rapid Transit Railway Company requires additional equipment.

Galveston, Tex.—The Galveston City Railway Company expects to buy 15 motor cars soon.

Griffin, Ga.—The Griffin Street Railway Company desires more cars and stock.

Keokuk, Iowa.—The Keokuk Electric Street Railway and Power Company will buy additional equipment.

Madison, Wis.—The Madison Street Railway Company will buy five cars.

Peoria, Ill.—The Central Railway Company intends to buy three 100,000-watt generators, one 350-horse power engine and two 30 feet double truck cars, each equipped with two 20-horse power Edison motors.

Portland, Ore.—The Multonomah Street Railway Company needs ten motor cars.

Provo, Utah.—The Provo City Railway Company desires more trailer cars.

Rochester, N. Y.—The Rochester Electric Railway Company intends to buy more cars and additional power.

Rockford, Ill.—The West End Street Railway Company will soon need more motor cars and another electric generator.

Sault Ste Marie, Mich.—The Sault Ste Marie Street Railway Company will buy a full equipment for a 3½-mile extension.

Springfield, Ill.—The Peoples' Electric Railway Company will soon require ten additional motor cars.

Toledo, O.—The Toledo Consolidated Street Railway Company will soon require ten more cars.

Trenton, N. J.—The Trenton Horse Railway Company desires to purchase fifteen electric motor cars.

Webb's City, Mo.—The Twin City Railway Company needs another horse car.

West Superior, Wis.—The Douglas County Street Railway Company will soon require ten new cars.

Change of Power.

Tacoma, Wash.—The Point Defiance Street Railway Company will change its motive power to electricity.

Ashland, Wis.—The Ashland Street Railway Company intends equipping its entire line with electricity.

Beaver Falls, Pa.—The street railway here is to change its motive power to electricity.

Cincinnati, O.—The Pendleton, Mt. Lookout and East Walnut Hill Railway Company is to use electricity as the motive power for its road.

Fort Smith, Ark.—The Fort Smith Railway Company intends changing from animal to electric power.

Galveston, Tex.—The Galveston City Railway Company is converting the power of all its lines into electricity.

Manchester, Va.—Mayo's bridge line is to adopt electricity as its motive power.

New Brunswick, N. J.—The City Railway Company is negotiating with W. D. Higgins of the Short Electric Railway Company for the introduction of the Short gearless motor on its lines.

Portland, Ore.—The Portland and Vancouver Railway Company contemplate changing to the storage battery system.

St. Louis, Mo.—The cable division of the St. Louis and Suburban Street Railway, is to use the overhead trolley system of electricity.

Foreign Notes.

Halifax, N. S.—The railway company is expecting six new closed cars from New York. Supt. Adams has gone to Canada after more horses.

Paris, France.—It is said that a subterranean electric tubular tramway is to be constructed from the Bois de Boulogne to the Bois de Vincennes, passing under the Boulevard Diderot the Rue de Rivoli, Place de la Concorde and the Avenue des Champs Elysees.

Toronto, Ont.—It is reported that E. A. McDonald accepted $4,500 from Noel Marshall, to stop injunction proceedings in the Kiely-Everett street railway franchise, and Noel Marshall now claims that McDonald tried to secure $15,000 more by threatening to publish a print of the photograph of the check received.

New Roads.

Altoona, Pa.—Millsville and Altoona are to be connected by two electric street railways.

Augusta, Me.—It is said that Col. E. C. Farrington and Charles C. Hunt, are trying to organize a stock company to build an electric road to Hammond's Grove.

Bryan, O.—The citizens here want an electric street railway.

Chicago, Ill.—A subterranean electric railway is to be built from the river end of Cass street to 83d street under Wabash avenue. The tunnel is to be wide enough for four tracks.

Deadwood, So. Dak.—The citizens are talking of an electric street railway to Spearfish.

New York, N. Y.—Property owners along Sixth avenue have petitioned the Mayor to grant a franchise for a cable road along that thoroughfare.

Stockton, Cal.—J. H. Henry, the street railway magnates of San Jose and Sacramento, is thinking of constructing an electric road here.

St. Augustine, Fla.—A movement is on foot for a street railway here.

Vincennes, Ind.—Vincennes is to have an electric street railway.

Waterville, Me.—It is said that contracts are now being made out for an electric street railway between Waterville and North Vassalboro.

Incorporations.

Chicago, Ill.—The Wabash Avenue Subway Transportation Company has been incorporated with a capital stock of $10,000,000, to construct an electric road under Wabash avenue from the river to 83d street. Incorporators: George W. Cole, Silas Rhodes, J. W. Pease, Maria Beasley and Pleasant Amick.

The Northwestern Street Railway Company was incorporated August 1, with a capital stock of $25,000, to construct street railways in the city of Chicago and a number of suburban towns. Incorporators: Eugene B. Weeks, Alfred Ellsworth and John A. Pierson.

Elmira, N. Y.—The East Side Railway Company was incorporated, July 29, with a capital of $50,000. The road will cover about five miles of streets in this city.

The West Side Railway Company was incorporated July 29, with a capital stock of $100,000, to construct ten miles of tracks in this city.

Indianapolis, Ind.—The Anderson Belt Railway Company has been incorporated with a capital stock of $30,000, to run a belt line in and about the city. Incorporators: C. P. Garvey, William L. Finch, J. L. Fortner, J. C. Morgan, J. L. Kilgore, L. M. Cox and W. T. Durbin.

Steubenville, O.—The Stubenville Railway and Electric Company was incorporated in West Virginia August 3, with a capital stock of $100,000, to operate an electric street railway in this city and supply light and heat. Incorporators: E. B. Gathrop, C. C. Hughes, Pittsburg, Pa. and Donald B. Toucey, of New York City.

Election of Officers.

Detroit, Mich.—At a meeting of the directors of the Detroit City Railway Company, July 30, G. M. Hendrie, W. A. Hendrie and C. Currie resigned from the board, and Thos. M. Waller, W. W. Book and Willard B. Ferguson were elected to take their places.

Flushing, L. I.—At the annual meeting of the stockholders of the Flushing and College Point Electric Street Railroad, July 26, the following Board of Directors was elected for the ensuing year: Joseph Dykes, Samuel McCreary, Henry Clement, George Pople, Joseph K. Murray, John Hepburn, E. P. Stratton and David Master. At a subsequent meeting of the Board the following officers were elected: Joseph Dykes, president, E. P. Stratton, vice-president, David Master, secretary and John Hepburn, treasurer; Executive Committee: Messrs. Stratton, Hepburn, and Pople; Finance Committee: Messrs. McCreary, Murray and Clement.

Framingham, Mass.—Mr. Thomas T. Robinson has been elected treasurer of the Framingham and Ashland Street Railway Company.

Increase of Capital.

Joliet, Ill.—It is said that the Joliet Street Railway Company is to increase its capital stock to $250,000.

Peoria, Ill.—The Ft. Clark Horse Railway Company has increased its capital stock to $500,000.

Legal.

Brooklyn, N. Y.—Judge Cullen, of the Supreme Court, has decided that the Brooklyn Railroad Company will have to run its horse cars to the Greenwood Depot of the Prospect Park and Coney Island Railroad. The Brooklyn Railroad Company contracted with Culver's line to run its cars over the Prospect Park and Coney Island Railroad (Culvers) on Ninth avenue and from 15th street to Greenwood Cemetery, to connect with Culver's steam road to Coney Island. When the road from the Park to Coney Island adopted electricity, the Brooklyn railroad company stopped carrying passengers to Culver's road, claiming that the contract gave either road the power to terminate it on six months notice if that part of the road used steam. In summing up Judge Cullen said, that although electricity is generated by steam, it could not be said that steam power is used to run the cars.

Emporia, Kan.—Judge Graves has refused to appoint a receiver for the Emporia Street Railway.

New York, N. Y.—It is said that the Corporation Counsel is to sue a number of street railway companies for the expense of repairing streets which they had opened up for construction purposes and failed to repair.

Pittsburg, Pa.—The Pittsburgh Traction Company is being sued by Daniel S. Beck for $2,000 damages, for injuries received in a collision July 1.

A suit entered in 1889 by B. F. Rafferty and others, against the Central Traction Company for damages caused by the depreciation in the value of the plaintiffs' property caused by the construction of the company's street railway, has been decided in the plaintiffs' favor by Judge Ewing.

Pueblo, Col.—The Pueblo City Railway Company through the courts prevented the Mayor from signing an ordinance giving the new street railway company right-of-ways on certain streets here, the Judge declaring the franchises null and void. The new street railway company has filed an appeal bond before the Supreme Court, intending to contest the decision of the District Court.

Sioux City, Ia.—The Kings Bridge Company of Canton, O., and the Northern Car Company of Robbinsdale, Minn., have filed mechanics liens against the property of the Sioux City Rapid Transit Company; the first for work done on the stations, the latter for rolling stock furnished.

Washington, Pa.—The Citizens' Traction Company is being sued for $5,000 for damages caused to a lady on December 5, 1890, by being dragged by a car on which she attempted to step.

Financial.

Baltimore, Md.—The Baltimore Traction Company paid $11,483.34 park taxes for the quarter ending June 30. The company's gross receipts for June were $59,000.

Carthage, Mo.—The property and franchises of the Carthage Street Railway Company have been purchased by J. Guinney, of Pierce City. Mr. Guinney, who is an experienced electrician, will replace the mules with electric power.

Casualties

Buffalo, N. Y.—On July 21, a motor car on the Niagara street line ran into a carriage containing two men, throwing them out and seriously injuring them.

Dubuque, Iowa,—On July 26 a man thrown from a car while rounding a curve, was struck by the car and instantly killed.

Marion, Ind.—On July 30 a horse attached to a cart, becoming frightened at a passing electric car, plunged around until it threw a boy, an occupant of the cart, almost under the wheels of the motor car, seriously injuring him.

New York, N. Y.—A few days ago an engineer on the Sixth avenue elevated, got off his engine at 155th street and Eighth avenue to walk along the track to the dispatchers office; he had gone but a few steps when the engine backed down upon him and badly injured him.

Pittsburg, Pa.—On August 3 a car on the Pittsburg and Birmingham traction line, ran into a cart, throwing out and severely injuring its occupant. On the same date another car on the same line ran into a horse car of the Short line, at Carson and Tenth streets, throwing it almost to the pavement and tearing away an entire side.

Salem, Mass.—While a motorneer was standing in front of his car on July 26, some one turned the power on the car, running him down and severely hurting him.

Track Extensions.

Ashland, Wis.—The Ashland Street Railway Company will extend its line 2½ miles.

Beaver Falls, Pa.—It is expected the street railway will be extended about four miles in the near future.

Berkley, Va.—The Berkley Street Railway Company will extend its tracks half a mile, shortly.

Birmingham, Ala.—The tracks of the Birmingham Railway and Electric Company are to be extended 15 miles.

Bristol, Tenn.—A four mile extension is to be made to the tracks of the Bristol Belt Line Railway Company.

Centralia, Ill.—The Centralia and Central City Railway Company is to extend its tracks 1½ miles.

Charleston, S. C.—The Enterprise Railway Company will construct a two-mile extension to its track.

Chicago, Ill.—The Chicago City Railway Company will build an additional three-quarters of a mile of cable road.

Cincinnati, O.—The Pendleton, Mount Lookout and East Walnut Hill Railway Company will extend its track two miles this fall.

The Mount Auburn Cable road contemplates a four mile extension.

Cleveland, O.—The Cleveland City Cable Railway Company will extend its track twelve miles.

The Valley Railway Company has been granted permission to lay a switch track to the river.

Dayton, O.—The Oakwood Street Railway Company will make an extension of one mile.

Denver, Col.—The Tramway Company contemplates extending its system to Valverde and Manchester.

Elmira, N. Y.—The Elmira and Horseheads Railway Company will extend its electric track some 3½ miles.

Fort Smith, Ark.—The Fort Smith Railway Company will make an extension of two miles to its line.

Fort Scott, Kan.—The Fort Scott Rapid Transit Railway Company will make an extension of five miles to its track.

Great Falls, Mont.—The Electric Street Railway Company will build an extension of nearly three-quarters of a mile.

Griffin, Ga.—The Griffin Street Railway Company will make an addition of one mile to its tracks.

Keokuk, Iowa.—The Keokuk Electric Street Railway and Power Company will make an extension of two miles to its track.

Lansing, Mich.—The Lansing City Railway Company will extend its track 2½ miles.

Madison, Wis.—The Madison City Railway Company contemplate an extension of 3½ miles.

Nashville, Tenn.—The United Electric Railway Company will make an extension to its track of about two miles.

Franchises.

Anderson, Ind,—The Council has given a thirty year franchise to the Electric Street Railway Company.

Denver, Col.—The Metropolitan Railway Company has been granted a franchise to construct an electric railway. The company is required to construct 12 miles of road before the close of the present year.

The Denver Electric Railway Company has been granted a franchise to operate in North Denver.

Erie, Pa.—The Council has granted the Erie Transit Company permission to use certain streets for street railway purposes.

Matteawan, N. Y.—The Board of Trustee has granted a franchise for an electric street railway to Fishkill Landing.

Mineral Ridge, O.—The County Commissioners have been asked to grant a franchise to the Mineral Ridge and Niles Electric Street Railway Company.

Salem, Mass.—The Naumkeag Street Railway Company has been granted permission to construct the overhead electric trolley system on a number of streets in this city, the work to be completed by January 1, 1892.

Spokane Falls, Wash.—The City Council has been asked to pass an ordinance granting permission to the Ross Park Street Railway Company, to construct a street railway on certain streets here.

Springfield, O.—The County Commissioners have granted to J. A. Blount, representing an Eastern company, the right-of-way to build an electric street railway from Springfield to the Masonic Home grounds.

Syracuse, N. Y.—The Consolidated Company and the Depot Belt Line, have petitioned for franchises covering nearly the same territory.

Youngstown, O.—The city has been asked for another street railway franchise.

Personal.

The report of the Stillwater and Mechanicsville Street Railway Company, Schuylerville, N. Y., for the quarter ending June 30, is as follows: gross earnings $1,609.50, operexpenses $1,078.17, fixed charges $277.88, net income $253.45; for the corresponding quarter of last year the gross were $1,551.70, net income $68.03.

Mr. J. Lawless who was for several years superintendent of the Metropolitan Railway, of Kansas City, Mo., and who is one of the best known cable engineers of the country, has accepted the position of manager of the Paterson Railway Co., of Paterson, N. J., which will shortly change its horse system to that of electricity. Having had a personal acquaintance with Mr. Lawless for many years we feel no hesitancy in congratulating the Paterson Railway Company in having secured the services of so competent a manager.

Mr. F. R. Chinnock, State Agent for the Edison General Electric Co., was in Cortland, N. Y., during the past week.

During the past week we received a very pleasant, though brief, call from Mr. W. R. Mason, General Manager of the Electric Merchandise Company, of Chicago. Mr. Mason was on his way to Richmond, Va., on business connected with the Burton Electric Heater, in which he is considera bly interested.

Mr. Frank X. Cicott who was recently in Europe in the interest of the Electric Merchandise Company, and the Tramway Rail Company gave us a call during the past week. While abroad he organized a company to publish a street railway paper in London, which will be known as the *Tramway and Railway World*, with the headquarters at 16 St. Helen's Place, Bishopsgate, E. C.

Dr. F. A. C. Perrine, Chief Electrician of John A. Roebling's sons Company, of Trenton, N. J., was in New York last week. (We understand that he did not go to the clambake.)

During the past week we had the pleasure of receiving a call from Mr. H. R. Hammeken, general manager of the Electric Engineering and Supply Company of Syracuse. The splendid success he met with while in New York convinced him that New York was not a bad place to be in after all and had himself put up for non-resident membership in the Electric Club in order to make his calling and election sure.

BUSINESS NOTE.

The following is self-explanatory.

Office of H. Gore & Co.,
Pavers and Street Railway Builders.

54 Kilby Street, Boston, July 2, 1891.

Durnham & Duggan Railway Appliance Co, B, ostonMass.

Gentlemen: In reply to yours of the 30th, will say that we find the Duggan Street Railway Chair (several thousand of which we have laid) to be all that is claimed for it and in the construction of track, it is more quickly and securely applied than any we know of.

The surface and alignment of the track laid with these chairs are perfect and the fact that no bolts or nuts are used, that the chair has a large surface bearing upon the ties and that the rails may be removed from the track without disturbing the chairs or ties are valuable features which all street railway people will appreciate.

We recommend the "Duggan Chair" as a cheap, strong and reliable chair and remain,

Yours truly,

(Signed) H. Gore & Co.

DELAWARE & HUDSON COMPANY.

For the information of those who have never visited the Canadian metropolis, but who are intending to go to the Montreal meeting, it may be stated that the shortest and most interesting line between Montreal and New York is the Delaware & Hudson Railroad. Parties from the West can go to Schenectady or to Albany, connecting at either point with the "D. & H." road, and see something of Saratoga, Lake George, Lake Champlain and the marvelous scenery of the Adirondack Mountains. The "D. & H." stands at the head in the number and importance of the summer resorts along its line, and in the number of summer tourists carried in its trains.

Arrangements should be made to include a stop at the Hotel Champlain on the west shore of Lake Champlain, three miles south of Plattsburgh, which, architecturally and in beauty of location of surroundings, is perhaps the finest affair of its kind in the world

Mr. J. W. Burdick, general passenger agent of the Delaware & Hudson Railroad, Albany, N. Y., will be glad to send by mail an illustraten guide of the line, upon receipt of six cents in stamps, to cover postage.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued August 4, 1891.

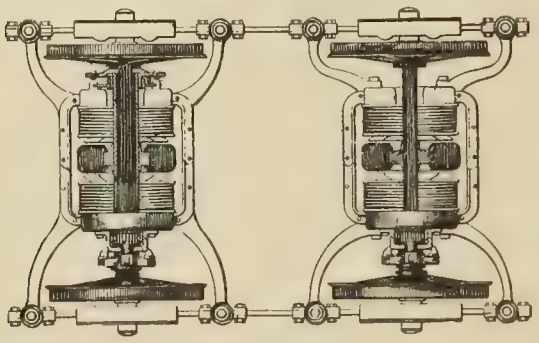
456,970. Car Propelled by Electricity. Sydney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Dec. 15, 1890.

A propelling motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with the axle, and field-magnets mounted on side bars connecting the pedestals and journal-boxes of the car and upheld by the journal-boxes independently of the car-body and the main car-springs.

456,979. System for Conducting Electric Currents. Edward Britt, Davenport, Iowa, assignor of one-half to Oswald Hill, same place. Filed Oct. 11, 1889.

Metal insulated adjustable bolts supported by a chair with wire connecting each of them with the main conductor, vertical standards with adjustable collars supported upon each chair and coiled springs attached to, and a threaded screw passing through each sectional conductor.

457,015. Trolley for Electric Railways. Sydney H. Short, Cleveland Ohio, assignor to the Short



456,970—CAR PROPELLED BY ELECTRICITY.

Electric Railway Company, same place. Filed March 29, 1890.

A spring actuated lever carrying rollers or brushes into contact with an overhead line conductor, with a dash-pot connected with the lever for checking and limiting the upward movement of the latter.

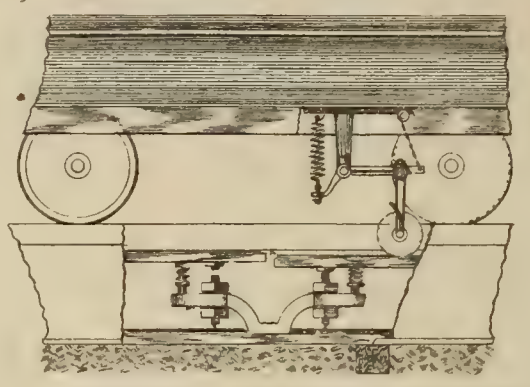
447,016. Electric Car-Brake. Edmond Verstraete, St. Louis, Mo., assignor of one-half to Peter M. Kling, same place. Filed July 26, 1890.

An armature adapted to be brought into frictional contact, one part being fixed to rotate with the axle and the other being held against rotation by means of an arm secured to it, and a rod secured to the car-body and provided with a perforation through which the arm freely passes.

457,036. Electric Motor for Street-Cars. Elihu Thomson, Swampscott, and Edwin W. Rice, Jr., Lynn, Mass. Filed Jan 19, 1891.

An electric motor for railway-cars, comprising a field-magnet frame having journal-bearings for the axle, extensions for the armature-bearings, and interiorly-projecting poles arranged in pairs above and below the armature, field-coils surrounding the respective pairs of poles, and an armature filling the space inclosed by the poles and field-coils, and geared to the axles through a single reduction-gearing comprising a pinion on the armature shaft and a gear-wheel on the axle.

457,045. Apparatus for Oiling Railway Tracks. Thos. L. Ennis, El Paso Tex. Filed April 12, 1889.



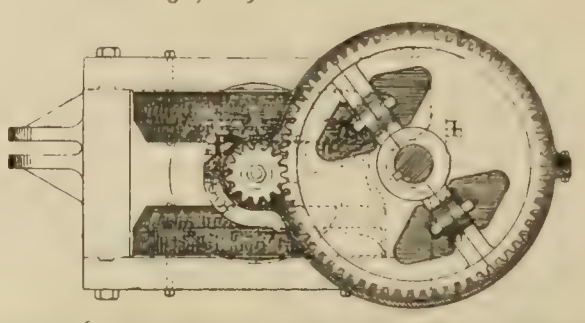
456,979—SYSTEM FOR CONDUCTING ELECTRIC CURRENTS.

An oil-tank arranged on the car, with a telescopic tube depending from it, and having a valve arranged within the tube controlled by a lever adapted to be manipulated by the driver of the car.

457,067. Electric Car-Brake. Craig R. Arnold, Sharon Hill Pa. Filed Aug. 21, 1890.

A brake-magnet having brake-shoes constituting the opposite poles of the magnet and bearing, respectively, upon two car-wheels, which with the section of rail between them form a closed magnetic circuit from one pole to the other of the magnet.

457,102. Electric Railway Motor. Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 30, 1891.



457,036—ELECTRIC MOTOR FOR STREET CARS.

An electric railway motor having a field-magnet frame or shell inclosing the armature on all sides, and having projecting inwardly an upper pole surrounded by a field-coil and a lower unwound pole.

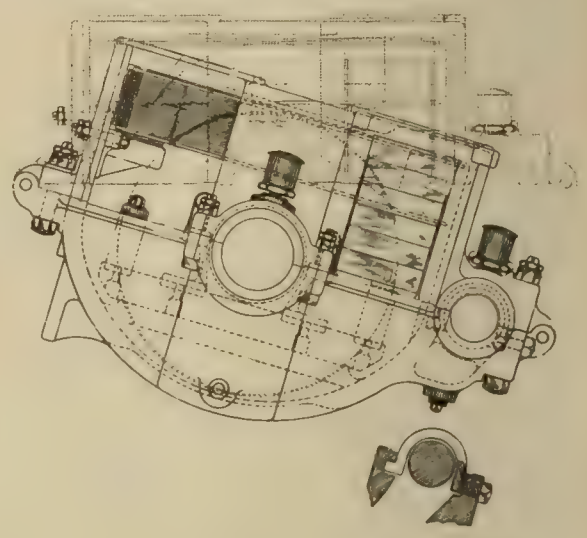
457,106. Electric Conductor. Eben M. Boynton, West Newbury, Mass., assignor to the Boynton Bicycle Railway Company. Filed Dec. 15, 1890.

As a means for guiding a bicycle-car and conveying the electric current to the motor, a compound overhead beam consisting of two rails, one of which carries the outgoing, and the other the returning current, the beams being insulated one from another and from their supports.

457,240. Electric Railway. Samuel E. Wheatley and John W. Schlosser, Washington, D. C., assignors to the Wheless Electric Railway Company, same place. Filed April 2, 1891.

A continuous main-line conductor or lead from the generator, in combination with a series of working conductors arranged end to end having a switch for each to connect it temporarily with the main line, a mechanism actuated by an advancing car to close the switch, and an electro-magnet in the working circuit to hold the switch in a closed condition until the circuit is opened at another point.

457,324. Rotary Track-Cleaner. Nelson Newman, Springfield, Ill., assignor of two-thirds to Geo. A. Sanders, and Samuel J. Willett, both of same place. Filed Jan. 27, 1891.



457,102—ELECTRIC RAILWAY MOTOR.

A brush shaft carrying a brush with a lifting-bar pivoted to move vertically in relation to the axle and a counter-shaft carried by the lifting-bar and having a pinion adapted to mesh with a pinion on the axle, and a sprocket chain passing around sprocket-wheels on the counter-shaft and the brush-shaft.

457,325. Sanding Device for Street-Cars. Nelson Newman, Springfield, Ill., assignor of two-thirds to George A. Sanders and Samuel J. Willett, both of same place. Filed April 6, 1891.

A sand box or receptacle adapted to be carried by a car-body provided with a fixed nozzle and having a vertical guide-tube arranged within the box or receptacle in line with the nozzle or outlet. A conical valve within the guide-tube closes or opens the outlet from the box.

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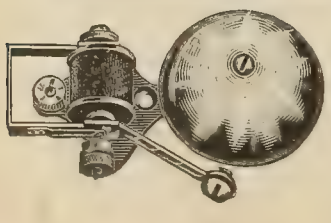
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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

WEEKLY.

Vol. IX. NEW YORK, AUGUST 22, 1891. No. 34.

DIRECT ELECTRIC ELEVATOR.

The accompanying cut represents a new direct electric elevator recently placed on the market, which combines some radically new and novel features in this style of machine. Unlike all others, the armature runs continuously at full speed, during the hours of work, which has the three-fold advantage of getting the entire efficiency of the motor to start the load, the economy in the current consumed and the avoidance of all annoyance and expense entailed by burning the armature, blowing out fuses, and injuring expensive rheostats and switch boxes.

The reversible motion is converted from the motor to the screw-shaft by means of frictional gearing which is noiseless and effective in its operation, enabling the operator in the car to have such perfect control over the machine, that the car can be moved to such a nicety as to be started and stopped within a fractional part of an inch, a feature not possessed by other machines of this type.

The worm is cut from steel of selected stock. The worm wheel is extra heavy and cast of nickel bronze making it very tough and durable. With a view of reducing the friction to a minimum, a ball thrust collar is used. The drum is of large size turned and grooved to fit the wire cables. There is a stop motion on the machine which enables the car to be run at full speed and be stopped automatically at the extreme travel of the run.

The slack cable stop, in the event of the car meeting any obstruction in its descent, engages a clutch at the end of the drum shaft, stopping the machine instantly, and locking it so that the car can make no further descent.

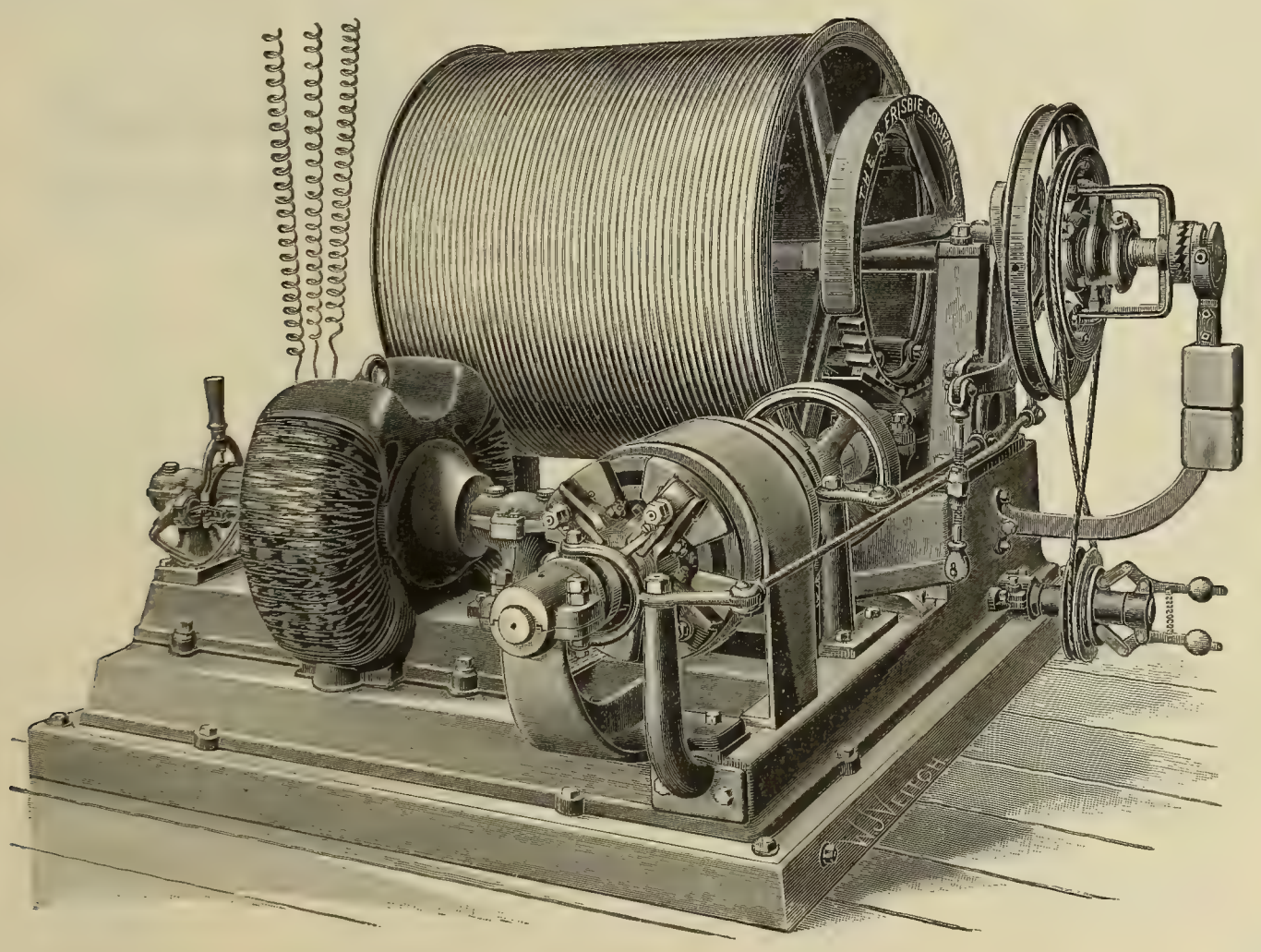
In the event of the current becoming impaired for any reason while the car is descending with a heavy load, the speed governor on the machine operating by reason of the centrifugal force, throws out a friction clutch and puts on a powerful brake which stops the machine instantly. Floor space is frequently quite an item and this machine has the advantage of being very compact.

The motor is one of the well-known "C. & C" Electric Motor Company's make, and is fitted with that company's new self-oiling bearings and carbon brushes. This motor is too well and favorably known to require any extended description at our hands.

These machines can be run at a high rate of speed and yet the car can be started and stopped very smoothly.

They are made by the D. Frisbie Company, of New Haven, Conn., and 112 Liberty street, New York City, and where erected they are giving entire satisfaction. This concern erects power elevators of all kinds, and has shipped them to all parts of the country, and this, its latest production, will no doubt receive the same favorable reception and deserve the same good name which their other machines have always had. For catalogues and further information, application should be made to either of the above places.

Letters patent have been applied for by the inventor.



ELEVATOR OPERATED BY ELECTRIC POWER.

ELECTRO-DEPOSITION OF METALS.

Gold may be deposited from its solution of the double cyanide of gold and potassium in good condition under the influence of a very feeble current, such as that obtained from an earth battery composed of buried coke opposed to buried scrap iron. This is mentioned to show how easily the metal may be deposited. A properly constructed battery should always be used to ensure proper control of the current, which may, however, have an electro-motive force of only half a volt. Copper is also a metal easily deposited from its solution of copper sulphate. This solution will deposit copper on zinc, iron, and steel, by simply immersing these metals in the solution, but the copper so deposited can be easily rubbed off again, as it is only a mere film obtained by chemical ac-

tion on the surface of the immersed metal. The electro-motive force needed to decompose a solution of copper sulphate may be as low as half a volt, and need not in most cases exceed one volt. Higher tensions than these are used to overcome resistances met with in actual practice, and to effect rapid decompositions of the metal. To deposit copper from its alkaline solutions, a current of higher tension is needed, ranging from five to ten volts, according to the resistance of the work in the circuit. Silver requires a current of higher tension to deposit it from its solution of the double cyanide of silver and potassium, than that employed to deposit gold from the corresponding solution. A tension of from one and one-half to two volts is necessary, and this may have to be increased if the solution is not rich in metal, the electrodes are far apart, or other resistance interposed in the circuit.

Although such metals as gold, copper, and silver may be easily deposited in good condition from suitable solutions when employing an electric current of low tension, this only touches the fringe of comparatively easy deposition or otherwise, and the rapidity of the process under suitable conditions. The condition of the deposited metal is greatly affected by the tenuity or the density of the solution, and the density of the current, as well as the electro-motive force or tension. Some metallic salts need a higher tension current to decompose them than others, but the main consideration must be directed to current density rather than current tension, since the quantity of metal deposited from a solution in a good condition in a given time, will greatly depend upon the number of amperes of current we can get through the solution. The salts of nickel, zinc, tin, and iron, appear to need a current of higher density to decompose them than those of gold, silver, and copper.

WATCHMAN'S ELECTRICAL DETECTORS.

There seems to be a prevailing impression that so-called watchmen's clocks are not altogether infallible in their records, and they may be tampered with in order that they will show an accurate record, whether the watchman does his duty or not. There may be some justification for this impression, as some watchmen's clocks do possess this inherent weakness.

Some night watchmen are faithful to their duty and many are not. If the clock can be manipulated to show a clear and regular record, those of the latter class are liable to take advantage of the fact and sleep on duty or absent themselves from their post, thus jeopardizing the safety of property and possibly human life.

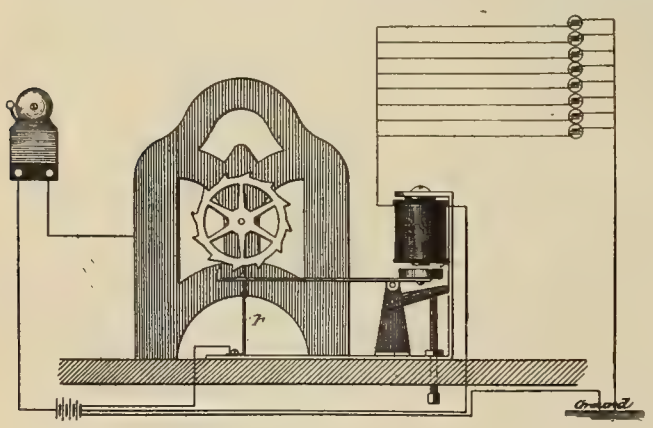


FIG. 2.

All improvements in watchmen's clocks naturally are in the line of overcoming the possibility of tampering, and, as usual, electricity is depended on to aid in the solution of the problem.

Mr. Harvey S. Park, of Chicago, Ill., recently patented a clock of this character which possesses some very valuable features.

To overcome the objection to ordinary time detectors, which are subject to manipulation in various ways, Mr. Park so arranges his electric currents that each station or signalling apparatus is out of the circuit at all times, excepting for a brief period of time within which it is the duty of the watchman to signal his presence at such station, and if he fails to do so an alarm will be sounded at any desired place. Hence, as long as the alarm remains quiet it is understood that the watchman is performing his duty, and only in his failure to do so will the alarm be sounded.

In Fig. 1, which is a vertical section of the

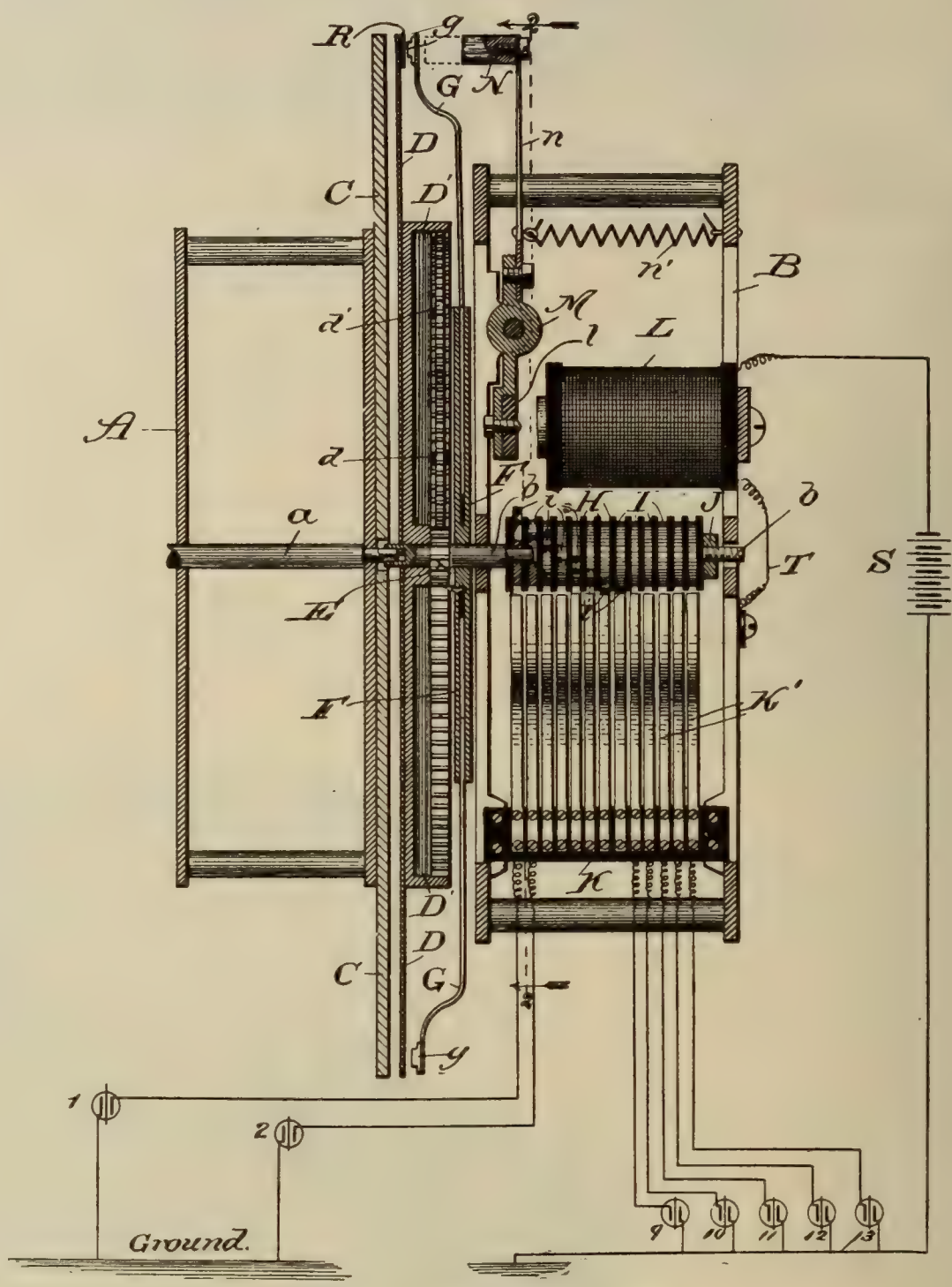


FIG. 1—WATCHMAN'S DETECTOR.

apparatus complete, A is a frame or case containing ordinary clock-works, *a*, the arbor or shaft that carries the minute-hand of the clock. Mr. Park uses the works of a clock without either its dial or hands.

B is the frame or case of the electrical part of the apparatus; *b*, a shaft or arbor supported in such case, engaging with and rotated by the arbor *a*; C, a door or gate to which the frame A is attached, and which closes the box in which the electrical devices are kept; D, a paper dial, on which are printed the twelve hours in the same order as they appear upon an ordinary clock-dial; D′, a disc or wheel loosely mounted upon the arbor *b*; E, a cog-wheel rigidly mounted upon the same arbor; *d d′*, idler-wheels mounted upon the rearward side of the wheel D; F, a slotted disc firmly fixed to arbor B and rotating with the same; G, arms secured in the disc F, in which they may be adjusted in various positions; *g g*, type attached to the front side of these arms; H H, washers or collars mounted upon the arbor *b*; I, contact-plates mounted upon the arbor *b*, alternating with the washers H; *i*, contact-points on such plates; J, a nut for adjusting the tension of the plates and washers; K, a bar of hard rubber or other suitable insulating material; K′, a number of spring-arms attached to the bar K; L, one of a pair of electro-magnets; *l*, an armature; M, a rock-shaft, to one end of which such armature is attached; N, a hammer; *n*, the handle thereof attached to the other end of the rock-shaft; *n′*, a spring for withdrawing the hammer; O O, the sides of the case or cabinet in which the device is contained; *o o*, brackets attached to such sides; PP′, spools mounted upon such brackets; R, an inked ribbon passing from one spool to the other; S, an electric battery to actuate the magnets, and 1, 2, 9, 10, 11, 12, and 13 stations to be visited by the watchman.

The operation is as follows: If the watchman is required to register from station 1 at 1 o'clock in the morning, the dial D, should be attached to the disc F in such a way as to bring the figure "1" opposite the hammer at or just before 1

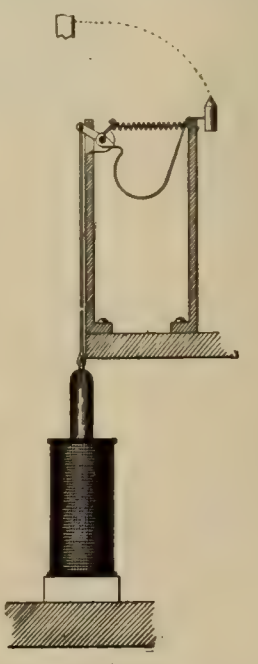
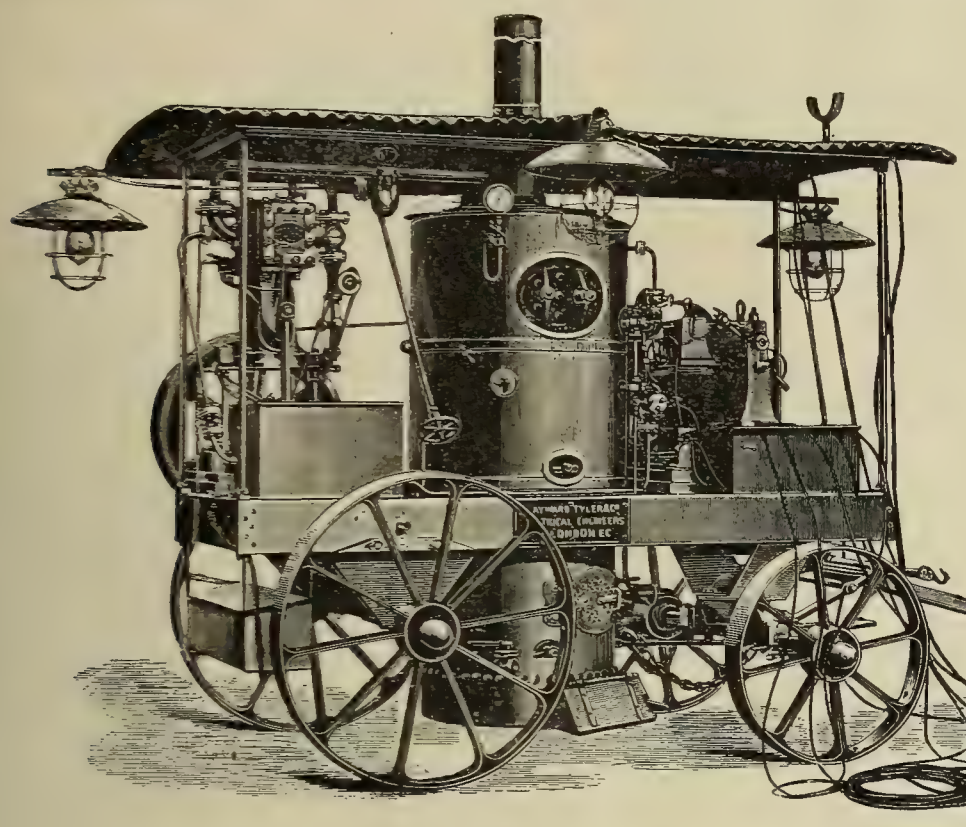


FIG. 3

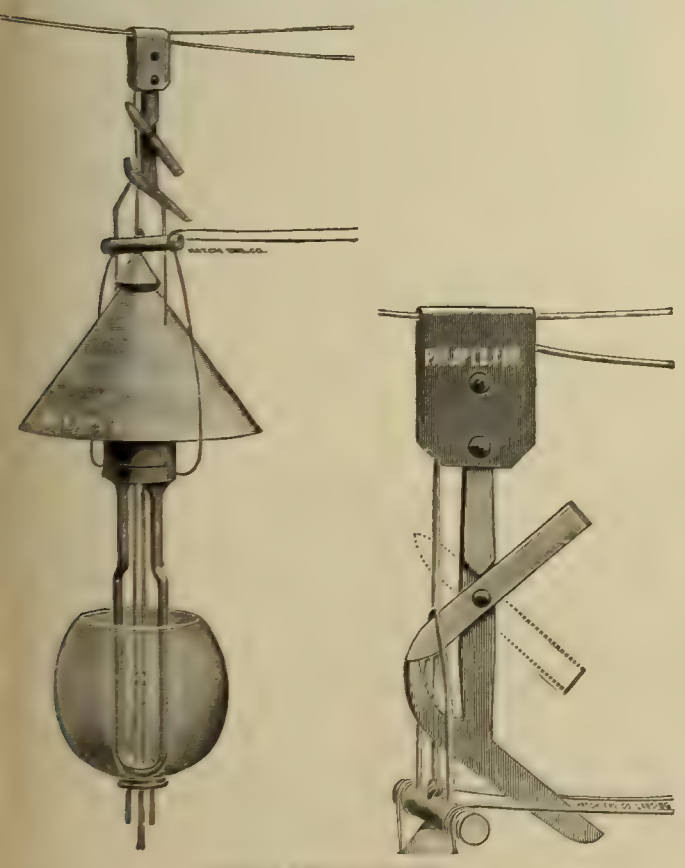
o'clock. At the same time the arm G bearing the numeral "1" should, by the revolution of the arbor *b*, be brought underneath the hammer and opposite the figure "1" upon the dial. Just before these parts come into this position the arm

K', which is connected with the station 1, contacts through the revolution of the arbor *b*, with the contact-point *i* upon the corresponding plate I. When the watchman arrives at the station, he presses a push-button, or in any other suitable manner closes the circuit. The armature *l* is sharply attracted toward the magnet, and the hammer N strikes against the arm G, and by means of the interposed ribbon R imprints the number borne by such arm upon the dial. The rock-shaft and hammer are so constructed that



PORTABLE ELECTRIC LIGHT PLANT.

when the armature is first attracted the hammer will be thrown forward with sufficient force to make the necessary impression; but, the armature still continuing in contact with the magnet, the hammer will gradually come to a state of rest at a short distance from the arm. In other words, the travel of the armature toward the magnet is not sufficient to cause the hammer to strike against the arm G, so that the hammer is provided with a spring-handle, which bends and allows the hammer to reach and strike against the arm G, forcing it against the dial. Precisely the same method is followed in visiting all the stations. The parts are so adjusted that in every



ARC LAMP HANGER.

instance the proper hour and the proper arm come together under the hammer just after the proper spring K' has come into contact with its corresponding plate I.

Fig. 2 shows the apparatus used in connection with the instrument shown in Fig. 1 for the purpose of ringing an alarm when the watchman, for any reason, fails to transmit the signal at the proper time from a station.

It will be understood that the alarm-bell is to be located in the office of the general superintendent having charge of the watchmen, whose business it is to visit the station and register their visits, or, if desired, it may be placed in the residence of the owner of the building, bank, store, factory, or works intended to be visited by the watchman, so that he will be immediately apprised of the failure of the watchman to perform his duty.

Mr. Park has also secured letters patent on improvements in solenoids and spool magnets for the purpose of securing a greater extent of movement in the core.

Reference to fig. 3 will show, with hardly any explanation, the action of this device. When the magnet is energized the core will be drawn downward towards the centre of the helices, thus throwing the hammer forward. When the current ceases the spring will retract the hammer and raise the core.

This device is used as a part of the watchman's clock system above described.

PORTABLE ELECTRIC LIGHT PLANT.

A portable electric light plant may be put to a great variety of uses, and is invaluable for emergencies, where places inaccessible with the ordinary means of lighting, have to be illuminated at night. We give below an illustration of such a plant constructed by Messrs. Hayward Tyler & Co., of Whitecross street, London, for a large dock company. It is mounted upon a frame carried by four wrought iron traveling wheels, and is fitted with a pole for two bullocks. The boiler stands in the centre, the engine being at one end the dynamo at the other. The boiler is six feet six inches high, by two feet nine inches in diameter; the fire-box is crossed by two tubes eight inches in diameter. The engine has a cylinder five inches in diameter by six inches stroke, and is of the inverted type, with Pickering governor. By means of a belt it drives the dynamo. It supplies four incandescent lamps of 200 candle-power each. Each lamp is provided with a strong enamelled iron reflector fitted with a wire-guard, and a length of twin flexible cable.

The facts and illustrations are taken from the *Electrical Review* of London.

A NEW ARC LAMP HANGER.

The accompanying cuts represent the action of the Paddock Safety Arc Lamp Hanger just being placed upon the market by the Central Electric Company of Chicago.

This hanger is very simple in its construction, and is so well illustrated in the cuts that it hardly needs any further description. The hanger insures absolute safety from the falling of lamps and all attendant dangers and expenses by reason of insecure fastening, or the breaking of ropes. Combined with the hanger is a sleet proof pulley, which is always indispensable in this sort of device. The hanger is being placed upon the market at an extremely low price, and is especially recommended to companies who have tried expensive things of this sort that have proven failures.

PROGRAMME OF THE MONTREAL CONVENTION.

The following is the official programme of the meetings of the National Electric Light Association to be held in Montreal next month.

The sessions of the Convention will be held from ten o'clock in the morning, until two o'clock in the afternoon; final adjournment for the day being had at the latter hour.

On the 8th of September the reports of the following committees will be read and discussed:

Committee on Relations of Manufacturing and Central Station Companies, Committee on Data, Committee on World's Columbian Fair, Committee on Legislation, Committee on Underground Conduits and Conductors, Committee on Safe Wiring.

On the 9th of September the discussion of T. Carpenter Smith's paper read at the Providence Convention on the "Distribution and Care of Alternating Currents," will take place, and the following papers will be read and discussed:

W. C. Warner—"Various Forms of Carbons for use in Arc Lamps." Capt. Eugene Griffin—"Three Years' Developments of Electric Railways." H. Ward Leonard—"A Central Station combining the Advantages of both Continuous and Alternating Current Systems."

On the 10th of September the reading and discussion of the following papers: J. I. Ayer—"Some Details of the Care and Management of an Arc Lighting Station, as Practiced in the Municipal of St. Louis." C. J. Field—Subject to be announced. George A. Redman—"Central Station Lighting by Water Power." J. J. Burleigh—"Uniformity of Method in Keeping Central Station Accounts."

An Executive Session will be held on the 10th of September, to elect three new members of the Executive Committee and to name the place of the next meeting.

The following is the programme arranged for the entertainment of the National Electric Light Association of the United States by the Citizens' Executive Committee, Montreal.

Monday, Sept. 7th, 3 P. M.—Opening proceedings of the Convention in the Windsor Hotel, Address of welcome by His Worship the Mayor and other distinguished members of the Reception Committee.

8 P. M.—Formal opening of the exhibition by His Excellency the Governor General.

Tuesday, Sept. 8th, 2.30 P. M.—Drive through the city and around the mountain.

8 to 11.30 P. M.—Conversazione at Redpath Museum, Molsom Hall, McGill College.

Wednesday, Sept. 9th, 2.30 P. M.—Fire Department display on Champs de Mars.

5 to 7 P. M.—Garden Parties.

8 P. M.—Banquet at the Windsor Hotel.

Thursday, Sept. 10th, 2:30 P. M.—Through the kindness of the Harbor Commissioners, trip by

Continued on page 519.

THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER, TELEGRAPHY, TELEPHONY, AND ALL PHASES OF ELECTRICAL DEVELOPMENT

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THE MONTREAL CONVENTION.

A glance at the programme of the meetings of the National Electric Light Association, to be held at Montreal next month, shows that the business to be transacted will be of extraordinary importance and interest to all connected with the electric light industry.

Apart from the business of the convention, the entertainments provided for the members are varied and many. It is gratifying to Americans to know that our Canadian friends intend to give them a warm reception socially as well as in a business way, and no doubt this Canadian hospitality will do much in the way of bringing the business relations of the two countries into closer communion.

The social feature of the convention will far excel anything of the kind ever before enjoyed on similar occasions in other cities, and if our Canadian friends follow this up with business with a corresponding degree of enthusiasm, the object of holding the convention in Montreal will have been realized in its fullness.

The entertainment feature is, of course, incidental to the main purpose of meeting in Montreal. The American manufacturers are not going there solely for the purpose of having a good time; there is business in view, and it is characteristic of Canadians to combine business with pleasure in such a way as to make their guests feel like accepting the invitation to "come again," which they are sure to receive.

We hope that both sides will receive great benefit through the convention.

On September 9, the second day of the convention, the discussion on Mr. T. Carpenter Smith's paper, read at the Providence Convention last February, will take place. This paper, it will be remembered, was on the "Distribution and Care of Alternating Currents," and was one of the most complete and interesting ever read on the subject. A very complete abstract of this paper will be found in the issue of the Electrical Age of February 28, last.

The other papers to be read, as indicated in the programme, which is published on another page of this issue, are all of an interesting character, and no doubt, will be profitable to all connected with electrical industries.

ELEVATORS RUN BY ELECTRICITY.

In almost every issue we have occasion to describe some new application of electric power, and it is noticed that the electro-mechanical power is frequently applied in situations where it would be almost impracticable to use power in any other form.

We describe and illustrate on our first page a very practical application of electric power—an electric elevator.

Elevators are indispensable in business buildings these days, and such a building without an elevator is usually a non-paying investment. Many old buildings are put on a paying basis simply by the introduction of a lift, and the number of such structures thus equipped is rapidly increasing. It is not always easy, however, to put an elevator in an old building, where steam power must be used to operate it. In such a case, in addition to the space required for the elevator shaft, space must be provided for a steam plant, if one is not already installed. Electricity, however, simplifies the problem very greatly.

The whole mechanism of an electric elevator requires very little space as compared with that usually occupied by a steam plant, and requires far less care and attention.

In new buildings for the same reason electric elevators are very much favored, and many of these valuable machines are being installed. They are noiseless and perfectly controllable, and by the use of safety devices there is no danger whatever of the elevator car dropping in case of derangement of the machinery, and in every way they seem to fulfil every requirement of a safe and efficient elevator.

THE EDISON CONVENTION.

The convention of the Association of Edison Illuminating Companies, held in this city last week, was probably the most important one ever held by that association. As usual, it was held behind closed doors, but we have been enabled to provide our readers with a brief report of what transpired at the meetings that was of general interest.

This association excludes from its meetings representatives of the electrical journals, and it is only through the courtesy of the officers that any report of the proceedings can be had. The meetings are in the nature of a family gathering and for this reason those who are not members of the family are not admitted.

There were many important papers read, and the relation of the parent body to the subordinate companies, the status of the lamp case and other matters of a more or less private character were explained to the members.

The out-of-town members will leave New York with pleasant remembrances of their trip to the metropolis, for an excellent reception and entertainment was given them during their stay.

INFORMATION ABOUT THE MONTREAL CONVENTION.

General C. H. Barney has been appointed General Manager of the Electrical Exhibition to be held in Montreal in connection with the convention of the National Electric Light Association next month. The General is on the ground attending to matters pertaining to his office, and he reports that most of the space has been allotted, although some choice plots remain. He advises prompt application for space by those who intend to exhibit.

The Windsor Hotel has been selected as the headquarters of the National Electric Light Association during the coming convention, to be held at Montreal, beginning on the 7th of September next, and the meetings will be held in the spacious Windsor Hall in the hotel.

The rates of charges for board have been obtained from the two larger hotels, and are as follows:

Windsor, $3.50 to $5.00 per day each; St. Lawrence Hall, $2.50 to $4.00 per day each. The price varies in accordance with the character and location of room. Letters addressed to either of these houses "Montreal, Canada," will receive prompt attention.

Special rates of railroad fare have been obtained from the various traffic associations on the "certificate plan," and those attending will pay full fare going to Montreal and one-third fare returning, provided they return by the same route by which they went. Arrangements will no doubt be made for special trains, for the accommodation of delegates and friends from Chicago, New York City, Boston and other principal cities. For further particulars regarding local transportation the following named gentlemen may be addressed:

George F. Porter, Girard Building, Philadelphia, Pa.; R. D. McGonnigle, Allegheny County Light Co., Pittsburg, Pa.; W. A. Kreidler, *Western Electrician*, 6 Lakeside Building, Chicago; E. R. Weeks, Edison Electric Light and Power Co., Kansas City, Mo.; James I. Ayer, Municipal Electric Lighting and Power Co., St. Louis, Mo.; A. B. Shaw, *Electrical Engineer*, 620 Atlantic avenue, Boston, Mass.; C. O. Baker, Jr., 136 Liberty St., New York City.

Special rates of freight have been granted by the Canadian railroads, by which exhibitors are obliged to pay freight only one way, provided the goods remain the property of the original owner.

A very delightful yachting trip up the beautiful Richelieu River, for the special entertainment of the lady visitors and friends, has been determined upon by the subcommittee in Montreal appointed to attend the same. The yachts will sail up the Richelieu River from Iberville to Isle aux Noix, on which is situated the historic Fort Lennox, with its old time moat and memories of early Canada.

HOW TO REACH MONTREAL.

For the information of those who contemplate visiting Montreal in connection with the Convention of the National Electric Light Association, which begins September 8, we give below a schedule:

Through Montreal sleeping cars *via* N. Y. C. & H. R. R. R. and Delaware & Hudson R. R. leave Grand Central Depot, New York, at 7 P. M., arriving in Montreal 7.15 A. M. The day train with through cars leaves Grand Central station at 9.20 A. M., arriving in Montreal at 9.15 P. M. Passengers leaving New York on either the Albany or Troy night boats on the Hudson River connect at Albany the following morning with trains to the boats on Lake George and Lake Champlain, arriving in Montreal at 9.15 the same evening. Tickets reading *via* "the D. & H." are accepted for passage on steamers of the Champlain Transportation Co. on Lake Champlain and *vice versa*.

Returning, the through day train leaves Montreal 7.15 A. M., and arrives in New York 8.50 P. M. Through night train leaves Montreal 5.50 P. M., and arrives in New York 6.45 A. M. Passengers desiring to take the trip through Lake Champlain or Lake George, or both, South bound, should leave Montreal 5.50 P. M., arriving at Bluff Point (Hotel Champlain) 8.55 P. M., and take steamer "Vermont" on Lake Champlain, which leaves Bluff Point at 7.10 A. M., and arrives at Fort Ticonderoga 12.40 P. M., at which point connection is made with the through day train, arriving in New York 8.50 P. M. Or, if trip through Lake George is included, connection at Fort Ticonderoga is made with steamer on Lake George, which leaves Baldwin at 1 P. M., and arrives at Caldwell (south end of Lake George), at 4.30 P. M., there connecting with train running to the Hudson River night boats from Troy or Albany due in New York the following morning.

Continued from page 517.

boat down the St. Lawrence and the Lachine Rapids, stopping on the way at Caughnawaga.

5 to 7 P. M.—Garden parties.

Friday, Sept. 11th, 3 P. M.—Lacrosse Match. In the evening, Promenade Concert at Sohmer Park, through the courtesy of Messrs. Lavigne and Lajoie.

Saturday, Sept. 12th, 7 P. M.—Excursion to Quebec at reduced rates.

In addition to the above, yachting parties are being arranged for the entertainment of the ladies.

CONVENTION OF EDISON ILLUMINATING COMPANIES.

The Seventh Annual Convention of the Association of Edison Illuminating Companies met at the Murray Hill Hotel, New York, at 10 o'clock A.M., August 11, according to the call issued by the Executive Committee, with a very full attendance. The list of members following will be seen to comprise representatives from a large number of Edison Illuminating Companies from all over the country, in addition to the representatives sent by the Edison General Electric Co., and Mr. Edison.

The morning session was taken up with the reception of credentials of delegates, an address by the President of the Association, the reading by Prof. A. E. Kennelly, of Mr. Edison's laboratory, of reports of Committees on "Grounding Neutral Wire on Three-Wire Systems," and "Lightning Protection," and a report by C. P. Gilbert, of Detroit, Mich., Chairman on "Dangers to Edison Circuits from crosses with High Potential Conductors," which was read by Mr. H. Ward Leonard, manager of the Light and Power Department of the Edison General Electric Co.

These reports were followed by a free discussion on the topics treated in each.

The convention extended the privileges of a portion of its session to Mr. A. S. Hibbard, General Superintendent of the American Telephone and Telegraph Co., and Mr. John J. Carty, Electrician of the Metropolitan Telephone and Telegraph Co., during the discussion of the reports on Protection from Lightning and High Potential Circuits.

On reconvening, at 2.30 P.M., the delegates were invited by the officials of the Edison Illuminating Co., of New York, to visit, in carriages, their various operating stations and the new Elm street station now in process of construction; also to accept the further hospitality of this Company in a dinner at the Brighton Beach Hotel, returning in the evening.

The 26th street station was the first one visited, and its completeness in every detail elicited the admiration of the members. They went up on the roof where the method of exhausting the steam into the chimney flues was explained; they then inspected the huge coal bins, which hold 1,800 tons of coal; the testing and dynamo rooms, etc., etc.

The new Elm street station was next visited. The plant at this station is a temporary one, but the permanent plant is now being erected. The building is of the most substantial construction, and its front is of artistic design.

In the evening the members enjoyed a banquet at the Hotel Brighton, Coney Island, after which they returned to the city.

SECOND DAY'S PROCEEDINGS.

The second day's meeting was called to order promptly at 10 A. M. by the President, John I. Beggs. The morning was taken up in the discussion of Prof. A. E. Kennelly's report on the "Grounding of the Neutral Wire in Three-Wire Systems," read on the first day; the reading of a paper by Prof. Wm. D. Marks, supervising engineer and general manager of the Edison Electric Light Company, of Philadelphia, on "How to Get Paying Loads for Stations"; the reading of a paper by Mr. R. S. White, on "The Edison Meter in the Brooklyn Station;" an address by Mr. Sam'l Insull, Second Vice-President of the Edison General Electric Company, on the present business policy of the parent company, the outlook in the patent suits, the condition of the business, etc.

Executive Committee: A. L. Smith, C. P. Gelbert, Thos. P. Merritt, H. J. Smith, Leigh Carroll, John I. Beggs (*ex officio*).

After the election the reports of the Executive Committee, and of the Treasurer were read.

An invitation was then extended to the delegates by the Edison Electric Illuminating Company, of Brooklyn, to visit its station at the close of the afternoon session.

Papers were then read as follows: "Incandescent Lamps for Decorative Purposes," by Mr. L. Steiringer.

At the afternoon session the present officers of the Association were re-elected for 1891–92, as follows: President John I. Beggs, Vice-President C. L. Edgar, Secretary W. J. Jenks, Treasurer W. S. Howell.

"Some Practical Ideas on Distribution," by Leigh Carroll, Birmingham, Ala.

"Mechanical Meter," with an exhibition of model, by A. E. Kennelly, of the Edison Laboratory.

"Peculiar Feature of Edison Feeder System," by Wilson S. Howell.

"Success of the Mutual Insurance Idea in Electric Light and Power Stations," by W. J. Jenks.

Toronto was selected as the meeting place for '92, at the invitation of Mr. Frederic Nicholls, of the Edison Electric Illuminating Company of Toronto.

The convention then adjourned.

On Thursday, on the invitation of the Edison General Electric Company, the members left the Grand Central depot at 6 A.M. on a special train for Schenectady, N. Y., for the purpose of visiting the Edison works. The train arrived at Schenectady shortly after 10 A.M. and the day was pleasantly spent in inspecting the great factories and a general good time was had. The party returned to New York in the afternoon, arriving in the city at 7:15. Breakfast, dinner and supper were served on board the train and the members will long remember the pleasure they derived from the trip.

In the evening the New York Illuminating Company again took charge of the members and in a body they visited the new Madison Square Garden, where they were filled with music from the inimitable Gilmore's band and admiration for the electrical plant of the mammoth building, which they also inspected.

On Friday some of the members visited the Edison Laboratory, Orange, N. J., the Edison Lamp Works, Harrison, N. J. and the New York Works.

Thus ended the meeting of 1891.

The following is a list of the members present: Edison General Electric Company: Samuel Insull, second Vice-President; J. P. Ord, Comptroller; S. Dana Greene, Assistant to 2nd Vice-President; Morris Slattery, Agent Southern District; F. R. Upton, General Manager Lamp Manufacturing Department; Sidney B. Paine, District Manager, New England District; W. S. Kelley, Engineering Department; H. T. Edgar, Engineering Department; W. T. M. Mottram, Assistant to District Manager Southern District; S. A. Douglas, New England District. Edison General Electric Company, J. Hobart Herrick, vice president; E. H. Johnson, director. L. Stieringer. Lamp Manufacturing Department: Wilson S. Howell, Inspector, Francis E. Jackson, Inspector. Light, Power and Intelligence Departments: H. Ward Leonard, General Manager. Legal Department: W. J. Jenks, E. W. Hammer, W. H. Lauman. Eastern District: Chas. D. Shain, District Manager. Southern District, A. H. Reece, District Manager. Official Stenographer, W. J. Sullivan. Edison Laboratory, A. E. Kennelly. Edison Electric Illuminating Company of New York City: R. R. Bowker, 1st Vice-President; J. B. Skehan, Treasurer; H. J. Smith, General Operating Superintendent, J. Van Vleck, Arthur Williams, Henry Stephenson, Superintendent Underground Construction; F. M. Tottingham, Superintendent 2nd District; Frank H. Briggs, Acting Superintendent 3d District; J. E. Sayles, General Agent. Edison Electric Illuminating Company of Brooklyn, N. Y.; C. E. Chinnock, Director; W. D. Barstow, General Superintendent. Edison Electric Illuminating Company of Boston, Mass.: Walter C. Baylies, Vice-President; C. L. Edgar, General Manager; W. A. Hill, Cashier; Chas. E. Pattison. Harrisburg Electric Light Company, Harrisburg, Pa.: John I. Beggs, Director; W. R. Fitzpatrick, Superintendent and Electrician. Edison Electric Illuminating Company of Detroit, Mich.: C. P. Gilbert, Secretary and Manager; Hoyt Post, Attorney; Barton L. Peck, Motor Inspector. Grand Rapids Edison Light and Fuel Gas Company, Grand Rapids, Mich.: A. F. Walker, Superintendent; T. C. Harnish, Constructor. Appleton Edison Light Company, Appleton, Wis., A. L. Smith, President. Consolidated Electric Light Company, Birmingham, Ala.: Leigh Carroll, Secretary and General Manager. Des Moines Edison Light Company, Des Moines, Ia.: J. A. Colby, Director, Secretary and Manager. Columbus Edison Electric Light Company, Columbus, O.: A. W. Field, Secretary and Manager. Edison Electric Light and Power Company, St. Paul, Minn.: George H. Finn, Secretary and Treasurer. Edison Electric Illuminating Company, Lawrence, Mass.: W. H. Wolvekamp, Electrician. Edison Electric Illuminating Company, Topeka, Kansas: W. W. King, Superintendent. Edison Electric Illuminating Company, Westchester, Pa.: Maurice Hoopes, Superintendent. Edison Electric Light and Power Company, Kansas City, Mo.: W. Preston Hix, Director. Tiffin Edison Electric Illuminating Company, Tiffin, Ohio: A. Kaup, Manager. Edison Electric Light and Power Company, Little Rock, Ark.: G. H. Van Etten, President. Elgin City Railway Company, Elgin, Ill.: Chr. Wustenfeld, Manager. Scranton Illuminating Heat and Power Company, Scranton, Pa.: J. E. Parrish, Superintendent. Wilmington City Electric Company, Wilmington, Del.: C. Reginald Van Trump, General Superintendent and Manager. Toronto Incandescent Electric Light Company, Toronto, Canada: Frederick Nicholls, Manager and Secretary. Renovo Electric Light, Heat and Power Company, Renovo, Pa.: J. H. Sheddy, General Manager. Forest City Electric Light and Power Company, Rockford, Ill.: M. A. Beal, Secretary, Treasurer and Manager. Mt. Holly Electric Light and Power Company, Mt. Holly, N. J.: J. L. Jamison, Superintendent and Treasurer. Edison Electric Illuminating Company, Rochester, N. Y.: H. L. Brewster, Secretary. Edison Electric Illuminating Company, Amsterdam, N. Y.: J. H. McClement, Vice-President; H. K. McCoy, General Manager; T. D. Mosscrop, Secretary and Treasurer. Winston-Salem Railway and Electric Company, Salem, N. C.: J. H. McClement, President; H. S. Cooper, General Manager. Edison Electric Illuminating Company, Hazleton, Pa.: J. Edwin Giles, Manager. Edison Electric Illuminating Company, New Orleans, La.: Wm. Oswald, Director. Edison Electric Illuminating Company, Philadelphia: Wm. D. Marks, supervising engineer and general manager. Edison Electric Illuminating Company, Paterson, N. J.: Wm. M. Brock, manager and secretary. Edison Electric Illuminating Company, Pottsville, Pa.: George H. Barker, manager. Toronto Incandescent Electric Light Company, Toronto, Can.: J. K. Kerr, director and attorney. Reading Electric Light and Power Company, Reading Pa.: T. P. Merritt, J. K. Righter, general manager. Edison Electric Illuminating Company, Brooklyn.: R. Lindsay. Edison Electric Illuminating Company, New York: W. I. Donshea, assistant electrician: J. H. Tyler, superintendent meter department: H. A. Campbell, assistant superintendent. Edison Electric Light Company, York, Pa.: G. P. Yost, president, C. A. Eisenhart, vice-president, H. S. Wrest, director, W. F. Wollin, superintendent. Edison General Electric Company, New York: engineering department, G. D. W. Williamson, A. E. Winchester, J. H. Vail, assistant engineer-in-chief, W. S. Andrews, technical assistant. Grand Rapids Edison Light and Fuel Gas Company, Grand Rapids, Mich.: John R. Markle, director.

EXHIBITS AT THE EDISON COMPANIES' CONVENTION.

A "Universal" Arc Lamp burning on an Edison circuit attracted considerable attention at the convention of the Associations of Edison Illuminating Companies, at the Murray Hill Hotel, last week. The lamp hung in the vestibule between the hall and the room in which the sessions were held, and gave a beautiful white and remarkably steady light. There was an entire absence of noise and sputtering, and it required a mental effort to realize that it was a real arc light, so different was it from the ordinary light.

Quite a display of "V V" switches was made at the convention. The exhibit included "V V" service end switches and cut-outs; "V V" ceiling blocks for moulding, cleat and concealed work, "V V" stage receptacle and plug, which is fireproof and water-proof, and made in two-wire and three-wire sizes from 25 to 100 amperes. "V V"

switches are made in 30 sizes, from 50 to 600 amperes.

Crocker-Wheeler Electric Motor-Fans succeeded in keeping the temperature in the meeting rooms down to a comfortable degree. One of Edison's new experimental meters was exhibited.

Among the "outsiders" seen about the hotel during the Convention were H. L. Lufkin, of the C. & C. Motor Company, R. B. Corey of the Electric Construction and Supply Company.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,

FIRST FLOOR, "WORLD" BUILDING,

NEW YORK, Aug. 15, 1891.

Mr. W. A. Stadelman, manager of the Equitable Engineering and Construction Company, Philadelphia, gave us a pleasant call a few days ago.

Mr. W. H. Spencer, general manager of the Standard Metal Tie and Construction Company, 15 Cortlandt street, was taken sick while visiting Saratoga, but we understand not seriously.

Mr. C. E. Moore, of the Moore Electrical Manufacturing Company, Hudson avenue and 13th street, this city, has just returned from an extended trip through the Eastern States, with a large number of orders and better health.

Mr. S. M. Hamill, of the Brush Electric Company, 34 Union Square, this city, is making a visit in the Eastern States and closed an order for three million arc light carbons on August 12. This is said to be the largest carbon order ever given by one firm.

The Standard Metal Tie and Construction Company, 15 Cortlandt street, is equipping the Philadelphia and Reading Railway at Columbia avenue and 16th street, Philadelphia, with its new tie as a sample equipment. It has also been doing some work in the West.

Mr. C. O. Mailloux, expert electrical engineer, is supervising the wiring for incandescent lighting, bell, burglar alarm, annunciator and watchman's clock systems in a number of mansions at Newport, R. I., among which is the new marble palace of Mr. W. K. Vanderbilt.

The Norwich Insulated Wire Co., has purchased the old Callender plant at Harrison, N. J., and will commence at once to put up new buildings and fit up the entire plant with new machinery, which means an expenditure of about $20,000. The machinery will include everything necessary in the manufacture of insulated wires, such as the company manufactures.

Mr. William Fay, general agent of the Steuben Electric Manufacturing Company, Hornellsville, N. Y., was in town the past week and met your representative at the office of the Hunt Engineering Company, 238 Washington street, Brooklyn. Mr. Fay is having big success manufacturing dynamos without commutators for direct and alternating current lighting; also automatic steam engines of special design, which I hear will surprise the users of steam engines in general. Hornellsville is the home of glass producers, and this company makes a specialty of making incandescent lamps. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	90 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	12 50
American Electric Motor Co.(N.Y.)	1,000,000	2500	5 00
American Private T'phone (N. Y.)..	50,000	100 00	98 00
American Telegraph and Cable....	14,000,000	100 00	80 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co. (N. Y.)	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	180 00
Bell Telephone 7's	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light....	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light..	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brunswick Elec. L. & P.	50,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.).	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s....	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000.000	50 00	40 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	16 50
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	16 50
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N Y.).	500,000	20 00	10 00
City of London Elec. Ltg. Co. (Ltd.)	4,000,000	50 00	60 00
Columbia Canal 6's (Ga.)	200,000		*102
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)...	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	4 50
Cons. Gas & E.L.Co. of West Co.6's.	250,000		par
Cons. Gas & E. Co. Batavia, 6's....	80,000		par
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)...	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's..	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	9 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)...	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., (Phila.)..	1,000.000	100 00	80 00
Edison General	14,000.000	100 00	99 00
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	17 50
Elizabeth E. L. Co. (N. J.)	100,000	10 00	4 00
Equitable G. & E. Co. (Utica).	4,000		†
Erie Telephone	4,800,000	100 00	45 05
Ess ck Printing Tel.	5,000,000	100 00	40 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)..	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)....	100,000		par
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co.	4,000,000	25 00	11 50
G. T. Woods Mfg. Co. (Ky.)	2,000,000	10 00	2 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	
Hackettstown Elec. Light (N. J.).	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*102
Hunt Engineering Co. (Brooklyn)..	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1 000,000	100 00	75 00
Int. Okonite, Limited.	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	80 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7.500.000	100 00	13 50
Laclede Gas pref.	2,500,000	100 00	40 00
Laclede Gas 5s.	10,000,000		*73
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s.	50 000		par
Little Rock Edison E. L. & P. 6's...	30,000		par
Littleton Water & E. L. Co. 6's.	75,000		par
Livingston E. Lt. Co. (Mont.) 6s..	30 000		*99
Long Branch Electric Light..	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5's (N.Y.)..	1,000 000		par
Marysville L. & W. Co. 6's (Ohio)..	60,000		par
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500 000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	75 00
Morristown L. H. & P. 5s (N. J.)...	17,500		*105
Morristown L. H. & P.	50,000	100 00	110 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust.	9,000,000	100 00	15 50
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	49 00
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock...	2,535,000	100 00	93 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt...	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150 000	100 00	85 00
Newark E. L. & P. Co. 6's Ohio..	50,000		par
North American Phonograph.	6,600,000	100 00	
North New York, Lighting	150,000	100 00	10 00
Northern Elec. L. & P. (Phila.).	200,000	10 00	
Northwest Elec. Co. 6's Manitoba..	50,000		par
Postal Telegraph.	10,000,000	100 00	30 00
Passaic, Electric Light.	15,000	100 00	92 00
Paterson, Electric Light.	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton).	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	
Richmond L. H. & P. 5's.	150,000		*90
Rockaway Beach Elec. Light.	50,000	100 00	70 00
Rockaway Elec. Lt. Co. 6's.	75,000		101
Russell Electric Co. (Boston).	300 000	5 00	5 50
Saratoga Gas and Elec. Light 6s...	300,000		*86
Saginaw E. L. & P. Co. 6's Mich....	50,000		par
San Diego Gas & Elec. Co. 6's Cal..	750,000		par
Sawyer-Man Electric Light Co(N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y..	100.000	100 00	
Shaver Corporation., N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Swan Incandescent.	800,000	100 00	5 00
Standard Ug'd Cable Co.	1,000,000	100 00	95 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y)...	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	39 50
Thomson-Houston Pref.	4,000,000	25 00	24 75
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers 6's.	100.000		par
T.-H. L. H. & P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.).	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.).	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.).	1,370,000	100 00	
United Elec. Light and Power.	3,000,000	100 00	80 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's.	150,000		par
Utica Elec. Light Co. 6's.	150,000		par
Vine Street Motor Co. 6's (Colo.)....	100,000		par
Welsbach Inc. Gas.	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	80 00
Westinghouse Electric Co.	7,000,000	50 00	11 50
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			17 50
Yonkers, L. & P.	50,000	100 00	92 00

*Per cent. †Registered Stock.

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Since writing the article which appeared in the issue of Aug. 15, in reference to the Blake Transmitter Patent, I have received the following: "National Telephone Company, Limited. Telephone Patents. Notice. As it has recently been publicly stated in several quarters that the telephone patents held by the National Telephone Company expired on the 30th of July, the directors deem it their duty to give public notice that this statement is only true with regard to the first of Edison's transmitter patents, and that the various forms of carbon transmitter in common use in this country (the Blake, the Hunnings, the Crossley, etc.) are covered by later patents which do not expire until the latter part of 1892 and the beginning of 1893. The directors desire to warn the public that the manufacture, sale, and use of these instruments, and of instruments constructed in colorable imitation thereof, will continue to be an infringement of the company's patent rights." This may be taken as official and the shareholders can rest easy; for a few more days the people will "tote the something load" and then bid the fundamental telephone patents good-night. The scramble two years from now will be to secure an interest in the shares representing the successful combination of the greatest number of improvements under one management. Will it be the Western Union with a sub company? or is it possible to overcome the constructional position held by the Bell Company? we shall see.

H. WARD LEONARD & CO.

Mr. H. Ward Leonard, the General Manager of the Light and Power Department and also of the Intelligence Department of the Edison General Electric Company, resigned on August 3, in order to start an independent electrical engineering business under the above title. The new concern will be an incorporated company under the laws of the State of New Jersey. Mr. Leonard will take with him several well tried assistants who have been associated with him in the past, some of them as far back as 1885. Among those who will thus be connected with the company are A. St. C. Vance, E. H. Harrison, C. H. Bloomer and August Munning.

The company will operate especially in a field which is full of promise for the future and is at present inadequately occupied, namely, the transmission of power by electricity and the application of electric motors to the operation of special machinery, such as is not at present operated by electric motors, or whose operation is subject to improvement by careful attention to the requirements of the case.

Mr. Leonard's experience since 1883, when he became a member of Mr. Edison's first electrical engineering staff, has brought him into contact with every branch of electric light and power work. He has held positions from lowest to the highest in the exploiting parts of the business, as well as in the constructing and in the operating of every kind of electric light and power plants, and it is not, therefore, altogether surprising that he should feel willing to resign his office with the Edison Company to take up a line of work which promises so well for one having such an exceptional experience as he has been fortunate enough to have had.

H. Ward Leonard & Co. will have one important feature of their business which will be entirely unique, namely, an Electrical Intelligence Department. To any isolated plant, the company offers at a very moderate subscription price the privilege of corresponding upon any electrical subject of practical interest and thus an isolated plant will be able to secure expert information as to its own plant and the best methods of operating it, and about any new electrical apparatus, or methods and principles underlying various devices and the prices thereof. For central station

companies, whose queries would go further into steam engineering and methods of distribution, and also would cover business question, as to relations with consumers, system of accounts, etc., an additional charge will be made.

This scheme strikes us as an excellent one and we have no doubt that any plant will get several times the value of the subscription price by placing before this company the matters upon which it desires information, data and statistics; as Mr. Leonard created and developed the Intelligence Department of the Edison General Electric Company, he has had the broadest possible experience in this line, since information, of every character issued to those in the Edison Company has been issued by the Intelligence Department of that company. In case the expert judgment of the company be desired as to the comparative merit of various competing apparatus or methods, such expert judgment will be given by special arrangement, although the company prefers to merely supply full information under the subscription arrangement and allow the purchaser to form his own conclusions.

H. Ward Leonard & Co., will do no manufacturing and will do no supply business; neither will they under any circumstances act as the selling agents of any concern, directly or indirectly.

They will, however, act for the purchaser, either as consulting engineers, supervising engineers, inspectors or purchasing agent. When acting in this way they will make charges based upon the contract price.

The various parent companies will, no doubt, welcome the advent in the electrical field, of an electrical engineering concern of this order whose experience and ability is undoubted and who are free from prejudice and have no affiliations of any kind with any of the various electrical concerns. Any parent electrical company can refer a prospective purchaser to such a concern as this with confidence that any opinion given by it to the purchaser will be based on the honest judgment of those thoroughly competent to judge any practical electrical question.

H. Ward Leonard & Co., will make a specialty of the transmission of power and the application of electric motors to such uses as necessitate the application of a wide experience in both mechanical and electrical engineering. Such application of electric motors as are met with in elevators, pumps, hoists, mine tramways, printing presses, etc., are those which this company feels itself especially qualified to undertake under guarantee of perfectly satisfactory results.

Manager C. A. Benton, of the Detroit Electrical Works, has devised a new arrangement for propelling electric ventilating fans. Hitherto the fans put up have received their power from electric light circuits and have soon burned out. Mr. Benton, by tapping the Highland Park Electric Railway Company's wire, which runs in front of the company's works, has two fans which have been running successfully for several weeks. Each is driven by an one-eighth horse-power motor.

REMOVAL OF THE ELEKTRON MANUFACTURING COMPANY.

The manufacturing department and general office of The Elektron Manufacturing Company will, on the 17th inst., be moved to Springfield, Mass., where the company has secured the property on State street, formerly known as the Bullard Repeating Arms Works.

The property, which is one of the finest in the state, is connected by side track with the N. Y. & N. E. R. R., and is conveniently situated for receiving and shipping goods by all the railroad lines centering in Springfield.

For the convenience of its patrons in New York City and vicinity, the company is now fitting up an office, store room and work shop at 89 Liberty street, which will be in charge of Mr. Robert Watson.

Nothing will be spared in fitting up the new factory to make it one of the most complete plants for the manufacture of electrical machinery, and as the company has recently doubled its capital stock, it assures its customers that it will shortly be in a position to serve them better than ever before.

EASTERN NOTES.

The Electrical Specialty Company, of Pawtucket, R. I., which was incorporated in that State in July, 1890, to manufacture cut-out boxes for arc lights circuits, Thomas' mast-arms, pole-steps and sockets, carbon holders, Sweet's transformers, arc lamp insulators, etc., has developed an extensive business in these specialties. Its mast-arms are in use in more than a dozen cities, and its cut-out boxes are met with everywhere, being used in no less than fifty different places. Fred. H. Angell, the noted salesman, is hustling for the company.

Mr. C. E. Bibber, manager of the Consolidated Electric Manufacturing Company, 196 Summer street, Boston, Mass., has just brought out a new open circuit battery. The elements are two carbon plates with zinc in the centre. The zinc and carbon elements are used with a salt solution, and it is claimed no decomposition of the zinc takes place. It is said to give a current of six amperes at a pressure of 1.7 volts. The company thinks the battery will sell on sight.

The Bibber battery, a new open circuit battery, has a cylindrical carbon with the zinc rod running through the centre, supported by a glass washer set in the top of carbon. The latter forms the cover to the battery. This battery is to make Mr. C. E. Bibber, the manager of the Consolidated Electric Manufacturing Company, 196 Summer St., Boston, more famous than ever.

PERSONAL.

Mr. C. O. Baker, Jr., of Baker & Co., the well-known assayers and smelters, Newark, N. J., has the sympathy of a large circle of friends in the loss of his father by death.

WESTERN NOTES.

The "Perfect" insulator sold by the Central Electric Company, is being received with very gratifying favor by construction men and already a considerable number have been sold.

Mr. W. H. McKinlock, president of the Central Electric Company, is away on his well-earned vacation and writes that he is finding both health and pleasure in the surf on the Jersey coast.

BUSINESS NOTES.

On August 8 the Ball Engine Co., of Erie, Pa., shipped eight car loads of machinery to the Key West Gas & Electric Light Co. of Key West, Fla., consisting of three large engines, two boilers, pumps, heaters, condensers, piping, etc.

The Minnesota Brush Company, of Minneapolis, Minn., let the contract of putting its entire system of wire underground, to the Standard Underground Cable Company, Pittsburgh, Pa.

The advertisement of F. E. Marsland, of 84 West Broadway, New York, who is the manufacturer of enameled signs, appears in another column. These enameled signs are made of material that will withstand the effect of the weather in all climates, and which renders them the most durable signs in use. Having a glazed surface, they require no cleaning. Those desiring goods of this character cannot make a mistake in corresponding with Mr. Marsland.

The following is a copy of a letter received by Messrs. Truex & Vail, 136 Liberty street, this city, which explains itself:

ELIZABETH SCHUYLER ELECTRIC LIGHT COMPANY,
ELIZABETH, N. J.

MESSRS. TRUEX & VAIL:

GENTLEMEN.—I wish you could have been at our station yesterday during the storm which was the heaviest we have ever experienced. The Swinging Ball Arresters were busy and don't you forget it. Well sir! there was not a single lamp or converter hurt. The wind blew our line down in two places, but that was all. There are going to be more storms and the man that has his plant equipped with the Swinging Ball Lightning Arresters will be all right.

My telephone line is the only one working in this city. I have it protected by a Swinging Ball Arrester.

Thanking you for the prompt shipment of our last order, I am,

Very truly,
F. H. TIDMAN.

THE JEROME KIDDER BATTERIES.

JEFFERSON CITY, MO., Jan. 21, 1891.

J. Kidder Manufacturing Co.

GENTLEMEN: I have batteries of five different makes. I prefer your make to any I have. Your Faradic machines give a more agreeable current, and the different currents are easily controlled to suit the condition.

Yours truly,
A. C. DAVISON, M. D., 402 Jefferson st.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued August 11, 1891.

457,338. Electrical Switch. Harry H. Blades, Detroit, Mich. Filed Nov. 3, 1890.

A circuit-switch, consisting of a pivoted two-part lever joined at the pivotal point, and one part having an armature to co-operate with an electro-magnet, and a spring acting to maintain the two parts of the lever in line with each other, the armature part of the lever being held by the electro-magnet after the other part of the lever is moved to cut off the current from the main line until the motor has come nearly to rest.

457,339. Electric Switch. Harry H. Blades, Detroit, Mich. Filed Nov. 10, 1890.

An armature carried by a support independent of the hand-switch, and mechanism connected with the armature of a magnet adapted to engage and hold the switch in its closed position until the magnet is de-energized by the cessation of current through the motor-circuit.

457,343. Magnetic Belting. Thomas A. Edison, Llewellyn Park, N. J. Filed Sept. 10, 1890.

The combination, with large and small magnetic pulleys, the smaller pulley being more strongly magnetic than the arger, of a magnetic belt passing over the pulleys and having transverse iron bars bearing upon them, the bars being curved on their inner faces to fit the smaller pulley.

457,358. Brush-Holder for Dynamo-Electric Machines or Motors. Cyprien O. Mailloux, New York, N. Y. Filed March 18, 1891.

A holder-body having separate uprights provided on their inside with a screw-thread, a brush-holding block or follower guided on it, and an adjustable head having an interrupted screw-thread adapted to be brought into engagement with the screw-head on the uprights, and a spring interposed between the same and the follower.

457,362. Electric Steam Generator and Heater. Willis Mitchell, Malden, Mass., assignor to the Butterfield-Mitchell Electric Heating Co. Filed Nov. 29, 1890.

In a steam-generator, the combination of a water reservoir with a heating device consisting of a series of layers alternating with water-spaces, a wire forming part of an electric circuit and wound on the layers within the spaces, and inlet and outlet pipes connecting the heating device and reservoir.

457,374. Safety Device for Electric Wires. John H. Sedlmeyer, Johnstown, Pa. Filed Oct. 23, 1890.

The combination, with the main conductor or line-wire, of a normally dead conductor parallel therewith; a clock mechanism, a spring-retracted switch-lever connected with the line-wire and held in engagement with its contact point by the clock mechanism, a detent-lever forming part of the clock mechanism, an armature-lever engaging the detent to release it, and an electro-magnet for operating the armature and electrically connected with the normally-dead wire.

457,407. Self-Regulating Electric Converter. Thomas Spencer, Pittsburg, Pa. Filed Dec. 17, 1890.

An electric converter having a secondary coil wound upon a different portion of the core to that of the primary,

and having a portion of its convolutions remote from the primary coil wound in the reverse direction.

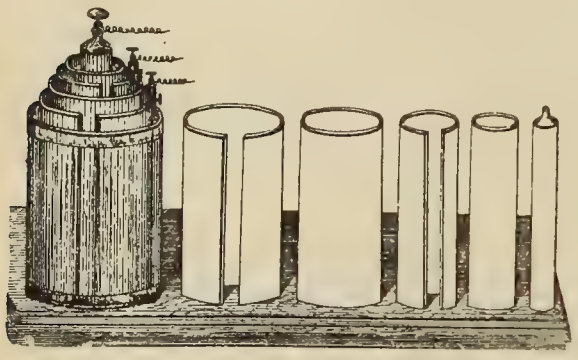
457,430. Electric Battery. Flavien Poudroux, Paris, France. Filed March 6, 1891. Patented in France.

A carbon and zinc element having a solution between them consisting of azotate of potash, binoxide of manganese, bichromate of soda, and sulphuric acid in water, in combination with a second carbon element having between it and the zinc element an exciting solution consisting of chlorhydrate of ammonia and azotate of potash, and an outer inclosing cell or casing containing a second depolarizing solution in contact with the second carbon element.

457,453. Electric Meter. Eugene Meylan and Wenceslas C. Reckniewski, Paris, France, assignors to Réné Heurtey, same place. Filed Nov. 10, 1890. Patented in France, England, Belgium, Germany, Switzerland and Austria-Hungary.

An electric meter consisting of an electric motor of constant speed, an electric balance, an elastic cam, a totalizer, and a coupling device adapted intermittently to impart the action of the motor to the totalizer under the operation of the cam, the whole adapted to effect automatically at regular intervals a record of current upon the totalizer.

457,454. Annunciator. Walter R. McCann and Simon S. Creider, Sterling, Ill. Filed April 23, 1891.



457,430—ELECTRIC BATTERY.

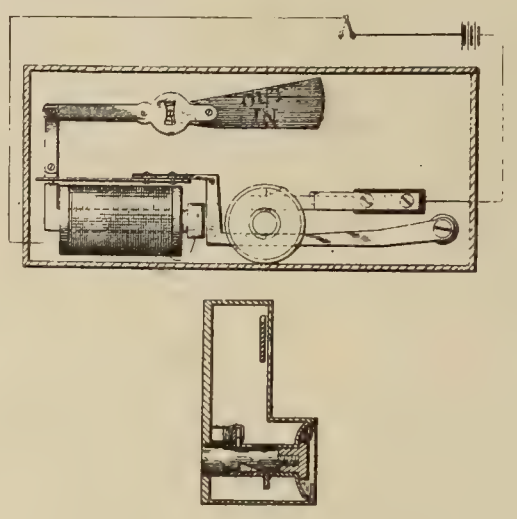
The combination of an indicating device, a mechanical actuator controlling a circuit-closer, and a magnet included in a circuit with the circuit-closer, actuating the indicating device to increase its movement.

457,477. Automatic Telephone System. Hammond V. Hayes, Cambridge, and Henry D. Sears, Lynn, assignors to the American Bell Telephone Company, Boston, Mass. Filed Feb. 3, 1891.

A series of lines converging to a central station from a series of sub-stations, a motor-driven circuit-changing drum at the central station of each line, the drum being normally at rest maintaining the circuit of its own line closed, but capable of revolving and of thereby disconecting its own line from its normal terminal and connecting it with each of the several lines of the system successively through their respective drums and their controlling mechanisms, stopping and starting mechanism for each drum, comprising a normally open local circuit, an electro-magnet included therein, the armature-lever of which normally constituting a detent for the drum-motor, but adapted upon the closing of the local circuit to disengage the same, a polarized relay in the main-line circuit, controlling the local-circuit, the armature of the relay being adapted to rest where last placed to move and close the local circuit when a current of given direction is caused to traverse the main line, and to move reversely and open the local circuit when a current of opposite direction traverses the main-line a mechanical shifting device, such as a snail-cam, mounted on the drum axis and adapted to move the relay-armature to its resting position on the completion of a single revolution of the drum and thereby independently of main-line, currents to open automatically the local circuit and stop the drum at unison, and a constantly operating signal-transmitting device for each line included in the normal circuit-terminal thereof and adapted when the line is not in use to send a distinctive signal indicating its number over its own circuit and also over any circuit which may have connected itself therewith.

457,483. Automatic Electric-Circuit Switch. Wm. L. Silvey, Lima, Ohio. Filed April 19, 1889.

The combination of a pivoted switch-lever, a flexible electric conductor connecting the lever to the main-line circuit, a carbon-holding device, a hook attached to the switch-lever, a pivoted switch-latch engaging the hook on the switch-lever, a spring for holding them in engagement, a screw tor regulating the tension of the spring, an electro-magnet whose coils are in circuit with the switch-lever and its contact points, an armature attached to the switch-latch, a split contact for making electrical connection with the switch-lever, a carbon-point mounted on the switch-contact, a carrier therefor, and a forwardly-propelling device for moving the carbon and carbon.carrier, whereby the electric circuit is maintained between the carbon-contacts until the switch-lever and split contact plate have become entirely separated.



457,454—ANNUNCIATOR.

457,534. Electric Motor. Warren S. Hill, Boston, Mass. Filed June 23, 1890.

An electric motor the field-magnets of which are composed of plates of sheet metal clamped between the end plates, recesses in the end plates, and rods having reduced ends passing through the sheet-metal plates and end-plates and secured by bolts, whereby the whole is securely clamped together.

457,555. Electrode for Secondary Batteries. Leonard Paget, New York, N. Y. Filed June 5, 1890.

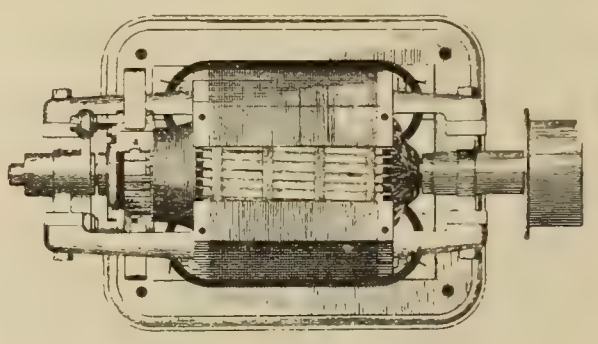
An electrode for a storage battery having an active core in contact with the connecting-lug of the electrode and a perforated conducting envelope surrounding the core and insulated from the connecting-lug except through the working faces of the active core.

457,561. Apparatus for Heating by Electricity. Rankin Kennedy, Kilmarnock, Scotland. Filed Nov. 20, 1890. Patented in England.

A core forming an open or discontinuous magnetic circuit, a magnetizing-coil, and a source of pulsatory currents with a body composed wholly or in part of iron adapted to be placed in the incomplete portion of the magnetic-circuit and heated by secondary currents induced therein.

457,572. Switch. Sigmund Bergmann, New York, N. Y., assignor to the Bergmann Manufacturing Company, same place. Filed Jan. 26, 1891.

In a switch, the combination, with terminals, connecting pieces, and a source of electricity, of wires leading from the source of electricity to certain of the terminals, line wires connected to the other terminals, a wire leading from each of the first-named wires and terminating in contact-pieces, a switch movable to touch either of the contact



457,534—ELECTRIC MOTOR.

pieces, an electro-magnet, a wire extending from the movable switch to one end of the electro-magnet, a wire extending from the other end of the electro magnet to one of the wires first named, and a wire extending from one of the line wires to the wire connecting the movable switch and electro-magnet.

457,573. Means of Suspending and Controlling Electric Lamps. Sigmund Bergmann, New York, N. Y., assignor to the Bergmann Manufacturing Company, same place. Filed Feb. 25, 1891.

The combination, with an electric switch having a movable part from which extends a tube or arm, of wires or conductors extending along the tube or arm and depending therefrom and electrically communicating with one part of the switch, whereby the wires or conductors may be made to adjust the switch.

457,657. Wind Apparatus for Generating Electricity and Charging Secondary Batteries. James M. Mitchell, Lawrenceville, assignor of one-half to William A. Camp, Green Way, Ga. Filed March 23, 1891.

In an apparatus for generating electricity, the combination, with a wind wheel, of a shaft journaled in a drum or casing, an armature mounted on the shaft, a field magnet arranged in the drum, a pivotal support for the drum, conductors arranged upon the support and contacting with conducting devices on the bearing for the pivotal support, a working circuit and a derived circuit for the dynamo, and an automatic device closing the working circuit when the dynamo generates acurrent of predetermined strength and breaking the circuit and making the derived circuit when the current falls below a given point.

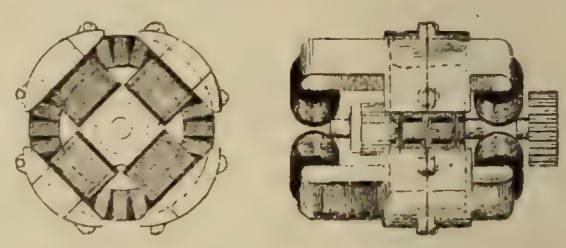
457,687. Electric Light Hanger. Frank A. Weimer, Stanberry, Mo. Filed March 28, 1891.

In an electric lamp hanger, a core formed of elastic material with flexible conductors twisted around it, and the whole formed into a spiral.

457,745. Electrically-Heated Oven. Willis Mitchell, Malden, Mass. Filed Nov. 29, 1890.

An oven or heater provided with successive layers of non-conducting material, and a wire which forms part of an electric circuit and is wound in successive layers between the non-conducting layers.

457,752. Electrical Matrix-Making Machine. Willoughby W. Street, Springfield, Mass. Filed Nov. 15, 1890.



457,754—DYNAMO-ELECTRIC MACHINE OR MOTOR.

In a matrix-making machine, the combination, with an index plate, of a series of plates independently movable, each plate being accessible through the holes or guides of one group or class of characters only, and circuit-closers or contacts controlled or operated by the plates.

457,754. Dynamo-Electric Machine or Motor. Edward M. Waring, Brooklyn, assignor to himself and James G. White, and Joseph F. Porter, New York, N. Y. Filed March 23, 1891.

In a dynamo electric machine or motor, a field magnet consisting of two star-shaped formations carrying field coils on their arms or branches standing in parallel planes, the arms or branches of the two formations being arranged in pairs in the same radial planes with their ends joined to form pole-pieces, in combination with an armature shaft having its bearings in the centre of each formation, and an armature and commutator located on the shaft and between the two star-shaped formations, whereby a compact and symmetrical machine is produced in which the commutator and armature are protected from injury.

457,761. Connections for Electric Conductors. Joseph Dillon, Larchmont, assignor of one-half to H. J. Reilly, New York, N. Y. Filed Jan. 16, 1890.

The combination of a holder constructed to receive and hold electric conductors, a cover constructed to be applied to the holder, a fixed support, and a locking device to lock the cover to the support.

457,762. Electric Air-Pump. Allen A. Dittmar and Hugo Falkenhausen, New York, N. Y. assignors of one-third to Albert L. Reinmann, same place. Filed Jan. 23, 1891.

In an electric air-pump, suction and discharge compartments communicating with the pump cylinders by valve openings, in combination with solenoids placed over openings in the top plates of the compartments and having movable cores which pass through the openings in the top plates and act as valve-stems, so as to open and close the respective valve openings by electric currents conducted alternately through the respective solenoids.

457,763. Electric-Light Carbon. William P. Eltringham, Dubois, Pa. Filed April 27, 1891.

A composition to be used for producing electric light carbons consisting of coke, pitch, and borax or its equivalents.



NEW YORK AUGUST 22, 1891.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

J. B. TALTAVALL, *President*, T. R. TALTAVALL, *Sec. and Treas.*
W. T. HUNT, *Vice-President*, E. V. CAVELL, *General Manager*

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RAILWAY DEPARTMENT ELECTRICAL AGE
FIRST FLOOR, WORLD BUILDING,
Telephone, 2361 Cortlandt. NEW YORK.
Cable Address (All Cables) "ELECTAGE."

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"NO PENT-UP UTICA CONTRACTS OUR POWERS."

The exception which has been taken to the policy we have adopted in devoting our columns to the interests of *all kinds* of street railways, independent of their motive power, on the grounds that STREET RAILWAY NEWS is but a department of an electrical paper, and should consequently confine itself to electric traction only, appears to us to be altogether too contracting.

Purporting as it does to give a "weekly record of the street railways of the world," it would be inconsistent to confine its columns solely to the interests of any one particular form of tractive power, simply because it chanced to have been whelped within the fold of a journal representing whatever that power might be.

The title of the "ring within the ring"—"Street Railway News"—implies nothing but the fact that its excuse for living consists in giving "news," by reason of its making its appearance more than four times as often during a year as any other street railway publication known. How, then, could it consistently continue to give a "weekly record of the street railways of the world" if it was the exponent of but one system of street car propulsion?

Horse railways still constitute a majority, and a very healthy majority, too, of our system of inter-urban transportation. The splendid enterprise of the advocates and promoters of the trolley system of electrical propulsion has succeeded in getting either in operation or under contract a little over one-third of the whole number of street railways in North America. The cable men can establish their claim to nearly half a hundred roads, while the dummy locomotive builders have their motors scattered pretty thoroughly through the country. Add to these the storage-battery interests, those of the ammonia or other motor men, and it will be seen that a journal like STREET RAILWAY NEWS must embrace all the interests of its constituency.

While we may share the beliefs that cable railways are usually wise investments, where very heavy grades have to be overcome, and where the amount of travel is enormous, as in Chicago, where over 50,000,000 passengers were carried in one year over the Chicago City Railway Company's cable line, while we realize perfectly that the trolley system has made marvellous strides, and that nearly 400 roads are already equipped under that system—allowing that animal traction is fast passing into innocuous desuetude, still, we cannot give it as our honest, candid conviction that any of these different methods of street car propulsion will ever be universally adopted. Therefore do we treat upon all methods, discuss and exploit all systems with equal impartiality, confident that such policy will give the best satisfaction to the constituency we represent.

Thus, free and unrestricted, fearless and independent, hampered by no interested stockholders, restrained by no outside influences, either good or bad, we shall continue to push forward to the goal we set out for at our birth: standing our ground firmly, when convinced that we are right, and frankly acknowledging ourselves wrong when so convinced.

If, in the adoption of this platform, the wisdom of its policy fails to be demonstrated at the proper time, we alone will be the losers; but, until it is, we shall be able to say that

"No pent-up Utica contracts our powers."

UNDERGROUND FEEDERS.

On another page we publish an interesting article in reference to the experience in Minneapolis and St. Paul with underground feeders for the electric railway system in those cities.

The conductors themselves are devoid of insulation and are drawn through conduits which are made of insulating material and surrounded by an insulating substance of considerable thickness.

The insulation tests show excellent results and yet it is not surprising when one takes into consideration the mass of insulating material surrounding the feeders.

This system differs radically from the usual methods of placing electric conductors underground and the practical results in the "twin cities," seem to show that it meets every exacting requirement.

ORIGINAL ELECTRIC RAILWAY.

Mr. A. M. Tanner, an English electrician, thinks he has discovered the name of the original inventor of transmission of force by electricity and the electric railway with overhead conductor. In a communication to an English electrical journal, which we print elsewhere in this issue, he sets forth the facts in the case as developed by himself. He claims that Alexander Bessalo, an Italian, is the original inventor, and quotes documentary evidence to the effect that Bessalo obtained French patents on his invention in 1855. On Feb. 24, last, Mr. F. L. Pope delivered a lecture before the American Institute of Electrical Engineers in which he described and exhibited the original model of an electric railway constructed in 1837 by an American, named Thomas Davenport. Mr. Pope found several of Davenport's models while he was pursuing his investigations into that inventor's history, and the one he exhibited on the occasion of his lecture, was found in the cabinet of the Female Seminary in Troy, N. Y. The records of that institution showed that it was purchased in 1840, and from authentic evidence and records Mr. Pope calculated that the model must have been constructed three or four years earlier. While nothing was said by Mr. Pope with particular reference to Mr. Davenport as the discoverer of the fact that power could be transmitted to a distance by means of electricity, the fact stands that Davenport's electric railway model embodied this principle. In the face of these records, therefore, Mr. Tanner's claim that to Alexander Bessalo is due the credit of being the original inventor of electric power transmission and the electric railway, does not seem to have any substantial foundation.

A NEW DEPARTURE IN ELECTRIC AND CABLE CARS.*

A growing tendency to the use of longer cars where the motive power is other than that of animals, has developed the fact that but very little can be added to the length of a car of the ordinary type without considerable sacrifice of the time taken to load and unload passengers, and an increased difficulty in collecting fares on long cars having a platform at each end. The adoption of electricity and cables as motive powers, and the consequently quicker transit, has increased in a wonderful degree the number of passengers carried, and the railroad companies naturally seek to add to their carrying capacity in the most economical manner. To increase the seating capacity in a car without adding to the length occupied on the street of the present horse car, and to attend to the passengers and collect the fares by the employment of one man as conductor, are the two directions by which this economy is reached. In a new car just completed for the Lindell Railway Company of St. Louis, the economical features above referred to are accomplished. This car is the invention of John A. Brill, vice-president of the J. G. Brill Company, and the novel features embraced in it are covered by three patents. The most evident novelty is that the car has no end platforms but has a vestibule or platform enclosed on three sides near the centre which is open only on one side of the car, and connects with the two compartments by doorways. The front platform of an ordinary car has no use except for the motorman, carrying no passengers, but in this car the whole of this platform with its unnecessary length and weight is dispensed with.

The car is divided into two compartments separate from each other; the forward compartment is for the usual mixed passengers and the rear compartment is intended primarily for the use of smokers, the larger being 17½ feet long and the smaller 10½ feet long. The seats are placed transversely with capacity for two persons on a seat on each side of the aisle, and there is a seat on the closed side of the vestibule for three persons. At one end of the single step there is a convenient space guarded by a stout handrail of polished brass for the conductor to stand in, from which point he has complete control of the car, and can easily reach passengers who require his assistance in getting on or off. The seats can be arranged if preferred in the usual manner of street cars, that is, longitudinally—on the sides. The total seating capacity of the car is 46 persons.

With this arrangement of the entrance near the middle of car it is evident that the passengers will not require so long a time to get to or from their seats as they would in case where the entrance is placed at one end and with the same reasoning the conductor can reach both ends for collecting the fares with greater facility, and having this advantage, one man can collect all the fares and attend to all of the passengers.

An ordinary horse car is 23 feet long, and with the horses attached occupies 35 feet in the street, seats 22 persons and requires one conductor. The new style of car is only 31′ 6″ extreme length and seats 46 persons, and can be worked with equal ease by one conductor. As it carries as many passengers as two ordinary horse cars, there is a saving of one conductor for a given number of passengers. The saving in wages alone on a line using 100 cars is from $200 to $250 per diem, representing an annual saving of over $70,000, an amount sufficient alone to pay a dividend greatly in excess of the average dividend on street railroads. In cities with crowded streets like New York, Philadelphia and Chicago, the saving of one half the street space of cars is an



FIG. 1—FRONT VIEW.

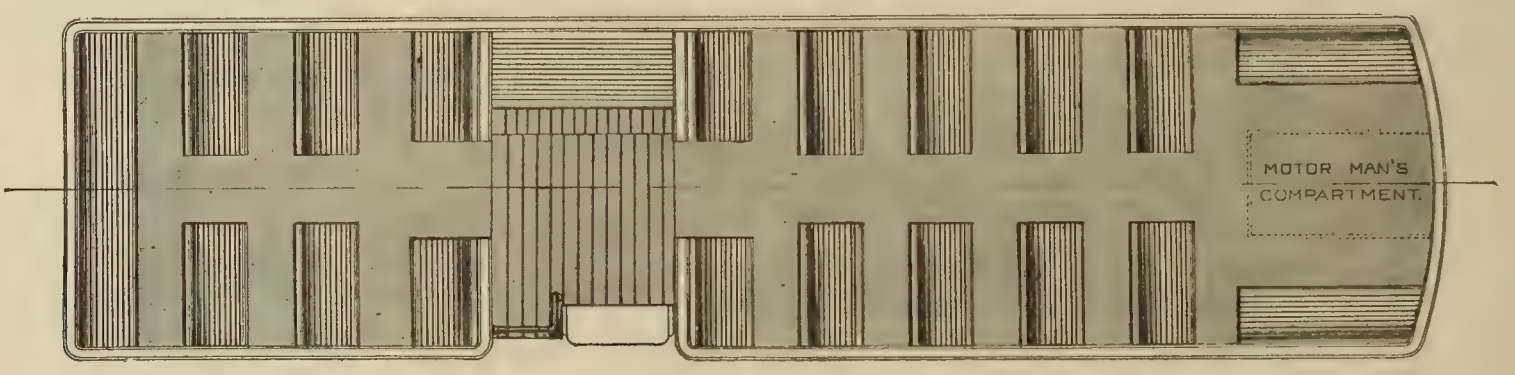


FIG. 2—PLAN VIEW.

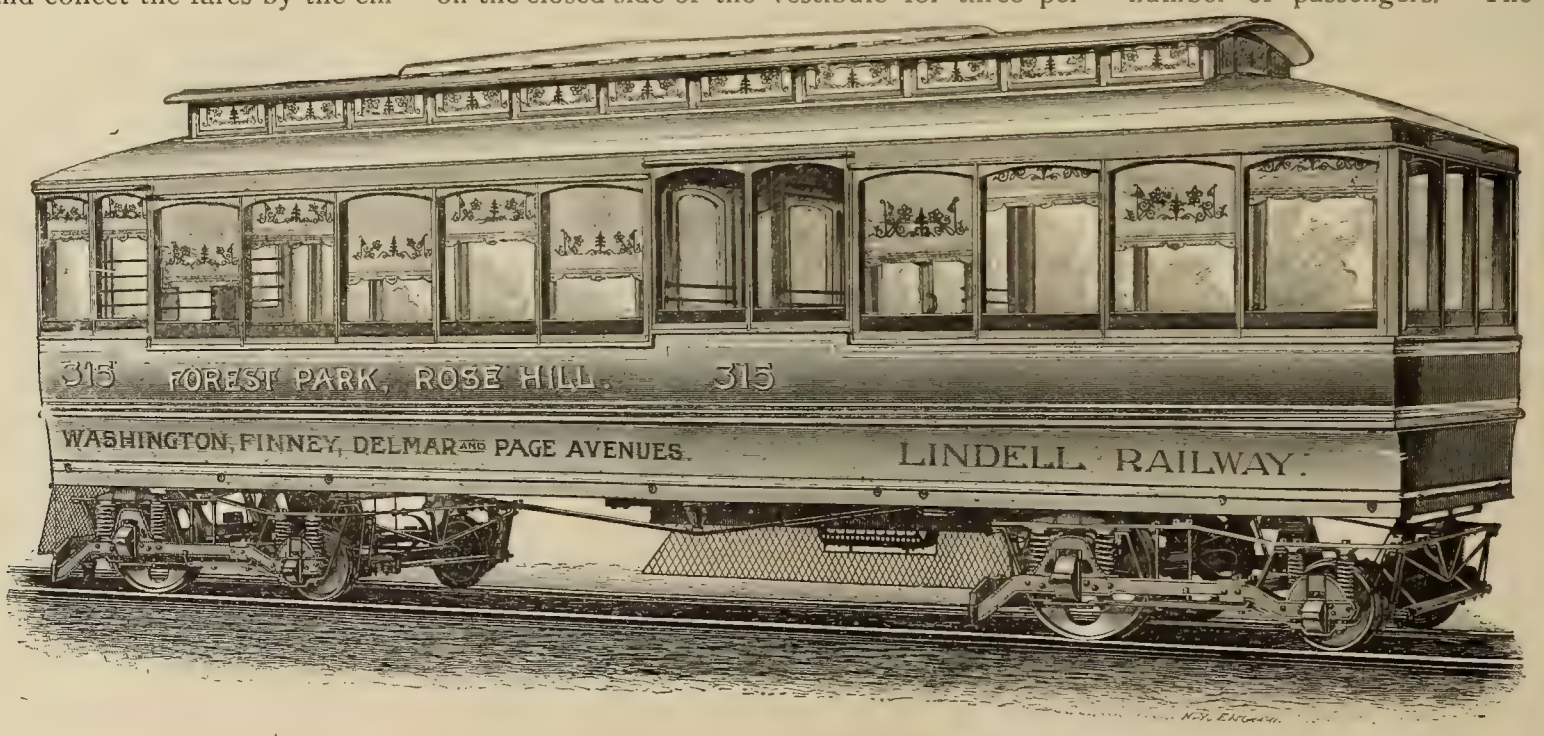


FIG. 3—REAR VIEW.

*J. G. Brill Company, Philadelphia.

item of enormous advantage; and this car is only 7½ feet longer than the adopted size of motor cars, with vestibuled ends, which seats only 22 persons. The motorman stands in a place 4 feet long and 2¼ feet wide, well sheltered, but with complete view of the track. This space is partitioned off with mahogany panels and plate glass sash, by which he is freed from all crowding and interference by passengers. Another important advantage which this long car has over a train of motor car and "trailer" is the superior control in stopping the car which, in the train, cannot be made to act as promptly as desired, unless by use of the automatic brake.

The Lindell Railway Company, with its characteristic generosity and desire to give its patrons the very best that can be had, has ordered this car to be finished in the most elegant manner, with solid mahogany, polished plate glass, embroidered linen shades, polished brass mountings, and seats where a passenger will not have to struggle for the 17 inches usually allotted to him.

The successful working of this long car with electric motors is dependent, however, on the use of Brill's patented maximum traction trucks, on which more than 90 per cent. of the traction is upon the two pairs of driving wheels of the trucks; and the peculiar form of the truck entering the bottom frame of the car body, sets the car so low that it required only a single step of the usual height at the entrance. The use of this style of truck on the Newark Passenger Railway, Newark, N. J., has made a great success of the operating of long cars at a time when the company was on the point of abandoning their use as being a failure, by reason of the deficient traction and excessive height of the car body, which caused two steps to be necessary.

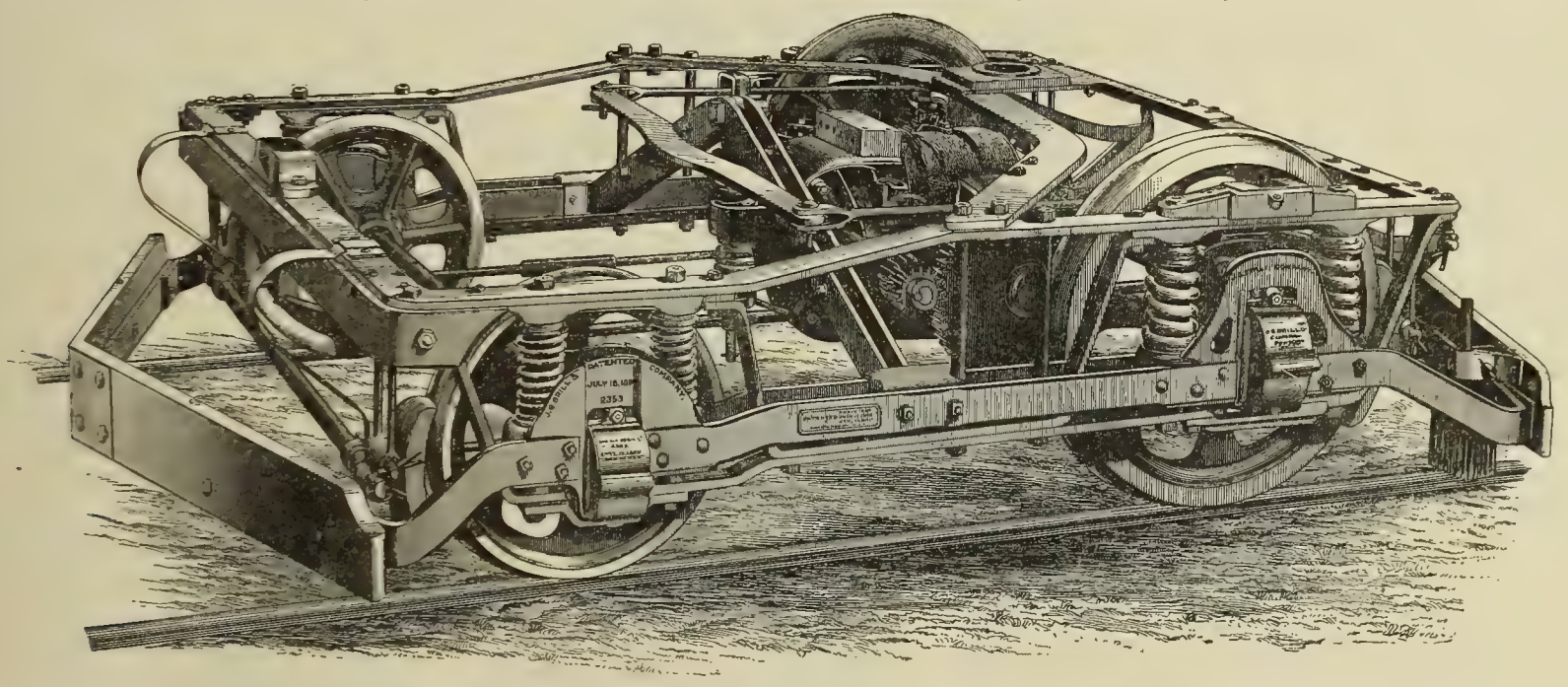


FIG. 4—NO. 11 MAXIMUM-TRACTION PIVOTAL TRUCK.

THE ORIGINAL INVENTOR OF THE TRANSMISSION OF FORCE BY ELECTRICITY, AND OF AN ELECTRIC RAILWAY WITH OVERHEAD CONDUCTOR.*

BY A. M. TANNER.

For some time it has been known to the writer that a French patent, issued in the name of Henry Gilbee on the 16th day of January, 1855, No. 22,114, contains a description of a method of transmitting force by electricity, and the employment of electric motors for the propulsion of cars on railways, either the track rails or an overhead conductor being used to convey the current. Upon examining the original documents of the patent in question it soon became apparent that some person other than the patentee was the inventor of the various forms of electric motors and special uses thereof as described in the patent and its two certificates of addition. This opinion was strengthened by the fact that an English patent, No. 148, of 1855, issued in the name of de Fontaine-Moreau, and substantially embracing the subject matter of the first certificate of addition of the French patent of Gilbee, is stated to be "a communication." As Gilbee figured in the original French documents as the *employé* of the patent agent who took out the English patent, it became necessary to find the real inventor of the subject-matter set forth in the French patent. Lithograph drawings filed with the patent application were undoubtedly made in Italy, as they bear the names of the Italian draughtsmen and address of the lithographer in Turin. A slight clue as to the identity of the inventor was obtained when the name "Bessolo" was noticed written in lead pencil on the patent document. The writer then remembered that a French engineer, several years ago, stated in a discourse on the transmission of force by electricity that one Bessolo, and not Gramme, was the discoverer of the transmission of force by electricity. The source of information, however, was not given, and it was thought by the writer that no published description existed of the Bessolo invention.

The pencil-written name on the French patent was taken up as a clue, and inquiry in various places soon revealed the real facts in the case, and the writer was permitted to see a document on file in the secret archives of the Conservatoire Nationale des Arts et Metiers.

The following is a copy of the document in question, which is said to have been deposited by Alexander Bessolo on the 26th day of October, 1883.

[COPY.]

I, Henry Gilbee, of No. 9 Sackville Street, Piccadilly, London, son of the late William and Charlotte Gilbee, born in London in the year 1831, do solemnly and sincerely declare that in the year 1855, when I was employed in the Patent Office of the late Peter Armand Le Comte de Fontaine-Moreau, brother-in-law of my mother, at Paris, 39 Rue de l'Exchiquier, I took out, by order of him, in my name, under the title of "Systeme de Moteur Electrique," a French patent dated January 19th, 1855, and also a Belgian patent dated January 22d, 1855, which invention I fully believe Mr. Bessolo (Cavaliere) Alexander, late Peter, born at Corea, Italy, at present retired major, to be the inventor and author, and I further declare that Mr. Bessolo, in the commencement of the year 1855, gave orders to the said Patent Office in Paris to take out the patents in the countries before mentioned under the title of "Moteur electro magnetique rotatoire à reaction entre le fer," for which purpose he sent the description and two lithographed drawings, marked A and B, and a special procuration to take out in my name French and Belgian patents, on the condition that afterwards I would transfer the said patents to him. I further declare that the sheets of drawings marked A and A′ B B′, have been respectively lithographed on the same stone as sheets A and B, and that I deposited them at the French and Belgium Patent Offices in order to confirm that I received the above from him. I further declare that I saw the autographic pamphlets marked C, and the two manuscripts marked D and E (the first was a copy) frequently in the hands of Mr. Bessolo between the months of May and July, 1855, at the said Patent Office in Paris, for the purpose of preparing the definite description. I therefore make this declaration to justify Mr. Bessolo as being the author of the said invention, and that I merely took them out by his procuration, and I make this solemn declaration conscientiously believing the same to be true and by virtue of the provisions of the statutory declarations October, 1835.

(Signed) H. GILBEE.

Subscribed and declared at the Mansion House, in the City of London, this 17th day of October, 1883. (Signed) HENRY KNIGHT, Lord Mayor London.

Here follow legalizations of the Lord Mayor's signature by the Italian Consul General at London, and then the Director of the Conservatoire des Arts et Metiers certifies that the copy of the affidavit left at his bureau is like the original seen by him.

Having now conclusively established the fact that Alexander Bessolo was the real inventor of the subject matter contained in the patent taken out in France in the name of Gilbee, I will now review the second certificate of addition of said patent, which in unmistakeable language contains a description of the transmission of force by electricity. I will give the description in the original as follows:

[TRANSLATION.]

TRANSMISSION TO A DISTANCE.—In cases where there is need of the work of any motor at a certain distance from the site of the latter, use may be made of the force at one's disposal to give direct motion to a magneto electric machine, which by means of telegraphic wires communicates the current to an electro-magnetic motor. Thus in tunneling mountains, use might be made of water power or of wind, to put in motion one or several magneto-electric machines, which would communicate their current, of course to a motor, and the connection may then be made with the machine with which the tunneling is done, and which is placed in the tunnel itself.

It is needless to say that Gramme and his coworker Fontaine cannot, in view of the foregoing description, maintain the claim that they were the first to propose the transmission of force by electricity at the Vienna Exposition of 1873. Another portion of the description in the second certificate of addition of the Bessolo patent, obtained through the procuration of Gilbee, will now be considered. Many uses of the patented electric motor are referred to, such as driving screw propellers, ventilating fans, aerial ships, and submarine boats, but the most important feature is

*London *Electrical Review*.

where the propulsion of cars on railways is referred to. After disclaiming the use of batteries carried by the car, it is stated that "batteries are located at the different stations and the electric current from the same is conveyed to the electromotor locomotive by the rails, or by a conductor insulated from the ground and supported on poles in a manner analogous to telegraph wires, which might even be supported on the same poles. The adherence is ensured by the electromagnetic attraction exerted between the wheels and the rails, or by the solidity of pairs of wheels of one or several vehicles when they are connected by means of cords, chains or belts." The description is silent to a traveling connection between the electric motor on the car and the overhead conductor; but obviously such a connection was contemplated by the inventor, and the description thereof was left out by inadvertence, and not because it was not understood that a traveling connection had to be provided between the overhead conductor and the motor on the car. It will, of course, be held that a published description, in order to defeat a patent, must be clear, and in such terms as to enable any one skilled in the art to make and use the invention described. Viewed in this light, the French patent might not be sufficient to stand a judicial test as a bar to the validity of a patent claiming broadly the electric railway system with an overhead conductor and traveling connection supplying the current to the car motor. This article, however, is not a legal argument, and does not pretend to be anything but a review of the inventions of a meritorious inventor who had a clear conception of the transmission of force by electricity, and a railway system with an overhead conductor in what has been termed the infant age of electricity. It has been ascertained by the writer, but not yet confirmed by personal investigation, that an Austrian patent, granted to Alexander Bessolo on the 3d day of December, 1855, is for an electromagnetic motor, and applications thereof, in which is found a description of the traveling connection between the overhead conductor and the car motor.

P. S.—Since writing the foregoing article, the discovery has been made that *La Lumière Electrique*, of December 8, 1883, contains an illustrated article concerning Bessolo's French patent. The subject, however, is not treated in the same way as by the present writer, and the bearing of the patent upon the transmission of force by electricity on railways is not brought into the foreground.

FINANCIAL DEPARTMENT.

It will pay you to carefully spend a few minutes each week over the growing list of street railways under the several heads and note the capital represented; also to follow the quotations, and then at the end of the year, note and compare the increase in capital, mileage, rolling stock and earnings, as shown by the price current. The time will come soon when you will find a few thousand to your credit unemployed beyond bank allowance for balance, and the odd hour or two spent will enable you with unerring certainty to place your surplus to your satisfaction. Many of us can recall the first street car which appeared in our city or town, but very few can even now point to the first man of our acquaintance who has lost money by investing in street car securities.

The supply of accommodation nowhere meets the demand of the traveling public; extension and more service is the call from all points. It is no longer a luxury, but a necessity, and they all pay, even the Montague street cable road, the shortest in the country, and in which the trainman, although carrying the *élite* of Brooklyn, performs his duty in his shirt sleeves, pays something over the interest on its bonds in the dull season. When the snow and ice make the hill weary-climbing on foot there is no reason why a dividend on the stock may not result. There are a great many industries closely allied to, yet distinct from surface carriage which will occur to the observing man and in some of these, by preference, his spare capital may find fruit. We desire success to both investor and industry.

STREET RAILWAY QUOTATIONS.

The following are the latest prices for street railway securities in New York, as quoted by Geo. B. Ellery, Financial Editor, Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Albany Street Railway Co. (N. Y.)	$750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Atlantic Ave. Ry. Bkln	1,000,000	50 00	*115
Atlantic Ave. Ry. Bkln. 1's	140,000		*103
Birmingham Ry & Elec.Co.,6's (Ala)	1,500,000		par
Broadway Ry. Bkln	525,000	100 00	185 00
Broadway Ry. Bkln. 1's	350,00		*101
Brooklyn City R.R.	6,000,000	10 00	15 50
Brooklyn City R. R. 5's	6,000,000		*100
Brooklyn Elevated	13,260,000	100 00	25 00
Brooklyn Elevated, 1's	3,500,000		*111
Brooklyn Elevated, 2's	1,250,000		*83
Benton Belfontaine (St. L.)	324,000	100 00	100 04
Benton Belfontaine 7's (St. L.)	50,000		*100
Broadway & 7th Ave. (N.Y.)	2,100,000	100 00	305 02
Bleeker St. & Fulton Ferry (N.Y.)	900,000	100 00	26 00
Broadway & Newburg (O)	1,000,000	100 00	110 00
Brooklyn St. R.R. (O)	310,000	100 00	125 00
City Elec. St. R.R. 6's (Ark)	200,000		par
Citizens (St. L.)	1,500,000	100 00	105 00
Cass Ave. Fair. (St. L.)	300,000	50 00	49 00
Chicago City (Ill.)	6,000,000	100 00	305 00
Chicago Passenger (Ill.)	1,000,000	100 00	96 00
Chicago Passenger (Ill.) 6's	400,000		*100
Central Park N. & E. R.	1,800,000	100 00	125 05
Cleveland Cable (O)	2,000,000	100 00	25 00
Cleveland Cable Pref. (O)	2,000,000	100 00	105 00
City R.R. (San Fran.)	800,000	100 00	100 00
California St. (San Fran)	1,000,000	100 00	109 00
Cincinnati, (O.)	5,775,000	50 00	109 00
Cincinnati, (O.) 7's	300,000		*102
Charleston City, (S. C.)	100,000	50 00	65 00
Coney Island & Bkln. Ry	500,000	100 00	120 00
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Crosstown Ry., 1's	200,000		*105
Dry Dock, E. By. & Bat. (N.Y.)	1,200,000	100 00	138 00
Dry Dock, E. By. & Bat., 7's, (N.Y.)	840,000		*100
Eighth Ave. (N.Y.)	1,600,000	100 00	250 06
East Cleveland, (Ill.)	2,000,000	50 00	85 00
Ferries & Cliff House, (Cal.)	2,500,000	100 00	42 00
Ferries & Cliff House, (Cal.) 6's	650,000		*108
Fulton Elevated, Bkln., 1's	1,621,000		*93
Germantown, (Pa.)	1,500,000	50 00	95 00
Gloucester St. Ry. Co. (Mass)	60,000	100 00	95 00
Jamaica & Brooklyn Road Co.	197.480	20 00	20 00
Jamaica & Brooklyn Road Co. 5s	500,000		*99
Kings Co. Elevated	3,250,000		12 00
Kings Co. Elevated, 1's	3,377,000		
Kings Co. Elevated, 2's	2 432,000		*58
Lehigh Ave. (Phila.)	1 000,000	50 00	66 00
Louisville St. Ry. (Ky.)	5,000,000	100 00	20 00
Louisville St. Ry. Pref. (Ky.)	1,000,000	100 00	70 00
Montague St. Ry., B'klyn	150,000	100 00	97 50
Missouri, (Mo.)	2,500,000	100 00	250 00
Mound City, (Mo.)	1,000,000	100 00	200 00
Market St. (San Fran.) 6's	3,000,000		*123
Mount Auburn Cable, (O.)	300,000	100 00	50 00
Mount Adams & E. Park	1,400,000	50 00	107 00
Northern Central, (St. L.)	200,000	100 00	105 00
North Beach, (Cal.)	1,000,000	100 00	53 00
North Chicago City R.R.	500,000	100 00	171 00
North Chicago Street R. R.	5,000,000	100 00	162 00
People's St. R. R. (St. L.)	1,000,000	50 00	75 00
People's St. R. R. (Pa.)	1,500,000	25 00	41 00
Pawtucket, (R. I.)	270,000	100 00	92 00
Phila. City	1,000,000	50 00	143 00
Ridge Ave. (Phila.)	750,000	50 00	215 00
Short El. Ry. Co. (Clev.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co.	16,000		†
St. Louis Ry. (Mo.)	1,000,000	50 00	75 00
St. Louis Cable, (Mo.)	1,000,000	100 00	15 00
St. Louis Cable, 5's	1,500,000		*101
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Elevated, Bkln., 1's	5,500,000		*107
Vine St. Motor Co. (Colo.) 6's	100,000		par
West Chicago Street R. R.	10,000,000	100 00	126 75
West End St. Ry. (Boston)	2,000,000	50 00	64 00
West End St. Ry. (Boston) Pref.	6,400,000	50 00	81 50
Winston-Salem Elec. St. R.R. (N C.)	250,000	100 00	75 00

*Per cent. †Registered Stock.

As very few street railway securities are dealt in on the Stock Exchange, the above prices are mostly approximate, but will be found very near the mark.

TEST OF GEARLESS MOTOR.

A few days ago the Short Electric Railway Company, of Cleveland, O., made a practical test of one of its new gearless motor cars on one of the Cleveland lines and it is said that the result was an entire success. The car was run on the Broadway line doing heavy service. A trailer was attached, and both were loaded to their full capacity. The motor car behaved well and took the curves and grades with great ease.

In order to test the new motors, the brakes were set tight upon the trail car and the full load was drawn on the track and around a curve with entire ease. Hon. Tom L. Johnson, the president of the Brooklyn street railroad, was an interested spectator and was thoroughly delighted by the remarkable tests, particularly the small amount of electric power taken by the motors. Mr. Short himself handled the car throughout the run.

The car itself is very handsome, having plate glass windows and special brass trimmings. It is painted the standard Pennsylvania railroad color and is lettered with the Short Company name and the words "Gearless Motor, Noisless," on each dashboard.

The car is to be sent to various parts of the country for exhibition before railway men, its first destination being Albany, N. Y., where a large equipment contract is pending.

On the occasion of this test the motor car ran as noislessly as a horse car and there was an entire absence of the peculiar whirr of the ordinary motor. It is said that the cost of repairs is reduced 75 per cent. by using the gearless motor.

ARC LAMPS FOR RAILWAY CIRCUITS.

The use of incandescent lamps upon street railway circuits has been unsatisfactory and expensive on account of the great fluctuation in the candle-power of the lamps and their consequent short life. The renewal of lamps has been a prominent factor in the running expenses of every plant. Recognizing these facts, the Universal Arc Lamp Company, 42 to 44 Broad street, New York, has designed an arc lamp especially to fulfill all the conditions and wants of the street railway circuit. It is claimed that they adapt themselves automatically to all fluctuations of the voltage, maintaining a bright white light without the disagreeable features of hissing and flickering. They burn ten in series on 500 volts direct current, and are provided with automatic cut-outs, so that if one lamp ceases to burn from any cause, it affects in no way the other lamps in series with it. Letters from Mr. L. S. Dumoulin, superintendent electrical department, West End Street Railway Company, Boston, Mass., from the Edison General Electric Company, of New York, regarding a competitive test made by their experts and those of the Central R. R. of New Jersey, in the latter's station at Jersey City. Frank J. Sprague and many others, speak very highly of the lamp. They are guaranteed to accomplish all the results claimed for them.

NO TRUTH IN THE REPORT.

It having been reported that the Edison motors are being discarded in street railway work in Minneapolis, Minn., Mr. Thomas Lowry, the president of the company denies the report in a letter of which the following is a copy:

August 8, 1891.

Mr. John Muir, Gen'l Manager Railway Dep't,
Edison General Electric Company, New York.

Dear Sir.—Referring to the newspaper report to which my attention has just been called, saying that the Minneapolis Street Railway Company has discarded the Sprague-Edison motors, I would say there is no truth whatever in the statement. We are using the motors and they are giving satisfaction.

Yours truly,

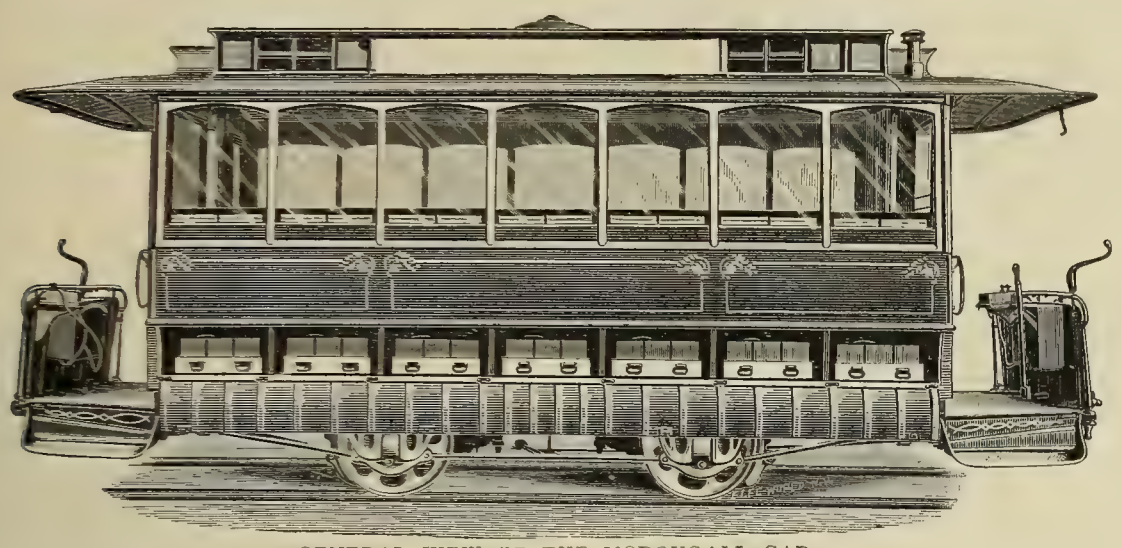
(Signed) Thomas Lowry.

The New York Equipment Company, 15 Wall street, this city, seems to understand the requirements of its buyers as it has just put out a compact little pocket memorandum book, made entirely of celluloid. This company buys, sells, and exchanges street railway equipment. Rails and fastenings are its specialty.

McDOUGALL ELECTRIC CAR.

On Tuesday, August 18, an exhibition test was given of the electric storage battery car now running on the Steinway and Hunter's Point R.R.

This car is run on the McDougall system, and is the result of several years experimenting. The storage cells used are those of the Gibson Electric Company, and there are 100 of them, of the 52 D type.



GENERAL VIEW OF THE MCDOUGALL CAR.

The truck of the car is provided with a motor of the single magnetic circuit type, with the pole pieces, yoke and field cores made of mitis iron, and the armature of laminated sheet iron. The power of the motor is communicated to one of the axles through the medium of double spur gearing. The motor is suspended in a way that gives considerable flexibility to the system, allowing for variation in every direction. The gearing is all encased in metal covers, which are easily removable, and all the bearings are self-lubricating.

The motor is series wound and high efficiency is claimed for it. Practical tests seem to bear out the claims made for it, and as to speed, the car has done remarkably well. It has run from the stable to the beach and back, total distance, 7,400 feet, in 10 minutes and 45 seconds.

The car was made by the well-known car builders, John Stephenson Company, New York, and runs with great ease.

The main feature of the electrical system is its flexibility, and the easy motion of the car when running is all that could be desired.

Mr. Townsend Wolcott, the well-known expert electrician, was in charge, and he in conjunction with Mr. W. M. McDougall has devoted many years of experimental work in this direction. They claim now to have a system of car propulsion which meets every requirement, and the result of Tuesday's test goes far to sustain their claim.

PERSONAL.

Mr. J. G. Brill, of the J. G. Brill Company, Philadelphia, was in town last week and gave us a pleasant call.

GENERAL NOTES.

The Second Avenue Passenger Railway Company, of Pittsburg, Pa., carried 1,808,993 passengers during the past year. The receipts were $88,492.45; expenditures, $61,094,49; surplus, $27,397.96. The company paid no dividends during the year.

The Metropolitan Street Railway Company, of Macon, Ga., recently ordered from the Ball Engine Co., of Erie, Pa., a complete plant, consisting of a 150 H. P. Tandem Compound engine, boiler, heater, pump, etc. It expects to have a perfect installation.

Work on the Broadway Cable Road, New York, is progressing rapidly. At the lower end the conduit and tracks have been laid and the street repaved as far as Pine street.

The Feigel Car Company of New Utrecht, L. I., office 108 Wall street, has been unusually busy this year and has had to refuse orders. The company has just finished for the Mansfield O., Electric Street Railway five cars, and six for the Meridan (Conn.) Horse Railroad Company. Among the orders this year some have gone as far south as Galveston and Atlanta, and northwest as far as Manitoba; also to Pawtucket, R. I. The Messrs. Watson and J. E. Whittlesey are very active young business men.

SUCCESS OF THE MINNEAPOLIS STREET RAILWAY COMPANY'S UNDERGROUND CONDUIT SYSTEM.*

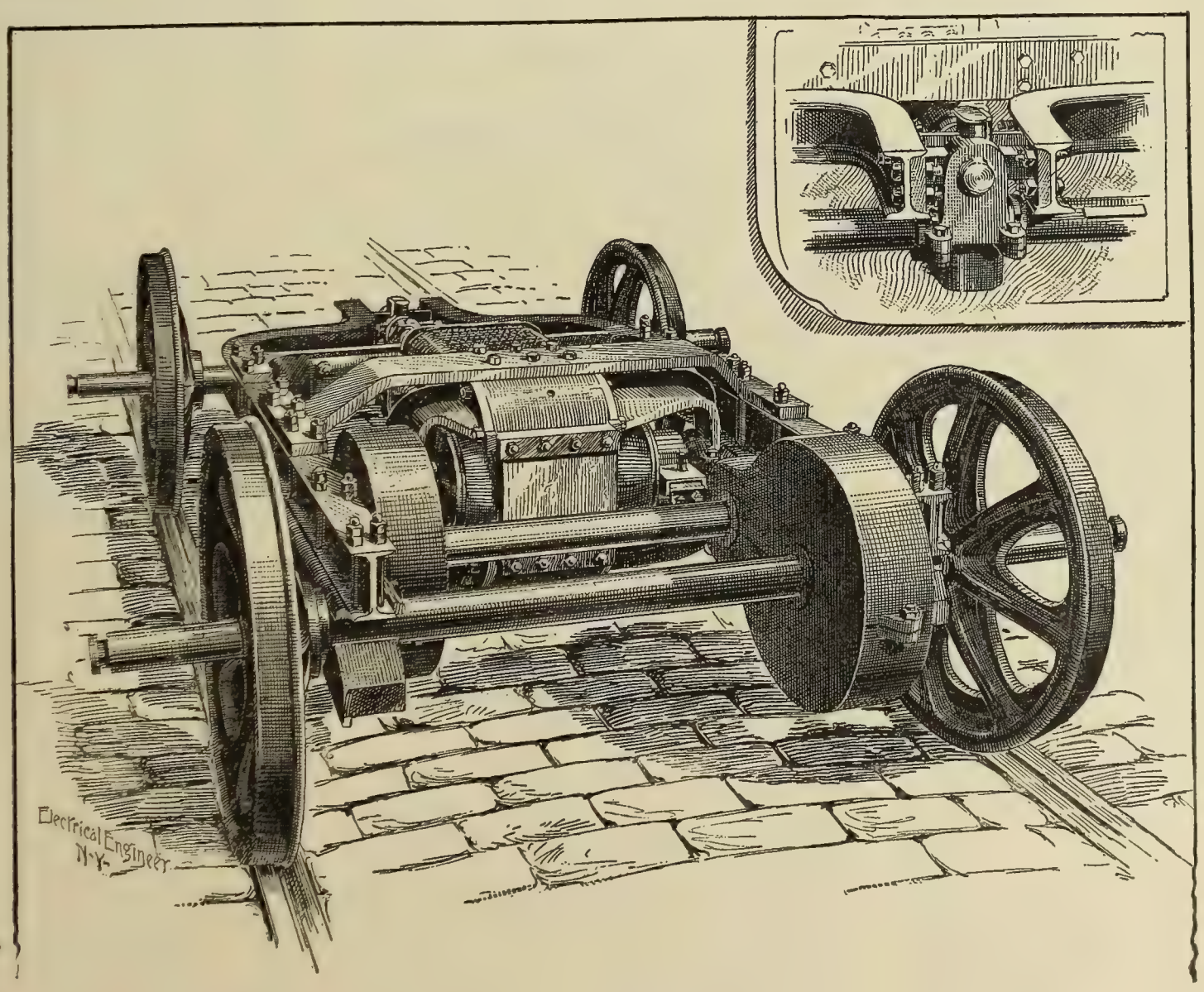
The electric system of the Minneapolis Street Railway and the St. Paul City Railway Companies is without doubt the most complete and one of the most extensive in the world.

The underground conduit system employed by the Minneapolis Street Railway Company for carrying its mains and feeders has several times been mentioned in our columns. A series of tests having been recently obtained from the Street Railway Company, we take pleasure in bringing the matter before our readers again.

The novelty of the system employed throughout lies in the fact that there is not a wire in sight in the heart of the city except the overhead trolley wire. The feeders, mains and track feeders are contained in a conduit underground; the trolley wire connecting with the feeders by means of a sub-feeder through the hollow iron supporting poles.

The conduit is located between the tracks and is built as follows: Two inch plank, first treated by boiling in fernoline, is used for constructing a long trough of the desired size. This trough is so nailed together as to be continuous and without joints from manhole to manhole, a distance of 408 feet. The trough is placed below the surface at such a depth that the top is six inches below the paving blocks.

The conduit proper consists of a number of heavy paper tubes. The tubes employed are one inch and one inch and a quarter



TRUCK AND MOTOR OF THE MCDOUGALL CAR.

*Interior Conduit and Insulation Co., New York.

inside diameter, laid in the trough in ten foot lengths and separated from each other and the sides and bottom of the trough by rings or spacers. The tubes are made continuous from manhole to manhole by use of a telescopic joint. After the tubes have been properly put in place, pitch liquified by heat is poured in filling the interstices and leaving a series of highly insulated raceways with a solid insulating filling, impervious to moisture, around them.

The system is the first installation of underground conductors ever made in which bare copper wires were drawn into a conduit without other insulation than the conduit itself. There is at the present time about 60 miles of bare copper cable resting in the conduits varying in size from 100,000 to 500,000 C. M. The insulation resistance on the entire amount of tubing, with overhead trolley and outlying feeders, as shown by actual test, is as high as 1,081,147 ohms.

A large amount of this conduit has been in service since September, 1890, and has not developed a single fault.

The most emphatic and reliable tribute to the excellent results of this new method is found in the additional order for 200,000 feet of tube recently filled by the Interior Conduit & Insulation Company. The original order was for 400,000 feet.

Some recent tests of the feeders in the conduits show an insulation resistance which is commendatory to the system and speaks for itself :

FEEDER.	OHMS.	LENGTH.
A	37,719,598	3,122 feet.
B	18,647,094	5,172 "
C	2,251,122	8,048 "
D	10,288,096	9,082 "
E	1,790,898	7,218 "
F	1,815,078	8,048 "
G	1,488,031	5,172 "

The drop in the potential at the terminal of the feeders employed in the conduit is 5 per cent.

The winter is the critical time for any out door electrical installation, either overhead or underground. Now, with the practical results of the first installation before us, there seems to be no reason for any further erection of unsightly poles carrying wires from one-half inch to one inch in diameter and marring the beauty of our streets. Now that we have actual proof of an underground system successfully withstanding the severe winters of Minnesota, let the electrical street railway people take advantage of this and thereby accede to the universal demand of the public and place the wires underground.

The Week's Record of Street Railway Notes.

CALIFORNIA.

Oakland.—The Oakland Consolidated Street Railway Company is having some of its new cars equipped with Thomson-Houston motors.

CONNECTICUT.

Bridgeport.—The Bridgeport Horse Railroad Company has completed its extension to Old Mill Green.

GEORGIA.

Columbus.—Eugene P. Lynch, Jr., of New York, commenced construction work on the new electric line here August 6.

The North Highlands Street Railway Company is constructing its road with all possible speed, and expects to have cars running soon.

Savannah.—A successful trial trip was made by the Street Railway Company, August 5.

ILLINOIS.

Chicago.—It is understood that the Chicago and Jefferson Transit Company has secured franchises and right-of-ways on a number of streets in this city. The company was incorporated with a capital stock of $1,000,000, and has been quietly working for nearly a year. The road is to use electricity. Among the chief stockholders are President Hosmer, Secretary Soule, A. F. Dexter, L. Pratt, John F. Thompson, John J. Fenn and W. Proudfoot.

KANSAS.

Kansas City.—It is said that a machinist here has invented a compressed air motor for street railways.

MARYLAND.

Baltimore.—The North Avenue Electric Company is to receive two new electric cars.

On August 10, the property owners on North avenue formed themselves into the North Avenue Protective Association, intending to prevent the laying of independent tracks on North avenue by the North Avenue Electric Railway Company. The association insists on the new company using the tracks of the Union Railway Company.

Canton.—The citizens of this place are asking the Green line to cable its road.

Cumberland.—The Electric Street Car Company has ordered three new motor cars.

MASSACHUSETTS.

Beverly.—It is said that the Union Street Car Company has offered to sell its entire plant to the Beverly and Danvers Street Railway Company,

Brockton.—It is reported that the street railway companies of Brockton and Avon are to be consolidated.

Holyoke.—The electric street railway made a successful trial trip August 6.

Quincy.—The firm of Badger Bros. has just put a self-oiling trolley-wheel on the market.

Salem.—The Naumkeag Street Railway Company has just received six new motor trucks from the J. G. Brill Company of Philadelphia.

Worcester.—The Consolidated Street Railway Company will have its extension completed in a few days.

MINNESOTA.

Duluth.—The stockholders of the Duluth Street Railway Company have had a receiver appointed for the road.

Minneapolis.—Owing to the sewer construction the opening of the Second street and Hennepin avenue boulevard line has been delayed.

The street railway company has installed an arc light plant in its power house to illuminate the roadway between Lakes Calhoun and Harriet.

The street railway interurban mail system is now in operation.

St. Cloud.—The Thomson-Houston Company is after the St. Cloud street railway system.

NEW HAMPSHIRE.

Dover.—Williams & Sons have just completed a belt for the Omaha (Neb.) Street Railway, 116 feet 10 inches in length, 5 feet in width and ½ an inch thich. It is made of pure oak butts in sections, and is said to be one of the largest ever made in the factory.

Nashua.—The street railway company has purchased four new cars.

NEW YORK.

Brooklyn.—It is said that the belt line street railway running from Ft. Wadsworth to New Brighton and Port Richmond, is to be bought by a syndicate who intends to rebuild the road throughout and equip it with electricity.

New York.—It is reported that the Broadway Company has acquired control of the Twenty-ninth street cross-town line.

PENNSYLVANIA.

Bethlehem.—The street railway track on Main street is completed.

Lebanon.—The street railway is about completed.

The Lebanon and Annville Street Railway Company has received another car from the John Stephenson Company of New York, making four cars so far delivered.

Reading.—It is said that the Council has asked the Street Railway Company to pay half a cent to the city for each passenger carried.

West Chester.—The West Chester Street Railway Company has ordered three new cars.

Williamsport.—A trial trip was made over the electric street railroad August 5.

RHODE ISLAND.

Providence.—Work has been begun on the Interstate Street Railway connecting Providence, North Attleboro, Attleboro and Pawtucket.

Ft. Worth.—The entire property of the Ft. Worth Land & Railway Company has been purchased by Boston capitalists for $75,000.

San Antonio.—The electric street cars have stopped running to Beacon Hill.

Waco.—The electric street car line is nearly completed to College Heights.

VIRGINIA.

Lynchburg.—The Rivermont electric street railway was recently opened to the public, giving it nearly nine miles of track between Rivermont and South Lynchburg.

WASHINGTON.

Tacoma.—The formal opening of the cable railway took place August 4.

WISCONSIN.

Fond du Lac.—It is said that a Boston syndicate is negotiating for the purchase of the street car line here.

Racine.—The Belle City Street Railway Company has been purchased by C. H. Holmes, of St. Louis for $90,000. The purchase was made on condition that seven miles more of territory should be included. The new owners will equip it with electricity.

Franchises.

Dubuque, Ia.—The franchise of the Dubuque Street Railway Company has been amended so as to include the right-of-way to the northern limits of the city.

Marblehead, Mass. — On August 11, the Selectmen granted the request of the Naumkeag Railway Company, of Salem, for leave to extend its electric system to this place.

San Francisco, Cal.—The Market Street Railway Company has been granted a franchise to construct and operate a street railway along a number of streets of this city.

The Omnibus Cable Company has been granted a franchise to construct and operate a street railway on Stanyan street.

Syracuse, N. Y.—The Syracuse Electric Railway Company has been granted permission to construct, maintain and operate a double track street railway through and upon a number of streets here.

New Roads.

Dayton, O.—The citizens desire an electric street railway.

East Liverpool, O.—It is stated that Cleveland capitalists will build a street railway here.

Keene, N. H.—A street railway from Keene to South Keene is being strongly agitated.

Oswego, N. Y.—An electric street railway is to be constructed here.

Pekin, Ill.—The citizens desire a street railway.

Possible Purchases.

Bradford, Pa.—The Bradford and Kendall Street Railway Company, will require equipment for a three mile extension.

Charlestown, W. Va.—The Charlestown Street Railway Company will probably require a complete electrical equipment next year.

Corvallis, Ore.—The Corvallis Street Railway Company will require additional equipment. Ralston Cox is superintendent.

Cumberland, Md.—The electric street car company will require a number of trailer cars this winter.

Little Rock, Ark.—The City Electric Railway Company requires 28 motor cars, and probably equipment for the construction of a two-mile extension. H. B. Bradford is superintendent.

Memphis, Tenn.—The Citizens' Street Railway Company requires a complete electrical equipment. R. Semmes is the general manager and secretary of the company.

Port Townsend, Wash.—The Port Townsend Belt Electric Railway Company, of which Julius S. Potter is president and E. Dutcher general manager, will require additional equipment for a four-mile extension.

Richmond, Va.—Andrew Rizzini will need an electrical equipment for his street railway between Jeffersonville and Tazwell, C. H., Va.

Spokane, Wash.—The Spokane Street Railway Company, of which Fred Bruch is superintendent, will require four or five new cars shortly.

Vancouver, Wash.—The Columbia Land and Improvement Company will require electrical equipment for five and a half miles of road. L. M. Hidden is superintendent.

Change of Power.

Brockton, Mass.—Avon has granted the Brockton Street Railway Company permission to use electricity on its lines in that town. It is said that the Brockton Aldermen will grant the same privilege.

Little Rock, Ark.—The City Electric Street Railway Company is changing the motive power of its system to electricity.

Memphis, Tenn.—The Citizens' Street Railway Company is to use electricity for its motive power.

Montgomery, Ala.—The mule cars are to give way to electricity.

Richmond, Va.—It is thought Andrew Pizzini, of this city will change the motive power of his street railway between Jeffersonville and Tazwell C. H., Va., to electricity.

Spokane Falls, Wash.—The Cook Motor Railway Company is to change from steam to electricity.

Toledo, O.—The Woodland Avenue and West Side Street Railway Company is to use electricity.

Vancouver, Wash.—The Columbia Land and Improvement Company is to change its motive force to electricity.

Election of Officers.

City Island, N. Y.—F. Underhill has been appointed superintendent of the Pelham Park Railway Company, in place of Mr. Charles Miller.

Indianapolis, Ind.—Mr. J. P. Frenzel has been appointed president and manager of the Citizens' Street Railway Company.

Incorporations.

Buffalo, N. Y.—The Buffalo and Williamsville Electric Railway Company of Williamsville, Erie Co., N. Y., was incorporated August 10 with a capital stock of $50,000. The company proposes to build a street railway between the northern boundary of Buffalo and Williamsville. Incorporators, Hascal Taylor, John Satterfield, Robt. Parsons, Freeman M. Vilas, all of Buffalo and Jas. Chalmens, of Williamsville, N. Y.

Chicago, Ill.—The West and South Towns Horse Railway Company, of Chicago, has been incorporated with a capital stock of $100,000; to construct a street railway from Lawndale to Lake Michigan, through the city of Chicago. Incorporators: C. L. Bonney, L. C. Bonney and M. A. Bonney.

The Elevated Single Track Cable Construction Company, of Chicago, has been incorporated with a capital stock of $500,000; to construct elevated cable ways for transporta-

tion. Incorporators: G.W. Cole, Pleasant Amick and J. E Marder.

The Low Adjustable Car Company, of Chicago, Ill., has been incorporated with a capital stock of $1,000,000 to supply Low adjustable cars to railroads. Incorporators, George J. Sherman, H. N. Greene and Brian Philpot.

The International Electric Railway Company, of Chicago, has been incorporated to manufacture street railway appliances. Incorporators, D. L. Coe and others.

PORTLAND, Ore.—The Portland and Southern Railway Co., of this city, was incorporated August 7, with a capital stock of $10,000,000, to build, buy, sell, lease, maintain and operate means of transportation by horse, steam or electric street railways. Incorporators, Frank Sperling, W. S. Mason and Mose Meyer.

LEGAL.

LEBANON, Pa.—Judge Simonton has dissolved the injunction against the Lebanon and Annville Electric Railway Company brought by Henry S. Heilman, to prevent the railway company from occupying the street in front of his residence.

LEXINGTON, Ky.—It is said that Judge Barr has decided that the K. U. Company can use the tracks of the Belt line until he decides some other points in the contract between the companies.

LOUISVILLE, Ky.—Judge Barr has decided that the Lexington Belt line had no right, even if it owned the tracks, which it claimed to do, to try and get possession of the property without permission of the Court. The Judge said when a road is operated by another, it is in the possession of the one operating it, and use cannot be taken by occupancy or serving of notice. In summing up Judge Barr said that the Belt line tracks were in the possession of the receiver of the Kentucky Union when the controversy began, and he gave an order for the immediate restoration of the property to that company.

MINNEAPOLIS, Minn.—The street railway company is being sued by a passenger who was abused and assaulted by other passengers on an electric car, the conductor and driver of which refused to aid the complainant.

PITTSBURG, Pa.—Judge Ewing has decided that the Central Traction Company must remove its tracks from High street. The company will appeal to the Supreme Court.

SAN FRANCISCO, Cal.—The Market Street Railway Company is being sued for $10,000 by a former employé, who claims that he was struck and seriously injured by a car owned by the company while in its employ.

TRACK EXTENSIONS.

BRADFORD, Pa.—The Bradford and Kendall Street Railway Company is to extend its track three miles.

BROOKLYN, N. Y.—President Uhlman, of the Brooklyn Elevated Road, expects to commence an extension of the Fifth avenue line, down Third avenue to Fort Hamilton, in October.

CHARLESTOWN, W. Va.—The Charlestown Street Railway Company is extending its lines.

CORVALLIS, Ore.—The Corvallis Street Railway Company will extend its track one mile.

LITTLE ROCK, Ark.—The City Electric Street Railway Company will extend its track about two miles.

MANCHESTER, N. H.—The street railway is to double track Granite bridge.

NEWTON, Mass.—It is said that the Newton Street Railway Company will extend its tracks to Watertown.

TOLEDO, O.—The Toledo Consolidated Street Railway Company purposes extending its track five miles.

TRENTON, N. J.—The City Railway Company will extend its track two miles.

The Trenton Horse Railway Company will make an extenson to its track of four miles.

PORT TOWNSEND, Wash.—The Port Townsend Belt Electric Railway Company is to extend its system four miles.

PALATKA, Fla.—The Street Railway Company intends completing the belt route over the heights at once.

PITTSBURG, Pa.—The Citizens' Traction Company is to extend its electric road about five miles during 1892.

PORTLAND, Me.—The Portland Railway Company has extended its tracks to Stroudwater, a distance of three miles.

PROVO, Utah.—The Provo City Railway Company will extend its tracks six miles.

ROCKFORD, Ill.—The West End Street Railway Company is about to extend its line a mile and one-half.

SALT LAKE CITY, Utah.—The Salt Lake Rapid Transit Company has been authorized to construct and operate a second track along its present route.

SAN FRANCISO, Cal.—It is said the Cliff House and Ferries Railroad Company is to make another extension to its lengthy system.

SAULT STE MARIE, Mich.—The Sault Ste Marie Street Railway Company will extend its tracks three and one-half miles.

SPRINGFIELD, Ill.—The Peoples' Electric Railway Company will add two miles to its track.

SPOKANE, Wash.—The Spokane Cable Railway Company contemplate a considerable extension to its tracks.

VANCOUVER, Wash.—The Columbia Land and Improvement Company will extend its track three miles in the near future.

WASHINGTON, Pa.—The Electric Railway Company has extended its tracks to the borough line.

WEBB CITY, Mo.—The Twin City Street Railway Company will make an extension of one mile.

WEIR VILLAGE, Mass.—The Horse Street Railway Company will probably extend its track about one-half a mile.

WEST SUPERIOR, Wis.—The Douglas County Street Railway Company is to extend its track three miles.

CASUALTIES.

BOSTON, Mass.—An electric car ran over and killed a seven year old boy August 7.

LYNN, MASS.—On August 8 a horse car and an electric car collided, severely injuring two passengers and breaking both cars.

MORE KIND WORDS.

PATERSON RAILWAY COMPANY,
PATERSON, N. J., Aug. 14, 1891.

E. V. CAVELL, Esq., General Manager Railway Department ELECTRICAL AGE, New York.

My Dear Sir:—It was with a great deal of surprise as well as pleasure, that I saw your name announced as above, and that you decided to give the street railway men a weekly report of matters pertaining to their interest.

The move is a good one and bound to be a success, and in this progressive age when improved street car transportation, whether by electricity, cable or steam, is engaging the attention of every railroad man, we want to know as soon as possible the progress being made and all the latest improvements.

Knowing your "push" and energy I feel satisfied this new departure in street railway journalism will be hailed with satisfaction by all street railway men as well as others. Yours very truly,

EDW. J. LAWLESS, Manager.

J. G. BRILL COMPANY, CAR BUILDERS,
SIXTY-SECOND STREET AND WOODLAND AVENUE,
PHILADELPHIA, PA., Aug. 11, 1891.

E. V. CAVELL, Esq., General Manager Railway Department ELECTRICAL AGE, New York City.

Dear Sir:—I have read your paper with great satisfaction. There is not such a mass of stuff in it as in some of the monthly papers, and in my estimation therein lies its merit, as I have time to read it. It is newsy and terse, and is like a good daily newspaper compared with a padded Sunday or weekly sheet. Yours, truly,

JOHN A. BRILL, Vice-President.

Mr. F. H. Leonard, Jr., Vice-President of the Electric Engineering and Supply Company, Syracuse, N. Y., writes: "We appreciate the value of your paper highly and have already received a large number of inquiries regarding our specialties illustrated in the same. We place a high value on the Official Directory of Street Railways, which is remarkable for accuracy and of much benefit to our traveling men, as well as to this office in obtaining proper directions for circular matter. We believe you are on the right track in publishing a weekly journal in the interests of street railways, which cannot fail to be appreciated by interested parties who want the news."

Mr. John N. Stewart, President of the Ohio State Tramway Association, Cleveland, O., writes as follows: "The management is to be congratulated on having so greatly improved the department over which the footprints of 'Cavell' are so noticeable."

The *Pacific Lumberman, Contractor and Electrician*, (San Francisco), of July 30, says: "The ELECTRICAL AGE has added a department of street railway news that is of great value."

BUSINESS NOTE.

The following is a copy of a letter which explains itself:

WILKES-BARRE & WEST SIDE RAILWAY COMPANY.
WILKES-BARRE, PA., Aug. 5, 1891.

A. C. VOSBURGH, Sec., The New Process Raw Hide Co., Syracuse, N. Y.

Dear Sir:—We have been using your raw hide armature pinions for over a year and find them the best and most durable pinion that we can buy. We consider the New Process Raw Hide the best in the market to-day.

Yours truly,

(Signed.) PIERCE BUTLER, Secretary.

DELAWARE & HUDSON COMPANY.

For the information of those who have never visited the Canadian metropolis, but who are intending to go to the Montreal meeting, it mya be stated that the shortest and most interesting line between Montreal and New York is the Delaware & Hudson Railroad. Parties from the West can go to Schenectady or to Albany, connecting at either point with the "D. & H." road, and see something of Saratoga, Lake George, Lake Champlain and the marvelous scenery of the Adirondack Mountains. The "D. & H." stands at the head in the number and importance of the summer resorts along its line, and in the number of summer tourists carried in its trains.

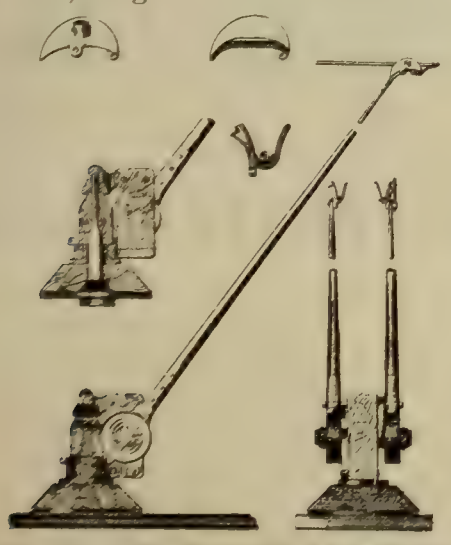
Arrangements should be made to include a stop at the Hotel Champlain on the west shore of Lake Champlain, three miles south of Plattsburgh, which, architecturally and in beauty of location of surroundings, is perhaps the finest affair of its kind in the world.

Mr. J. W. Burdick, general passenger agent of the Delaware & Hudson Railroad, Albany, N. Y., will be glad to send by mail an illustrated guide of the line, upon receipt of six cents in stamps, to cover postage.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued August 11, 1891.

457,334. Pole Trolley and Stand for Electric Street Railways. Thomas E. Adams, Cleveland, Ohio, assignor to the Brush Electric Company. Original application filed June 11, 1889. Divided and this application filed April 30, 1891.



457,334—POLE TROLLEY AND STAND.

A spark-catcher arranged to press against the under side of the line conductor at one end of the trolley.

457,356. Trolley-Pole for Electric Railways. Charles A. Lieb, New York, N. Y. Filed March 28, 1891.

A trolley-pole having a tubular metallic conductor inclosed therein.

457,357. Electric-Car Motor. Cyprien O. Mailloux, New York, N. Y. Filed March 18, 1891.

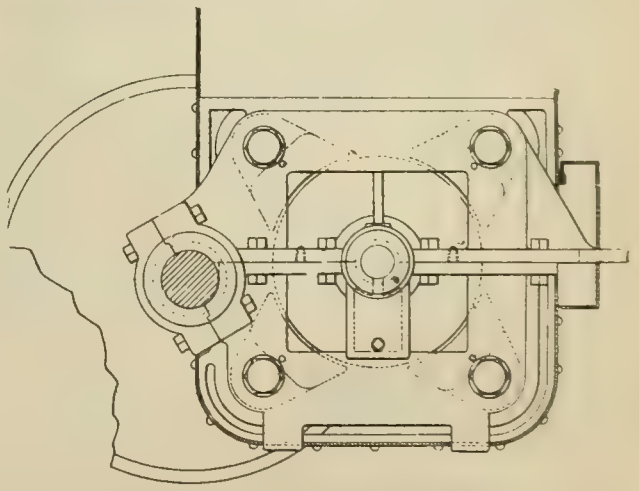
A motor-frame made in two parts, one supported upon the car axle or truck, while the other part supports the armature and is attachable and detachable from beneath the first, so that it may be lowered with the armature, leaving the upper part in place.

457,359. Friction-Gear for Electric-Car Motors. Cyprien O. Mailloux, New York, N. Y. Filed March 18, 1891.

In an electric-railway motor, the combination of the field-magnet yoke plates or pieces sleeved on the car-axle and forming side frames or bars on which the armature is mounted, of an intermediate eccentric sleeve between the axle and the yoke-bearings, and a worm or other gear-wheel connected to the sleeve and surrounding the axle.

457,377. Trolley for Electric Railways. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Nov. 6, 1889.

The combination, with a trolley-shoe constructed with a



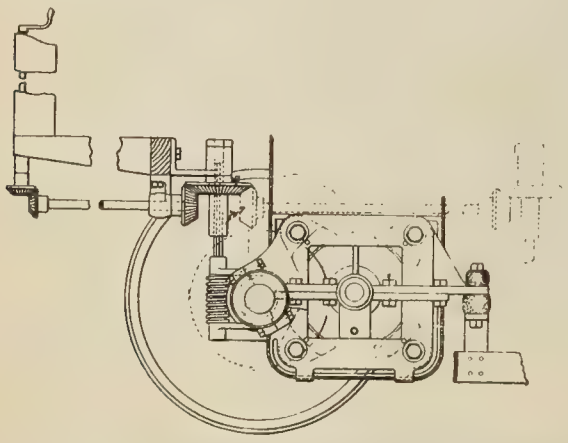
457,357—ELECTRIC CAR MOTOR.

receptacle having a spring in it, of a contact-block located in the receptacle and adapted to be pressed against a trolley-wire by the spring.

STREET RAILWAY PATENTS—Continued.

457,378. Trolley. Sidney H. Short, Cleveland Ohio, assignor to the Short Electric Railway Company, same place. Filed March 26, 1890.

The combination, with a base, a swivel-pin thereon, and a block having a vertical socket in its lower end adapted to receive the swivel-pin, and a horizontal bearing located directly above the upper end of the socket, the block being mounted on and supported by the upper end of the pin, of an arm mounted on the bearing and carrying at its upper end a contact wheel or brush, and connected at its lower end at a point below its axis with a spring.



457,359—FRICTION GEAR FOR ELECTRIC CAR MOTOR.

457,382. Electric Railway. Michael H. Smith, Halifax, England. Filed Dec. 16, 1887. Patented in England and in Germany.

Two parallel positive conductors in one horizontal plane, two parallel negative conductors in another horizontal plane and cars carrying collectors arranged to make contact with all the conductors simultaneously.

457,404. Street-Railway Switch. Henry H. Olds, Indianapolis, assignor of one-half to Seth Matthews, Mooresville, Ind. Filed March 24, 1891.

The combination of a switch forming part of a street-railway, a casing extending from beneath it to a point between the rails of the track and formed with slots in its top, the connecting-rod extending within the casing with its ends bent up and extending through the slots, one end to engage with the switch and the other end provided with an anti-friction wheel, and a device on the front of a car arranged with its forward end in position to strike the wheel and extending back at an angle sufficient to force it to one side and throw the switch.

457,540. Track-Clearing Attachment for Railway Cars. George R. Perry and William H. Perry, Concord, N. H. Filed Jan. 24, 1891.

In a track-cleaning device, the combination, with the axle of a car, of a gear-wheel mounted thereon and an arm pivotally secured at one end of the axle and having bearings upon one side, a cleaning-wheel journaled at the free end of the arm provided with a gear-wheel, a shaft journaled in the bearings having a wheel at each end, engaging with the gear-wheels, and means for adjusting the free end of the arm.

457,565. Signaling-Telegraph for Cable Railways. Theodore A. B. Putnam, New York, N. Y., assignor, by direct and mesne assignments, of seven-eights to Ella S. Webster and Albert Comstock, same place, and Joshua W. Powell, Brooklyn, N. Y. Filed March 13, 1889.

Means for enabling a signal to be instantaneously sent from any car to the power-house, consisting of an electric circuit comprising a conductor extended along the track or portion thereof whereon the cars are driven by the cable, a source of electric energy in connection with the circuit, an electro-magnet at the power-house for signaling purposes in communication with the circuit, and circuit manipulating devices upon the respective cars for influencing the circuit to enable signals to be sent by any gripman to the power-house to cause the cable to be stopped or otherwise controlled.

457,599. Truck for Electric Motors. George M. Brill, Philadelphia, Pa. Filed June 19, 1890.

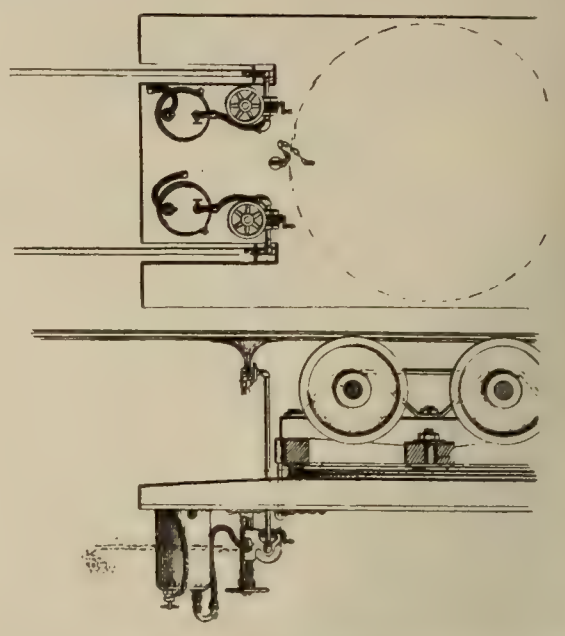
The combination in a wheeled vehicle having side beams carried by the axle-boxes, of a motor pivotally supported at one end on the axle of the vehicle and the free end supported from the side beams, the point of the support of the free end of the motor being above its free end.

457,660. Hanger for Trolley-Wires. Nelson Newman, Springfield, Ill. Filed Sept. 23, 1890.

An insulated hanger with a flat non-conducting base having hooks attached to it and adapted to engage the supporting-wire, and a depending flat metallic web lying at right angles to the base and rigid therewith, the lower end of the web being doubled or bent upon itself to provide a broad bearing or contact for the trolley-wire.

457,702. Apparatus for Removing Snow and Ice from Railway Tracks. Norman H. Bruce, Waterford, assignor of part to George H. Morrison and Charles P. Kimball, Lansingburg, N. Y. Filed Nov. 6, 1890.

In a track-cleaning apparatus, the combination, with a car-truck, of a reservoir for containing combustible fluid, a fluid-supply pipe communicating with the reservoir, a burner-carrying pipe provided with a burner and having a jointed or swiveled connection with the fluid-supply pipe to swing thereupon in a vertical plane for placing the burner-carrying pipe perpendicular with the burner below the truck-platform, and means for swinging the burner-carrying pipe and adjusting the fluid-supply pipe vertically in a rectilinear path.



457,702—APPARATUS FOR REMOVING SNOW AND ICE FROM RAILWAY TRACKS.

457,736. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Filed June 21, 1886.

A conduit for an electric railway, provided on its upper portions with lateral flanges formed integral with the side walls, the flanges being provided with drainage-apertures, in combination with working conductors, located within and insulated from the conduit.

457,740. Car-Truck. Moses G. Hubbard, Chicago, Ill. Filed Feb. 25, 1890.

The combination with the single wheel-piece on each side, of yoke-pedestals having each a spring-base on its outer end only, formed integral with the pedestal and adapted to receive the springs supporting the car-body mounted directly thereon, the yoke-pedestals being constructed to embrace and hold the journal-boxes and permit their removal from the lower ends of the yoke.

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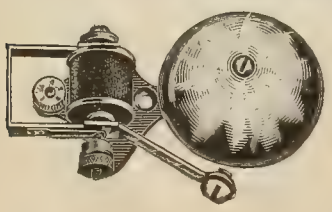
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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

WEEKLY.

Vol. IX. NEW YORK, AUGUST 29, 1891. No. 35.

A BROOKLYN ENTERPRISE.

The Hunt Engineering Company of Brooklyn is now entering upon the second year of a successful career, and is the largest general electric construction company in the city of Brooklyn. The success attained has been through the efforts of Mr. George W. Hunt and Mr. Albert E. Rich, who formed a partnership over a year ago under the name of the Hunt Engineering Company, and opened a very modest office at 177 and 179 Montague street, Brooklyn.

Shortly after this, it was successful in obtaining its first contract for the installation of an electric light plant on board the Steamer "Winthrop", one of the fleet of the New York, Maine & New Brunswick Steamship Company's steamers, plying between New York, Bar Harbor, Eastport, and St. John, New Brunswick. The successful operation of this plant was the stepping stone to many others, and last year this company installed in central station and isolated work, over 10,000 incandescent electric lights, one of the most important plants being at the Broadway Theatre, Norwich, Conn., where the building was wired for 650 incandescent lights, supplied with current from an alternating machine at the central station of the Norwich Electric Light Company. This installation in many respects was different from any theatre wiring that had ever been done and all the circuits in the building were controlled from three different switchboards located in various parts of the building. The main switchboard, which was designed especially by this company, located on the stage, was an expert piece of mechanical and electrical engineering, and the water rheostat which controls the candle power of the lights is probably the most successful and most satisfactory of any toning device in any theatre, as the lights can be raised and lowered without the unpleasant jumping from one candle power to another.

The other two switchboards are located, one in the lobby, and one in the gallery of the theatre, so that in case of fire or accident, all the lights could be turned on or off or each circuit separately, as might be desired by the ushers.

The following letter which the Hunt Engineering Company received from Mr. Blackstone, the Treasurer of the Norwich Opera House Company, shows the satisfaction with which the plant was accepted.

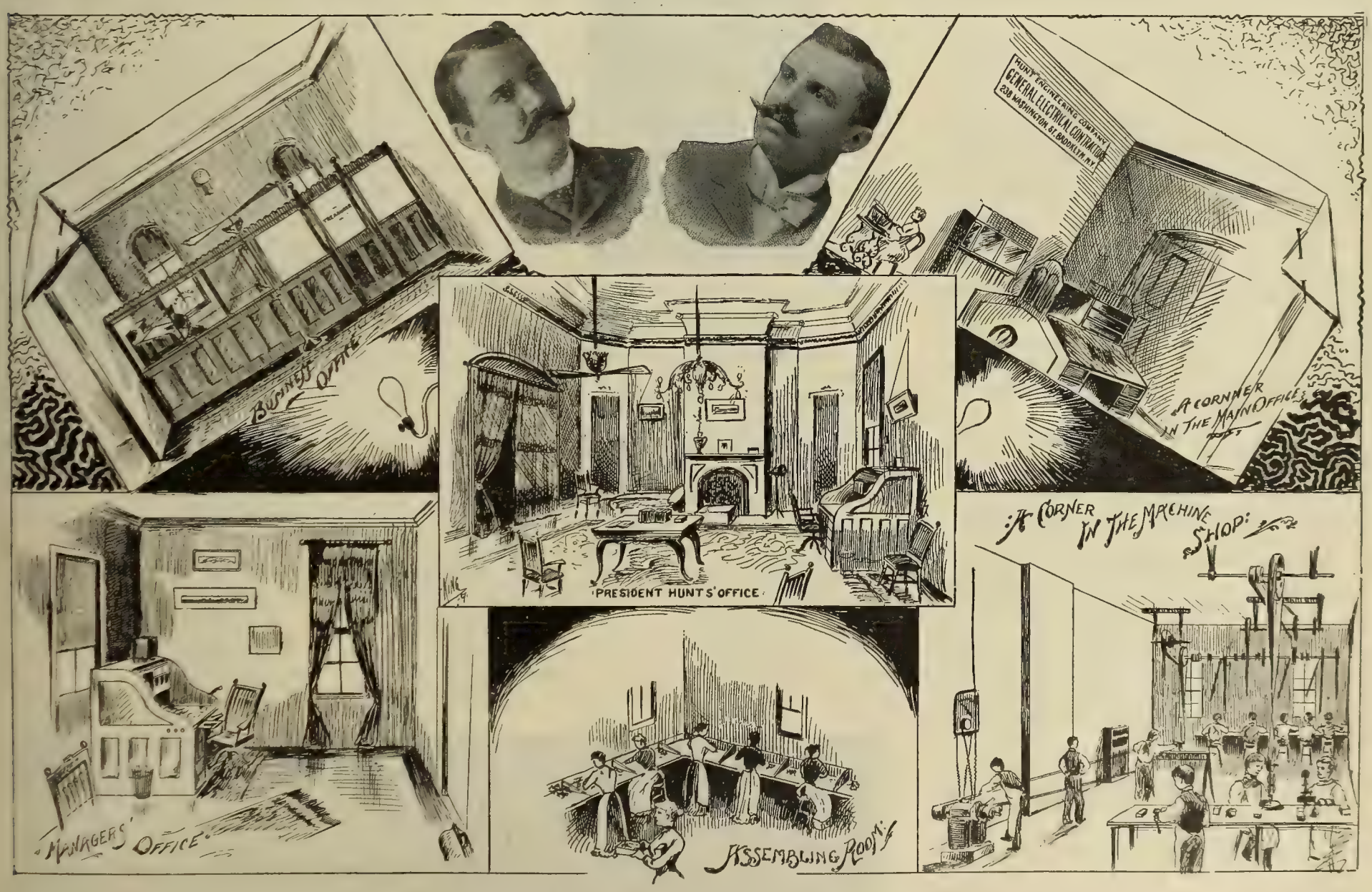
NORWICH OPERA HOUSE COMPANY,
NORWICH, Conn., Dec. 8, 1890.

HUNT ENGINEERING COMPANY,
Brooklyn, N. Y.

Dear Sirs:—It is with great pleasure that we congratulate ourselves, and write you that your electrical wiring for our new theatre is a perfect success.

By the terms of our contract it was only to be accepted, when approved by the Board of Underwriters for New England, the superintendent of our local electric lighting company, the chief of our fire department, and ourselves.

All these parties unite in saying that it is a most complete job. Workmanship and material both first class. The brilliancy of our opening night and the ease and rapidity with which all of the



VIEWS OF THE HUNT ENGINEERING COMPANY'S OFFICES AND FACTORY.

650 lights were controlled attest fully to the satisfaction which your work has given.

Yours very truly,
Norwich Opera House Company,
J. D. F. Blackstone,
Treasurer.

The position occupied by this company as electrical engineers and constructionists afforded it the opportunity of installing and handling many of the different systems and appliances upon the market, which resulted in Mr. Hunt and Mr. Rich simplifying many of the devices which they used in construction work and obtaining a number of very valuable patents, which include lamp sockets, switches, branch blocks, ceiling rosettes, and everything which goes to make up a complete system for incandescent installation, with the exception of the dynamo, wire and lamps.

The rapid growth of the business resulted in the Hunt Engineering Company being incorporated on January 1, 1891, moving into larger quarters, and taking up the manufacture of its electric supplies under its own patents, both for use in the company's construction work and for the trade in general.

Mr. George W. Hunt, the President of the Company, was born in Boston, Mass., the birth place of electric lighting, but has lived in Brooklyn nearly all his life, and having had a thorough schooling and practical experience in electricity, at an early age he engaged himself in light construction work, principally for railway and telegraph companies, and was for two years in the employ of the Brooklyn Elevated Railway Company, and at that time constructed their railway telegraph and signal service.

He has also held a number of other prominent positions, and was connected with the Chief Engineer's office of the Department of City Works, and now holds the position of Assistant Superintendent of streets in the City of Brooklyn.

Mr. Albert E. Rich, the Secretary and General Manager, is also a New Englander, and for some time was connected with the Daft Motor Company, and probably installed more motors for them in New York city than any person ever other connected with that company. He is thoroughly familiar with every branch of the electrical business, and is an excellent business manager.

Mr. Hunt and Mr. Rich are assisted by a corps of bright people in this line of business, and the company has every prospect of becoming one of the largest construction and manufacturing concerns in the field.

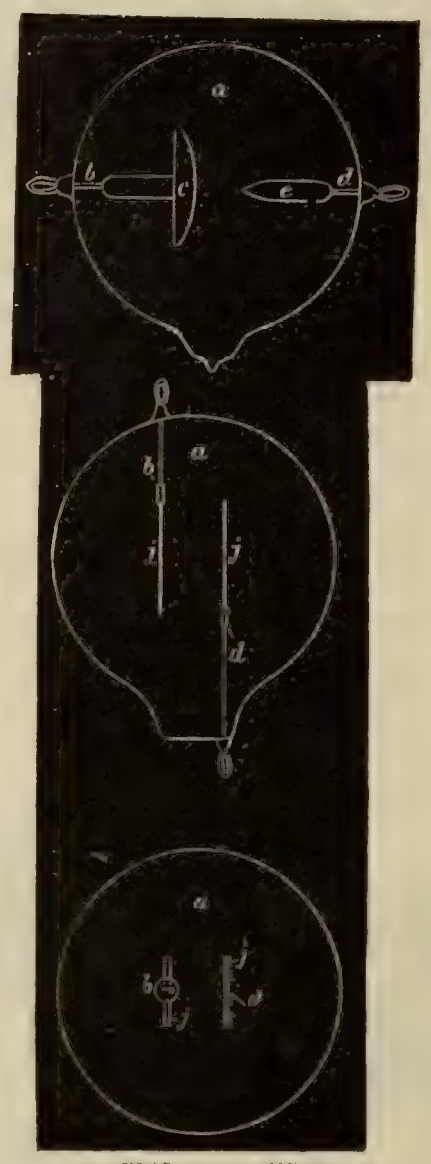
Mr. Rich, the General Manager, reports that up to date, this company has more construction work in view and under estimate than it had all last year, and the first plant under the course of construction this year is for the Weston Furnace Company of Manistique, Mich., which will be ready to start in a few days, it being an arc plant of the Ball system.

ELECTRIC LAMPS WITHOUT A FILAMENT.*

BY R. KENNEDY.

In a series of experiments during the years of 1881 and 1882, researching the properties of alternating currents and induction coils, some experiments were made with highly exhausted tubes and bulbs having two platinum wires entering as conductors, different currents and pressures of electricity being used to produce discharges through the vacuum; it was observed frequently that with high pressures from an induction coil giving a current with a frequency of about 150 alterations per second, and a pressure which could be varied from 1,000 to 10,000 volts, we could raise the temperature of the platinum points entering the exhausted bulbs or tubes, so high that they fused. The noticing of this effect led to the construction of the lamp shown in Fig. 1 (this figure is taken from patent specification 4,752 of 1882).

The pencil-shaped conductor was a piece of Carre carbon, about 2 mm. diameter, such as was then used in Joel's semi-incandescent lamps, the other conductor was a button of carbon; both conductors were heated, when the current at high pressure from the induction coil was turned, and



FIGS. 1, 2 AND 3.

with about 7,000 to 8,000 volts the pencil rose to a temperature sufficient to melt the platinum wire to which it was attached, there was no appearance of anything like an arc, the pencil heated up uniformly all over, the button heated also, but its large mass prevented a great rise in temperature.

Figs. 2 and 3 are a plan and elevation of another lamp, from same specification; here, two extremely light plates were used, and the wires coated with insulating materials up to the point of contact with the plates.

The plates first used were made by carbonizing thin vegetable parchment paper. This lamp was better than the first, due to the smaller mass of the plates—they could be kept glowing—while the conductivity of the platinum for heat kept down the temperature at the points of contact, *b*, *d*. This lamp also ended by the platinum wires, *b*, *d*, fusing close to the plates, when the coil was turned on with all the pressure at command.

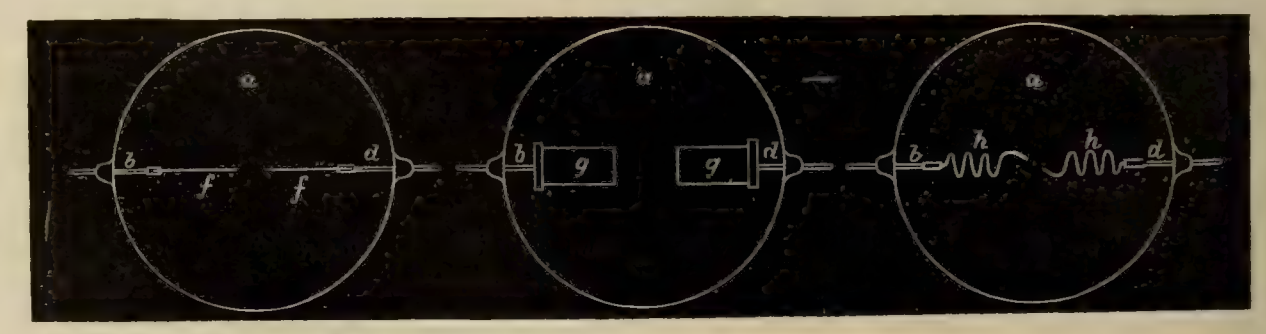


FIG. 5. FIG. 4. FIG. 6.

Figs. 4 and 5 are a side and edge view, respectively, of another lamp; and Fig. 6 is a view of another with spiral conductors, *h*, *h*. In all of these lamps carbon was used, and good effects obtained, the carbon glowing intensely, while the fusion of the platinum was not readily brought about.

Similarly constructed lamps were made with infusible oxides and mixtures, but carbon gave the best results, its only objectionable feature noted being the blackening of the bulbs, just as had been found with ordinary filament lamps.

The dynamo used was a Siemens Brothers' alternator, and a step-up induction coil about 12 to 1 ratio. A mercury pump of improved Geissler make was used for the vacuum making.

In all cases we used low frequency, 150 alternations persecond, and to prevent the current at high pressure discharging round the bulb from wire to wire outside, the wires were always entered from opposite sides.

I obtained my light in these lamps with high pressure and low frequency. M. Tesla obtains his light by using high frequency and high pressure combined.

*Electrical Review, London.

STREET LIGHTS IN CITIES.

Census Bulletin, No. 100, issued by the Department of the Interior, July 22, 1891, relates to the social statistics of cities. It contains a table giving figures touching public street lamps in 50 large cities in the United States. These lamps refer only to those paid for by the municipalities.

From the table it is seen that the annual cost of each gas lamp varies from $50 in New Orleans, $43.80 in San Francisco and $37 in St. Louis to $15 in Indianapolis and Canton, $15.60 in Minneapolis and $17.50 in Hoboken.

The annual cost of each electric lamp varies from $440.67 in San Francisco and $237.25 in Boston to $58.46 in Denver and $68 in Chicago.

The table gives many interesting figures. In Detroit, for instance, the streets are lighted exclusively by 827 electric lights. There are no gas lamps in use. Denver has 1750 electric lamps and no gas lights and Lynn, Mass., Hartford, Conn., Los Angeles, Cal., Lawrence, Mass., Dallas, Tex., Portland, Me., Duluth, Minn., Davenport, Ia. and La Crosse, Wis., each use electric lights exclusively.

Of the large cities Cincinnati is the only place not lighted by electric lights paid for by the city. The streets are lighted by 8,168 gas lamps and 1,715 vapor lamps.

The city using the largest number of electric lights is St. Louis, which is 3,231. Chicago has only 422.

New York City has 25,483 gas lamps and 1,369 electric lights.

Chicago has the largest total of lights of any city in the country, *viz.:* 32,793.

Decay of Magnetism.—Some persons have sought to explain the slow decay of magnetism by reference to chemical changes of the surface due to oxidation, moisture, etc., and have proposed to prevent such decay by gilding, silvering, or lacquering the surface of the magnet. Such remedies are entirely ineffectual, and the supposition on which they are based is erroneous.

The Edison General Electric Company has filed articles of incorporation in Boise City, Idaho, in order to comply with the requirements of the constitution of that state, which makes this formality necessary in order that a foreign company may do business regularly in the state.

ELECTRIC MOTORS FOR ELEVATORS.

One of the best motors designed for elevator work is that manufactured by the Keystone Electric Company, of Erie, Pa. The machine, as shown in Fig. 1, is constructed in the most careful manner, especial care being taken with the armature bearings, which are of extra length and size. The company equips the motor with either sight feed oil cups or automatic self-oiling bearings with ample cellars, so that there is no waste of oil therefrom. The motor can be connected either with elevator or hoist of ordinary construction, either by belt as shown in Fig. 2, by gearing, or coupling the armature directly to the end of the driving shaft of the elevator or hoist.

There is no rheostat or resistance mechanism used with the motor, the controlling and reversing switch being connected to and operated simultaneously with the brake mechanism of the elevator by means of the ordinary hand rope in the car or by means of any of the ordinary devices used for starting and stopping elevators. The motor receives the full force of the current without injury and without any danger of the armature burning out. It runs only while the elevator is in actual use, consequently no current is used when the latter is standing still, economizing in the use of current and in the wear of the machinery. The elevator can be instantly started or stopped at any point without the slightest jerk or jar, and reversed and started in the opposite direction with perfect safety.

to be superior to any other make for this purpose, and there is a total absence of noise or jar while in operation.

The firm has just shipped a two horse-power motor to Scranton, Pa., and in Erie installed one two-horse-power motor in a wire-fence factory, a two horse-power motor in a pattern shop, a three horse-power motor in a Sturdevant blower for the Edison Electric Light and Power Company, and

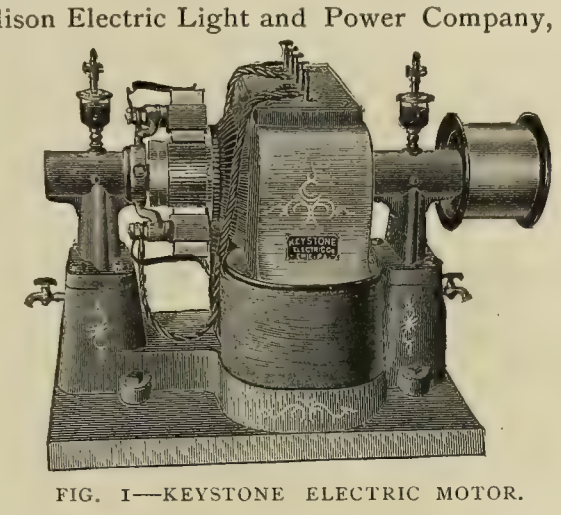


FIG. 1—KEYSTONE ELECTRIC MOTOR.

a five horse-power motor for the Erie Piano Company. Wherever these motors have been used, no matter what machinery they are running, they have given entire satisfaction.

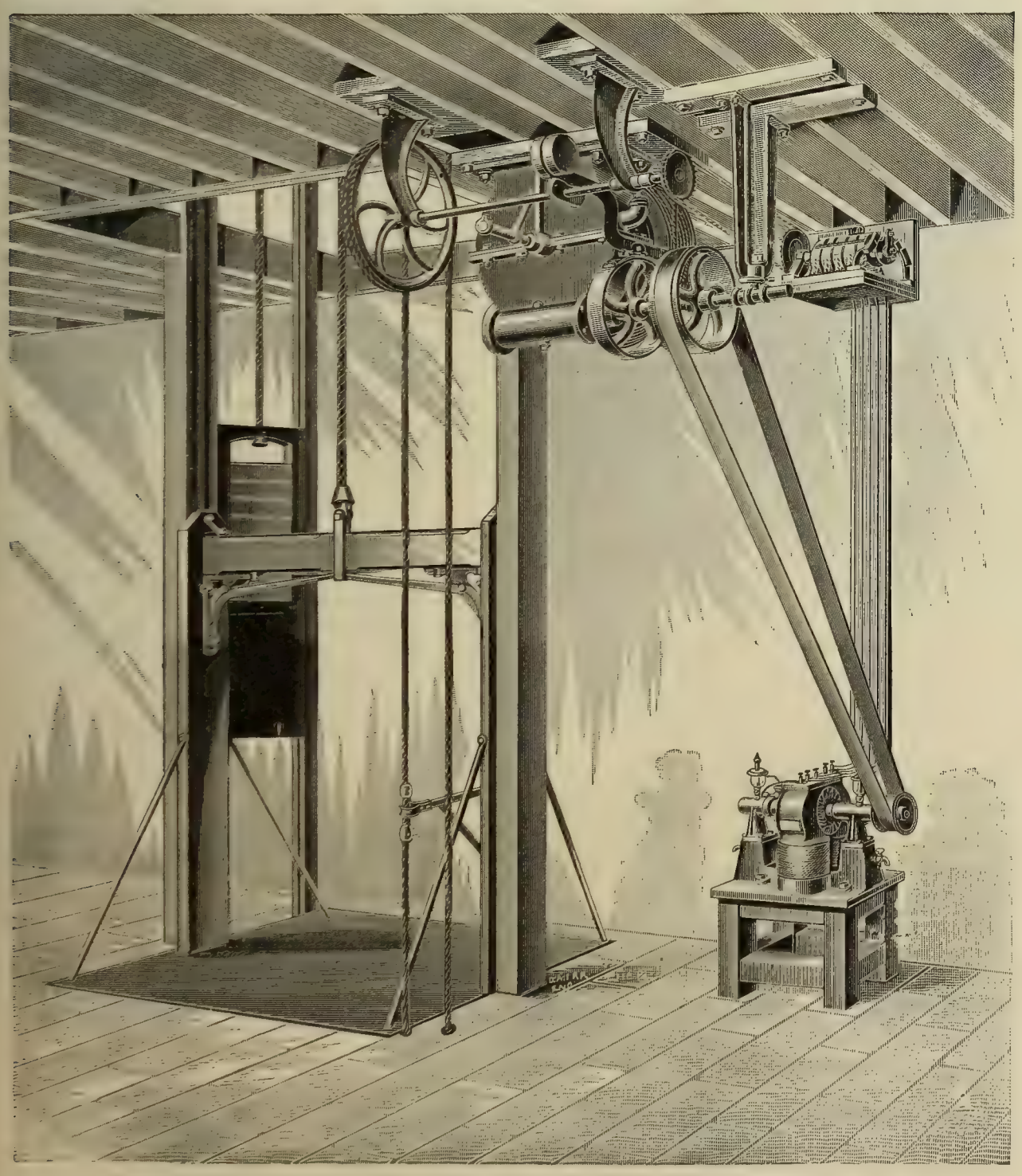


FIG. 2—KEYSTONE ELECTRIC MOTOR OPERATING AN ELEVATOR.

The company makes these elevator motors in standard sizes of 3, 5, 7½, 10 and 15 horse-power, and other sizes specially built to order. In point of durability, efficiency, mechanical construction and economy of operation, they are guaranteed

OLD-TIME AND MILITARY TELEGRAPHERS.

The eleventh annual re-union of the Old-Time Telegraphers and Military Corps was held in Washington, D. C., August 19, 20 and 21. There were over 100 delegates in attendance, many of whom began their telegraph service before the '50s. The headquarters of the Societies were at the Ebbitt House, and there were present many prominent telegraph officials, electrical people and ex-telegraphers from all sections of the country.

The session of the Old-Timers was held on Wednesday morning, with President George C. Maynard in the chair. In his annual address, reviewing the work of the society in the past and what it proposed to do in the future, he stated that it was the intention to make an interesting collection of relics connected with the telegraph, and place it in the National Museum at Washington.

In the afternoon of the same day the Military Corps held its meeting. It resolved to continue its efforts to secure from Congress proper recognition and standing, on account of their semi-military service during the war.

The Old-Timers resumed their meeting immediately after the adjournment of the Military Corps. The officers for the ensuing year were elected, and Omaha selected as the place for the next annual meeting. Major E. Rosewater, of the Omaha *Bee*, was elected president of the Old-Timers, and Mr. William J. Dealy, manager of the New York Western Union office, was re-elected secretary and treasurer.

The second day was devoted entirely to sight-seeing in and about the city and in the evening a banquet was held at the armory of the National Rifles. On Friday an excursion was given to Mount Vernon.

MONTREAL MENTION.

The Electric Merchandise Company, Chicago, will be "at home" in Parlors 14 and 16 Windsor Hotel, Montreal, during the convention, and will be represented by Messrs. D. B. Dean and W. R. B. Willcox. An exhibit of some specialties in line material will be made, and also some few sets of the Burton Electric Heater will be shown in operation.

The Electric Engineering and Supply Company, of Syracuse, N. Y., will have a display of electric light and railway specialties at the exhibition. The company will be represented by J. L. Hines, J. D. McIntyre, and F. H. Leonard, Jr.

GENERAL NOTES.

A cross is to be constructed on the top of the Western M. E. Church, Minneapolis, Minn., which will be furnished with 52 incandescent lights; the wiring alone will cost in the neighborhood of $600.

The flouring mills and the flouring mill district, Minneapolis, Minn., are to be lighted by electricity from a central station.

The much-talked-of ball game between the Okonite base ball club, composed of employés of the Central Electric Company and the Kerite Club, made up of the pick of the Western Electric Company, was played at Lincoln Park, Chicago, on the 15th inst., and resulted in a victory for the Okonites by a score of 11 to 7.

The Electric Merchandise Company, Chicago, report a very large business during the last month, both in orders for complete equipments of new roads, and also for a large number of extensions. The well known standing of this company is a guarantee to would-be purchasers that material offered by them will be found satisfactory in every respect.

The Burton Electric Company, through its selling agent, the Electric Merchandise Company of Chicago, reports sales of the Burton Electric Heater to the West End Road of Boston (20 cars), Jamestown, New York, Newburyport, Mass., Spokane Falls, Wash., New Albany, Ind., and Sioux City, Iowa. These heaters have passed satisfactorily the experimental stage, and are to-day a fully demonstrated practical and commercial success.

THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER, TELEGRAPHY, TELEPHONY, AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

Established 1883.

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HORSE RACING BY ELECTRIC LIGHT.

The directors of the Garfield Park Racing Association, Chicago, are considering the question of conducting races at night time if the electric light can be adapted to the purpose of illuminating the track. We understand that they have already invited electricians to submit plans for the accomplishment of this object and there is no doubt at all that the idea is practically feasible The Garfield Park track is a mile long and it could be illuminated by electric lights in such a way that the race throughout its entire length could be viewed from the grand stand at night as well as by day, and without any blinding effect on the riders of the horses.

This proposition opens up an opportunity for the exercise of ingenuity and we would not be surprised to hear, before long, of a practical solution of the problem.

What the effect of night-racing would be on the horses and those directly concerned, of course, is worthy of consideration, but it has no bearing on the question whether racing can be carried on at night by the aid of electric light. We think it can; it will, of course, require a little experimenting to determine the best method of illuminating the track.

AMERICAN PATENTS IN GERMANY.

A press dispatch from Berlin on August 19 gives the following interesting information:

A patent lawyer of Berlin, Mr. Edwyn A. Brydges, declares that hundreds of American patents—some of them of great importance—have been cancelled here and the use of these American inventions made free to whoever cares to have them. This has been due to ignorance of the requirements of the German patent law on the part of Americans. Paragraph 11 of the Imperial German Patent law of 1877, provides that a "patent can be withdrawn after the lapse of three years.

1. If the patentee neglects to work his invention in the country.

2. When it appears conducive to the public interest that permission to use the invention be granted to others and the patentee refuses to grant such permission for an adequate compensation and on good security."

Many Americans have paid no attention to this paragraph. They have failed either to work their patent in Germany or to dispose of the right of manufacture to some German house within the three years' legal limit. Another cause for the forfeiture of many American patents in Germany has been the failure to pay the taxes due.

PLATINUM FOR LAMPS.

A fortune awaits the lucky one who discovers a satisfactory substitute for platinum. Since the incandescent lamp was made a commercial success the demand for platinum has enormously increased, while it cannot be said that the supply has increased in the same proportion. The main source of supply is Russia, and it is practically controlled by the Russian Government. A small supply comes from South America, but it is a very small portion of the total quantity required in lamp making.

As the output of lamps increases it will not be long before the platinum question will be a serious one unless an increased and constant supply can be attained and depended on, or a reliable substitute for the metal is found.

Platinum possesses some remarkable properties which render it especially adaptable for use as leading-in wires in incandescent lamps. It has a high fusion point which is essential, and its rate of expansion is the same as that of the glass in which the platinum leading-in wires are embedded. It is obvious, therefore, that a proper substitute for this valuable metal must not melt at high temperatures and its rate of expansion and contraction must correspond with that of glass. The integrity of the vacuum in the bulk depends upon the latter fact, and it may be regarded as a wise provision of nature that a substance exists which exactly fulfills these peculiar requirements of the commercial incandescent lamps. But as we have already pointed out, platinum is limited in supply and the demand for it is constantly increasing, and it is evident that if the supply cannot be increased human ingenuity will have to be depended upon to solve the problem which confronts the lamp manufacturing industries like a spectre.

THE TELEPHONE IN ENGLAND.

In an article on the abolition of telephone rentals, the London *Electrical Review* in its issue of July 31, last says: The expiry of the Edison patent will, in all probability, mark the commencement of a new era in the development of telephone communication. With the demand for increased efficiency has also come that for a more equitable system of charging for the use of this convenient and expeditious method of intercourse. At present, the same annual rent is required from the subscriber who perhaps only uses his instrument once or twice daily, as from the stockbroker whose daily "calls" often amount to hundreds. Again, the provision made for the great body of the non-subscribing public, in the shape of "call boxes," is, to say the least, neither ample nor easily accessible. Such a state of things, in which the public convenience is clearly sacrificed to that of the various companies concerned, is certainly not a common-sense one, and our present purpose is to enquire how it may be remedied with increased satisfaction and profit, to both the general public and the telephone companies. With regard to subscribers, the system of charging according to the number of conversations naturally presents itself, as being perfectly fair in principle, while it does away with a good many superfluous calls, and thus lightens the labor of the exchange attendants. On the other hand, however, it may be urged that the increase of clerical labor, rendered imperative by the necessity of keeping an account for each subscriber, more than balances these advantages. Clearly, then, there is but one way in which the proposed reform can be effected, and that is: By the introduction and adoption of a system whereby communication can be obtained from any point of a far spreading city like London, payment being made at the time each conversation takes place, without the customer being subjected to the formality and inconvenience attendant upon the use of the present "call box." That the idea of prepayment for each conversation is feasible is proved by the great success which has attended its adoption by the English Government upon the London-Paris telephone line. Another argument in its favor is, that if properly carried out in the manner indicated above, it would completely prevent the frauds to which the telephone companies are at present subject. It is a well-known fact that, although telephone subscribers are prohibited from allowing outsiders to use their instruments, they are so frequently and persistently pestered by their non-subscribing friends for "the use of your telephone for a moment" that they are obliged to give way occasionally, and thus the company is defrauded. The adoption of such a scheme as that propounded above would, it is obvious, put a complete stop to this, supposing the principle of "payment before conversation" to be taken as a *sine quâ non*.

The Druggists' Association of Baltimore is on a strike against the excessive rental charges for the telephone, and has decided to stop the use of the instruments, as far as its members are concerned. The association and the telephone company could not come to an agreement and the former decided to appeal to the legislature for relief in the matter of tolls.

SPECIAL TRAIN FOR MONTREAL.

As we go to press, we receive information that an Electric Light Convention special train will leave the Grand Central depot, Forty-second street, New York, for Montreal, at 9 A. M., Sunday, September 6, and will arrive at Montreal the same night. The route will be *via* New York Central and Hudson River and Central Vermont roads.

INFORMATION ABOUT THE MONTREAL CONVENTION.

HOTELS.

The rates of charges for board have been obtained from the two larger hotels, and are as follows:

Windsor, $3.50 to $5.00 per day. St. Lawrence Hall, $2.50 to $4.00 per day. The price varies in accordance with the character and location of room. Letters addressed to either of these houses "Montreal, Canada," will receive prompt attention.

HOW TO GET THERE.

Through Montreal sleeping cars *via* N. Y. C. & H. R. R. R. and Delaware & Hudson R. R. leave Grand Central Depot, New York, at 7 P. M., arriving in Montreal 7.15 A. M. The day train with through cars leaves Grand Central station at 9.20 A. M., arriving in Montreal at 9.15 P. M. Passengers leaving New York on either the Albany or Troy night boats on the Hudson River connect at Albany the following morning with trains to the boats on Lake George and Lake Champlain, arriving in Montreal at 9.15 the same evening. Tickets reading *via* "the D. & H." are accepted for passage on steamers of the Champlain Transportation Co. on Lake Champlain and *vice versa*.

Returning, the through day train leaves Montreal 7.15 A. M., and arrives in New York 8.50 P. M. Through night train leaves Montreal 5.50 P. M., and arrives in New York 6.45 A. M. Passengers desiring to take the trip through Lake Champlain or Lake George, or both, South bound, should leave Montreal 5.50 P. M., arriving at Bluff Point (Hotel Champlain) 8.55 P. M., and take steamer "Vermont" on Lake Champlain, which leaves Bluff Point at 7.10 A. M., and arrives at Fort Ticonderoga 12.40 P. M., at which point connection is made with the through day train, arriving in New York 8.50 P. M. Or, if trip through Lake George is included, connection at Fort Ticonderoga is made with steamer on Lake George, which leaves Baldwin at 1 P. M., and arrives at Caldwell (south end of Lake George), at 4.30 P. M., there connecting with train running to the Hudson River night boats from Troy or Albany due in New York the following morning.

Special rates of railroad fare have been obtained from the various traffic associations on the "certificate plan," and those attending will pay full fare going to Montreal and one-third fare returning, provided they return by the same route by which they went. Arrangements will no doubt be made for special trains, for the accommodation of delegates and friends from Chicago, New York City, Boston and other principal cities. For further particulars regarding local transportation the following named gentlemen may be addressed:

George F. Porter, Girard Building, Philadelphia, Pa.; R. D. McGonnigle, Allegheny County Light Co., Pittsburg, Pa.; W. A. Kreidler, *Western Electrician*, 6 Lakeside Building, Chicago; E. R. Weeks, Edison Electric Light and Power Co., Kansas City, Mo.; James I. Ayer, Municipal Electric Lighting and Power Co., St. Louis, Mo.; A. B. Shaw, *Electrical Engineer*, 620 Atlantic avenue, Boston, Mass.; C. O. Baker, Jr., 136 Liberty St., New York City.

HEADQUARTERS OF THE ASSOCIATION.

The Windsor Hotel has been selected as the headquarters of the National Electric Light Association during the coming convention, and the meetings will be held in the spacious Windsor Hall in the hotel.

PROGRAMME OF CONVENTION.

The following is the official programme of the meetings:

The sessions of the Convention will be held from ten o'clock in the morning until two o'clock in the afternoon; final adjournment for the day being had at the later hour.

On the 8th of September the reports of the following committees will be read and discussed:

Committee on Relations of Manufacturing and Central Station Companies, Committee on Data, Committee on World's Columbian Fair, Committee on Legislation, Committee on Underground Conduits and Conductors, Committee on Safe Wiring.

On the 9th of September the discussion of T. Carpenter Smith's paper read at the Providence Convention on the "Distribution and Care of Alternating Currents," will take place, and the following papers will be read and discussed:

W. C. Warner—"Various Forms of Carbons for use in Arc Lamps." Capt. Eugene Griffin—"Three Years' Developments of Electric Railways." H. Ward Leonard—"A Central Station combining the Advantages of both Continuous and Alternating Current Systems."

On the 10th of September the reading and discussion of the following papers: J. I. Ayer—"Some Details of the Care and Management of an Arc Lighting Station, as Practiced in the Municipal of St. Louis." C. J. Field—Subject to be announced. George A. Redman—"Central Station Lighting by Water Power." J. J. Burleigh—"Uniformity of Method in Keeping Central Station Accounts."

An Executive Session will be held on the 10th of September, to elect three new members of the Executive Committee and to name the place of the next meeting.

PROGRAMME OF ENTERTAINMENT.

The following is the programme arranged for the entertainment of the National Electric Light Association by the Citizens' Executive Committee, Montreal.

Monday, Sept. 7th, 3 P. M.—Opening proceedings of the Convention in the Windsor Hotel, address of welcome by His Worship the Mayor and other distinguished members of the Reception Committee.

3 P. M.—Formal opening of the exhibition by His Excellency the Governor General.

Tuesday, Sept. 8th, 2:30 P. M.—Drive through the city and around the mountain.

8 to 11:30 P. M.—Conversazione at Redpath Museum, Molsom Hall, McGill College.

Wednesday, Sept. 9th, 2:30 P. M.—Fire Department display on Champs de Mars.

5 to 7 P. M.—Garden Parties.

8 P. M.—Banquet at the Windsor Hotel,

Thursday, Sept. 10th, 2:30 P. M.—Through the kindness of the Harbor Commissioners, trip by boat down the St. Lawrence and the Lachine Rapids, stopping on the way at Caughnawaga.

5 to 7 P. M.—Garden parties.

Friday, Sept. 11th, 3 P. M.—Lacrosse Match. In the evening, Promenade Concert at Sohmer Park, through the courtesy of Messrs. Lavigne and Lajoie.

Saturday, Sept. 12th, 7 P. M.—Excursion to Quebec at reduced rates.

In addition to the above, yachting parties are being arranged for the entertainment of the ladies.

THE EXHIBITS.

Special rates of freight have been granted by the Canadian railroads, by which exhibitors are obliged to pay freight only one way, provided the goods remain the property of the original owner.

FREE OF DUTY.

Arrangements have been made for the admission of all goods in bond, and the exhibition building will be constituted a temporary bonded warehouse, duty to be paid only in case of sale.

SOME OF THE EXHIBITORS AT MONTREAL.

The ELECTRICAL AGE, New York; Eureka Tempered Copper Company, North East, Pa.; Chas. A. Schieren & Co., New York; Standard Underground Cable Company, Pittsburgh, Pa.; W. J. Johnston Company (Limited), New York; Standard Electrical Time Company, New Haven, Conn.; Standard Paint Company, New York; Fort Wayne Electric Company, Fort Wayne, Ind.; Electrical Engineering and Supply Company, Syracuse, N. Y.; Eugene F. Phillips Electrical Works (Limited), Montreal, Can.; Pelton & Guilleaume, Cöln, Germany; International Okonite Company, New York; Weston Electrical Instrument Company, Newark, N. J.; The Johns-Pratt Company, Hartford, Conn.; The Ball Electric Light Company, Toronto, Can.; The *Electrical Engineer*, New York; Interior Conduit and Insulation Company, New York; Robert Mitchell & Co., Montreal, Can.; Thomson-Houston International Electric Company, Boston, Mass.; Toronto Construction and Electrical Supply Company, Toronto, Can.; H. Ward Leonard, New York; Dominion Wire Manufacturing Company, Montreal, Can.; T. W. Ness, Montreal, Can.; Edison General Electrical Company, New York; Norwich Insulated Wire Company, New York; Excelsior Electric Company, Boston, Mass.; Canadian Electrical Construction, Manufacturing and Supply Company, Montreal, Can.; Russell Electric Company, Boston, Mass.; *Electric Power*, New York; McGill University, Montreal, Can.; La Boiteaux Electric Motor and Fan Company, Cincinnati, O.; Electric Secret Service Company, New York; New York Insulated Wire Company, New York; Hart & Hegeman Manufacturing Company, Hartford, Conn.; M. E. Dansereau, Montreal, Can.; The Connecticut Motor Company, Plantsville, Conn.; John Fitzgerald, Montreal; The E. S. Greeley & Co., New York; The Jewell Belting Company, Hartford Conn.

CORRESPONDENCE.

PRIMARY BATTERIES.

EDITOR ELECTRICAL AGE:—A reply to your correspondent, "P. B.," in your issue of August 15, is desirable chiefly because it offers a convenient opportunity to give wider publicity to my reasons for preferring the bichromate of sodium to the bichromate of potassium in bichromate batteries. Others may prefer to use the chromic acid; with them I have no disagreement, though I usually employ the sodium salt.

It is unfortunate that your correspondent did not take the trouble to quote me correctly. I do not say in primary batteries "that it is necessary to heat the water to the boiling point or the bichromate will not dissolve," but that "the potassium bichromate must be dissolved by the aid of heat." Everybody knows that this salt will dissolve even in cold water, but to make a saturated solution heat is necessary. Under directions for setting up a bichromate cell, I direct that the salt should be dissolved by heating the water to boiling, and that, I still insist, is the best method. "P. B." labors under a delusion if he supposes that his method of making the solution is anything novel. I tried it many years ago, and have seen these directions repeated a great many times. Nevertheless it is never successful unless an excessive amount of acid is used. As an illustration, I put 100 gms. of the bichromate in a litre of water and then added 100 cubic centimetres of strong sulphuric acid, that is, one of acid to ten of water, by volume. After stirring thoroughly, the solution was allowed to stand for sixteen hours, when I found ten grams remaining undissolved. Now a litre of water will take up something over 100 gms. of the potassium salt, and no more acid than one-tenth by volume should be added at first. But if the solution is made by the method of "P. B.," it will be unsaturated and is the sooner impoverished, even though the bichromate in that case is "dissolved by the aid of heat." The point made in the book is not so much the advantage of dissolving in the cold as the greater solubility of the sodium salt, so that a denser solution is easily made, which not only lasts longer, but supplies oxygen much more rapidly at the carbons by diffusion.

If "P. B." will read carefully section 36 of my little book, he will discover that I have not recommended Bunsen's formula which he so much despises, but have given on the next page the quantity of acid per litre of water required by 100 gms. of the bichromate. Similar directions are given for the sodium salt.

Your correspondent's experience is either very limited in the use of the potash salt or else he has used weak solutions if he has never discovered the compact crystals of chrome alum in the bottom of the jar. If the cell is used nearly to exhaustion they are almost invariably found on the bottom of the jar and sometimes on the carbons.

The sodium bichromate is readily obtained in little towns like this one; it certainly should be procurable in New York without the necessity of taken an unbroken package. But whether it is or not is entirely aside from the question of its superoriity over the corresponding salt of potassium as a depolarizer. There is not the slightest difficulty about keeping either. If left in the open air in very damp weather it will deliquesce; but a little can only is needed to keep it in condition for use. I have no trouble with it in my laboratory.

Finally, the question of mechanical depolarization is entirely foreign to the relative merits of the potassium and sodium salts. Such mechanical methods I have made illusions to, but without casting any reflections upon them. The "Laboratory Professors," for whom "P. B." evidently has little respect, will cordially welcome any mechanical methods of depolarization which experience proves to be practicable. Formerly it was the theoretical professor who was much despised by the practical man; but now it seems the "Laboratory Professor" too, must come in for his share of obloquy.

If "P. B." or any one else has a primary battery that "can do any work that can be done by storage cells," let him bring it forward without delay, and I shall take pleasure in describing it in the next edition of my little book. But so long as his success is not demonstrated I must be excused for describing batteries as they are.

H. S. CARHART.

ANN ARBOR, Mich., August 15, 1891.

THE MONTREAL CONVENTION.

The Phonograph Company will have a complete display of phonographs at the Montreal exhibition. They will be in practical operation and the visitors will have an opportunity to listen to phonographic music, singing, etc. The phonograph will probably be the great attraction for Canadians as there are none of these instruments in use in the Dominion. A number of long distance telephones will also be in operation between the exhibition and some of the principal American cities.

The Bell Telephone Company has offered to place instruments at different parts of the exhibition hall for the accommodation of those who attend the Convention.

The Edison Company has offered to light with arc and incandescent lights, at its own expense the tent which is to be placed on the McGill grounds for the conversazione.

Mr. A. J. Corriveau of Montreal, has received a telegram from Messrs. Calm & Bender of Berlin, Germany, saying that they had shipped goods for the electric light exhibition.

BALTIMORE NOTES.

The Southern Electric Company, J. F. Morrison, president and general manager, has an elegant electrical supply house here, carrying a full line of electric railway, electric light and general supplies. This is the only headquarters here for every thing electrical in this section. Mr. Morrison is one of the most popular electricians in the country, having been Mayor of Baltimore several years, and was president of the Electric Light Association several terms. Every body speaks highly of him in Baltimore.

The Automatic Switch Company is doing an excellent business in their Whitingham automatic switches for motors. Its electrician has just brought out a new motor of simple and novel design. One in incomplete form was running a fan, and power was furnished from one large cell of storage battery. The battery is furnished by an enterprising genius of an electrician in Baltimore, for fifty cents fully charged and when run down furnishes a new one; the storage battery runs the above motor twelve days and sometimes longer.

Mr. D. Murdock is hustling T. H. apparatus here, and he seems to be quite popular.

NEW INCORPORATIONS.

July 31.—The Edison Light, Heat and Power Company, of Wheeling, Va.; capital stock $500,000. Incorporators: Alex. Mitchell, August Rolf and George E. Stifel, all of Wheeling, W. Va.

July 30.—Roland Park Company, Baltimore, Md., capital stock $1,000,000. Among other functions the company will supply electric light outside of Baltimore city. Incorporators: Roland R. Conkling, Richard I. Capron and Douglas H. Thomas.

The Carpenter Electric Light and Motor Company of the District of Columbia has been incorporated in West Virginia with a capital of $100,000.

The Malden Electric Light Company has just declared a 2 per cent. quarterly dividend.

The Kinsey Wright Electrical Company of Denver, Col., was incorporated August 10 with a capital stock of $25,000, to manufacture electric, hydraulic, steam and hand elevators. Incorporators: Parvin Wright, S. W. Wright and John C. Fyfe.

The Pneumatic and Electric Tool Company of Jersey City, N. J., was incorporated August 8 with a capital stock of $300,000, to manufacture, sell and lease pneumatic and electric tools. Incorporators: E. Baldwin, New York City; E. Max, Brooklyn, N. Y.; J. Griffin, Jersey City; N. J. A. F. Blackner, Brooklyn, N. Y.

The Continental Development Company, Richmond, Va., was incorporated July 31 with a capital stock of $800,000. Incorporators: L. Lamb, T. A. Lamb, J. E. Tarpin, J. H. Harvey, and A. H. Felthaus.

The Brenham Compress Oil and Manufacturing Company of Brenham, Washington County, Tex., was incorporated August 5 with a capital stock of $150,000, to operate compress, cotton seed oil and electrical plants. Incorporators; D. C. Gidding, William Perry and Thomas Dwyer.

The Brighton Water and Electric Light Company of Brighton, Col., was incorporated August 7 with a capital stock of $20,000, to supply the town of Brighton with water and electric light. Incorporators: William H. Malone, Willard C. Kidder and James McKeon.

The Wagner Electric Manufacturing Company of St. Louis, Mo., was incorporated August 7 with a capital stock of $25,000. Incorporators: H. A. Wagner, E. G. Ellis, A. Blair and F. Schwedtmann, all of St. Louis.

The Crescent Insulated Wire and Cable Company of Trenton, N. J., was incorporated August 4 with a capital stock of $50,000, to manufacture insulated compound for the covering of wires and cables, and the manufacture of electrical appliances. Incorporators: Richard R. Whitehead, C. Edward Murray, and Harry T. Soliday, all of Trenton, N. J.

The Edison Electric Illuminating Company of Atlanta, Ga., has been incorporated with a capital stock of $10,000. Incorporators: I. F. Dickinson, W. H. Rhett and W. H. Inman, of Atlanta, Ga.

The Highland (Ill.) Electric Light and Power Company was incorporated August 6, with a capital stock of $8,000. Incorporators: Edward Fentz, Henry Buchheim and Fred. Siegrist.

July 31.—Riverside Edison Company, Riverside, Ill., capital stock $40,000, to operate an electric light and power plant. Incorporators: W. W. Hutchinson, Lewis Lusk and M. C. Myers.

July 29.—Boston and Great Falls Electric Light and Power Company (Massachusetts and Great Falls, Mont.), capital stock $150,000; to produce electricity for light, heat and power purposes, and conduct a general electric lighting business. The company has officies in Jersey City and Boston. Incorporators: Albert S. Bigelow, Clarence H. Bissell and Charles O. Parsons.

July 20.—Radford Water, Light and Power Co., Radford, Va., capital stock $1,000,000, to conduct water, electric, gas and steam works. Incorporators: F. J. Kimball, J. I. Doran and J. H. Dingee.

Virginia City Company, Portsmouth, Va., capital stock $1,000,000, to supply water, electricity and gas. Incorporators: J. H. Dingee, S. H. Norris and R. S. Brock.

Washington-Charlottsville Construction Company, Charlottsville, Va., capital stock $100,000, to conduct a water, gas and electric light business. Incorporators: R. W. Darby, A. S. Johnson and W. Deitz.

July 29.—The Cambridge Electric Light and Power Company, Cambridge, Washington county, N. Y.; capital stock $7,000, to supply electricity for light, heat and power purposes. Incorporators: Jerome B. Rice, John L. Agan, Andrew B. McNish, all of Cambridge, N. Y.

July 31.—The Edison Light, Heat and Power Company, of Wheeling, Va.; capital stock, $500,000. Incorporators: Alex. Mitchell, August Rolf and George E. Stifel, all of Wheeling, W. Va.

July 30.—Roland Park Company, Baltimore, Md.; capital stock, $1,000,000. Among other functions the company will supply electric light outside of Baltimore city. Incorporators: Roland R. Conkling, Richard I. Capron and Douglas H. Thomas.

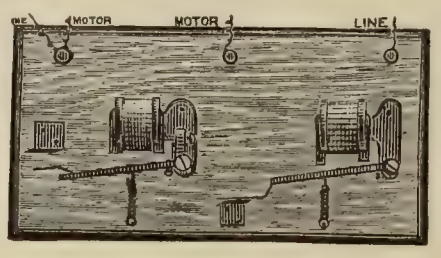
The Armour Electric Light, Fuel and Power Company, of Chicago, Ill., was incorporated August 17, with a capital stock of $5,000,000, to supply gas and electricity for light, heat and power, and to manufacture and sell machinery for producing the same. Incorporators: Martin C. Burt, Allan T. Bennett and Clarence O. Scudder.

August 4.—Penn Yan Electric Light and Power Company, Penn Yan, N. Y., capital $100,000; incorporators, Henry Q. Stimpson, Boston, Mass.; Henry Russell, Albany, N. Y.; Calvin Russell, Jr., J. T. Birkett, Howard L. Woodruff and W. S. Bruen, of Penn Yan.

The Crescent Insulated Wire Company has been organized in Trenton, N. J., by Richard B. Whitehead, C. Edward Murray and Harry T. Solliday, all of Trenton. The firm proposes to manufacure an insulated compound for the covering of wires and cables, and electrical appliances of all kinds; capital stock $50,000.

CIRCUIT-PRESERVING SWITCH.

This little device will automatically preserve the continuity of an "arc" circuit when it is used in connection with a motor and the usual switch. In case the circuit is opened at the motor the Circuit-



WOODS' CIRCUIT-PRESERVING SWITCH.

Preserving Switch will instantly and automatically shunt the current around the break.

The use of the device will prevent fires, loss of time and customers. It is the invention of Mr. G. T. Woods, 109 *World* Building, New York.

TELEPHONE NOTES.

The New England Telephone Company is replacing its round poles at Hyde Park, Mass., with square, hard pine poles, similar to those used by the electric light company.

The telephone company of Detroit, Mich., is laying a new cable to Windsor, Ont.

It is said that the small hill towns of Hampshire county, Mass., are to be connected by telephone.

The Central Union Telephone Company, of Alton, Ill., is arranging to rebuild its lines to Edwardsville and Venice.

The Bell Telephone Company has increased its rates in the northern part of New York State.

The Chesapeake & Potomac Telephone Company is removing its telephones from the drug stores of Baltimore.

The telephone and telegraph companies of Cairo, Ill., have been compelled to reset a large number of their poles to avoid interference from the electrlc railway wires.

The Bell Telephone Company, of St. Louis, Mo., has been granted a permit to erect poles along 17th street from Spruce to Cherokee street.

The Nebraska Telephone Company, Omaha, Neb., is to erect a building for its exclusive use. It will be 62x62 feet and probably three stories in height. Its entire wire system is to be placed underground. Arrangements are being made to have everything in such shape that the large number of subscribers can be accommodated with the greatest facility.

The Erie Telegraph & Telephone Company has declared a quarterly dividend of one per cent., payable August 17, to stockholders of record August 8.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, "WORLD" BUILDING,
New York, Aug. 22, 1891.

There is a letter at this office for J. S. D.

The many friend of Mr. James H. Mason, the well-known manufacturing electrician of this city and Brooklyn, sympathize with him in the loss of his little boy by death Aug. 19.

Ned Fox, the genial traveling salesman of the Phœnix Glass Company, is packing his trunk for an extended trip through the West, and no doubt he will return many large orders for the company's excellent goods.

Charles A. Schieren, of Chas. A Schieren & Co., Cliff and Ferry streets, this city, the noted makers of Electric Perforated leather belting, is now at the Electrical Exhibition at Frankfort-on-the-Main, and will return full of news.

It is said that the Phœnix Electric Manufacturing Company, of Massillon, O., are about to manufacture incandescent lamps on an extensive scale. Mr. James Bradley, the general manager of the company, was in this city recently, on business connected with this department.

Mr. Henry M. Shearer, who was associated for several years with the Blue Line Railway of Rochester, N. Y., is now affiliating with the Western Electric Company of Chicago, Ill. There is no doubt but that the railway department under his assistance will receive a new impetus.

E. H. Peck, of the Phœnix Glass Company, has just returned from a week's stay at the company's factory at Pittsburg where he has been superintending the work of selecting a large number of new samples. He reports the factory filled with orders and the demand for the company's goods increasing daily.

The National Electrical Manufacturing Company has removed its office from 14 and 16 Vesey street, New York, to its factory at Milford Conn. All orders for the many specialties manuf[illegible] by this company, and all other commun[illegible] should be addressed direct to Milford, Co. ...

Charles L. Eidlitz, of 10 West 23d street, this city, is hard at work with his big Cumberland Gap Hotel and Sanitarium isolated electric light plant. The wiring is going on at a very fast gait, and he will soon be ready to equip the plant with engines, boilers, etc. He has also several other isolated plants in this section under way. He receives some very large orders for the Economic incandescent electric lamp, which is very efficient and proves satisfactory wherever used.

The Ticonderoga Machine Company, of Ticonderoga, N. Y., has increased its capital to $125,000. The company is preparing to manufacture its special mining machinery, paper mill machines, and the Woodbury engines on a larger scale, and has completed a new shop, 140x80 feet. A five-foot iron waterway and Leffel water-wheel have been added to its water power. The company is sole licensee for the manufacture and sale of the Woodbury engines in the New England States, New York and New Jersey. It has just opened an office in Room B, 126 Liberty street, New York, where W. B. Hammond will be pleased to attend to the wants of the steam power buyer.

Tucker & Hall, 136 Liberty street, this city, are spoken of in the highest terms for the completeness with which they finish their work. They contract to do all the wiring in connection with complete electric light installations, and will contract for complete electric light central stations, including engines, boilers, power house, wiring, dynamos, etc. They have every facility, as well as the practical knowledge necessary to undertake the most intricate electrical work. They are installing electric light plants in some of the largest buildings in this section.

Mr. Peter Claus, the New York representative of the Germania Electric Company, manufacturers of the Shaefer Incandescent Lamp, has opened offices at his old address, 63 Broadway, New York. Mr. Claus lately patented a valuable improvement in self-regulating dynamos, which, it is said, will be a great improvement in general electric lighting from central station and isolated plants. Mr. Claus has had a most practical education, as he was connected with one of the largest manufactories of electrical apparatus in Berlin, and has invented and patented many improvements in dynamos since he came to this country, about three or four years ago.

The Crocker-Wheeler Electric Motor Company has secured the services of Mr. Gano S. Dunn, electrical engineer, to superintend and direct very fine work connected with the manufacture of the Crocker-Wheeler motors and other specialties. Mr. Dunn is an expert mathematician and stands well as an electrician. The company has also with it Mr. A. Hartman, as shop superintendent. This gentleman has had six years' experience in motor work. The fact that the company is thus increasing its force shows the careful attention it is paying to the manufacture of its electrical specialties.

The Imperial Porcelain Works, Trenton, N. J., successor to the Trenton China Company, deciding to manufacture insulating fittings for the electrical trade, has added a number of kilns, and made sufficient other improvements to pursue this branch exclusively. The company has manufactured insulation supplies for a number of years, and its cut-outs, switch boxes, socket bases and insulators are known as being among the best manufactured in the United States. The offices of the company are at the corner of Mulberry street and Clagg avenue, Trenton, N. J. Mr. F. A. Huggans is preparing to make the "Imperial" fittings more extensively known than ever.

Mr. H. W. Seller, for many years superintendent of the engineering department of the Babcock & Wilcox Company, New York, is hard at work completing the first water tube boiler made under his patents, at the works of the company. The company's works are at Watertown, N. Y., and Mr. Seller is making his headquarters at 36 Cortlandt street, this city. He has secured the co-operation of some prominent capitalists in New

York and Watertown, with large works in the latter place. Mr. Seller, no doubt, was the chief spirit in the successful development of the boilers now so largely used by electric light and power and street railway companies. Of the latter we may mention particularly the Buffalo Street Railway Company, the West End Railway Company, of Boston, and all the boiler plants in the various Edison stations throughout the United States. Mr. Seller also supervised the installation of boilers in many other large plants. Most all prominent engineers and experts have expressed themselves favorably regarding the new water tube boiler now being completed at the company's works, to be installed in a large paper mill.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	90 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	14 00
American Electric Motor Co.(N.Y.)	1,000,000	2500	5 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co. (N. Y.)	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bay Shore Elec. Light (L. I.)	8,000	50 00	
Bell Telephone	15,000,000	100 00	182 00
Bell Telephone 7's	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brunswick Elec. L. & P.	50,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	16 50
Brush Illuminating (N. Y.) 6's	300,000		par
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	16 50
Brush Swan (Ithaca)	50,000	10 00	8 00
Burrell Electric Signal Co. (N.Y.)	500,000	20 00	10 00
City of London Elec. Ltg. Co. (Ltd.)	4,000,000	50 00	60 00
Columbia Canal 6's (Ga.)	200,000		*102
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	4 00
Cons. Gas & E.L.Co. of West Co.6's.	250,000		par
Cons. Gas & E. Co. Batavia, 6's	80 000		par
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	9 00
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	50 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		par
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., (Phila.)	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	97 00
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	20 00
Elizabeth E. L. Co. (N. J.)	100,000	10 00	4 00
Equitable G. & E. Co. (Utica)	4,000		†
Erie Telephone	4,800,000	100 00	45 05
Essex Printing Tel.	5,000,000	100 00	50 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		par
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co.	4,000,000	25 00	11 50
G. T. Woods Mfg. Co. (Ky.)	2,000,000	10 00	2 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*102
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	80 00
Kankakee Electric Co., 6's Ills.	50,000		par
Kansas Elec. Co., 6s, Mo.	20,000		*96
Laclede Gas Co.	7,500,000	100 00	15 00
Laclede Gas, pref.	2,500,000	100 00	40 00
Laclede Gas 5s	10,000,000		*73
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		par
Little Rock Edison E. L. & P. 6's	30,000		par
Littleton Water & E. L. Co. 6's	75,000		par
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		*102
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	75 00
Morristown L. H. & P. 5s (N. J.)	17,500		*105
Morristown L. H. & P.	50,000	100 00	110 00
Nassau Mf'g. Co. (New York)	100,000	10 00	9 00
Nat'l Ant. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	17 00
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 25
N. Y. and N. J. Tel. and Tel 6s	1,500,000		par
N. Y. and N. J. Telephone Stock	2,535,000	100 00	94 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark E. L. & P. Co. 6's Ohio	50,000		par
North American Phonograph	6,600,000	100 00	
North New York, Lighting	150,000	100 00	10 00
Northern Elec. L. & P. (Phila.)	200,000	10 00	
Northwest Elec. Co. 6's Manitoba	50,000		*95
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	90 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Pennock Elec. Ry. Co. (N. Y. & N. J.)	500,000	1 00	50
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston	200,000	25 00	30 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	75 00
Rockaway Elec. Lt. Co. 6's	75,000		*103
Russell Electric Co. (Boston)	300,000	5 00	5 50
Saratoga Gas and Elec. Light 6s	300,000		*86
Saginaw E. L. & P. Co. 6's Mich.	50,000		par
San Diego Gas & Elec. Co. 6's Cal.	750,000		par
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation., N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	10 00
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co (N. Y.)	1,000,000	100 00	95 00
Staten Island L., H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	39 50
Thomson-Houston Pref.	4,000,000	25 00	24 75
T.-H. Electric Co. 5's Boston.	500,000		par
T.-H. E. L. Co. Yonkers, 6's	100,000		par
T.-H. L. H. & P. Co. Binghamton, 6's	100,000		par
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.)	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
U. S. Drug Stores (Ltd.) ord.	300,000	5 00	7 00
U. S. Drug Stores (Ltd.) pref.	250,000	5 00	6 00
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine Street Motor Co. 6's (Colo.)	100,000		par
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	81 50
Westinghouse Electric Co.	7,000,000	50 00	11 50
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			17 00
Yonkers, L. & P.	50,000	100 00	92 00

*Per cent. †Registered Stock.

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

There is a quick and large fortune for investors in electric motors to be made before 1892 dawns upon us. There are fully a dozen systems in hand to-day, either of which at a comparatively small expense can be placed in active service. They range from improved storage batteries, constructed so differently from the "Brush" and filled with a material which admits of lighter weight, longer life, and more hours per charge that interference is not even thought of, to underground trolley connection, which will not require any change from the present tracks in daily use. Danger to person or property is lessened in most of these, and absolutely eliminated in the others. They are also in all stages, from incorporated companies, with a few cars running, to the granting of the patent, in which case opportunity offers for official position and control of the introduction and continuous business. The storage batteries are all contained within the motor-car, whether primary or secondary. The latter are charged at any convenient point. The trolleys are various, some using one rail and some the other, while again others use a centre rail, with different methods of contact; still others a conduit similar to the cable. The money required for interests varies from $5,000 upward, and where any considerable portion can be procured for the bed-rock amount it will no doubt be returned in full this Fall. Such is the expectation. The rapid strides being made in this line will be permanent—not dependent on the weather or climate, either at home or abroad, as in the case of our cereals, which, being up to-day, must be down again in the near future; or cotton, which, having seen its lowest price per pound, will seek a higher level soon. There is more and safer money-for-money in electrical industries than in any other issue.

One of the latest bulletins issued by the Census Bureau is of great interest to all who are financially concerned in municipal street lighting. The contract price paid for gas per lamp is $50 in New Orleans, $43.80 in San Francisco, $37 in St. Louis, $15 in Indianapolis, and $17.50 in Hoboken per year, while the annual payments for electric lamps range from $440.67 in San Francisco, $237.25 in Boston, $58 46 in Denver, and $68 in Chicago. The bulletin statistics include fifty cities, and all but three use electric light; thirty-five own their water-works. When we balance our books at the end of our second ten years' experience in municipal electric control, there can be no doubt but they will show the cost of the then standard method of illumination so clearly that the investment will admit of no wider range than a government annuity, the income being scaled to meet each local condition.

We congratulate our contemporary, *The Mail and Express*, on the successful laying of the corner-stone of its new home on the 19th of August, in the midst of a grand display of bunting, music, and speeches, by Elliott F. Shepard, Jr. May the financial status of the enterprise never grow less, and when the day comes for occupying the new building, may its news be received, composed, printed and distributed by electricity. It is fully abreast of the times to-day; may it keep there. The son will naturally step into the father's shoes, and with the opportunities at his command during his apprenticeship, the public are justified in expecting and will cheerfully pay for unprecedented service. Greater New York will require talent superior in many respects to retain her present journalistic condition.

The Great Western Electric Supply Company, of Chicago, is paying 2 per cent. quarterly on the preferred stock, and 6 per cent. on the common stock is near at hand. These can be had for par or a slight advance at present. Another year will find them much higher. Among other dividends paid we note Edison Electric Illuminating Company, Lebanon, Pa., semi-annual 4 per cent.; Quincy Electric Light and Power Company, 6 per cent.; New England Telegraph and Telephone Company, 75 cents per share; Thomson-Houston Company, Boston, $1 per share: Middletown Electric Light Company, Conn., 2 per cent.; New Britain, semi-annual 3 per cent.; Edison Company, Louisiana, 2 per cent. I have heard of no default.

BUSINESS NOTES.

A 35 H. P. engine built by the Ball Engine Company, of Erie, Pa., will supply the power for electric lighting for the Norfolk Beet and Sugar Company, of Norfolk, Neb.

J. W. Parker, the Philadelphia agent for the Ball Engine Company, of Erie, Pa., has sold an 80 H. P. engine to the Ivy City Brick Company, of Washington, D. C. Also an 80 H. P. engine to George Kelly & Co., of Philadelphia.

The Eclipse Blue Print Works, Electrical Exchange Building, 136 Liberty street, New York, is prepared to turn out blue prints from tracings or negatives and to do all kinds of mechanical drawing at short notice. The work is of the highest class and the figures the lowest.

Every one looking for small or large engines for electric light, isolated or central station plants, will do well to examine the graceful little Case automatic engines or the elegant line of heavy duty Ball automatic high speed engines of from 50 to 250 H. P., carried in stock by E. T. Copeland & Co., 106-108 Liberty street. They can also supply you with upright engines of all horse-powers where the space for power is limited.

Doying Brothers, electricians, Summit, N. J., are opening their new store on Maple street with a full line of electrical household specialties in conjunction with a full line of builders' hardware and house furnishing goods. These young men show their understanding of the needs and necessities of the business by equpiping their store with a general line of builders' hardware, as the buyers of household hardware buy large quantities of the electrical.

L. J. Wing Company, manufacturer of Wing Disc Fans, high speed engines, etc., reports the following among its recent sales of disc fans; New York *Sun* office, New York; New York *Press* office, New York; Christian Herald Publishing Company, New York; American News Company, New York; Central Safe Deposit Company, New York; Wheelwright & Co., Wall street, New York; Postal Tele-

graph Company, New York; Hotel Marlborough, New York; E. S. Higgins & Co., manufacturers of carpets, New York; New York Steam Fitting Company, New York; Columbia College, New York; G. A. Upton, Boston, Mass.; W. H. Tolhurst & Son, Troy, N. Y.; Cheney Bros., manufacturers of silk, Manchester, Conn.; F. J. Wheeler, Meriden, Conn.; Victoria Mills, Newburyport, Mass., and Standard Silk Company, Phillipsburg, N. J.

The Electrical Supply Company, Chicago, is sending out a neat pamphlet to the trade descriptive of its new quarters at the corner of Michigan avenue and Randolph street. It boasts now of occupying the largest building of any in the world devoted exclusively to the sale of electrical supplies.

RHEUMATISM CURED BY ELECTRICITY.

J. R. C. Davis, of Rushville, Neb., writes to Jerome Kidder Manufacturing Company, 820 Broadway, New York: The "Tip Battery" I purchased of you last spring works well. I was confined to bed last winter with acute muscular rheumatism affecting the muscles of right limb; could not move without suffering very acute pain. Six treatments from one of your batteries cured me after all medicines had failed. I believe yours the best battery made for the treatment of all diseases to which electricity is applicable.

Send for Electrical Age *catalogue of books.*

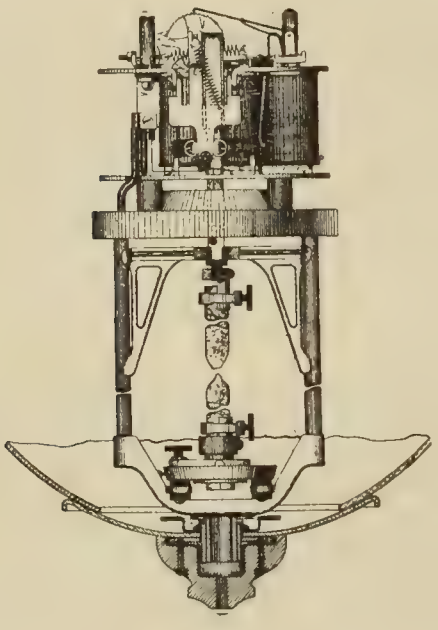
THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued August 18, 1891.

457,816. Automatic Telegraph. David Kunhardt, Aachen, Germany. Filed Sept. 23, 1890.

An improved automatic telegraph apparatus comprising a contact field composed of two series of positive and negative contact blocks arranged on the cylindrical surface of a wheel drum, over which passes an arm with sliding contact or springs to produce alternating currents generated by the connection with a battery, which currents are guided through bearing springs, rings and the contact springs carried by the arms to the series of contact blocks on the wheels, thence to angular supports connected to the line, whereby the currents may be utilized by making contact between the angular supports and a metallic cylinder belonging to each of them, the cylinders being divided into sets permanently connected to the contact pieces on the wheels and temporarily connected to line by the sliding contacts of the arms and the springs.

457,830. Illuminator for Electric Lamps. John von der Kammer, Chicago, Ill. Filed Jan. 10, 1891.



458,025—ELECTRIC ARC LAMP.

The process of manufacturing illuminators for incandescent electric lamps, consisting in first taking a quantity of celluloid threads and cleansing the same; second, subjecting the same to a slightly destructive action of acid or the like; third, immersing it in a thin paste of ground ground shoe-blacking mixed with water; fourth, drying and heating the same.

457,838. Electric Stop Mechanism. Washington H. Kilbourn, Greenfield, Mass., assignor to L. J. Gunn, Geo. E. Rogers, and H. O. Edgerton, all of same place. Filed Dec. 24, 1890.

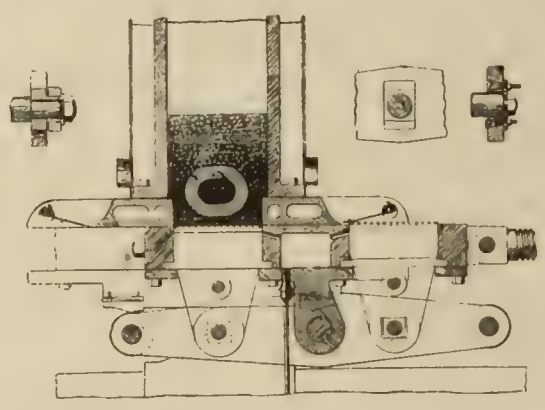
A tripping lever with a yielding detent adapted to be engaged by lugs on a drum, and electro-magnetic devices for controlling it.

457,855. Railway Signal. Lyman F. Munger, Rochester, N. Y., assignor of two-thirds to Thomas A. Smyth and James H. McCartney, same place. Filed Jan. 15, 1891.

The combination, with a main line connected at one end to a battery and a series of signals arranged in series therein, of two parallel conductors, one a continuation of the line and the other connected to the battery, and switches arranged between the parallel conductors for connecting them and operating the whole series of signals.

457,858. Tool for Grasping Wire. William E. Treen, Boston, Mass. Filed July 26, 1890.

A tool for grasping and holding electric wires, comprising a bed plate provided with an eye having a threaded opening and a longitudinal groove, and another plate hinged by an end thereto and provided with a groove in position to register with the groove in the first plate, and a screw bolt swiveled in the plate in position to enter the opening and provided with a head.



457,879—MACHINE FOR CASTING GRIDS FOR SECONDARY BATTERIES.

457,859. Billiard Register. Emery D. Waterbury and Archibald E. Rankin, Salt Lake City, Utah, assignors of three-fifths to Allen W. McEowen, Judson P. Fowler and Frank A. Marcher, all of same place. Filed Oct. 18, 1890.

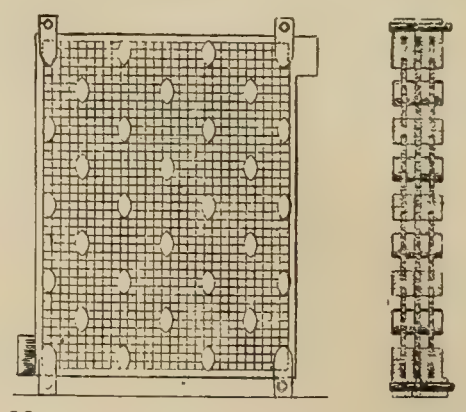
The combination, with a game register adapted to be actuated by the closing of a normally open electric circuit and a generator in and forming a part of the same, of means whereby the player closes the circuit at the beginning of each game, the means comprising a fixed contact piece connected electrically with one pole of the generator, a movable contact-piece, a light spring which tends to close the circuit at the contacts, a tubular bar and push buttons thereon, a spring retracted slide in the bar holding the movable contact piece normally away from the fixed contact, a latch pivoted in a slot in the bar and adapted to be tilted and moved in by a part of the slide when the latter is drawn out, and a cord by which the slide is drawn out.

457,865. Joint for Electric Conductors. George T. Manson, Brooklyn, N. Y. Filed April 1, 1891.

As a means for protecting joints in electric conductors, an elastic tube surrounding the insulation of the conductors on both sides of the joint, and clamping devices for compressing the tube into water-tight engagement with the insulation.

457,875. Electro-Motor Engine. Sebastian Ziani de Ferranti, Hampstead, England. Filed Sept. 24, 1888. Patented in England, France and Belgium.

The combination of an alternating current non-synchronizing electric motor, a single alternating current circuit or conductor in which the field coils of the motor are included, a synchronizing alternating current motor coupled with the first-named motor, whereby the non-synchronizing motor starts the synchronizing motor and drives it into synchronism with the alternations of the actuating current, and circuit connections whereby the synchronizing motor may then be connected in circuit.



457,880—PLATE FOR SECONDARY BATTERIES.

457,879. Machine for Casting Grids for Secondary Batteries. Albert F. Madden, Newark, N. J., assignor to John M. Pendleton, New Brighton, N. Y. Filed Sept. 29, 1890.

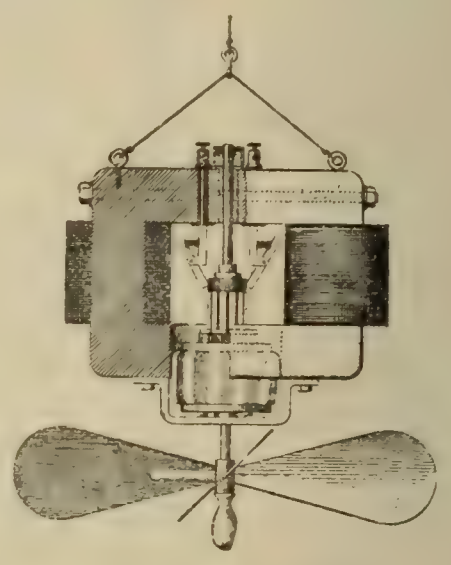
The combination of a metal receptacle, a movable mold carriage having a mold that closes the bottom of the receptacle when the carriage is in one position, a temperature regulating chamber the face of which closes the crucible when the carriage is in another position, and means for controlling the temperature of the chamber.

457,880. Plate for Secondary Batteries. Albert F. Madden, Newark, N. J., assignor to John M. Pendleton, New Brighton, N. Y. Filed Jan. 2, 1891.

An element or plate for an accumulator cell having separator plugs molded therein with a shank extending through the plate and heads on each side of the plate integral with the shank.

457,902. Electric Motor. Charles J. Kintner, New York, N. Y. Original application filed June 14, 1890. Divided and this application filed Oct. 1, 1890.

A method of diminishing friction between the rotary and fixed parts of an electric motor, consisting in causing the magnetism developed in the field magnets and the work done by the motor to act conjointly against the force of gravity on the rotary part and to thereby hold it off its lower end journal-bearing.



457,902—ELECTRIC MOTOR.

457,906. Electric Door-Opener. Richard J. Ward, Brooklyn, N. Y. Filed Sept. 15, 1890.

The combination, with the armature, electro-magnet and latch of an electric door-opener, of a lever whose shorter arm has a plane surface normally coincident with a similar surface on the latch and parallel to the planes of the latch and lever, and whose longer arm presses upon the armature in a direction perpendicular to the axis of the armature.

458,025. Electric Arc Lamp. Elihu Thomson, Swampscott, Mass. Filed Apr. 27, 1891.

The combination, in an arc lamp, of a rotary part supporting the upper carbon and pivoted in a lever, a starting magnet acting on the lever to lower the carbon support, a retractor to lift the lever to form the arc, and a magnet actuating feeding mechanism connected to and operating the rotary part to gradually lower the carbon.

458,063. Electric Wire Crossing. Charles H. McKee, St. Louis, Mo. Filed Jan. 26, 1891.

An electric wire crossing consisting of a cruciform frame having two bearings arranged in planes at right angles to each other upon each arm, and also having central bearings for the crossing wires.

458,115. Method of Electric Bending and Straightening. Elihu Thomson, Lynn, assignor to the Thomson Electric Welding Company, Boston, Mass. Original application filed May 21, 1886. Divided and this application filed Mar. 2, 1888.

An improvement in metal working, consisting in maintaining a continuous portion or given section of metal to be treated in position in an electric circuit between two current bearing electrodes or clamps until the same is heated to the desired plasticity, and then subjecting the heated metal to the action of a suitable forming or shaping device—such, for instance, as a plunger or die—normally out of connection with the metal while the current is passing through it.



NEW YORK AUGUST 29, 1891.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

J. B. TALTAVALL, *President*, T. R. TALTAVALL, *Sec and Treas.*
W. T. HUNT, *Vice-President*, E. V. CAVELL, *General Manager*

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RECOGNITION.

When we decided upon the publication of STREET RAILWAY NEWS as a distinct department of the ELECTRICAL AGE, we felt sure of receiving prompt recognition, and it has speedily followed, and one of the many congratulatory epistles appears in another column of to-day's issue.

Our correspondent, writing as a business man, avows his preference for *weekly*, rather than *monthly* information and rejects the latter as entitled to be called news at all, and he awards like commendation to the illustrations in advance of the monthly publications. We are encouraged to believe that the views of Mr. Joyce are shared by all our constituents, and that an almost universal welcome has been accorded to STREET RAILWAY NEWS.

MUST BE LISTED.

Referring to our editorial last week on the listing of street railway securities, we desire to so emphasize the shareholders' position that promoters will see the necessity, having utilized the investors' cash, to surround his collateral by a guard which shall enhance its credit among those on whom he may be forced to call in case the investment, or any considerable portion of it, is unexpectedly required for other purposes. In Europe one of the strongest points made in prospectuses is that the shares will be listed as soon as the rules of the Stock Exchange can be complied with and a quotation granted. Several of the industrial corporations brought out in New York have followed in the same path, and most of the trusts are either listed or dealt in as unlisted securities, but regularly, and the prices quoted with an asterisk designation in all the leading dailies. The street railroad interest is becoming too large to occupy an uncertain position. There should be, if the end cannot be gained in any other way, trusts formed to invest in electric and street railway bonds and shares, issuing trust shares of a less rate of interest; call it an air, electric, or street railway clearing house, if the term trust is obnoxious; list the new corporation's script or shares. Through this plan one would exchange a majority of the smaller companies' securities for one recognized as collateral by the New York banks and immediate relief be obtained when and as wanted, at regular rates and without incurring undesirable obligations. The autumn quarter day is near, and incomes must be reinvested; cannot the two ends under discussion be brought near enough for welding? It would be a good plan for some other city to make a specialty of street railway securities if New York declines them; there must soon be some recognized spot where the two can meet for the mutual satisfaction of investor and investment.

SAFETY IN THE ENGINE ROOM.

That it is almost impossible for a steam engineer to secure a situation to-day unless he has sufficient knowledge to operate an electric plant, is well known, and it would seem axiomatic to state the converse proposition, and say that no electrician should be held competent to superintend a central station, or even an isolated plant, whether for railway power distribution or isolated lighting, who does not know whether or not the steam plant which drives his dynamos is being worked not only with safety to the neighborhood, but also with reasonable efficiency and economy.

The weakest part of central station work, has been and still is more frequently found to-day in the boiler room, than elsewhere. Such being the case, we think that without intruding upon the special field of the more purely mechanical journals to an unfair degree, some articles upon these topics, will be welcomed by our electrical readers generally.

We commence in this issue a series of articles upon "Safety-valve Problems" from the pen of Mr. J. Stanford Brown, of New York, well known in his special field of electric light and power, and whose acquaintance with the steam end of the line may be gathered from his treatment of the subject in hand.

INTELLIGENCE MINIMIZES ACCIDENTS.

An incident which came under our observation recently illustrates the advantage of having men handling electric cars who thoroughly understand the principle of the motive force they are controlling.

In rounding a curve on the Bay Ridge, Bath Beach and Bensonhurst Electric Railway, a car left the track and did not stop until the rear wheels had cleared the track by several feet; but the trolley retained its connection with the overhead wire. Without any hesitancy the conductor connected the hind wheels of the car with the track by means of an iron bar, completing the circuit, and as soon as the current was turned on the car ran back to its proper position on the track. Not more than two minutes elapsed from the time of the derailment until the time the car was replaced on the track.

It is evident that where intelligent men are employed to run cars there must be fewer delays and accidents would be reduced to a minimum. Street railways throughout the country are changing their motive power to electricity to such an extent that it would be well for the present employés of the horse railway companies to gain, at least a superficial knowledge of the force they may soon be called upon to handle. Where electrical street railway companies employ quick-witted men like the one above referred to, they will find a large saving in operating expenses, although they may be required to offer better inducements in the way of salaries to procure such talent.

THE LARGEST STREET RAIL EVER MADE.

The accompanying illustration shows the section of the rail used on the Broadway cable road now in course of construction in New York City. This rail was made expressly for the Broadway line, and at the time it was rolled was the deepest and heaviest section of street rail ever turned out in this country. It is seven inches deep, has a five-inch base and weighs 91 lbs. to the yard. It is said to have been the most difficult shape ever rolled in this country and altogether is a fine piece of work.

These and the slot rails for this road were manufactured by the Johnson Company, Johnstown, Pa. and of the two about 3,500 tons will be required for the completed road.

RAPID TRANSIT IN NEWARK, N. J.

Possibly no city objected so strenuously to the adoption of electricity as a motive power for street railways as did Newark, N. J., in opposing the franchise of the Rapid Transit Company. The city was in great need of rapid transit, but the opposition to electricity as the means to that end was both bitter and long, and when it finally granted the franchise to the Rapid Transit Company it limited it by a large number of provisions, among which were the placing of poles between the tracks, the placing of electric lights upon them; to grant transfers and to pay to the city 5 per cent. of its gross receipts besides the regular taxes. The Rapid Transit Company accepted the conditions and constructed its road especially for electric propulsion of its cars, beginning operations August 25 last.

During the following November the Board of Trade declared itself in favor of the city railway system, and pledged its efforts to secure right-of-ways for the company for any extensions it might desire to construct.

The traffic of the road has been very large and the public feeling in regard to the change to electric power is radically different to what it was prior to the opening of the road.

In comparing the electric system with the horse railways the citizens say that the liability of accident is much less, as the electric car can be stopped much quicker; the streets are cleaner and the speed of the cars is far higher. They think that where an electric installation is of the best, the tracks properly constructed and the entire system properly managed the electric street railway is as safe, if not safer than any other method of transportation.

In a memorial recently drawn up by property owners along the route of the Rapid Transit Company, it is claimed that the construction and equipment is unsurpassed by any other road in operation in the country; that the service is regular and frequent and as rapid as can be had with safety; that the employés are always courteous; that the residents on adjacent streets are dependent upon it for transportation; that the construction and operation of the road has proven a benefit to the section through which it runs, by making the property on the streets more desirable and valuable; and that they are satisfied with the entire system and management. The only objection found by the citizens is the centre poles, and this coincides with the feeling of the company, who was compelled to place the poles between its tracks by the terms of the franchise.

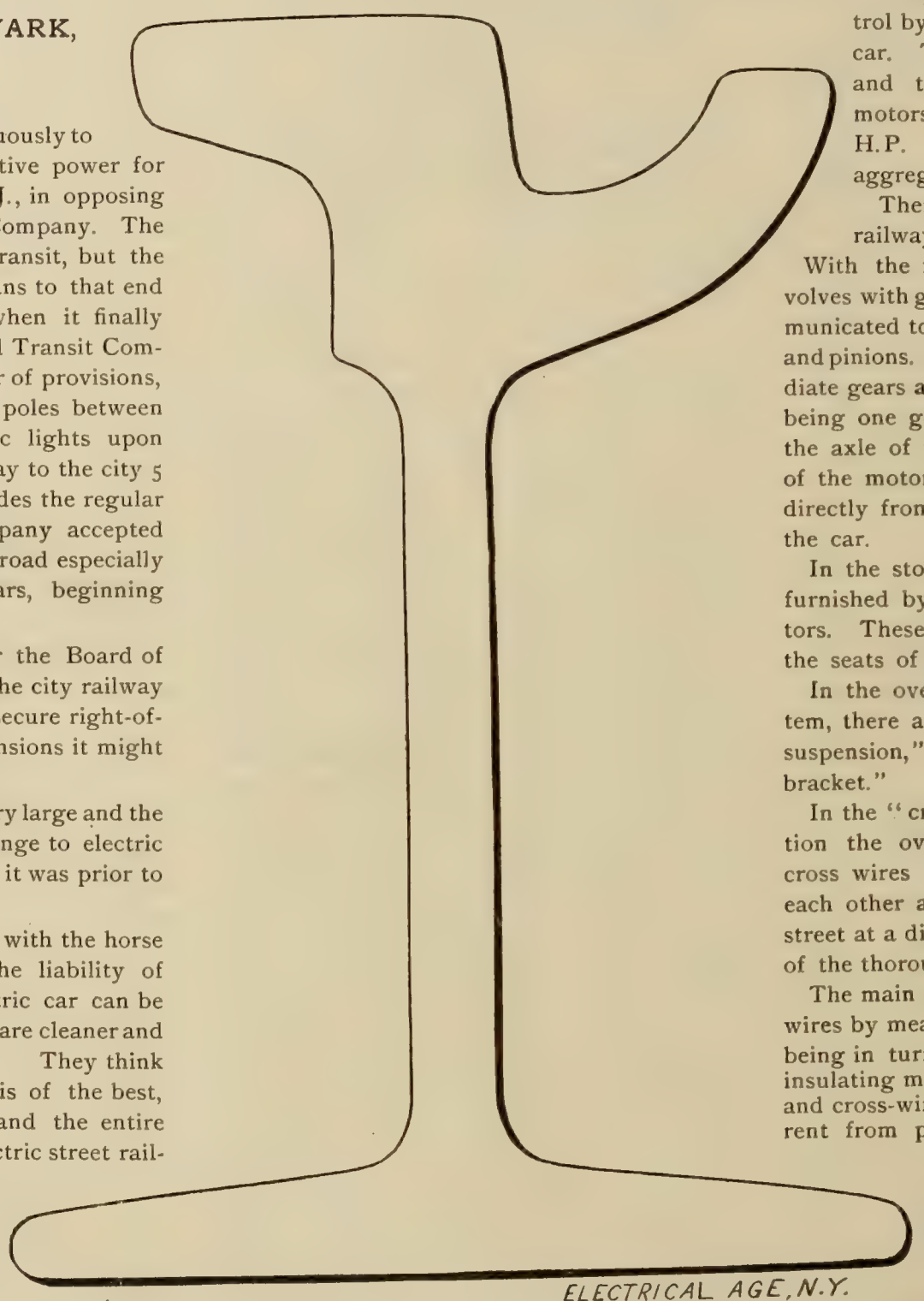
The adoption of electricity as a motive power has given the city the rapid transit it desired, and even those who bitterly opposed its adoption are now in its favor. The city reaps a large revenue from its 5 per cent. of the company's gross receipts, and the transfer system benefits patrons, the cars are run more frequently and the business men are transferred from their places of business much more rapidly than by the old horse car system. Beside these benefits the entire route is thoroughly illuminated by the company placing lights on its poles.

NEW YORK STATE STREET RAILWAY ASS'N CONVENTION.

OFFICIAL NOTICE.

The Ninth Regular (Annual) Meeting of The Street Railway Association, of the State of New York, will be held at the Hotel Metropole, Broadway and Forty-second street, New York City, on Tuesday, September 15, 1891, at 10:30 o'clock. A. M.

A Special Committee has been appointed to present a report at this meeting on the subject of "Electric Motive Power for Street Surface Railways," electricity being the leading topic of interest in the street railway community.



SECTION OF RAIL ON BROADWAY CABLE ROAD.

It is expected that the discussion following the report will develop the very latest information obtainable on the subject. Entertainment will be provided for the delegates, and every Company in the State is urged to be represented.

Wm. J. Richardson, Secretary.

ELECTRIC RAILWAYS.

There are two principal systems of electric railways at present; the overhead system and the storage battery system. In the former the cars are equipped with motors and the current taken from the overhead wire by means of a small structure on top of the car. This consists of a light trolley pole, supported upon a stout spring, so that it may move in any direction, and having at its upper end a grooved metal wheel, making a running flexible contact on the upper side of the working conductor. The flexibility of this arrangement is very great, it being able to follow with facility variations of the trolley-wire four or five feet in either a horizontal direction, or more than twelve feet in a vertical direction. By this means a constant contact is made by the trolley-wheel at different rates of speed or around curves, and for different heights of the trolley-wire. The current taken from the trolley-wire passes through the motor, through the wheels of the car to the track, back to the dynamo; the rails being grounded and usually connected to a continuous conductor running the whole length of the line.

In order to secure the necessary track adhesion by means of independent driving, and to permit the entire weight of the car and its contents to be available for traction, two motors are generally used on each car, one for each axle, with independent driving; at the same time both motors are capable of perfectly simultaneous control by a switch placed at either end of the car. This switch controls both the speed and the direction of movement of the motors. These motors are of 7½ to 20 H.P. normal capacity each, making an aggregate of 15 or 40 H.P. on each car.

There are at present two classes of electric railway motors, fast speed and slow speed. With the fast speed motor the armature revolves with great rapidity and the motion is communicated to the axle of the car by means of gears and pinions. In the slow speed motors the intermediate gears and pinions are either left out, there being one gear and pinion, the gear being on the axle of the car and the pinion on the shaft of the motor, or the motion is communicated directly from the armature shaft to the axle of the car.

In the storage battery system the power is furnished by storage battery cells or accumulators. These cells are stored when in use under the seats of the car.

In the overhead construction for the first system, there are three methods used: the "cross suspension," "single bracket" and "double bracket."

In the "cross suspension" method of construction the overhead conductor is supported by cross wires attached to poles placed opposite each other at the curb-line on each side of the street at a distance depending upon the condition of the thoroughfare, number of curves, etc.

The main conductor is supported from cross-wires by means of pieces of metal, called "ears," being in turn fastened to the cross-wires, some insulating material being placed between the ear and cross-wire. This insulator prevents any current from passing from the cross-wires to the poles.

The "single bracket" system is generally used where the tracks are placed on the side of the street near the curb. In this case the conductor is suspended over the middle of the track from brackets firmly attached to poles placed on either side of the track, as may be found most advantageous, the same sort of an insulator being used between the main conductor and the bracket as is employed in the "cross suspension" method.

The "double bracket" method is employed where straight double tracks are used and the distance between the tracks will permit. The two conductors are suspended over the centres of the tracks by means of double brackets fastened to poles which are set in the space between the two tracks, the same insulation being used as in the two previous forms of construction.

For the overhead system various forms of poles may be used; those most commonly employed, however, being of wood neatly painted, or iron. The iron pole is unquestionably the best which can be used for the purpose and can be made the subject of much fine work, and of such form as to be by no means a conspicuous feature of the system. The iron poles are generally made of sections of iron pipe carefully shrunk together, protected at the top by an insulated cap, and a cap

also being placed on the pole where it enters the earth. It is a general custom to set these poles in broken rock and cement, giving them a slight angle away from the tracks, so that when the cross wires are drawn taut the pole presents a neat appearance.

SAFETY VALVE PROBLEMS.

BY J. STANFORD BROWN.

From the age of steam we have now passed to that of electricity, and yet few seem to realize that we are still dependent upon steam as a source from whence to derive our electric force, except in those comparatively few cases where water is available.

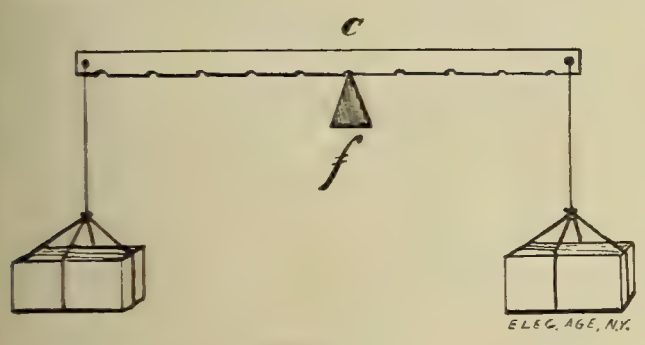


FIG. 1.

Such being the case, and the importance of safety to the general public having warranted State supervision of steam plants and the licensing of engineers, it is a matter of wonder that the mechanical laws and problems connected with the safety valve should not be accurately and clearly given in all text books of recent date.

Turning to Professor Whitham's "Constructive Steam Engineering," 1891, page 809—a work invaluable for reference—one is astonished at finding the "rules for setting weighted safety valves" incompletely given. "In Power and Transmission," vol. 6, page 76, the subject is treated in the non-mathematical style best suited, as many think, to the understanding of the "practical man." "The Colliery Engineer," vol. 11, page 200, April, '91, contains several solutions of the problems, one of which only is complete, but none of them make clear the physical as well as the mathematical relations of the quantities involved. "Safety Valves, their History, Antecedents, Invention and Calculation," by Mr. Barnet Le Van, is the imposing title of a serial now running in the *Canadian Electrical News*, beginning vol. 1, (No. 7) page 88, January, '91 and to which we shall refer again. More clearly treated still do we find the subject in *Power-Steam*, vol. 10 (No. 5) page 6, May, '90, although even this article fails to carry the demonstration as far as seems advisable and contains one slight inaccuracy to be pointed out when we come to it.

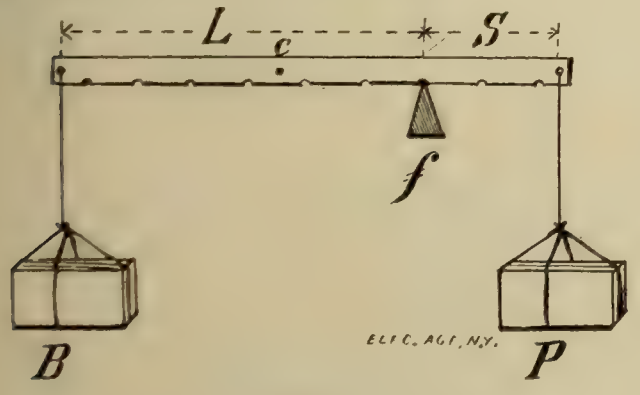


FIG. 2.

The fullest and most scientific exposition in any technical journal known to the writer, may be found in the *American Machinist*, vol. 12 (No. 34) page 4, of Aug. 22, '89, and vol. 12, (No. 36) page 4, of Sept. 5, '89, being papers Nos. 98 and 99 from the pen of Prof. J. G. A. Meyer.

In what follows we shall try to first make clear the meaning of the terms used in the treatment of the subject, from the standpoint of theoretical mechanics, then show how the quantities involved are related physically and how they may be exhibited in mathematical form, so that the facts are caught by the eye quicker and with less liability to mistake them when written out. Then taking up the other articles, to which references have already been made, the errors or omissions that have been made will be pointed out and to what extent they affect the results in practical cases.

The problems of the safety valve are purely of a mechanical nature and are treated in the text-book in that part of "Mechanics" which deals with forces in equilibrium; that is, balanced forces or statics. The lever—French, *levier;* German, *hebel*—is the first and greatest of the so-called "mechanical elements." Every kind of safety valve being some kind of a lever, the theory of the former is included in that of the latter as a special class of cases.

We are all familiar with forces and we have all heard that under the great law of the conservation of energy, action and reaction are equal. This simply means that our force will produce motion or stress, or both, according to circumstances and that the amount of such motion or stress or both, is numerically equal to the force.

A lever consists essentially of a rigid bar free to turn or teeter on an axis or point at any chosen position, between its two extremities. By rigid we mean inflexible; that is, that it will not bend under the effect of the forces exerted at the ends on either side of the axis or point of oscillation, which is called the "fulcrum"—French, *point d'appui;* German, *ruh*, *dreh* or *stutz punkt*—"Weisbach Theoretical Mechanics," page 255. In practice we usually have a force exerted against a mass or weight of material, and, since weight represents the force of gravity, we may consider and treat such a weight as properly representing "a force."

In the *Canadian Electrical News*, vol. 1 (No. 7) page 88, we read: "The resistance at 'f' (our fig. 1) is called the 'fulcrum,' from which it might wrongly be inferred that the fulcrum of a lever was a third force instead of simply being the point of application of a third force, which point acts only as balancing point for the other two forces or sets of forces." The distinction is important.

Take a rod about a yard long and file some nicks on its under side so that it will teeter without sliding on the fulcrum "f" (fig. 1) and provide weights which can vary the loads at the two ends of the rod or bar. By experiment it will be found that with equal weights at both ends, a balance can be had *only* with the fulcrum at the centre (fig. 1). And (2) as the fulcrum is moved toward either end (as in fig. 2) to maintain the balance, the weight at the end now nearest the fulcrum "f" must be increased by an amount exactly proportional to the distance between the centre of the bar "c" and the present position of the fulcrum "f." (3) if either weight be increased to keep the balance, the rod must be moved over the fulcrum shortening the distance from the fulcrum to the heavier weight an amount exactly proportional to the amount which that weight has been increased.

These are all the facts in the case and we have simply to explain them and show how we express such a law in mathematical form and show why in such form it can be made clearer to every one, and also to point out how and why the safety valve obeys it.

It has been assumed so far that the forces (for our weights represent forces) act always in parallel lines, as would be the case in figs. 1 and 2, because of the action of gravity. But let us suppose that our weight is counterbalanced not by another weight, but by some one pulling through a tension scale, as in fig. 3, where B=50 lbs. and "f" is at the centre of the bar. By experiment we find that when the tension is exerted as at "b," in a direction parallel to that of the weight "b," it is exactly equal to the weight "b" or 50 lbs.

In any other position as at "A" or "C," the tension exceeds 50 lbs. by an amount proportional to the angle of deviation. In other words, a given force gives a maximum effect when its direction is at right angles to the line drawn from such direction to the fulcrum. We also find that whatever the direction of the force to the bar, "fy" the effort of the force is measured by the perpendicular distance from "f," to the direction of the

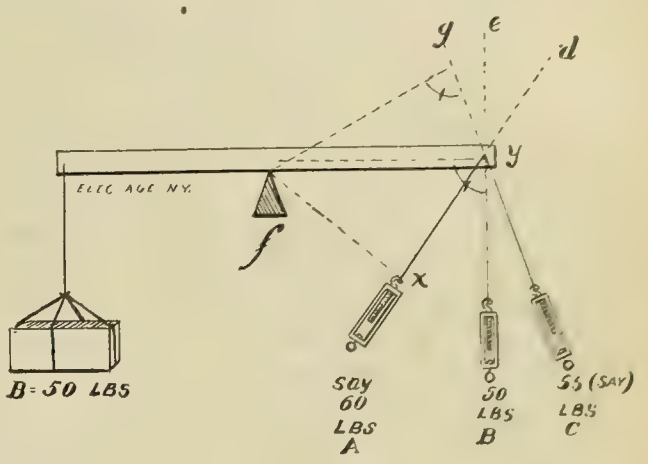


FIG. 3.

force and so this perpendicular distance is called the "lever arm" or "arm" or "lever" of the said force.

In figs. 1 and 2, it will be noted that the lever arms of both forces lie in the same straight line. Such levers are called straight levers (Weisbach Theoretical Mechanics, page 256) and also that the line of the lever arm coincides with the balancing bar.

We explain this because in some levers as the "bent" and "serpentine" forms (figs. 4 and 5) taken from "D. K. Clark's Manual of Rules, etc.," 5th Edition, 1890, page 296, the lever arms do not necessarily coincide in direction with the line of the rigid connection to the fulcrum. Compound levers need not be discussed as they are rarely, if ever, used for safety valves. Straight levers are of two kinds: A, one-armed, where both the forces act on the same side of the fulcrum (figs. 6 and 7); B, two-armed, where the forces act on opposite sides of the fulcrum (fig. 1).

While either kind could be used for a safety valve, all such valves in commercial use to-day are of the one-armed variety.

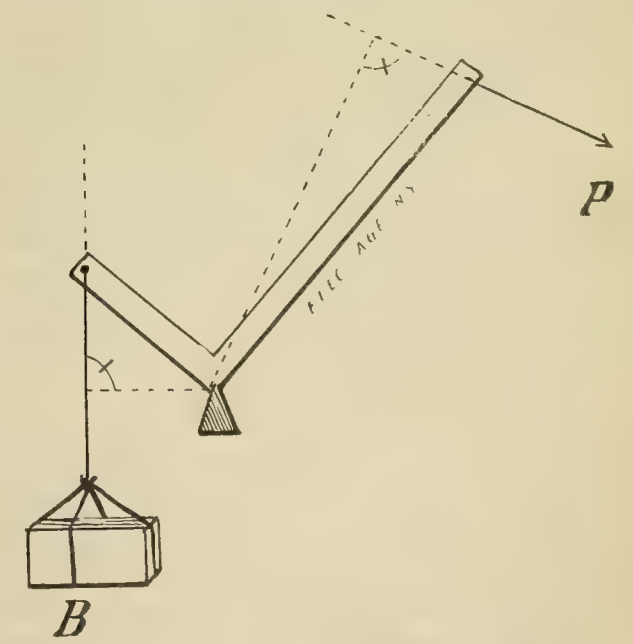


FIG. 4.

Straight levers are also divided into three classes according to which of the three quantities is involved and in the order named, *i.e.*, fulcrum, weight or force is centrally located with respect to the other two (figs. 1 and 6). Class 3 is seen at once to picture the ordinary safety valve.

We have seen that the maximum effect is attained when the arm of our force is at right angles to the direction in which it is acting. It is

at once manifest that when the force and its arm are so related that if the force be increased, a still greater effort is exerted against the opposite force on the opposite side of our fulcrum. In short the effect produced depends on both the amount of the weight and the length of its lever—that is on their product. This product then, is the measure of what the force can accomplish as regards pro-

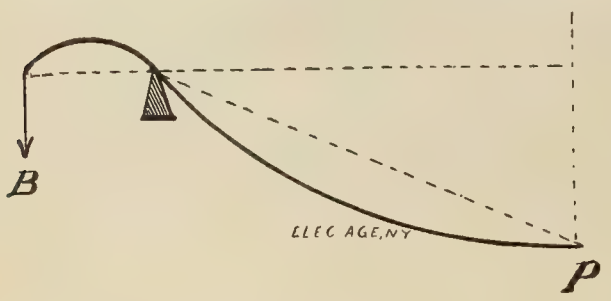


FIG. 5.

ducing or preventing rotation about the axis and is a quantity of great importance in mechanics. It has been called "the moment of the force," with respect to the point "f" or axis.

Thomson & Tait's Nat. Phil. 1, "f" *231.232*, page 233. This quantity is also called the "static" "or statical moment"—French, *moment des forces;* German, *statishe* or *kraft moment;* Weisbach, page 195—of the force not the "static momentum," [*Canadian Electrical News*, Vol. 1, No. 7, page 88] for "momentum" is an expression belonging to that part of mechanics called dynamics, which treats of bodies in motion. It is true the lever moves about the fulcrum, but it is the getting of equilibrium that is the important point.

The ratio of the length of the power (force) end of the lever to that of the weight end, is called the "leverage of the power." "D. K. Clark's Manual of Rules, etc.," 1899, page 297.

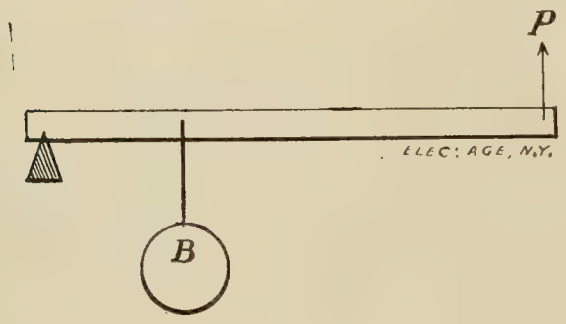


FIG. 6.

Going back to fig. 2, we have four quantities involved, which we shall designate by the letters, B. L. P. and S.

L, is the "arm" of the weight (or force) B; S, is the "arm" of the force (or weight) P; B L, is the "moment" of the weight (or force) B, and P S, is the "moment" of the force (or weights) P, and these moments we have seen must be equal in order to get a balance.

The values of P and S are so related that if P increases S must correspondingly and coincidentally decrease by exactly the same amount, and B and L are mutually related in exactly the same way. Quantities whose value change thus together, *i. e.*, depend upon each other, are called "functions."

(*To be Continued.*)

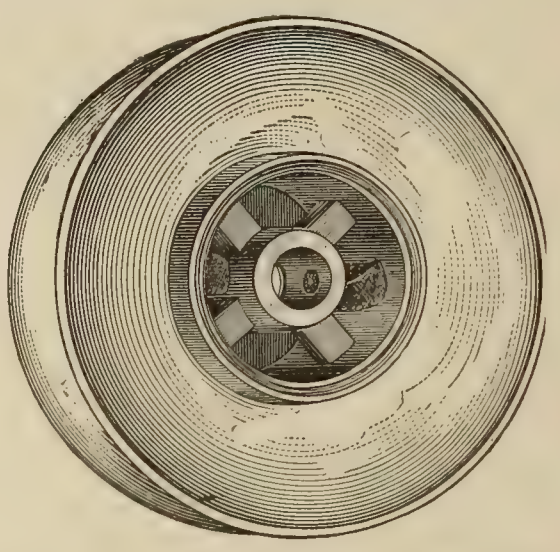
THEY NEED YANKEE ENTERPRISE.

The *Electrician* of London, in its issue of July 31 last says:—"A large and varied assortment of reasons can readily be marshalled up to account for the rapid development of electric traction in the United States, and its snail-like progress in the United Kingdom. If a reproduction of the results obtained with the electric cars on the Boston West End Railway could be guaranteed on this side of the Atlantic—and we know of no insuperable obstacle—even the most cautious of tramway directors might be induced to emerge from the 'experimental stage.' In Boston, according to our New York correspondent, electric traction costs nearly 10 per cent. less than horse traction per mile run, and its net earnings amount to over 77 per cent. more. Meanwhile, we in this country are still hammering away at battery traction, pending the advent of the perfect closed conduit."

SELF-OILING TROLLEY WHEEL.*

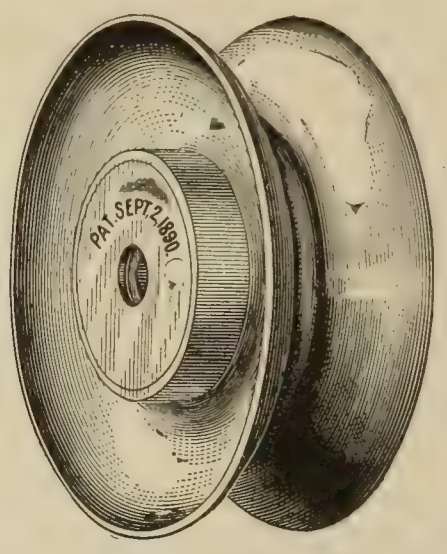
We illustrate herewith a trolley wheel that overcomes many objectionable features of the trolley wheels now in use.

Where wheels get dry from lack of oiling, there is a noise and a rattle that is very exasperating; but this device is self-oiling, making a well oiled



SELF-OILING TROLLEY WHEEL—FRONT VIEW.

bearing and securing smoothness of action with long life of the wheel. The perfect lubrication lessens the danger of the wheel slipping or jumping on the wire and saves time, labor and annoyance. The wheel is filled with any good lubricating oil through the space near the end of the bearing, as shown in the illustration, until flush with the bearing. The oil is fed through wicks to the pin and then passes back to chamber through a space on the end, using the oil over and over again.



SELF-OILING TROLLEY WHEEL—PERSPECTIVE VIEW.

The wheel requires no attention when once filled with oil, and the price is nearly as low as that of any other make of wheel.

ELECTRIC MOTOR TRUCK.

The electric motor truck illustrated herewith is the latest development of the Detroit Electrical Works, of which Mr. Frank B. Rae is electrician and engineer. The Rae system of traction is familiar to all electrical engineers, and it is well known that every addition to the system is an improvement. Mr. Rae believes that one motor is sufficient, and, as will be seen from the illustration, he has embodied this idea in this new truck. The truck frame is in one solid piece, and the motor is mounted lengthwise of the truck midway between the axles; the armature is placed lengthwise also, and the armature shaft is geared to the axles by means of beveled gearing cut by special machinery. The frame being in one piece and rigid, holds the axles and wheels in their proper position and reduces the jar and grinding. The car body rests on four powerful springs fastened to the truck frame, producing an ease and comfort to the passengers that must be felt to be appreciated. The motor used is the new standard 40 H. P. railway motor with which engineers are familiar.

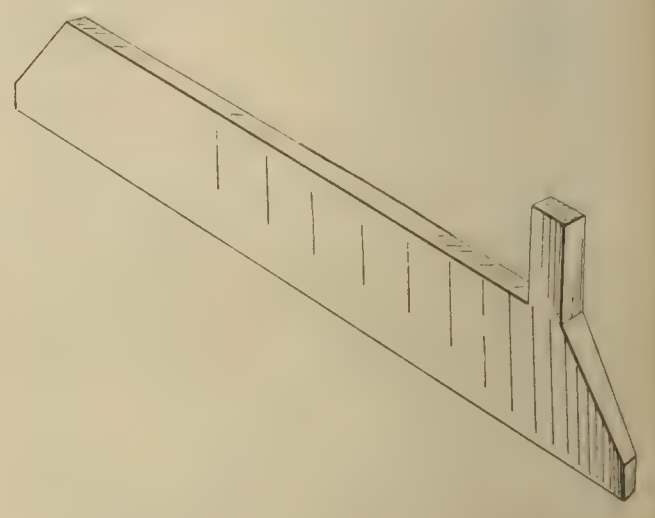
*Badger Brothers, West Quincy, Mass.

A NEW COMMUTATOR METAL.*

Hitherto pure tempered copper castings have been universally adopted for the construction of commutators. A new bronze has just been brought out, intended especially for this use. It is called "Silver Bronze," on account of its color, which is very nearly that of silver.

The new bronze is said to be far more durable than copper—harder and tougher in every way, non-oxydizable, and does not blacken, corrode or tarnish. It takes a polish equal to silver, is a good conductor, and sparking is said not to blacken it. It takes the contact of carbon brushes very kindly, being in the nature of an anti-friction metal. It does not contain zinc or tin, and even salt water has no corrosive effect upon it.

If all these claims are borne out in practice, it



SILVER BRONZE COMMUTATOR SEGMENT.

should prove a far better and more durable material for commutators than anything hitherto used. For the same reason it should be good for rheostat contact boards and analogous uses.

H. WARD LEONARD & CO.

We have just received, as we go to press, the prospectus of the new firm of H. Ward Leonard & Co., of this city. This company, the prospectus states, has been organized with the special object of undertaking work involving the necessity of a wide, comprehensive experience in the electrical field, and such a knowledge of electrical, mechanical, chemical and mining work as is necessary for the intelligent application of electricity to new uses and such as does not at present exist outside of the large electrical companies.

H. Ward Leonard & Co., is a corporation organizec under the laws of New Jersey, with a present authorized capital of $200,000.

The prospective purchaser will now be able to secure thoroughly competent service for any portion of the work in connection with the purchase, installation and operation, of his plant, and at an extremely moderate rate.

Our correspondent in Cronstadt, Russia, writes us that there is a capital opening there for street car lines, there being none in the city. The streets are broad and the population numbering about 50,000 souls, are fairly well to do.

Our correspondent at Three Rivers, P. Q., advises us that there is an opportunity there for the construction of a street railway; that, in his opinion, it would pay some enterprising American to obtain a franchise and build a line there. The population is about 10,000.

Mr. R. S. Vivian, of the American Bank Building, Kansas City, Mo., has been located in that city for nearly ten years, and has won an enviable reputation as a prompt disposer of investment securities, of which he handles all kinds, so long as they possess intrinsic merit. He is one of the few who make a specialty of street railway bonds, and parties desiring to place their bonds, can, very probably, arrange to do so through him.

*Barry & McTighe, 52 and 54 William street, New York.

BOOKS, CATALOGUES, ETC.

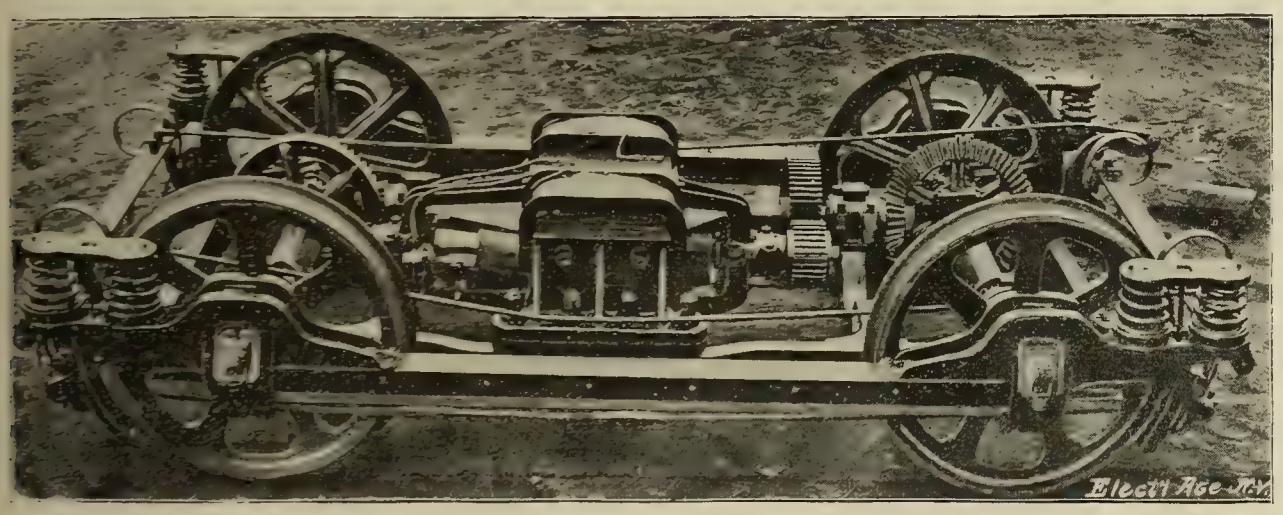
TELEPHONES, THEIR CONSTRUCTION AND FITTING.—By F. C. Allsop. E. & F. N. Spon, 12 Cortlandt street, New York.; pp. 191 and 168 illustrations. Price $2.00.

There has been a want for such a book as this for a long time, and its appearance is made at an opportune moment. It describes very fully receivers, transmitters and switch bells of all classes in use, and the magneto-generator and bell batteries; bells and relays take up an entire chapter in their full explanation. Switches and switchboards are also very fully considered, and instructions in erecting lines, connecting up instruments, testing for and removing faults, etc., are given in a very clear manner.

All the practical information we have at hand in regard to the telephone and it accessories is made up of fragmentary articles in the main, published at different times in technical journals, and electricians and the public in general will be glad to know that at last all useful information on the telephone can now be had in book form. This work is a practical treatise on the fitting up and maintenance of telephones and the auxilary apparatus, and no doubt it will find a place in every electrical library, as such will not be complete without a copy.

A PRACTICAL TREATISE ON THE INCANDESCENT LAMP. By J. E. Randall. D. Van Nostrand Company, New York; pp. 82, numerous illustrations. Price 50 cents.

The author of this little book, as electrician of the incandescent lamp department of the Thomson-Houston Company, is in a position to be an authority on this subject, and in compiling this work he has given information that cannot be found in any other publication. The entire subject has been treated in a manner neither scientific or technical, and every point described and discussed is within the understanding of any one not possessing even a rudimentary knowledge of electrical science. After describing the historical development of the lamp, Mr. Randall explains the principles envolved in its construction, and describes the different parts and their process of manufacture in detail. The manufacture of the carbon filament, the lamp bulb, the different parts of the socket and the process of producing a high state of vacuum in the bulb are very fully explained and illustrated; and the book, which is of a size to fit in the pocket, is adapted to both the manufacturer's and the student's wants. Mr. Randall shows that he has a thorough knowledge of the subject and every expert or amateur electrician should have a copy of this work. For sale by the ELECTRICAL AGE PUBLISHING CO., First floor, *World* Building, New York.



RAE'S ELECTRIC MOTOR TRUCK.

We have just received a copy of "The Phonopore Duplex Telegraph," by C. Langdon-Davies, containing instructions for the installation and working of the simplex phonopore telegraph to produce in combination with an ordinary telegraph a phonopore duplex service. The pamphlet is published by the Phonopore Syndicate, Limited, Blomfield House, E. C., London, Eng., and contains 26 pp. with numerous engravings of instruments, circuits and connections. The phonopores are intended to be worked on ordinary telegraph wires without interference with the ordinary uses of the wire.

ELECTRIC TRANSMISSION HAND-BOOK, by F. B. Badt, pp. 97 with 22 illustrations and 27 tables. Electrician Publishing Company, Chicago. Price $1.00.

This little work which is 4 x 6 inches in size, is full of valuable information pertaining to electric transmission, and is replete with practical information on this important subject. While its entire contents are extremely valuable to the practical electrical engineer, we find among its chapters considerable space devoted to condition of plant for least operating expenses, and condition of minimum total initial cost of transmission plant. Rules and formulæ are given for ascertaining the horse power of motors driving various classes of machinery for pulleys, belts and shaftings and directions for connecting and operting motors, electric light plants, etc. On account of the small size of the book, it is very convenient to carry in the pocket for ready reference.

We have just received the first number of the *Compass*, a new monthly journal devoted to the theory and application of mathematical instruments used by engineers, surveyers, architects, draughtsmen, and students, published by Keuffel & Esser Company, New York. The intention of the publisher is to give accurative information in regard to the construction and use of all mathematical instruments used, covering everything useful to the class for which it is written. The journal is tastefully gotten up, and from the appearance of the first number it seems that it will contain information that is not covered by any of the technical works on the subject.

The Ball Engine Company, of Erie, Pa., has just issued a very neatly gotten-up catalogue of improved Ball engines, embracing the simple, tandem compound, cross compound and triple expansion types. The catalogue is completely illustrated, showing the engines complete and in part; in addition to which there is considerable practical information relating to steam engines.

MAGNETIC CONSTANCY.

Strouhal and Barus, who have made so many researches upon the physical properties of steel, have examined the question of magnetic constancy in relation to form, temper, and exposure to fluctuations of temperature. They found that a glass-hard magnet, 119 diameters long, lost 30 per cent. of its magnetism when heated for six hours in steam at 100° C, but the same magnet, when re-magnetized, and again heated in steam, now only lost 5.3 per cent. The loss of magnetism on the first heating was found to vary in magnets of different lengths.

A magnet of 119 diameters' length lost 30 per cent.
" 108 " " " 28 "
" 35 " " " 49 "
" 14 " " " 67 "

In every case after protracted heating in steam, a condition was attained in which neither the specific magnetism nor the specific resistance (*i. e.*, the hardness as measured electrically) showed any appreciable further change. These investigators came to the conclusion that magnets so treated possess a special fixidity; and resist not only changes of temperature but mechanical shock, better than magnets prepared in any other way. As an example, they took a short magnet 2.5 centims. long, 0.5 centims. wide, and 0.3 centims. thick. This was boiled in water for four hours: then magnetized and kept two hours longer in steam. Its magnetic moment was then observed, after which it was laid on a wooden log, and violently beaten fifty times, both lengthways and sideways, with another mass of wood. It then showed a diminution of only $\frac{1}{900}$; and after a repetition of the beating only showed a loss of about $\frac{1}{400}$. In another experiment a tubular steel magnet was made glass-hard, magnetized, then heated for thirty hours in steam, re-magnetized and heated for ten hours more in steam. This magnet when allowed to fall ten times, on its ends, from a height of 1.5 meters, showed a permanent diminution of only $\frac{1}{4750}$ of its magnetism. It is accordingly recommended that all magnets for use in magnetic observations should be prepared as follows: *Make the magnets glass-hard: then place in steam at* 100° *for 20 or 30 hours, or longer for very massive magnets. Then magnetize as fully as possible, and then heat again for five* (*or more*) *hours in steam.* Such magnets will then be as constant as they can be made.

FINANCIAL DEPARTMENT.

The Brooklyn Elevated Railway Company's statement for the quarter ending June 30, 1891, shows gross earnings of $460,767; operating expenses, $251,298; net earnings, $209,463; other income, $2,896; fixed charges, $159,897; net income, $52,468; cash on hand, $23,937; profit and loss surplus, $157,873.

As showing the tendency of this age of improvement we would remind our readers that after July, 1892, horse cars will not be permitted in Washington. The City of London has had a law to the same effect for years, and it has been supported by all the officials. Permit after permit has been applied for but never granted. It will not be many years before, in greater New York, a street car drawn by horses will be a curiosity. The street car companies in the United States have adopted electric power on their road.

The consolidated street railway interests in Detroit under the new order of things will be known as the Citizens', and there is little doubt but the citizens will gain much by the change.

The West End Street Railway Company of Boston has issued its financial statement up to July 1, showing the net earnings for April, $115,935. May, $165,524, and June $212,259. This corporation on an expense of $4,000,000, is collecting from the public $5,100,000, and clearing a round million which, as the extensions and improvements are added, will in a few years be nearly doubled. President Whitney is credited with saying that the gain by electricity is as 22.34 cents per electric car mile against 12.27 cents by horse power. This is the story all over the country, and as soon as a method of electrical application becomes general the gap will be increased.

Whipple's reports for August, says: "The recent railway deal in Newark, N. J., means a

snug sum for the seventeen stockholders of the Rapid Transit Street Railway. The consideration of the transfer of the system to the Newark Passenger Railway Company, it is stated, was $1,000,000 on an original investment of $200,000 made a little over two years ago; 300 or 400 per cent. should satisfy the ordinary street railway investor." The public should be let in on a few deals of this kind to educate them. Now is the time to do it.

STREET RAILWAY QUOTATIONS.

The following are the latest prices for street railway securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

Names of Companies.	Capital.	Par.	Price.
Albany Street Railway Co. (N. Y.)	$750,000	100 00	$92 00
Almo Elec. St. Ry. 6s	200,000		par
Amsterdam Electric St. R.R. (N.Y.)	250,000	100 00	75 00
Atlantic Ave. Ry. Bkln	1,000,000	50 00	*115
Atlantic Ave. Ry. Bkln. 1's	140,000		*103
Birmingham Ry & Elec.Co.,6's (Ala)	1,500,000		par
Broadway Ry. Bkln	525,000	100 00	185 00
Broadway Ry. Bkln. 1's	350,00		*101
Brooklyn City R.R.	6,000,000	10 00	15 50
Brooklyn City R. R. 5's	6,000,000		*100
Brooklyn Elevated	13,260,000	100 00	25 00
Brooklyn Elevated, 1's	3,500,000		*111
Brooklyn Elevated, 2's	1,250,000		*84
Benton Belfontaine (St. L.)	324,000	100 00	100 04
Benton Belfontaine 7's (St. L.)	50,000		*100
Broadway & 7th Ave. (N. Y.)	2,100,000	100 00	305 02
Bleeker St. & Fulton Ferry (N. Y.)	900,000	100 00	26 00
Broadway & Newburg (O)	1,000,000	100 00	110 00
Brooklyn St. R.R. (O)	310,000	100 00	125 00
City Elec. St. R.R. 6's (Ark)	200,000		par
Citizens' Ry. Co. (Detroit)	1,000,000	100 00	100 00
Citizens (St. L.)	1,500,000	100 00	105 00
Cass Ave. Fair. (St. L.)	300,000	50 00	49 00
Chicago City (Ill.)	6,000,000	100 00	305 00
Chicago Passenger (Ill.)	1,000,000	100 00	96 00
Chicago Passenger (Ill.) 6's	400,000		*100
Central Park N. & E. R.	1 800,000	100 00	125 05
Cleveland Cable (O)	2,000,000	100 00	25 00
Cleveland Cable Pref. (O)	2,000,000	100 00	105 00
City R.R. (San Fran.)	800,000	100 00	100 00
California St. (San Fran).	1,000,000	100 00	109 00
Cincinnati, (O.)	5,775,000	50 00	109 00
Cincinnati, (O.) 7's	300,000		*102
Charleston City, (S. C.)	100,000	50 00	65 00
Coney Island & Bkln. Ry	500,000	100 00	120 00
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Crosstown Ry., 1's	200,000		*105
Dry Dock, E. By. & Bat. (N.Y.)	1,200,000	100 00	138 00
Dry Dock, E. By. & Bat., 7's, (N.Y.)	840,000		*100
Eighth Ave. (N. Y.)	1,600,000	100 00	250 06
East Cleveland, (Ill.)	2,000,000	50 00	85 00
Ferries & Cliff House, (Cal.)	2,500,000	100 00	42 00
Ferries & Cliff House, (Cal.) 6's	650,000		*108
Fulton Elevated, Bkln., 1's	1,621,000		*93
Germantown, (Pa.)	1,500,000	50 00	95 00
Gloucester St. Ry. Co. (Mass)	60,000	100 00	95 00
Jamaica & Brooklyn Road Co.	197,480	20 00	20 00
Jamaica & Brooklyn Road Co. 5s	500.000		*99
Kings Co. Elevated	3,250,000		12 00
Kings Co. Elevated, 1's	3,377,000		
Kings Co. Elevated, 2's	2,432,000		*58
Lehigh Ave. (Phila.)	1,000,000	50 00	6600
Louisville St. Ry. (Ky.)	5,000,000	100 00	2000
Louisville St. Ry. Pref. (Ky.)	1,000,000	100 00	7000
Montague St. Ry., B'klyn	150,000	100 00	
Montague St. Ry. (Brooklyn), 5's.	250,000		*98
Missouri, (Mo.)	2,500,000	100 00	250 00
Mound City, (Mo.)	1,000,000	100 00	200 00
Market St. (San Fran.) 6's	3,000,000		*123
Mount Auburn Cable, (O.)	300,000	100 00	50 00
Mount Adams & E. Park	1,400,000	50 00	107 00
Northern Central, (St. L.)	200,000	100 00	105 00
North Beach, (Cal.)	1,000,000	100 00	53 00
North Chicago City R.R.	500,000	100 00	173 00
North Chicago Street R. R.	5,000,000	100 00	162 00
North Chicago St., 5's			*97
People's St. R. R. (St. L.)	1,000,000	50 00	75 00
People's St. R. R. (Pa.)	1,500,000	25 00	41 00
Pawtucket, (R. I.)	270,000	100 00	92 00
Phila. City	1,000,000	50 00	143 00
Ridge Ave. (Phila.)	750,000	50 00	215 00
Short El. Ry. Co. (Clev.)	5,000,000	10 00	10 00
Sprague Elec. Ry. & Motor Co	16,000		†
St. Louis Ry. (Mo.)	1,000,000	50 00	75 00
St. Louis Cable, (Mo.)	1,000,000	100 00	15 00
St. Louis Cable, 5's	1,500,000		*101
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Elevated, Bkln., 1's	5,500,000		*109
Vine St. Motor Co. (Colo.) 6's	100,000		par
West Chicago Street R. R.	10,000,000	100 00	127 00
West Chicago St., 5's			*96
West End St. Ry. (Boston)	2,000,000	50 00	64 00
West End St. Ry. (Boston) Pref.	6,400,000	50 00	81 50
Winston-Salem Elec. St. R.R. (N.C.)	250,000	100 00	75 00

*Per cent. †Registered Stock.

As very few street railway securities are dealt in on the Stock Exchange, the above prices are mostly approximate, but will be found very near the mark.

THE WEEK'S RECORD OF STREET RAILWAY NOTES

COLORADO.

DENVER.—It is said that the Denver, Lakewood and Golden Street Railway Company is to use steam locomotives upon the system until spring, when the entire road will be equipped with electric power.

CONNECTICUT.

NORWICH.—The Norwich Street Railway Company has declared a semi-annual dividend of 3 per cent.

ILLINOIS.

CHICAGO.—The last quarterly tax of the Chicago City Street Railway Company was $4,498.75; of the North Chicago Street Railway Company, $2,417.50, and of the West Division Street Railway Company, $4,717.74.

IOWA.

FORT MADISON.—An electric street railway is to be constructed here.

SIOUX CITY.—The Sioux City Street Railway Company has adopted a system of switching by means of which all switching is done at one central station.

MANITOBA.

WINNIPEG.—The street railway company has received two new trailer cars from New York.

MASSACHUSETTS.

NEWBURYPORT,—The Newburyport and Amesbury Electric Railway Company has awarded the contract for the building of its new car house to the Leach & Grant Company, of Boston.

STONEHAM.—It is said that Myron J. Ferren, of this place, has patented an improved electric elevated railway.

WORCESTER.—The Worcester, Leicester and Spencer Electric Railroad was opened for traffic on August 18.

MICHIGAN.

JACKSON.—The electric street railway will be completed during September.

MINNESOTA.

MINNEAPOLIS.—Ninety-five trailer cars are ready for use on the electric lines; of these sixty are 14-ft. Pullman coaches, twenty-five 14 and 16-ft. Stephensons and ten 18-ft. Jones cars. The East Side car house, which has just been completed, will accommodate 100 motor and 200 trailer cars.

MISSOURI.

ST. LOUIS.—Subscription books for an electric road between Forest Park and Clayton have been opened.

NEBRASKA.

PLATTSMOUTH.—It is said that H. C. Harkney has leased the electric street railway system, and that he will give it a thorough overhauling.

OHIO.

TOLEDO.—The Consolidated Company is constructing an extension to Ironville.

The Toledo Consolidated Street Railway Company recently started its new electric road, the steam plant of which is supplied with four 150 H. P. Wharton-Harrison safety boilers, using natural gas for fuel.

PENNSYLVANIA.

ALLENTOWN.—It is reported that the Council has decided to tax the electric street railway company $25 for each car in use.

UTAH.

OGDEN.—The Ogden Street Railway Company has about completed its extensions to the city limits.

SALT LAKE CITY.—The Rapid Transit Street Railway Company has extended its lines to Murray, a distance of eight miles.

VIRGINIA.

RICHMOND.—The Highland Park branch of the Forest Hill line was opened August 13.

PERSONAL.

D. B. Dean, "hustler" for the Electric Merchandise Company, of Chicago, paid us a very pleasant call last week. Brother Dean was feeling particularly cheerful over his closing of a contract with the Citizens' Traction Company for its entire line equipment. Mr. Dean went on to Boston from New York.

POSSIBLE PURCHASES.

BINGHAMTON, N. Y.—The Binghamton Street Railway Company will require equipment for a three-mile extension. Address G. T. Rogers, general manager.

BOSTON, Mass.—The West End Street Railway Company will increase its equipment by the addition of 250 cars, with a seating capacity of 34 passengers per car, and its power by the addition of 20,000 H. P. by November 1.

CARTHAGE, Mo.—J. Guinney may require electrical and additional track equipment for his street car line.

BRIDGETON, N. J.—Bridgeton and Millville may contract for an electric railway between the two places.

DULUTH, Minn.—The Minnesota Point Street Railway Company will buy three additional horse cars, and possibly material for a 2½-mile extension. Address Walter Murray, manager.

ERIE, Pa.—Electrical engineers may possibly close a contract for the 12-mile electrical street railway between this city and North East, which is being strongly agitated.

JAMESTOWN, N. Y.—The electric street railway may desire additional equipment for its 8-mile extension to Falconer.

ORANGE, N. J.—The Orange, Crosstown and Bloomfield Railway Company may desire equipment for its proposed extensions.

ROCKFORD, Ill.—The West End Street Railway Company will buy two motor cars and one generator, and possibly material for a 1½-mile extension to its track.

SALT LAKE CITY, Utah.—The Rapid Transit Company may purchase material for an extension.

The Salt Lake Rapid Transit Company will require electrical equipment for a 10-mile track extension, Address J. S. Cameron, president.

The West Side Rapid Transit Company will require electrical equipment for upward of 10 miles of track, and probably about 20 motor cars. Address T. A. Davis, president.

SAN FRANCISCO, Cal.—The North Beach and Mission Railway Company desires electrical equipment for its road.

SIOUX CITY, Ia.—The Sioux City Street Railway Company will increase its equipment by from five to ten cars. Address J. F. Peavey, Sioux City, Ia.

INCORPORATIONS.

BALTIMORE, Md.—The Roland Avenue Electric Railway Company has been incorporated with a capital stock of $25,000, to construct and operate an electric railway outside the city limits. Mr. Whitridge is president.

CHICAGO, Ill.—The Chicago and Evanston Electric Railway Company was incorporated August 15, to construct and operate a passenger street railway system. Incorporators: John Lewis Cochran, Frank S. Gorton, Delaney H. Louderback and Alex. Clark.

The Homeward, South Harvey and Harvey Electric Dummy Railway Company was incorporated August 15, to construct and operate an electrical dummy railroad from South Harvey to Harvey, Ill. Incorporators: William C. Clinton, Isaac A. Hartman and Fred. A. Bangs.

MIDDLETOWN, O.—The Middletown Electric Street Railroad Company was incorporated August 10, with a capital stock of $100,000, to construct and operate an electric street railway in this city. Incorporators: H. Knight, H. P. Lane, J. M. Schenck, H. H. Hatch, Murray Schenck, Henry Behrens, W. T. Harrison and M. A. Thomas.

NORFOLK, Neb.—The Norfolk Street Railway Construction Company was incorporated August 15, with a capital stock of $25,000, to construct and operate an electric street railway. Incorporators: N. O. Whyman, C. A. Mast, Alexander Bear, James G. Hamilton and R. A. Stewart, all of Norfolk, Neb.

PORTLAND, Me.—The Combination Car Company was incorporated August 11, to manufacture and sell passenger cars for surface or elevated railroads. President, Daniel W. Scribner, of Portland; treasurer, Gilman B. Bolton, of Watertown, Mass.

SANDUSKY, O.—The People's Electric Railway Company was incorporated August 17, with a capital stock of $100,000, to construct an electric street railway and furnish electric power. Incorporators: Jacob Kuebeler, A. W. Prout, W. H. Gilcher, George Barney and Watson Hubbard.

CHANGE OF POWER.

BOSTON, Mass,—The West End Street Railway Company is to equip about 15 miles more of its track electrically, during the fall.

CARTHAGE, Mo —J. A. Guinney, of the horse street car line is desirous of adopting electric power.

RACINE, Wis.—The St. Louis Syndicate, which bought the Belle City Street Railway, is to change the motive power to electricity, shortly.

SALT LAKE CITY, Utah.—The West Side Rapid Transit Company, now using steam dummies, will change its motive power to electricity, shortly.

SAN FRANCISCO, Cal.—The North Beach and Mission Railway Company is to adopt electricity.

NEW ROADS.

ATHENS, Ga.—It is said that an electric street railway is to be constructed, connecting all the cotton mills and warehouses in the city.

BRIDGETON, N. J.—An electric railway between this place and Millville is being strongly agitated.

EAST LIVERPOOL, O.—A. W. Johnson has secured a right-of-way for an electric street railway between East Liverpool and Wellsville.

ERIE, Pa.—An electric railway between this city and North East is being strongly agitated.

HURLEY, Mich.—An electric street railway is to connect this place with Ironwood, Gile and Jessieville.

ELECTION OF OFFICERS.

ELKHART, Ind.—At a meeting of the Directors of the Elkhart Electric Railway Company, August 10, J. W. Ellis was elected secretary in the place of E. P. Willard, who was elected treasurer. P. Hill was made a director.

NEW BEDFORD, Mass.—At a meeting of the Board of Directors of the Union Street Railway Company, August 17, Hon. Weston Howland was elected president in place of Col. Samuel C. Hart, resigned.

PHILADELPHIA, Pa.—On August 16, the Board of Directors of the Lombard and South Streets Passenger Railway Company elected E. J. Moore, president, in place of E. D. Murphy, resigned.

CASUALTIES.

GALVESTON, Tex.—On August 14, a colored man was run over by an electric car and killed.

MINNEAPOLIS, Minn.—A man was thrown from an electric car last week, breaking one hip and severely bruising him otherwise.

SIOUX CITY, Iowa.—The conductor of an electric street car was caught between two cars last week and instantly killed.

SPRINGFIELD, Mass.—On August 16, an electric car ran into a carriage, severely injuring its occupants.

LEGAL.

MINNEAPOLIS, Minn.—The Minneapolis Street Railway Company is being sued for $3,017 damages by a passenger, who was thrown violently to the ground by the car starting before she had a chance to alight.

MONTREAL, Quebec.—The Street Railway Company is being sued for $1,500 by a passenger who fell off a car which the conductor neglected to stop.

TORONTO, Ont.—Philip H. Thomas, a prominent citizen, has applied for an injunction to quash the street railway by-law authorizing the transfer of the street railway system to the Kiely-Everett syndicate.

FRANCHISES

KANSAS CITY, Mo.—The Kansas City Consolidated Terminal Railway Company has been granted a franchise to construct a single or double track street railway on a number of streets here.

LEAVENWORTH, Kan.—The Council has declared the franchise of the Leavenworth and Suburban Street Railway Company forfeited for just cause.

SAUK RAPIDS, Minn.—The St. Cloud Street Railway Company has been granted the right-of-ways on the streets in the city for 50 years.

TRACK EXTENSIONS.

BINGHAMTON, N. Y.—The Binghamton Street Railway Company will extend its tracks three miles.

CARTHAGE, Mo.—The Street Railway Company is to extend its track.

DULUTH, Minn.—The Minnesota Point Street Railway Company is to exend its track two and one-half miles.

JAMESTOWN, N. Y.—The Electric Street Railway is to be extended to Chautauqua.

The Electric Street Railway is to be extended to Falconer Sept. 15.

ORANGE, N. J.—The Orange Cross-Town and Bloomfield Railway Company is to make two extensions; one to South Orange, the other to Montclair.

PITTSFIELD, Mass.—There is talk of the Pittsfield Electric Railway being extended to Dalton.

RACINE, Wis.—The syndicate which purchased the Belle City street car line, is to extend the line shortly.

ROCKFORD, Ill.—The West End Street Railway Company is to extend its track one and one-half miles.

SALT LAKE CITY, Utah.—The Salt Lake Rapid Transit Company will extend its track ten miles.

The Rapid Transit Company will probably extend its line across the river.

The West Side Rapid Transit Company is to extend its tracks ten miles to Great Salt Lake, equipping the entire route with electricity.

SIOUX CITY, Iowa—The Sioux City Street Railway Company will extend its tracks five miles.

MISCELLANEOUS.

Suit has been brought by Stephen D. Field against the Brooklyn and Jamaica Electric Railroad in the United States Circuit Court of the Eastern District of New York, for infringement of his patents. This is said to be a test case.

Dravo & Black, the Pittsburg representatives of the Ball Engine Co., Erie, Pa., have sold the Braddock Street Railway Company, Braddock, Pa., a 100 H. P. Ball engine, also heater, boiler, pump, etc. They have also sold the Pittsburg Plate Glass Company, two 150 H. P. Ball engines.

Messrs. Truex and Vail have secured an order from the Ottawa Street Railway Company, Ottawa, Ont., for their Swinging Ball Lightning Arrester. The street railway company recently lost two armatures through lightning, and desiring to protect itself from future casualties of the kind, it selected the Swinging Ball Lightning Arrester from among a number of others.

Mr. Chas. B. Allyn, President of the Brooklyn Railway Supply Company, Stamford, Conn., with New York office at 123 Chambers street, during a conversation with your representative said that his company has put up a new factory in addition to its other factories, 150 x 60 ft., two stories high, and is putting in the latest improved machinery. He reports business very good. The company's specialties are snow and street sweepers and snow plows.

CORRECTION.—In our issue of August 15, on page 513, under the head of "Business Note," the address of the letter should have been "The Burnham & Duggan Railway Appliance Co." By typographical error the name "Burnham" was rendered "Durnham".

CORRESPONDENCE.

NEW YORK, August 18, 1891.

EDITOR STREET RAILWAY NEWS,
New York City.

Dear Sir:—I am only expressing the appreciative views of a large number of your readers that you have added a regular street railway department to your eminently practical journal.

Hitherto we have had to depend upon the monthly publications, and important intelligence has frequently been withheld from us until it has even become "stale and unprofitable," and as "news" almost a dead letter.

Men of business nowadays even want their news for daily guidance, and though I quite understand that that cannot be given to us in these departments, yet we are well satisfied, and wish to recognize promptly that you have now met our requirements to the fullest extent practicable.

I would especially notice in this connection, that, besides the valuable information and news you publish, brought right up to date, your illustrations are both new and interesting, so that we have now all the practical materials we require for our business necessities. Wishing you continued prosperity,

Yours, very truly,
WILLIAM B. JOYCE.

The following letter is self-explaining:

THE RAPID TRANSIT STREET RAILWAY COMPANY, OF THE CITY OF NEWARK, N. J.
General Office, 275 Washington St.
NEWARK, N. J., July 16, 1891.

E. PECKHAM, Esq., President, Kingston, N. Y.,

Dear Sir:—We have now had the Radial Gear Cantilever truck your company made for us in active service for nearly three months under car 29, and in reply to your inquiry have to say, that it has fulfilled all our expectations, and is equal to all your representations.

It is superior to all other trucks that we have in our service. It is strong and rigid, but also flexible and easy to ride upon.

A special merit of the truck is the relief it gives the car bodies from the oscillation which is so noticeable in other trucks. Another feature of merit is the ease with which wheels can be taken out and replaced, with much less trouble and expense than in the ordinary trucks.

I cheerfully endorse your claims for its efficiency.

Yours truly,
(Signed) SAMUEL SHOCH, Gen'l Supt.

BUSINESS NOTES.

The Northern Car Company, of Robinsdale, Minn., is now completing the following orders: Fourteen cars for the Douglas County Street Railway, West Superior, Wis., to be equipped with Thomson-Houston electric motors; three cars for the Twin City Railway Company, Ironwood, Mich.; five cars for the Rapid Transit Company, Sioux City, Ia., and two cars for the Riverside Park Company, of Sioux City, Ia. A consignment of vestibule cars made by this company was recently shipped to Helena, Mont., and three of its cars will shortly be added to the equipment of the Duluth City Railway, Duluth, Minn. An extension 85x300 feet will shortly be added to the main building and the force increased to about 400 men. Mr. C. P. Jones is president; George P. Stearns, secretary, and W. B. Manier, superintendent.

The Electric Merchandise Company, of Chicago, has just secured the contract for all material necessary for the entire equipment of the Citizen's Traction Company, of Pittsburg, Pa. The Traction Company, being desirous of having the best material obtainable, gave careful inspection to all the different kinds of material manufactured and decided to give the order to the Merchandise Company, solely on the merits of its well-known devices.

The Burton Electric Company has just obtained an order for its electric heaters to be placed on all the cars of the Westminster & Vancouver, B. C., Railway. The cars are being fitted up with these heaters at the works of J. G. Brill Company, Philadelphia, who was authorized to procure the best heating appliances manufactured for such purposes.

DELAWARE & HUDSON COMPANY.

For the information of those who have never visited the Canadian metropolis, but who are intending to go to the Montreal meeting, it may be stated that the shortest and most interesting line between Montreal and New York is the Delaware & Hudson Railroad. Parties from the West can go to Schenectady or to Albany, connecting at either point with the "D. & H." road, and see something of Saratoga, Lake George, Lake Champlain and the marvelous scenery of the Adirondack Mountains. The "D. & H." stands at the head in the number and importance of the summer resorts along its line, and in the number of summer tourists carried in its trains.

Arrangements should be made to include a stop at the Hotel Champlain on the west shore of Lake Champlain, three miles south of Plattsburgh, which, architecturally and in beauty of location of surroundings, is perhaps the finest affair of its kind in the world.

Mr. J. W. Burdick, general passenger agent of the Delaware & Hudson Railroad, Albany, N. Y., will be glad to send by mail an illustrated guide of the line, upon receipt of six cents in stamps, to cover postage.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued August 18, 1891.

457,778. Closed Conduit System for Electrical Propulsion. William B. Heron, Brooklny, N. Y., assignor of one-half to Horace E. Bunker, same place. Filed Mar. 27, 1891.

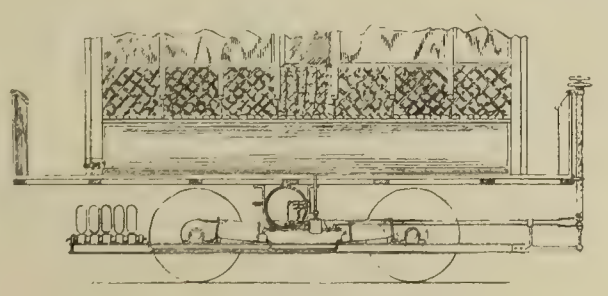
A conduit having a traveling armature in it, a wheeled vehicle with a motor and a magnet on it, a source of electrical energy leading to the motor to operate it, and an auxiliary source of electrical energy leading to the magnet to energize it to attract the armature.

457,786. Adjustable Axle for Cars. Hugo Lau, Dresden, Germany. Filed Mar. 30, 1891.

A car axle consisting of two sections arranged one within the other, one adapted for longitudinal movement within the other section, in combination with a spring located between the sections.

457,790. Car Starter and Brake. Elbert B. Phillips, Cleveland, O. Filed Feb. 9, 1891.

A combined car starter or propeller and brake consisting of an axle having teeth fixed upon it, an energy accumulator, a drum loose on the axle, a cord or its equivalent connecting the drum with the energy accumlator, pawls in the drum for driving the axle both ways, and mechanism for causing the drum to rotate in a contrary direction to the axle, the pawls being so constructed and mounted in the drum that during the rotation one or more will be caused to assume such a position in relation to the teeth fixed on the axle, that when the direction of rotation of the drum is reversed and the drum is then driven by energy previously accumulated the axle will be caused to rotate in the same direction as the drum.



457,792—STREET-CAR MOTOR.

457,792. Street Car Motor. William E. Prall, Washington, D. C. Filed Mar. 11, 1891.

In a car, the combination of a tank for compressed air, a hot water storage tank, two engines, each geared to turn a separate axle, a condenser having a condensing wall that will permit the escape of air, and pipes to exhaust from the engines into the condenser.

457,793. Street Car Motor. William E. Prall, Washington, D. C. Original application filed March 11, 1891. Divided and this application filed June 1, 1891.

The combination of an engine, a hot water storage tank located on and adapted to be carried with a vehicle and disconnected from a fire, the tank being charged with highly heated water under pressure in quantity suitable to drive the vehicle for a trip, inlet pipes opening directly through the wall of the engine cylinder, whereby water can be conveyed from the tank to the interior of the cylinder and introduced directly therein, distinct ports disconnected from the inlet pipes suitable for exhausting water from the cylinder, cocks or valves, and devices for operating the cocks or valves to alternately admit water upon each side of the cylinder piston and exhaust it from the other.

457,794. Traction Device. William E. Prall, Washington, D. C. Filed June 1, 1891.

A rack secured near the rail and provided with teeth which are approximately semi-ovoid in form, and a wheel made fast on a car-axle and provided with circular holes adapted to receive the teeth of the rack.

457,802. Electric Car-Truck. Thomas Tripp, Avon, Mass. Filed April 17, 1891.

The axles of a truck provided with loose geared wheels, each wheel being provided with a roller-carrying ring, to which are secured roller-carrying pins and sets of rolls which are located between the wheel-hub and the axle, and thrust-plate mechanism consisting of the thrust-plate

STREET RAILWAY PATENTS—Continued.

which is secured to the wheel and in operation rotates between the thrust-plate collars, which are firmly fastened to the axle.

457,831. Soda-Motor. Robert R. Zell, Baltimore, Md., assignor to the Zell Stored Power Company, same place. Filed Feb. 20, 1891.

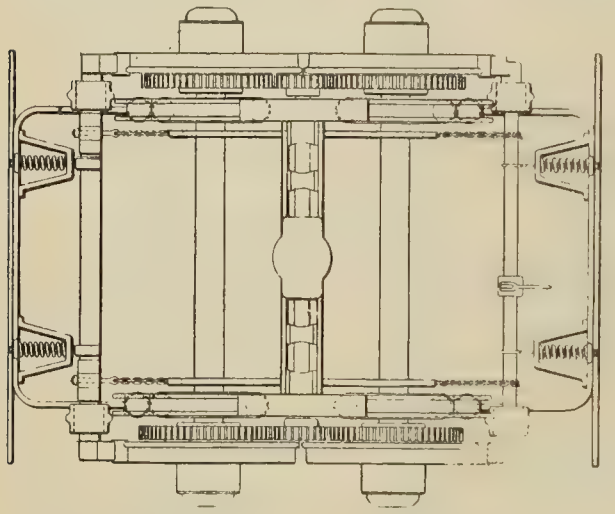
In an alkali-motor, the combination of the water and the alkali chambers, a pipe leading a mixture of compressed air and water-vapor into the alkali-chamber, and a vacuum-pump for drawing the mixture through the alkali.

457,832. Method of Operating Motors. Robert R. Zell, Baltimore, Md., assignor to the Zell Stored Power Company, same place. Filed March 18, 1891.

The method of operating an alkali-motor consisting in utilizing the heat of absorption of water-vapor in the alkali to generate steam from water exposed to its action, passing compressed air into the steam, utilizing the mixed steam and the air in a motor, and then utilizing the exhaust of the motor to generate heat of absorption.

457,836. Electric-Railway Appliance. Frederick E. Degenhardt, Chicago, Ill. Filed Oct. 13, 1890.

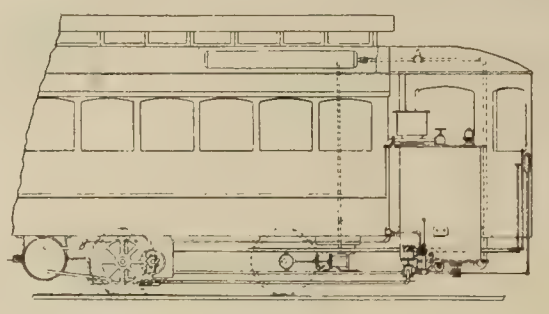
The combination of an electrical conductor with a series of chambers through which it successively passes, each composed of oppositely-faced receptacles, the lower containing sealing-fluid, beneath the surface of which the edges of the upper project, and movable contractors adapted



457,802—ELECTRIC CAR-TRUCK.

to engage the electrical conductor within the chambers and to be engaged exterior to the chambers by a conductor from a moving motor.

457,870. Electric-Railway System. Milton Shoemaker, Sioux City, Iowa, assignor of two-thirds



457,831—SODA-MOTOR FOR STREET CARS.

to James W. Martin, same place, and Jason Passmore, Duncannon, Pa. Filed Nov. 3 1890.

An underground conduit made of suitable material, in combination with a slotted continuous underground metal case containing the following, viz: a conductor, a metallic shield, a trolley-carriage having an inner plate, an outer plate which is extended to form a slot-bar, carriage-wheels, a pivot-bar, from which at a right angle is extended an arm carrying a trolley, the pivot-bar running into journal-boxes, a lower and an upper rail, upon which run the wheels of the trolley-carriage, and another lower rail upon which runs the trolley.

457,920. Railway-Car Heater. William C. Baker, New York, N. Y., assignor to the Baker Heater Company, same place. Filed Nov. 30, 1889.

The combination, with the railway-car heater having a fire-chamber and a supply at top for the fuel, of a wrought-metal case surrounding the heater and having an opening to give access to the ash-pit, slideways affixed to the casing adjacent to such opening, a door sliding vertically in the slideways, and spring latches for holding the door when closed.

457,933. Folding Gate for Car-Platforms. John A. Brill, Philadelphia, Pa. Filed Oct. 26, 1889.

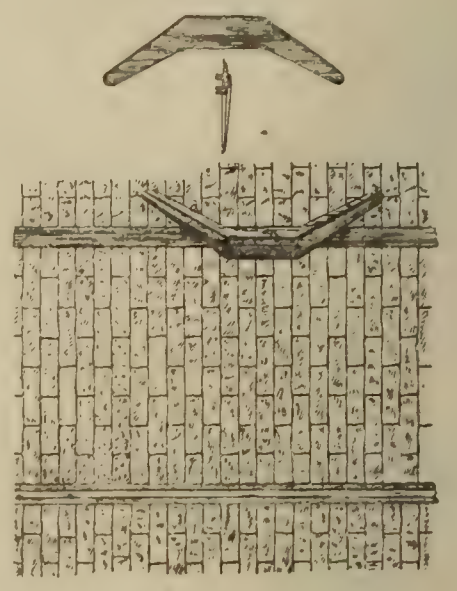
In a folding gate, the combination of lazy-tongs, levers, a tubular end bar, a fixed cap having a lug, and a loose sleeve having a lug connected to the levers, a tubular bar having a cap with a lug and pintle, and a sleeve with a lug for connection to the levers and cap.

457,944. Electric-Railway System. Samuel E. Wheatley and John W. Schlosser, Washington, D. C., assignors to the Wheless Electric Railway Company, same place. Filed Apr. 15, 1891.

A car provided with an electromotor and circuit connectinos from the working conductor through the motor, a local circuit including a storage-battery on the car, a switch for each section of the working conductor to connect it with the main line including closing magnets, one in the working circuit and the other in the local circuit, a rheostatic switch controlling the working circuit through the motor, lamps upon the car, and circuit connections through which the current from the working conductor is directed through the lamps, both when the rheostat is open and when it is closed.

457,972. Car-Replacer. Joseph A. McCray, New York, N. Y, Filed July 3, 1890.

A portable car-replacer composed of a centre body and opposite obliquely-placed wings, the former provided with parallel projections on its under side to take hold of the car-track and a guide-flange on its upper side, and the latter formed with inclined planes and flanges in continuation of the centre body.



457,972—CAR-REPLACER.

458,116. Elevated-Railway Plant. St. John V. Day, Chicago, Ill., assignor to the Day Elevated Railway Plant Company, same place. Filed Dec. 13, 1890.

An upper downwardly-curved cables and lower upwardly-curved cables, the versed sine of the lower cables being less than the versed sine of the upper cables.

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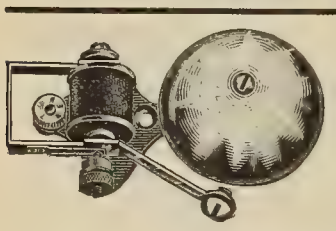
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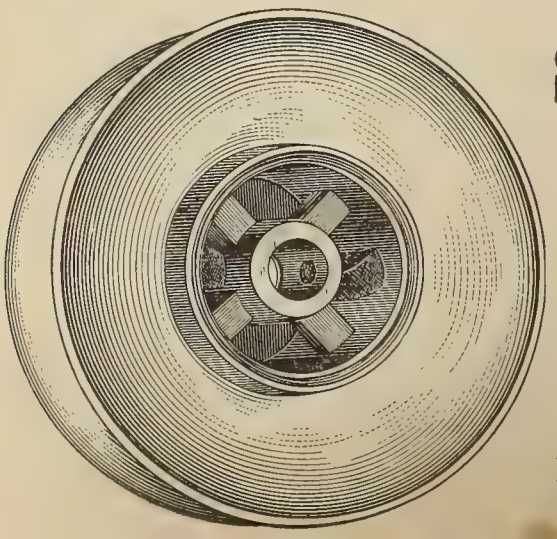
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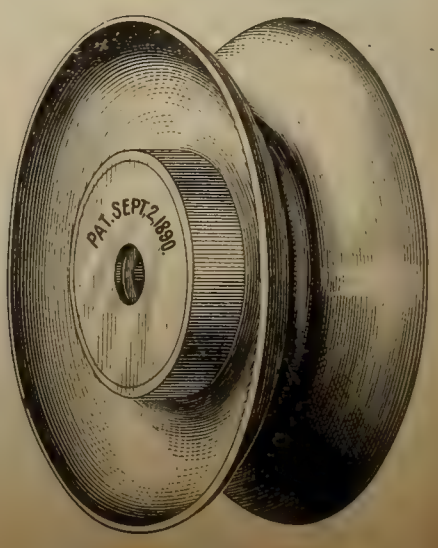


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Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.
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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

WEEKLY.

Vol. IX. NEW YORK, SEPTEMBER 5, 1891. No. 36.

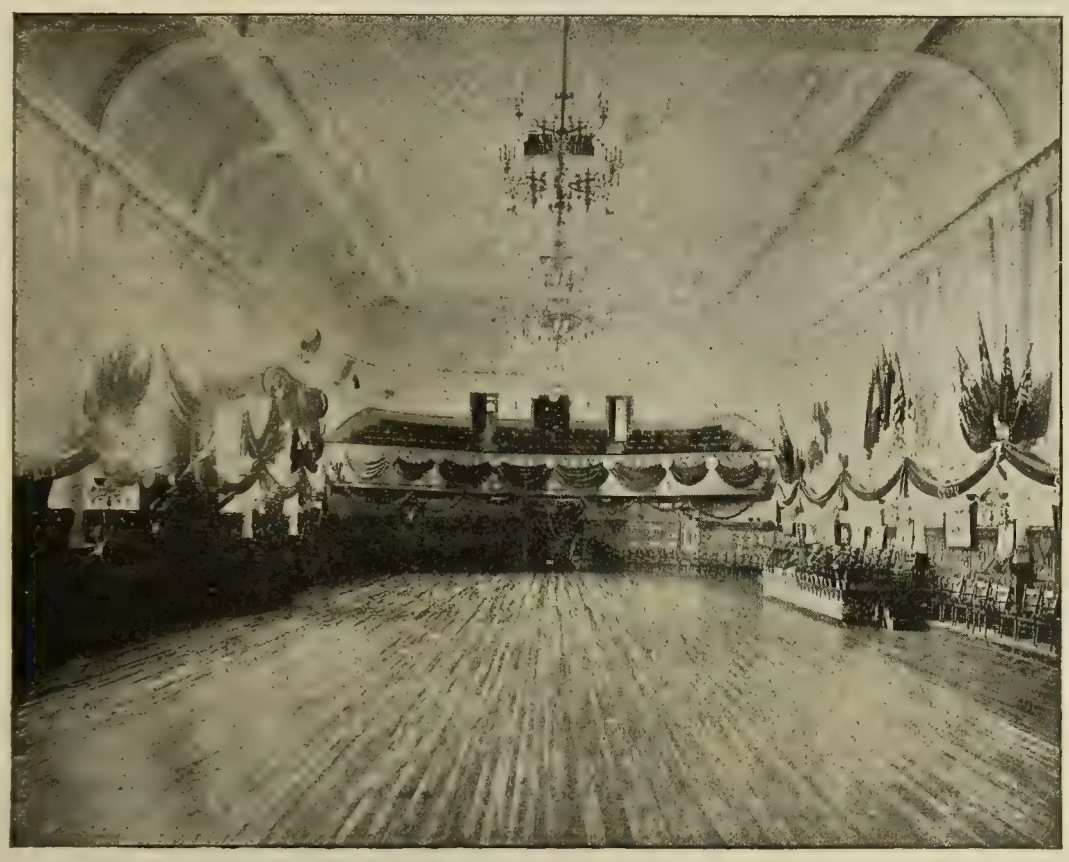
MONTREAL CONVENTION AND EXHIBITION HALLS.

The accompanying illustrations will be of interest at this time. The smaller one shows an interior view of Windsor Hall, in which the Montreal meetings of the National Electric Light Association of the United States will be held, beginning with September 7, next. This hall is part of the Windsor Hotel, which will be the headquarters of the Association during the Convention. It is 136 feet long, 60 feet wide and 60 feet high, and it has a seating capacity of 1,500 people. The view is from the stage, looking toward the rear of the hall.

Our second and larger illustration is that of the interior of the Victoria Skating Rink, in which will be held the International Electrical Exhibition in connection with the convention. The rink is at the rear of the Windsor Hotel, and fronts on Drummond street. It is about 200 feet long and 100 feet wide. The central part of the main floor is divided into four sections, as seen in the illustration. The two right-hand sections will be occupied by the display of the Edison General Electric Company, which will be of unusual magnitude and importance.

The smaller spaces under the galleries will be occupied by the exhibits of the various concerns to be represented, and the exhibition entire will be the crowning feature of the occasion.

The exhibition will close at 10 P. M., Sept. 16.



WINDSOR HALL WHERE THE CONVENTION WILL BE HELD.



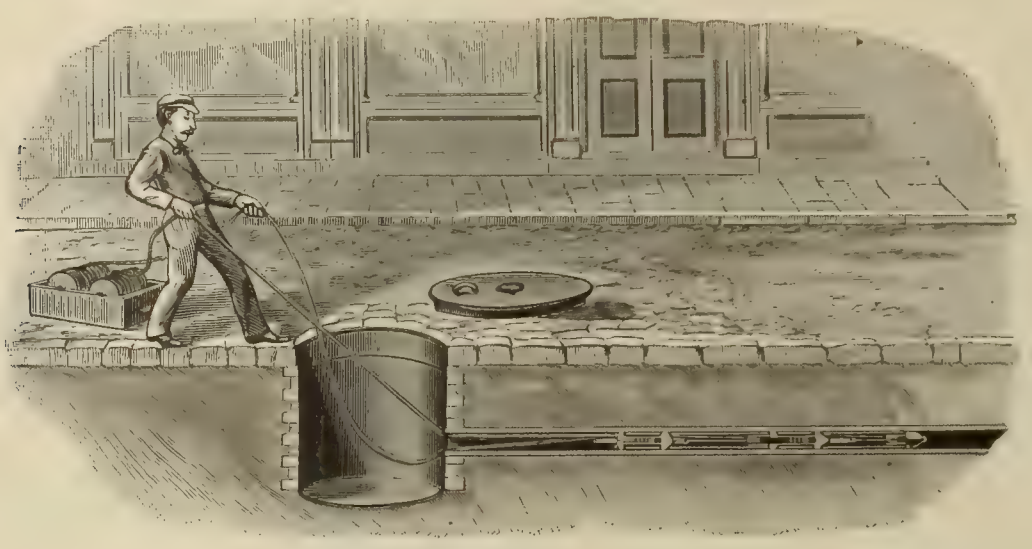
VICTORIA SKATING RINK WHERE INTERNATIONAL ELECTRICAL EXHIBITION WILL BE HELD.

ELECTRICAL PILOT LINE FOR DUCTS.

The accompanying illustration shows the application of a device which will be appreciated by electrical conduit constructing and operating companies.

According to the present practice, when it is desired to place a wire or cable in a conduit, it is usually necessary to "rod" the conduit. Mr. T. J. Cope, of the Cope Electrical Pilot Line Company, 6 and 8 North 6th street, Philadelphia, has however, patented a device which renders this work of easy and rapid accomplishment.

The object of the invention is to lay the pilot or



PILOT LINE FOR DUCTS.

lead line through electrical conduits quickly and cheaply, and avoid the necessity of blowing out gases, as the operator can work above ground if desired. A line can be run through iron, wooden or cement conduits of 400 or 500 feet in length in ten or fifteen minutes by one man, or half that time by two.

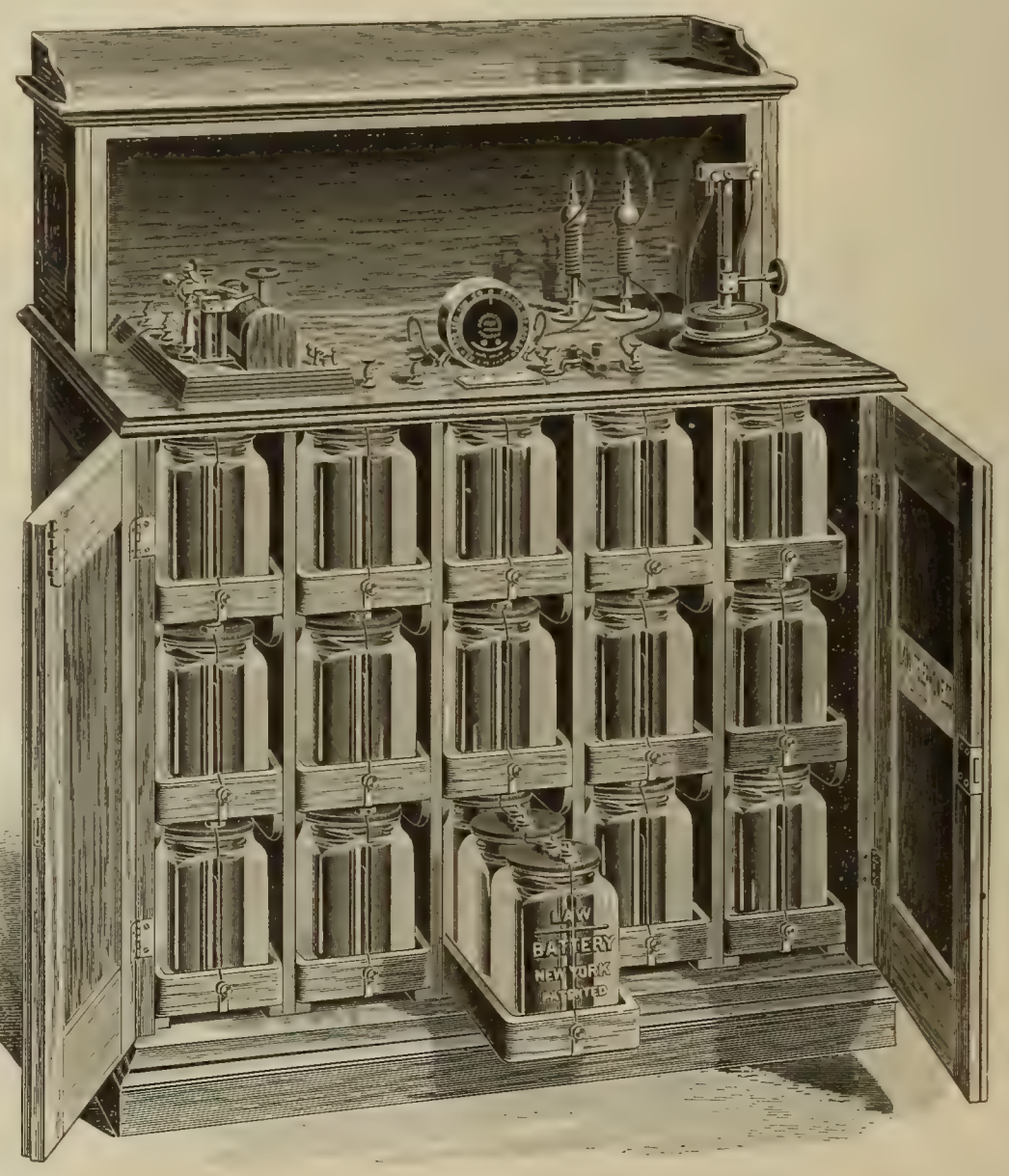
The machine will stand all the force that can be applied to the operating lines, and it will pass around curves of eight feet radius. Each full movement of the operating line moves the machine from four and one-half to five feet, and the operator averages about thirty movements per minute.

The machine is so arranged that, should the duct become obstructed, it can be thrown out of gear and withdrawn. The machines are made for all sizes of ducts varying from one and one-half to ten inches in diameter.

The Mechanical Equivalent of Heat.—A note has been received by the Paris Academic des Sciences from M. Constantin Miculesco on a new determination of the mechanical equivalent of heat. The principle of the method was the same as Joule's, *viz.*, the production of heat in a calorimeter by means of friction. The whole of the work done by Joule's experiments, however, was small, and hence a good time was required to obtain a sensible heating of the calorimeter, and some difficult corrections had to be made. To prevent this, M. Miculesco used a fairly powerful electro-motor to supply the work which was to be turned into heat. The apparatus comprised a 1 H. P. Gramme electro-motor, carried on a frame suspended on knife edges, the motor-shaft being central with the line of these supports. On a separate frame was mounted a calorimeter consisting of two concentric cylinders, so that the axes of the cylinders coincided with the centre line of the motor-shaft. By means of a flexible connection this shaft was coupled to one bearing paddles, which it caused to revolve in the water in the cylinders. Under such circumstances the frame carrying the motor tended to swing on its knife edges in order to balance the torque on the motor-shaft, and by correcting this tendency by carefully adding weights, this torque could be measured with great accuracy. The result obtained was $J = 777.7$ foot-pounds.

A NOVEL IDEA.

With reference to the placing of electric lights on the Grand Place, Brussels, Belgium, the *Independence Belge* of that city says: "At the present moment there is being studied in the offices of the Hotel de Ville an unquestionably original project for the electric lighting of the place which would get over the architectural and other objections which are raised to the suggestions for masts which have been sent to the special committee. The system submitted for examination by the electricity service consists of masts formed of high steel rods which would be drawn at nightfall from sheaths placed in the ground and which would be drawn back again at daybreak, so as to in no way alter the architectural appearance of the Grand Place during the daytime. It is proposed to work these movable masts by means of hydraulic pressure."



ELECTRO-THERAPEUTICAL OUTFIT

ELECTRO-THERAPEUTICAL OFFICE OUTFIT.

One of the most complete electrical outfits that a physician can have in his office practice is the one we illustrate and describe herewith, manufactured by the Law Telephone Company, 85 John street, New York. As is readily seen from the illustration, it contains everything needed in this class of work. The cut shows a faradic coil on the left, a milliammeter in the centre, with the pole-changing switch close to it, and on the right side of the cabinet, the current controller or regulator.

The cabinet shows the arrangement of the cells. The drawers in which the batteries are placed are arranged to hold four cells each. On the front of each drawer the word "zinc" is marked and on the back "carbon," and the drawers, together with the cells which they contain, are always placed in the cabinet in this position, as a portion of the drawers form part of the connections in the circuit. The wire from the zinc-pole of the battery is conducted to the pole-changing switch through a Bailey current regulator, and the wire from the carbon pole to the polarity switch and thence to the milliammeter. The outfit is arranged with one red and one green cord for connecting the electrodes, permitting the physician to trace the direction of the current if he finds it necessary.

The Bailey current regulator is a water rheostat used for regulating and controlling the current, and arranged so that the quantity of current reaching the patient can be graduated from *nil* to the full amount without any sudden shocking. The milliammeter used is one of the best, and it is a very delicate and sensitive instrument. The well-known Dubois-Raymond faradic coil is used. The outfit contains both a rapid and a slow interrupter.

The entire outfit is arranged to facilitate the greatest rapidity in using it. It will not only answer every requirement of the medical fraternity, but will also be an ornament to any office.

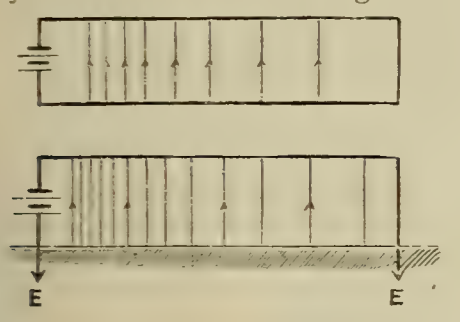
More than two-thirds of the space in the building of the Department of Electricity at the World's Exposition, Chicago, has been engaged by the firms who will make exhibits. Chief J. P. Barrett intimates that the late applicants will probably be compelled to take reduced area, as the space left is already getting limited.

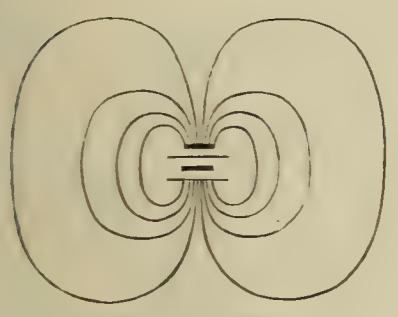
CAPACITIES OF TELEGRAPH WIRES AND CABLES.*

BY J. E. TAYLOR.

The theory of capacities of telegraph conductors under various conditions may be much simplified by regarding the matter from a consideration of the distribution of what are generally called the "lines of induction," but which may, perhaps, be more appropriately termed lines of strain.

At any instant of time the charges on a return



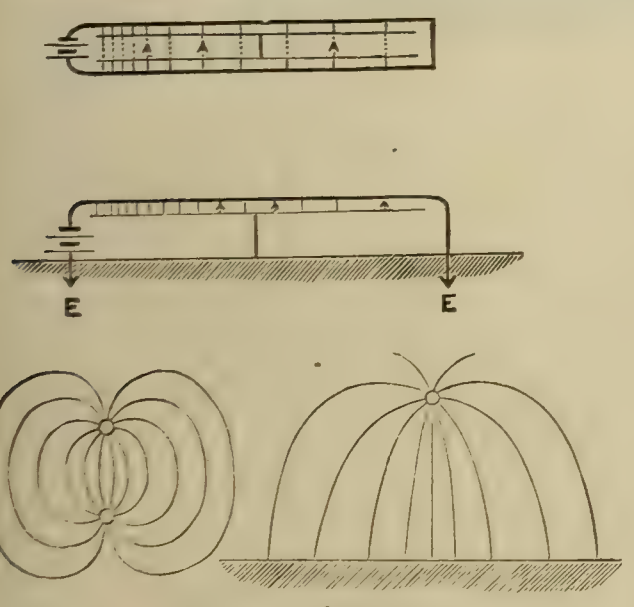


FIGS. 1, 2 AND 3.

system of overhead wires may be depicted by straight lines running directly through the intervening dielectric, as in fig. 1. These lines are not (at least in general) straight, but they are more simply considered thus.

In the same way the case of a single overhead wire may be represented as in fig. 2. The lines of strain are simply parts of the lines which extend from pole to pole of every galvanic battery, being the strain in the intervening dielectric. Thus the external electrostatic field of a battery might be represented as in fig. 3.

The case of two looped cables through which a current is flowing is represented in fig. 4, and fig. 5 represents a single cable earth-connected. In



FIGS. 4, 5, 6 AND 7,

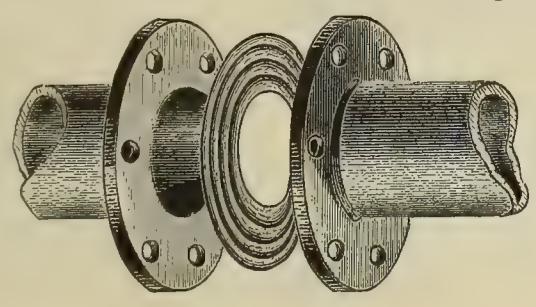
all cases the number of lines of strain is proportional to the E.M.F. of the battery and to the thinness of dielectric, that is, to the shortness of the lines. In fig. 4 the lines of strain are short circuited through the sheathings and water, those in one cable being simply the continuations of those in the other. It is thus readily seen that the capacity of the looped cables is exactly half that of the single earth-connected cable in fig. 5, for the length of the lines or columns is exactly doubled, and the average sectional area of each must therefore be doubled, for the same difference of potentials is maintained between their terminations. The number of lines, and therefore the capacity, is thus halved. The overhead lines of figs. 1 and 2 differ in no *essential* respect from these cables; but from a consideration of the distribution of the lines of strain in the two cases, as shown in transverse section of figs. 6 and 7, it is evident that since the expression $\frac{l}{a}$ (which represents the difference of potentials), where l is the length of any one line or column and a its average sectional area, must be the same in both cases, and that l is not doubled in the second case, the theory is a little more complicated. In fig. 7, l is large and a is also very large; and in fig. 6, although l is smaller, a is more than proportionally smaller owing to the lines having to converge at both terminations instead of only one as in fig. 7. The effect of this would be, that the number of lines in fig. 6 would be rather more than half that in fig. 7 for an ordinary case, that is, the capacity of the return system of overhead wires is rather more than half that of a single earth-connected wire.

This is entirely in accordance with experiment; M. Massin having recently made experiments with a view to determining exactly these capacities under certain stated conditions, when he found that the return system had about $\frac{7}{10}$ the capacity of the single wire.

*Electrical Review, London.

A METAL GASKET.

Engineers connected with electric light plants, who have been using destructible materials, such as rubber and hemp for packing connections and joints in their steam pipes and steam chests, will be interested in the metal gasket described and illustrated herewith. This metallic gasket now being put on the market by the U. S. Mineral Wool Co., No. 2 Cortlandt St., New York, may be substituted for the materials now in general



METAL GASKET.

use for packing. It consists of thin sheet copper stamped with concentric corrugations. The spaces within the bolt holes of the joint determines the width of the gasket, as shown in our illustration, and three to six corrugations are all that are necessary. If the flanges are thin and liable to bend when the bolts are tightened, it is best to extend the copper gasket the full width of the flange, making bolt holes in the gasket. Each corrugation makes the entire circle of the flange, and so long as the contact is kept perfect by compression the joints cannot leak, making it almost impossible for these connections to blow out with continued use. It may be put in place while steam is leaking through the valve. It is claimed to be unimpaired by repeated expansion and contraction, and for this reason answers well on pipes in which steam is alternately on and off. They are made of shapes suitable for different kinds of joints, and those who use them claim a saving of labor and cost in putting the pipes together, and that they make absolutely permanent tight joints.

The management of the Narragansett Hotel, Providence, R. I., is spending between $4,000 and $5,000 in renovating the dining-room. Among the improvements is the addition of two elegant electroliers and side brackets, which are being made by DeKosenka & Hetherington of Philadelphia, Pa., the well-known electrolier and combination fixture concern.

MONTREAL NOTES.

Mr. F. A. Barr, brother of Mr. M. D. Barr, president of the Edison General Electric Company, Peterborough, Ont., with district offices in the Temple Building, Montreal, may be found every day hard at work supervising the installation of the Edison exhibit. Mr. H. M. Linnell, of electric light and electric railway fame, and who is known to our readers all over the United States, manages the Edison business in Montreal. He is a persistent worker, constantly improving the efficiency of the plants here. He now has over 4,500 Edison incandescent lamps and a large number of arc lights on his circuits, and is enlarging the plant in the Temple Building by an additional dynamo of 1,000 lights capacity. The Edison Company will do itself credit with its exhibit at the coming convention.

The Bell Telephone Company came to the front with its usual courtesy, putting up poles and wires and connecting the electrical plant in the McGill University with the rink. There will be 300 or 400 H. P. supplied from the university, also telephone communication free.

The Thomson-Houston Electric, the Excelsior Electric and the Fort Wayne Electric people are here and working hard. It will be nip-and-tuck between them and the Edison Company for the best display. They are making big preparations and a handsome exhibit will be the outcome of their work. Mr. J. H. Waterman, chief engineer, is here with a big force wiring for the electric light T.-H. system between the rink and McGill University.

Mr. A. J. Corriveau has secured the agency of some of the largest manufacturers of electrical goods in the States and is preparing a large display. As is well known, he is agent for the Thomson-Houston Company, the Excelsior Electric Company, Fort Wayne Jenney Electric Company, C. & C. motors, Bryant Electric Company, of Bridgeport, Conn., the well-known manufacturers of switches, sockets, etc., and other equally prominent manufacturers of electrical specialties in the States. He is receiving a big line of goods for the exhibition.

T. W. Ness, of Montreal, will make a large display of telephones, household specialties, Sprague motors, etc.

The J. C. McLaren Belting Company, is a noted manufacturer of belts here, carrying a big line. It makes a specialty of oak tanned belting for dynamos, a number of which, it is understood, will be supplied to several big exhibits and one will run the press on which the daily convention edition of the ELECTRICAL AGE will be printed.

I met the Honorable Senator J. R. Thibaudeau, president of the Royal Electric Light Company here. The electric light station of the company is at 54 Wellington street, where it also has its offices and manufactory. It is furnishing nearly a thousand arc lamps from this station for city and commercial lighting. The company also owns the patents of the Thomson-Houston system for Canada. The Senator bespeaks in high terms of the success of the exhibition. Mr. D. A. Starr, the general agent of the company, gave your representative a kind reception at the offices August 21.

Mr. John Carroll, general manager and secretary of the Eugene F. Phillips Electrical Works, corner Canal and Shearer streets, is making himself felt as chairman of the Banquet Committee. He is an indefatigable worker and much credit is due him for the success of the Citizen's Committee, of which he is a member. The insulated wire manufacturing business carried on by the Phillips' Company, is having big success under Mr. Carroll's management.

Mr. F. Fairman, a member of the Citizens' Committee, is at the head of the Dominion Wire Manufacturing Company, with offices in the Temple Building, and is also a worker for the success of the convention, both mentally and physically, and he is financially giving every encouragement to the success of the Citizens' Committee. I may mention right here that the visitors from the States cannot conceive the many good things in store for them during the week of September 7 to 12.

(*Continued on page 551.*)

PORTABLE TELEPHONE BOOTH.

The telephone, to a great extent, is a secret or confidential means of communication between points distant from one another, and for the purpose of preserving secrecy, small booths have been made and placed in some convenient place in the office or warehouse.



FIG. 1—PORTABLE TELEPHONE BOOTH.

One of the essential qualities of these booths is that they shall be sound-proof, so that sound on the outside may not penetrate the interior and the conversation carried on over the telephone may not be heard outside of the booth.

Booths of this sort have of late become quite conspicuous in many public places and have attracted considerable attention and, no doubt, business as well, by their handsome and inviting appearance. One feature, however, was lacking, and that was portability, but that has been attained in a booth for which F. S. Tainter, Telephone Building, 18 Cortlandt street, New York, is sole agent.

This booth retains all the desirable points of the present standard sound-proof booths and possesses the additional feature of portability It can be folded up and moved from place to place without the use of tools, or incurring any other expense than is ordinarily necessary for moving any article of furniture.

These new booths are claimed to be in every way equal, and in some respects superior to the old style that are made in either oak or cherry, handsomely finished, with plate glass windows, in one standard size, suitable for either the reception of wall or cabinet sets of telephone instruments, grounds or metallic circuit lines.

Fig. 1 illustrates the booth complete and shows the telephone in the interior, as well as the double sound-proof door.

Fig. 2 shows the ground plan of the booth, and the same, folded for shipment, is also illustrated in this figure.

On July 27 Judge Hawley dissolved the injunction restraining Chief Engineer Scannoll, of San Francisco, from complying with the order of the San Francisco Board of Supervisors, requiring him to remove all the overhead electric wires.

AUTOMATIC ELECTRIC EXECUTION.

It is said that Dr. J. P. Gibbons, of Syracuse, N. Y., has invented a chair to be used in electrocutions, which automatically turns the current on and off without any other aid than that of the prisoner. The prisoner is placed in a reclining chair with his feet fastened to a foot board and his hands immersed in an alkaline liquid contained in a glass jar on each arm of the chair, to which the wires carrying the current are attached. The act of sitting in the chair opens a siphon, letting water into into a tin reservoir attached to the back of the chair. As the weight of the reservoir is increased by the water, the chair is tipped backward, and at a certain point automatically throws a switch, cutting in the full current which passes through the man's body from one hand to the other. The Doctor claims that the killing effect of the current is as effectual when passing through the body this way, as it is by the usual method, that of passing a current from above down. An effort will be made to have the chair adopted at Sing Sing.

ELECTRICALLY PROPELLED LIFEBOAT.

It is proposed in England to apply the Sims-Edison method of electrically propelling and controlling torpedoes to propelling lifeboats. The idea to a limited extent would seem to be feasible, but when, as a London contemporary points out, lifeboats sometimes have to go ten or twelve miles in order to reach a distant wreck, the practicability of the scheme may be questioned. In any event, the project is an extremely interesting one, and if it can be carried out in practice to meet all conditions it will be of great value in time of peril to the sailor.

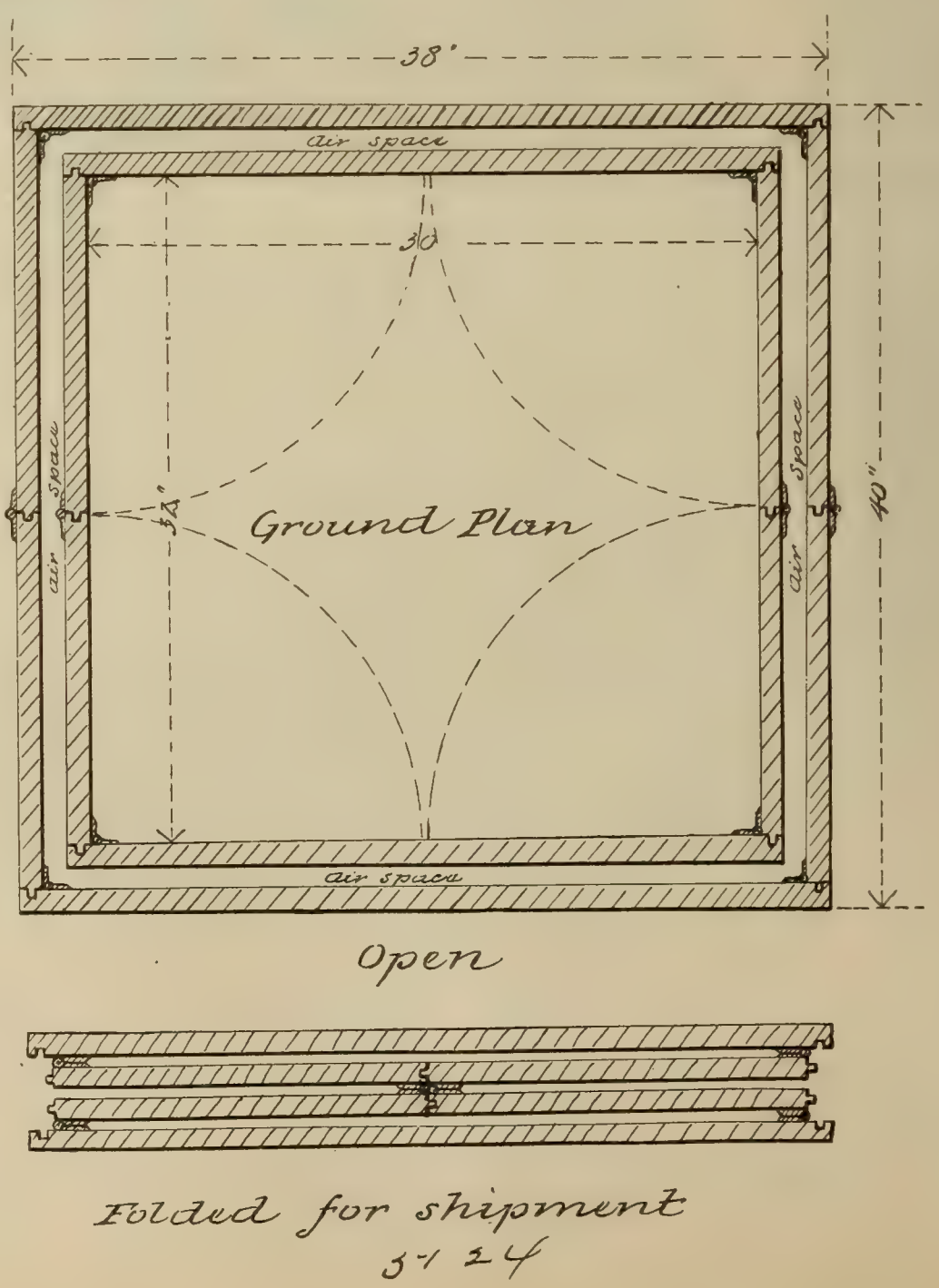


FIG. 2—GROUND PLAN OF BOOTH, AND THE SAME FOLDED.

WINDSOR HOTEL, MONTREAL.

The Headquarters of the National Electric Light Ass'n,

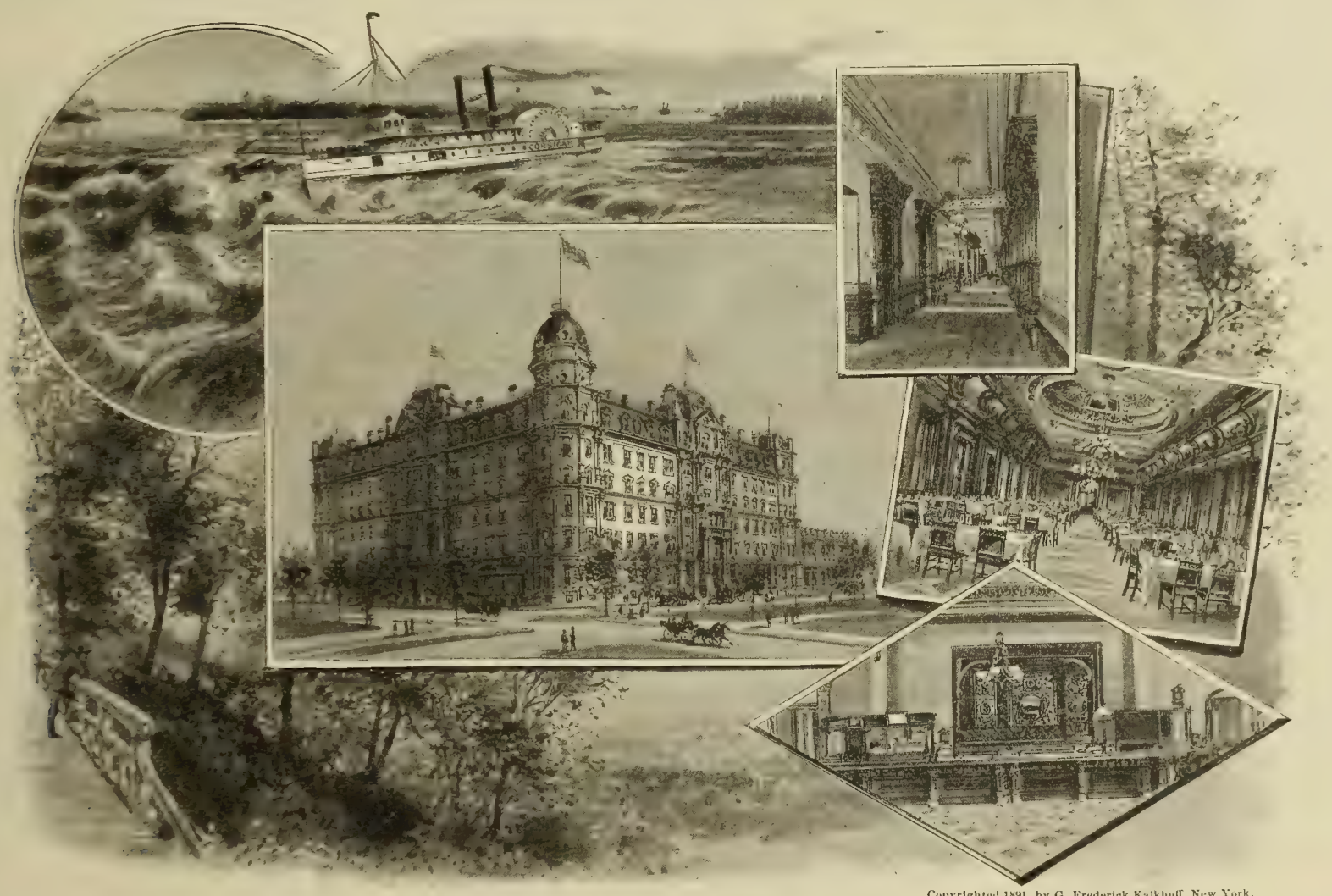
SEPTEMBER 7th, 1891.

The palatial Windsor is delightfully situated on Dominion Square in the fashionable quarter of Montreal. It is the first hotel in the Dominion of Canada, and in constructive substantiality, architectural dignity, thorough equipment, modern appointments and unsurpassed cuisine compares favorably with any hotel in the world.

The great new Hall of the Windsor will be used for the meetings of the Electrical Convention, while within one block are the great railway stations and the famous Victoria Rink, in which the Electrical Exhibition of the Convention takes place.

The Windsor is situated in the centre of the city of Montreal, and is convenient to all points of interest to the tourist.

It is headquarters of all tourists visiting the city, as well as all important conventions and meetings, and was built specially to meet the demands of first-class travel.



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Montreal, the metropolis of the Dominion of Canada, is one of the most beautiful and attractive cities in the world. Built on the broad St. Lawrence, at the foot of the Lachine Rapids, and at the head of ocean navigation, it possesses great advantages as a commercial centre, and hence its Public Buildings, Churches, Banks and Warehouses, are remarkably fine. The natural scenery of the vicinity, as viewed from the eminences of the Mount Royal Park, is magnificent. Mount Royal itself, clothed with firs, pines and maples, and decked with flowers and ferns, has so far taken on but few of the artificial adornments of a park, yet its natural sylvan beauty is unequaled by any other city park on the continent. The panorama of Montreal at its base, is in striking contrast to the river and mountain scenery stretching away to the horizon. Montreal is usually reached by the tourist by water from Niagara Falls, Toronto or the Thousand Islands, the steamers of the Richelieu & Ontario Navigation Company affording during their trips all the famous scenery of the St. Lawrence by daylight. The White Mountains, Saratoga, Boston, New York and Toronto are but eight to fourteen hours distant by rail. From Montreal direct and speedy communication is established to Quebec, Ottawa the Saguenay, Au Sable Chasm, Niagara Falls and the principal places of interest to the pleasure seeker. Parties making a lengthened sojourn in Montreal will find it abounding in resources of interest and pleasure. The descent of the Lachine Rapids—the finest of the St. Lawrence—can be enjoyed by taking the train to Lachine at 7.45 in the morning or by the 5 o'clock in the afternoon, running the rapids and reaching the city two hours afterwards; the drives about Montreal, in the Mountain Park, around Mount Royal, and along the banks of the St. Lawrence and Ottawa Rivers, afford delightful views, unsurpassed in America. Montreal is particularly attractive in the Winter season; the weather is sunny and bracing, and sleighing, skating, tobogganing and curling are enjoyed to perfection. Many scores of parties from New York, Philadelphia and Boston, come North every Winter to enjoy the sports and pastimes, and the number of such visitors increase year by year. The famous Winter Carnivals, with their Ice Palaces, Masquerades, Snowshoe Procession, and other unique entertainments, have proved so successful that Montreal is now considered a pleasure resort in Winter as well as in Summer.

The Windsor Hotel has been thoroughly re-decorated for the year 1891, and the proprietors are determined not simply to maintain the hotel at the high standard of excellence which has characterized its management from the first, but to introduce all the improvements constantly devised for the increased safety and comfort of guests. Its airy and commanding site on Dominion Square in close proximity to Mount Royal Park, makes it a delightful place of Summer residence; while it is within easy walking distance of the chief places of interest in the city. The table and attendance will be found unsurpassed anywhere on the continent.

G. W. SWETT, Manager.

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MONTREAL.

Next Monday, September 7, Montreal will be invaded, by friends, not by enemies, whose mission in this world at the present time is to spread light in dark places.

On that date the convention of the National Electric Light Association of the United States will meet in the Canadian metropolis and discuss matters pertaining to the business of electric lighting; at the same time an exhibition of extraordinary magnitude and importance of electrical goods and apparatus of every imaginable kind will be opened as an adjunct to the convention.

The proceedings of the convention promise to be of extreme interest to those engaged directly and indirectly in the electric light business, and every one connected with an electrical industry of any kind will learn something of value from the transactions of the meetings.

The convention will last three days and the exhibition nine, according to the programme. Heretofore the exhibitions held in connection with the conventions of the association have closed concurrently with the meetings, but this year an exception will be made, in deference, presumably, to the very general and natural desire on the part of the American manufacturers and dealers to create a market among our neighbors for American goods, and with this end in view allow our Canadian friends plenty of time to examine and study the exhibits in every aspect.

Much has been said about the coming convention and great preparations have been made to make the event an unqualified success in every way. The citizens of Canada, from the highest official down, have made elaborate preparations to accord the visitors a hearty reception and a royal good time, and no doubt the occasion will be long remembered by those fortunate enough to be in attendance.

We trust that much benefit will result to both parties in interest by holding the convention in Montreal, and that every one will enjoy their visit to that delightful city.

THE MONTREAL EXHIBITION.

A canvass in the trade has developed the fact that some electrical houses in the United States will not make any display of their goods at the Montreal Exhibition for the alleged reason that they can do no business with Canada on account of the existing duty. We believe these concerns are unwittingly committing a grave error, and will do themselves injury by failure to be represented at Montreal.

The above named reason for any house to keep away from the exhibition is, we think, essentially fallacious. The fact that the exhibition is to be held in a city outside of the jurisdiction of the United States is no reason for their staying away. The same reason may be applied with equal force with reference to our own cities. The convention is not going to Montreal for the sole purpose of entertaining our Canadian friends and showing them what a great and enterprising people we are. To be sure it is hoped that the holding of the convention there will result in the fostering and stimulation of trade in electrical goods between the two countries, and when our Canadian friends see and realize what wonderful things electricity can perform, as they will through the exhibition, it is natural to expect that there will be created within them a desire to enjoy the advantages to be derived by a more liberal and extensive use of the wonderful force. This sentiment will react on the present law which imposes a high duty on importations from the United States, and the feeling will then naturally tend toward reciprocity in trade, at least, if not free trade.

While this is one view of the possible result of holding the convention in Montreal, there is another way of looking at the matter, which appeals more directly to the manufacturer and dealer. The live business man or concern is not going to Montreal with an exhibit with the expectation of selling his wares to Canadians alone. He well knows that the convention and exhibition will bring to Montreal from the States many persons who will buy goods for delivery in the United States. There are always many buyers in attendance on these occasions and the fact that the exhibition is to be held in a foreign city this year will undoubtedly bring out a larger attendance than ever. The trip to Montreal will give many a long-hoped-for opportunity to visit the city and at the same time they can combine business with pleasure. They know that they can make their purchases just as well on foreign soil as in their own country. The goods they will contract for in Montreal will be delivered to them at their place of business in the States, and high duty or low duty, or no duty at all has nothing to do with such transactions.

It seems to us, therefore, that it is a mistake to not exhibit at Montreal simply because there is a barrier to trade between the countries in the shape of a tariff law.

There will be plenty of buying by American houses and those concerns who are to be represented at the exhibition will not lose anything for the expense and trouble they will go to to be at the front.

OF INTEREST TO EXHIBITORS.

General C. H. Barney, Manager of the International Electrical Exhibition, is sending out final instructions to exhibitors.

The Rink is now in condition for the installation of exhibits, which may begin at any time.

All goods intended for exhibition should be plainly marked with the name of the exhibitor himself, or exhibiting company, and should be addressed "Mr. So and So, Electrical Exhibition, Victoria Skating Rink, Montreal, Canada." If shipped from points in the United States they should be marked, in addition to the address, "For Exhibition, in Bond." As the Rink has for the term of the exhibition been constituted a bonded warehouse, all goods intended for exhibition purposes will be exempt from duty unless sold to Canadians.

The customs authorities will require the usual warehouse entry for the goods to be exhibited, and in order to facilitate matters in this direction, bills of lading and invoices in duplicate should be mailed direct to General Barney. One of the duplicates should be marked "certified correct" and signed by the person or an officer of the concern making the shipment. The prices on the invoices should be those which would be charged for the goods if sold in Canada.

Arrangements have been made with reliable parties in Montreal to do the carpenter work, electrical wiring, sign painting and lettering at the exhibition, and placing insurance on the goods.

AESTHETIC ELECTRIC LIGHTING.

Brussels is one of the finest cities of Europe and ranks very high in its architectural beauty. It is remarkable for the number and richness of its antique buildings, and it is excusable on the part of its citizens that they should watch with jealous care and prevent any avoidable marring of the beauty of their buildings and streets.

One of the finest public squares in the city is the Grande Place, and recently the question of lighting it by electricity came up before the authorities for consideration. In order not to affect the architectural appearance of the buildings by the use of permanent poles or towers for the electric light, an ingenious plan was proposed. The idea is to use masts constructed of steel rods, which may be dropped into a proper receptacle underneath the surface of the ground at daybreak, and drawn out at dark, or when the time arrives for the lighting of the lamps. By this method the poles will be out of sight in the day time and out of the way. It is proposed to use hydraulic power in raising the poles to place.

The idea on its face seems to be a good one. A telescopic pole might be used to advantage, as it would not require so great a depth below the surface.

FOREIGN NOTES.

The Electric Construction Corporation, Limited, of London, has secured the contract for the electrical equipment of the Liverpool Overhead Railway Company, and will work the line for two years at 3½d. per train mile for locomotive expenses. This line will probably be opened next spring.

The water power of Buochs, which is already used for working the Burgenstock Railway, Switzerland, is about to be employed in operating a cable line on the Stauserhorn. The water will actuate a turbine and dynamo, the current from the latter to be transmitted just over three miles to the three electric motors which will work the cable railway. The line will be nearly two miles long, and will be divided into three sections, each of which will be independent, and will be worked by a motor of 50 H. P.

(*Continued from page 549.*)

Prof. H. T. Bovey is another worker. He is, as you already know, professor of the new electrical section of McGill University, where it is proposed to teach electrical science more thoroughly, if possible, than at any other institution in North America. Every possible advantage will be offered to students here, and the handsome new building now being erected will contain a model installation in itself for both theoretical and practical study of the science.

Among the local people in the electrical trade I find Belanger Bros., practical electricians, 506 Craig street; E. Chanlaup, 587 Craig street, construction work; C. A. Martin & Co., 765 Craig street, large manufacturers of electrical annunciators, etc.; N. Simoneau, 2226 Notre Dame, constructing electricians; A. Pallascios, 390 St. James street, electrical supplies; J. Ross, Son & Co., 41½ William street, manufacturers of electrical wire; E. C. Mount, 766 Craig street, constructing electrician; J. A. Boudrias, 360 Rachel street, constructing electrician; Holmes Electric Protection Company, St. James street.

Mr. Kingsley just passed through here on his way to the big mica mine near here which he, with Mr. H. M. Linnell and others, recently acquired. He expects to get a piece of mica 5x6 feet for the exhibition.

W. T. H.

INFORMATION ABOUT THE MONTREAL CONVENTION.

HOTELS.

The rates of charges for board have been obtained from the two larger hotels, and are as follows:

Windsor, $3.50 to $5.00 per day. St. Lawrence Hall, $2.50 to $4.00 per day. The price varies in accordance with the character and location of room. Letters addressed to either of these houses "Montreal, Canada," will receive prompt attention.

HOW TO GET THERE.

Through Montreal sleeping cars *via* N. Y. C. & H. R. R. R. and Delaware & Hudson R. R. leave Grand Central Depot, New York, at 7 P. M., arriving in Montreal 7.15 A. M. The day train with through cars leaves Grand Central station at 9.20 A. M., arriving in Montreal at 9.15 P. M. Passengers leaving New York on either the Albany or Troy night boats on the Hudson River connect at Albany the following morning with trains to the boats on Lake George and Lake Champlain, arriving in Montreal at 9.15 the same evening. Tickets reading *via* "the D. & H." are accepted for passage on steamers of the Champlain Transportation Co. on Lake Champlain and *vice versa*.

Special rates of railroad fare have been obtained from the various traffic associations on the "certificate plan," and those attending will pay full fare going to Montreal and one-third fare returning, provided they return by the same route by which they went. Arrangements will no doubt be made for special trains, for the accommodation of delegates and friends from Chicago, New York City, Boston and other principal cities. For further particulars regarding local transportation the following named gentlemen may be addressed:

George F. Porter, Girard Building, Philadelphia, Pa.; R. D. McGonnigle, Allegheny County Light Co., Pittsburg, Pa.; W. A. Kreidler, *Western Electrician*, 6 Lakeside Building, Chicago; E. R. Weeks, Edison Electric Light and Power Co., Kansas City, Mo.; James I. Ayer, Municipal Electric Lighting and Power Co., St. Louis, Mo.; A. B. Shaw, *Electrical Engineer*, 620 Atlantic avenue, Boston, Mass.; C. O. Baker, Jr., 136 Liberty St., New York City.

HEADQUARTERS OF THE ASSOCIATION.

The Windsor Hotel has been selected as the headquarters of the National Electric Light Association during the coming convention, and the meetings will be held in the spacious Windsor Hall in the hotel.

PROGRAMME OF CONVENTION.

The following is the official programme of the meetings:

The sessions of the Convention will be held from ten o'clock in the morning until two o'clock in the afternoon; final adjournment for the day being had at the latter hour.

On the 8th of September the reports of the following committees will be read and discussed:

Committee on Relations of Manufacturing and Central Station Companies, Committee on Data, Committee on World's Columbian Fair, Committee on Legislation, Committee on Underground Conduits and Conductors, Committee on Safe Wiring.

On the 9th of September the discussion of T. Carpenter Smith's paper, read at the Providence Convention, on the "Distribution and Care of Alternating Currents," will take place, and the following papers will be read and discussed: W. C. Warner—"Various Forms of Carbons for use in Arc Lamps." Capt. Eugene Griffin—"Three Years' Developments of Electric Railways." H. Ward Leonard—"A Central Station combining the Advantages of both Continuous and Alternating Current Systems."

On the 10th of September the reading and discussion of the following papers: J. I. Ayer—"Some Details of the Care and Management of an Arc Lighting Station, as Practiced in the Municipality of St. Louis." C. J. Field—Subject to be announced. George A. Redman—"Central Station Lighting by Water Power." J. J. Burleigh—"Uniformity of Method in Keeping Central Station Accounts."

An executive session will be held on the 10th of September, to elect three new members of the Executive Committee and to name the place of the next meeting.

PROGRAMME OF ENTERTAINMENT.

The following is the programme arranged for the entertainment of the National Electric Light Association by the Citizens' Executive Committee, Montreal.

Monday, Sept. 7th, 3 P. M.—Opening proceedings of the Convention in the Windsor Hotel, address of welcome by His Worship the Mayor and other distinguished members of the Reception Committee.

8 P. M.—Formal opening of the exhibition by His Excellency the Governor General.

Tuesday, Sept. 8th, 2:30 P. M.—Drive through the city and around the mountain.

8 to 11:30 P. M.—Conversazione at Redpath Museum, Molsom Hall, McGill College.

Wednesday, Sept. 9th, 2:30 P. M.—Fire Department display on Champs de Mars.

5 to 7 P. M.—Garden Parties.

8 P. M.—Banquet at the Windsor Hotel,

Thursday, Sept. 10th, 2:30 P. M.—Through the kindness of the Harbor Commissioners, trip by boat down the St. Lawrence and the Lachine Rapids, stopping on the way at Caughnawaga.

5 to 7 P. M.—Garden parties.

Friday, Sept. 11th, 3 P. M.—Lacrosse Match. In the evening, Promenade Concert at Sohmer Park, through the courtesy of Messrs. Lavigne and Lajoie.

Saturday, Sept. 12th, 7 P. M.—Excursion to Quebec at reduced rates.

In addition to the above, yachting parties are being arranged for the entertainment of the ladies.

THE EXHIBITS.

Special rates of freight have been granted by the Canadian railroads, by which exhibitors are obliged to pay freight only one way, provided the goods remain the property of the original owner.

FREE OF DUTY.

Arrangements have been made for the admission of al goods in bond, and the exhibition building will be constituted a temporary bonded warehouse, duty to be paid only in case of sale.

CONVEYANCES.

Cabs may be obtained for transportation to any part of the ctiy for the low rate of 25 cents, making it a very convenient and cheap way of getting about.

CURRENCY.

In regard to currency, it will be of interest to state that United States money is accepted anywhere in Canada at its full value for all purposes. No exchange of currency is necessary.

SOME OF THE EXHIBITORS AT MONTREAL.

The ELECTRICAL AGE, New York; Eureka Tempered Copper Company, North East, Pa.; Chas. A. Schieren & Co., New York; Standard Underground Cable Company, Pittsburgh, Pa.; W. J. Johnston Company (Limited), New York; Standard Electrical Time Company, New Haven, Conn.; Standard Paint Company, New York; Fort Wayne Electric Company, Fort Wayne, Ind.; Electrical Engineering and Supply Company, Syracuse, N. Y.; Eugene F. Phillips Electrical Works (Limited), Montreal, Can.; Pelton & Guilleaume, Cöln, Germany; International Okonite Company, New York; Weston Electrical Instrument Company, Newark, N. J.; The Johns-Pratt Company, Hartford, Conn.; The Ball Electric Light Company, Toronto, Can.; The *Electrical Engineer*, New York; Interior Conduit and Insulation Company, New York; Robert Mitchell & Co., Montreal, Can.; Thomson-Houston International Electric Company, Boston, Mass.; Toronto Construction and Electrical Supply Company, Toronto, Can.; H. Ward Leonard, New York; Dominion Wire Manufacturing Company, Montreal, Can.; T. W. Ness, Montreal, Can.; Edison General Electrical Company, New York; Norwich Insulated Wire Company, New York; Excelsior Electric Company, Boston, Mass.; Canadian Electrical Construction, Manufacturing and Supply Company, Montreal, Can.; Russell Electric Company, Boston, Mass.; *Electric Power*, New York; McGill University, Montreal, Can.; La Boiteaux Electric Motor and Fan Company, Cincinnati, O.; Electric Secret Service Company, New York; New York Insulated Wire Company, New York; Hart & Hegeman Manufacturing Company, Hartford, Conn.; M. E. Dansereau, Montreal, Can.; The Connecticut Motor Company, Plantsville, Conn.; John Fitzgerald, Montreal; The E. S. Greeley & Co., New York; The Jewell Belting Company, Hartford Conn.

NEW INCORPORATIONS.

The Citizens' Fuel, Light and Power Company, of Celina, O., was incorporated August 8. Incorporators: A. F. Marsh, S. S. Scranton, Joseph May, T. P. Touvelle, D. Rush, J. M. Lisle and A. L. Bohrer.

The Edison Electric Light and Power Company, of Fresno, Fresno county, Cal., was incorporated August 10; capital stock, $100,000. Incorporators: John M. Ryan, Louis Gundelfinger, William Fahey, W. Degan, M. McCallum, all of Fresno, Cal.

The Columbian Electric Light, Power, Heat and Manufacturing Company, of Jersey City, N. J., was incorporated August 7, with a capital stock of $1,000,000. Incorporators: Julius Hirshfield and William Wright, of New York City, N. Y., and A. P. Morison, Montclair, N. J.

The Washington County Electric Light and Power Company, of Troy, N, Y., was incorporated August 11, with a capital stock of $10,000. Incorporators: Dagobert Zieser, Troy, N. Y., and F. C. Lovejoy, Shushan, N. Y.

The D. & D. Electric Manufacturing Company, of Minneapolis, Minn., was incorporated August 14, with a capital stock of $50,000, to manufacture and sell electric motors, dynamos, and all kinds of electrical machinery and supplies. Incorporators: Gilbert Donaldson and Thomas Davis, St. Paul, Minn., and Frederick G. James, Minneapolis, Minn.

Grand Haven Electric Light and Power Company of Grand Haven, Mich., was incorporated August 13, with a capital stock of $50,000. Incorporators: Oscar C. Mackenzie and Isaiah T, Greenacre, of Chicago, Ill., and Chas. C. Macomber, Grand Island, Vt.

The Georgia Electric Light Company, of Atlanta, Ga., has been incorporated with a capital stock of $600,000. Incorporators: H. M. Atkinson, H. E. W. Palmer, H. T. Inman, W. R. Royner, Morris Branden, George R. DeSaussure, J. H. Porter, Burton Smith and Walker P. Inman, all of Atlanta.

The Flint Creek Electric Power Company, of Butte, Mont., was incorporated August 12, with a capital stock of $25,000. Incorporators: Thomas T. Baker, Joseph H. Harper, Butte, Mont., and Alden J. Bennett, Virginia City, Mont.

The Hughesville Electric Light and Power Company, of Hughesville, Pa., was incorporated August 10, with a capital stock of $10,000. Incorporators: Chester E. Albright, M. D.; J. Sellers Kite, and Frank Cheyney, all of Philadelphia.

Fall River Electric Gas Machine Company, of Rockford, Ill., was incorporated August 8, with a capital stock of $50,000, to manufacture and sell gas and electric lighting machinery and supply gas and electricity. Incorporators: George D. Roper, George S. Roper and W. W. Wonser.

The Electric Light, Street Railway and Power Company, of Creal Springs, Ill., was incorporated August 12, with a capital stock of $6,000. Incorporators: W. DeBolt, C. L. Ostrich and W. S. Carroll.

The Kansas Fuel Gas Company, of Chicago, Ill., was incorporated August 13, with a capital stock of $1,000.000, to furnish electricity for light, heat and power. Incorporators: Thurston Gordon Hall, John A. Campbell and John H. Carruther.

AUGUST 3.—Maryville Electric Light & Power Company, Maryville, Mo., capital stock, $25,000. Incorporators, William Ross and J. W. Smith, of Maryville, Mo., and J. H. Tracy, St. Louis, Mo.

The Bradshaw Lumber Company, of Suffolk, Va., has been incorporated with a capital stock of $50,000, to construct and operate, among other business, electric light works. Incorporators: W. H. Bradshaw, W. H. Jones, Jr., C. W. Jenkins, J. L. Gray and E. E. Holland.

The Canada Gas and Fuel Company, of Chicago, Ill., was incorporated August 19, with a capital stock of $5,000,000, to manufacture and sell electricity for light, heat and power. Incorporators: Thurston Gordon Hall, Patrick Dowling, Thomas N. Daucey and Loftus E. Daucey.

The Wright & Starr Electric Company, of Philadelphia, Pa., was incorporated in West Virginia, August 21. Capital stock, $250,000. Incorporators: Benjamin F. Morley, Chester, Pa.; E. E. Starr, 37 South Third street, Philadelphia, Pa.

The Couer d'Alene City Illuminating Company, Couer dA'lene, was incorporated August 11, with a capital stock of $20,000. Incorporators: M. R. Kellinger, Charles D. Barry, B. Mahlum, W. L. Gleason, all of Portland, Ore.

LARGE INDUCTION COIL.

Dr. J. A. Fleming, M. A., in a London contemporary, thus describes Mr. Gassiott's large induction coil which was constructed in 1858, and which was considered a wonderful piece of apparatus.

The primary coil is of wire of No. 9 gauge, the helix in three layers and 15 in. in length, taking altogether 150 ft. of wire. The iron core is 18 in. in length and about 1¾ in. in diameter, of annealed iron wires, No. 16 gauge, annealed with the very greatest care, having been a fortnight in cooling. The primary wire has a cover of gutta percha, one-tenth of an inch in thickness; over this a glass tube. The secondary helix is divided into three bundles, each five inches in length, wound on cylinders of gutta-percha, the total length of secondary wire being 73,650 ft., or 14 miles. The secondary wire was insulated and wound vertically, that is, in separate flat helices. The condenser consisted of varnished tissue paper, three layers of each sheet between every sheet of tinfoil, and there were three condensers which could be employed, of 50, 100 and 150 square feet of coated surface respectively. The coil would give 12¼ in. sparks. The interruptor was a ratchet break worked by hand, which enabled various rates of interruption to be applied. This coil was used by Mr. Gassiott in his researches on electrical discharge in vacuo, and gave very fine effects.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, "WORLD" BUILDING,
NEW YORK, Aug. 29, 1891.

F. R. Chinnock, New York State agent for the Edison General Electric Company, has just been awarded the contract for lighting Cortland and Homer, N. Y., with the Edison arc system. Fifty 2,000 candle power lights will be used. Mr. Chinnock has also just completed a central station at Alexandria Bay, N. Y., with a capacity of 25 arc and 300 incandescent lights. He has also been awarded the contract for a central station of 800 incandescent lights at Ticonderoga, N. Y.

Mr. DeWitt B. Brace, of the Nebraska State University, Lincoln, Neb., is in town in the interest of that institution. Mr. Brace reports that 200 or 300 H. P. apparatus is to be put in the University for electrical experimental work. This additional equipment will cost $15,000. The University already has an electrical department, but the contemplated improvements provide for electrical engineering in all its branches, and it is proposed to have specimens of the principal dynamos and electric light systems. When the improvements are completed the Nebraska State University will be placed on an equal footing with the best college electrical equipments to be found in the country.

This office was favored with a call from Mr. E. H. Cutler, of the Elektron Manufacturing Company, during the past week.

Mr. W. D. Edwards, of Edwards & Co., 5–7 Dey street, this city, will start for Pueblo, Colo., to install a complete electrical household plant in the beautiful new residence of Hon. J. A. Thatchers. The building will be wired for a complete isolated electric light plant, as well as for a watchman's system, burglar alarms, annunciators, electric time, etc., all manufactured and supplied by Edwards & Co. This company, as is well known, has a large factory at 148th street and 4th avenue, New York.

C. A. Schieren & Co.'s offices, Ferry and Cliff streets, this city, have been remodeled. Mr. C. Burrell has Mr. Schieren's old office. The quarters have been extended, giving Mr. Schieren larger and finer offices for the reception of customers and friends. The business of this popular company has outgrown the old offices so the improvement was necessary. Mr. Schieren is by this time homeward bound from the Frankfort Electrical Exhibition, where he has an extensive display. Mr. Schieren will be given a fine reception on his return. Mr. Burrell, manager of the company, deserves hearty praise for the handsome improvements in the offices. The decorations are in good taste. Mr. Burrell is a most persistent worker, and the company is indebted to him for much of the success of its noted perforated electric and other belting.

The Hyer-Sheehan Motor Company, Newburg, N. Y., has brought out a new motor which is said to possess some excellent features. Mr. Sheehan visited New York recently and succeeded in securing some orders.

Mr. Charles A. Schieren, Jr., will be in attendance at the exhibit, at the Montreal convention, of Charles A. Schieren & Co.'s celebrated perforated leather belting, of which the company will have an attractive display.

The Ward arc lamps are steadily growing in favor. As they are used on low tension circuits there is a wide range of use for them. At the present time there are 740 of these lamps connected with low tension circuits of the Edison Illuminating Companies, and the light in all cases is remarkably steady and brilliant. Mr. Barstow, the general superintendent of the Edison Illuminating Company, of Brooklyn, speaks highly of the lamps. He has had some of them put on his circuits and they are giving excellent satisfaction.

The Magnolia Anti-Friction Metal Company, 74 Cortlandt street, New York, is distributing among its customers, with its compliments, a wall-scroll on which is a beautiful chromo of the flower magnolia. The work is artistically done.

The Eddy Electric Manufacturing Company, Windsor, Conn., through its Eastern agent, Mr. McIntire, is meeting with good success considering the demand for motors at this season of the year. I hear it is adding still more improvements to its apparatus. Its motors are A 1.

Messrs. James P. McQuaide and E. S. Perot of the National Conduit Manufacturing Company, were callers at this office the past week. Large quantities of the company's cement lined conduits are being installed in the principal cities of the United States. There is no doubt of the conduit's success when installed by competent engineers.

The International Okonite Company, of 13 Park Row, New York, has just issued price list No. 5 for 1891, of insulated wires and cables for telephone, telegraph, electric light, railway, mining and other purposes. The Okonite wires are so well known that our testimonial to their merits is not needed. The little pamphlet contains facts and tables in regard to the wires and their use that will be very handy to electrical engineers.

On making a call on the Himmer & Anderson Dry Battery Company, 123 Chambers street, I found Mr. Vitalis Himmer, the electrician of the company, running a small Porter motor, with two No. 15 cells, which he guarantees to run the motor for three days continuously, ten hours per day. For intermittent work the cells will run the motor for several weeks. The firm has orders on hand for nearly 10,000 cells of all sizes. It makes five different sizes of standard cells, both square and round, and guarantees a voltage of 1.80 and ten amperes of current.

Mr. Joseph Harris, agent for the Shaver Corporation, 207 Broadway, has secured a contract from the Tompkins Cove Construction Company, of Tompkins Cove, N. Y., for a bank system of Shaver telephones at its works, consisting of five lines from 500 to 1,000 feet in length. He is also to erect another line from the judges' stand to the betting ring at Sheepshead Bay race course, a distance of about 1,000 feet. He has several other contracts in view.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	90 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co. (Boston).	620,000	5 00	2 50
American Electric Motor Co.(N.Y.)	1,000,000	2500	5 00
American Private T'phone (N. Y.).	50,000	100 00	98 00
American Telegraph and Cable.	14,000,000	100 00	80 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit.	3,000,000	100 00	4 00
B. & S. Elec. Equipment Co. (N. Y.)	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	177 60
Bell Telephone 7's	2,000,000		*112
Boston Electric Light.	1,500,000	100 00	85 00
Brooklyn Edison Electric Light.	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brunswick Elec. L. & P. (Me.)	50,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		*102
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	16 50
Brush Swan (Ithaca)	50,000	10 00	5 00
Burrell Electric Signal Co. (N Y.).	500,000	20 00	10 00
City of London Elec. Ltg. Co. (Ltd.)	4,000,000	50 00	60 00
Columbia Canal 6's (Ga.)	200,000		*102
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co, N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500 000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	4 00
Cons. Gas & E. Co. Batavia, 6's	80 000		*95
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	10 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600.000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co. (N. Y.)	1,000.000	100 00	20 00
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		*99
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating (N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., (Phila.)	1,000 000	100 00	80 00
Edison General	14 000 000	100 00	97 50
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	20 00
Elizabeth E. L. Co. (N. J.)	100,000	10 00	4 00
Equitable G. & E. Co. (Utica).	4,000		†
Erie Telephone	4,800,000	100 00	45 05
Essick Printing Tel.	5,000,000	100 00	40 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		*95
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co.	4,000,000	25 00	12 50
G. T. Woods Mfg. Co. (Ky.)	2,000,000	10 00	2 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	
Great Western Elec. Sup. Co.	650,000	100 00	100 00
Great Western Elec. Sup. Co., pref	350,000	100 00	104 00
Hackettstown Elec. Light (N. J.).	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*105
Hunt Engineering Co. (Brooklyn).	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited.	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	80 00
Kankakee Electric Co., 6's Ills.	50,000		*99
Kansas Elec. Co., 6s, Mo.	20,000		*98
Laclede Gas Co.	7.500,000	100 00	17 25
Laclede Gas, pref.	2,500,000	100 00	40 00
Laclede Gas 5s.	10,000,000		*75
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		*94
Little Rock Edison E. L. & P. 6's.	30,000		*95
Littleton Water & E. L. Co. 6's.	75,000		*95
Livingston E. Lt. Co. (Mont.) 6s.	30 000		*99
Long Branch Electric Light.	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5's (N.Y.).	1,000,000		par
Marysville L. & W. Co. 6's (Ohio).	60,000		*103
Metropolitan Phonograph.	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	60 00
Morristown L. H. & P. 5s (N. J.).	17,500		*105
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g. Co. (New York).	100,000	10 00	9 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust.	9,000,000	100 00	17 00
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 25
N. Y. and N. J. Tel. and Tel 6s	1,500,000		*99
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150.000	100 00	85 00
Newark E. L. & P. Co. 6's Ohio.	50,000		*95
North New York, Lighting	150,000	100 00	10 00
Northern Elec. L. & P. (Phila.)	200,000	10 00	
Northwest Elec. Co. 6's Manitoba.	50,000		*95
North Western T.-H. Co.	750,000	100 00	105 00
North Western T.-H. Co., pref.	750,000	100 00	110 00
Postal Telegraph.	10,000,000	100 00	30 00
Passaic, Electric Light.	15,000	100 00	90 00
Paterson, Electric Light.	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Peoples' Elec. Light (Trenton).	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston.	200,000	25 00	30 00
Pittsburg Reduct Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Railway Improvement Co.	10,000,000	100 00	100 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.).	150,000	100 00	
Richmond L. H. & P. 5's.	150,000		90
Rockaway Beach Elec. Light.	50,000	100 00	60 00
Rockaway Elec. Lt. Co. 6s.	75,000		*103
Russell Electric Co. (Boston).	300,000	5 00	5 75
Saginaw E. L. & P. Co. 6's Mich.	50,000		98
San Diego Gas & Elec. Co. 6's Cal.	750,000		90
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation., N. Y.	100 000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	8 00
Sprague Elec. Motor Co.	16,000	100 00	†80 00
Swan Incandescent.	800,000	100 00	5 00
Standard Ug'd Cable Co (N. Y.).	1,000,000	100 00	80 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.).	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y).	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	45 00
Thomson-Houston Pref.	4,000,000	25 00	24 75
T.-H. Electric Co. 5's Boston.	500,000		*98
T.-H. E. L. Co. Yonkers 6's.	100 000		*39
T.-H. L.H.&P. Co. Binghamton, 6's	100.000		*39
Tucker Elec. Const. Co. (N. Y.).	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.).	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.).	1.370.000	100 00	
United Elec. Light and Power.	3,000,000	100 00	50 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370.000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100 000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000 000	10 00	7 50
Utica Elec. & Gas Co. 6's.	150,000		par
Utica Elec. Light Co. 6's.	150,000		par
Vine Street Motor Co. 6's (Colo.).	100,000		*95
Welsbach Inc. Gas.	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	83 25
Westinghouse Electric Co.	7,000,000	50 00	13 50
Westinghouse Elec. Co. Prof.	3,000,000	50 00	50 00
West End, L. (Boston)			18 75
Yonkers, L. & P.	50,000	100 00	75 00

*Per cent. †Registered Stock.

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

There is no doubt in the minds of many who, in the course of their summer peregrinations, have been and are stopping off for a few days at New York with the intention of not only seeing the sights of the great metropolis, but also obtaining sundry thousands of dollars on the security of their stocks for such time as will enable them to construct and equip the enterprise represented thereby, or to sell their bonds for sufficient cash or credit to aid in the maintenance of the local industry until it shall be more than self-sustaining, including the interest on the bond, that this financial centre is a very slow place for that kind of negotiation. Call money he may obtain, with the business certainty that a request will be found waiting for him on reaching his home office, to be followed very soon by a demand which will dis-

pel at once the calculation which was made showing such nice profits before he started on his travels. Most of the New York moneyed institutions are debarred by their charters or by-laws from investing in, or lending on security beyond the city or State which by any stretch of imagination can be classed as personal, and substantially the rest will not. The readiest plan is to seek the individual investor through respectable brokers who are on the spot, prepared to personally explain the commercial status of the collateral and show its ability to assume the pending responsibility, meet the payments promptly and return the principal at maturity. There is no lack of people with money to invest, but a day or two is not sufficient to find and interest them. September will be an active month and electric enterprises will be liberally financed, only to be more generously entertained through the fall and winter.

We record with regret the death of Postmaster General Raikes, of England, under whose authority the entire transmission of electric light, heat and power came. He has dealt most generously with Americans who have introduced electric enterprise into Great Britain, granting licenses at practically nominal rates. We trust his successor will prove equally generous in his reading of the Act of Parliament, which is a big mountain in the road when we wish to sell an electric patent or introduce it in the domain over which he presides.

Just as we go to press we are informed that the Electrical Exhibition to be held at the Crystal Palace, London, has been postponed from Nov. '91, to Jan. 1, '92. It is intended to make it as perfect a display of all the modern electrical achievements as possible. The greatest advance ever made in any stock, was the Himmelfahrt mine of Frieburg, which rose from 25 cents per share to $11,000 per share, and the largest amount of dividends on capitalization is the Mount Bishoff mine, near Tasmania, whose capital is only $60,000, and on that small amount has paid in dividends $7,500,000 and still keeps its lick up.

The financial credit of the United States to-day rates second to that of no first-class nation. In the gloomy days of the early '60s, when seven-thirties and ten-forties went begging for takers, often without finding them, who among us had an idea that within the century it would be possible to extend thirty millions bearing only four and one-half per cent. interest at the lower rate of two per cent? Surely, fact is stranger than fiction, and now curiosity will be aroused to find out how many of the retired bonds have been mislaid, or for any other cause will fail to put in an appearance at the treasury for cash. I am quite positive there are several electric bonds bearing interest from five per cent. to seven per cent. which can be purchased with the new two and one-half per cent. and the latter taken at par. Here is an opportunity to increase income from three per cent. to five per cent., with all human probability of getting a bond which will never default.

AT THE MONTREAL EXHIBITION.

The Standard Paint Company, 2 Liberty street, New York, will be represented at the Convention by Mr. Frank S. De Ronde.

Mr. C. S. Van Nuis, of Ajax Switch fame, will exhibit his goods in conjunction with the C. & C. motor display.

ANTI-FRICTION METAL.

Mr. A. W. Stieglitz, of 37 Lorimer street, Brooklyn, E. D., N. Y., has perfected a metal for journals known as the Columbus Anti-Friction Journal Metal, which is said to be superior to any other metal for the purpose in the market.

The best material is required for the wearing parts of all machinery. Possibly there is no other part of a machine more subject to friction than the journals; all kinds of metal have been used, and it is the endeavor of all manufacturers of machinery to use metal that will stand the hardest wear.

The journal metal manufactured by Mr. Stieglitz has been used for several years by a large number of firms who highly recommend it.

He has also gotten up a new metal called "gold metal," which is guaranteed not to tarnish when polished; it always keeps its gloss.

Mr. Stieglitz manufactures all kinds of hard solder, which are easy flowing and guaranteed to stand the severest tests.

BUSINESS NOTES.

Truex & Vail, of 136 Liberty street, received a large order from the Pittsburg Gas Light and Coke Company, of Pittsburg, Kan., for their Swinging Ball Lightning Arresters, and were informed by the party that he had suffered from lightning to the extent of $500 during the month of July, and has now decided to equip his plant with their lightning protector.

The Hotel Savoy, 59th street and Fifth avenue, New York City, has purchased for its electric light plant three 100 H. P. and one 60 H. P. engine through E. T. Copeland & Co., 106 Liberty street, New York. The engines are manufactured by the Ball Engine Company, Erie, Pa.

An 100 H. P. Tandem compound engine manufactured by the Ball Engine Company, of Erie, Pa., is to furnish power for the Beatrice Rapid Transit Company, of Beatrice, Neb.

A mining locomotive weighing 22,000 lbs. has been shipped by the Thomson-Van Depoele Mining Company, of Lynn, Mass., to the Blosburg mine, Pennsylvania.

In Vancouver, B. C., two C. & C. motors have been installed recently, and in the same place a Thomson-Houston motor has been added to a printing establishment.

That "Vulcanized Fibre" possesses incomparable qualities and a high reputation is evident from the fact that a number of other concerns are imitating the goods manufactured by the Vulcanized Fibre Company, Wilmington, Del. Each sheet of the genuine article is branded "Vulcanized Fibre." These goods possess excellent insulating qualities, and they are spoken well of in the trade.

The Ball Engine Company, Erie, Pa., has opened a branch office in Chicago in the Rookery Building, Room 606. Mr. Albert Fisher, widely known as a successful salesman and an agreeable gentleman, has been appointed manager, and will be glad to see his friends in his new quarters. Mr. Fisher has had a large experience in engines, and we predict for him success in his new connection.

More real pleasure can be obtained through the use of a Kodak than in any other way. It is a very compact apparatus, and one can take a picture of anything that strikes his fancy at a moment's notice. It is an excellent thing to take along when traveling, as it will enable the amateur to catch views that he could not otherwise obtain. There is no labor involved in the taking of pictures with a Kodak. You simply press the button and the Eastman Company, Rochester, N. Y., will do the rest of the work for you. Write them and ask for particulars.

The suit over the Ball Engine has been decided in favor of the Ball & Wood Co. of New York, by the United States Circuit Court.

It is probable that Prof. John P. Barrett, chief of the electrical department of the coming World's Fair, will either himself read or have read at the Montreal Convention an address on the subject of the great exposition in 1893.

WORDS OF COMMENDATION.

The following letter explains itself:

HABANA, August 21, 1891.

W. T. HUNT, ESQ., ELECTRICAL AGE, New York.

Dear Sir: This is to say that we note with the greatest pleasure the great growth and expansion of your paper and we want to congratulate you on the same. We well know that only through hard labor you could succeed, and indeed you are worthy of such a reward. Please kindly accept our most hearty congratulations for your success.

Yours very truly,

VASLIER & MOSQUERA.

KIDDER MEDICAL BATTERIES.

RUSSELVILLE, Pa., February 13, 1891.

Jerome Kidder Manufacturing Co.

GENTLEMEN: The 24 cell Galvanic Battery is at hand, used it this A.M., gives a remarkably smooth constant current. It is the finest galvanic battery I have had within a few years and the best, simplest. The large zinc surfaces give great quantity of current, superior, I believe, to the sharp exciting current from the many small zincs.

Very truly,

DR. TRUMAN COATES.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued August 25, 1891.

458,154. Automatic Gas-Lighting Apparatus. George D. Clarke, Chicago, Ill., assignor of five-eighths to Wilson S. Chapman, same place. Filed Dec. 30, 1890.

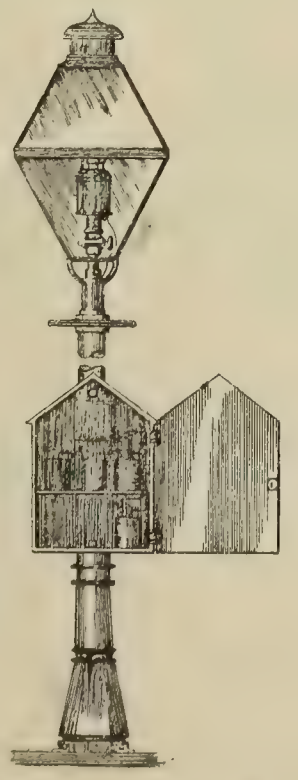
Sparking-contacts, against which the gas admitted through the core is adapted to be thrown, whereby the sparks are produced, while at the same time a magnet-armature is held by the attractive force of an electro-magnet.

458,160. Annunciator-Restoring Device. Robert P. Garsed, Norristown, Pa. Filed March 28, 1891.

Annunciator having operative indicators attached thereto and a suitably-supported bracket holding an inflatable body, a restoring rod with a projecting part suited to bear upon the inflatable body, and means for operating the same.

458,162. Electric Motor. Ludwig Gutmann, Fort Wayne, Ind. Filed Dec. 1, 1888.

In an alternating-current motor, the combination of field-magnet coils connected to a suitable generator, an armature provided with coils connected to a commutator, and brushes each independent and insulated from the other, each having more than one contact-surface in contact with the armature-coils, some of which lie in a weak magnetic field, the others in a stronger magnetic field.



458,154—AUTOMATIC GAS-LIGHTING APPARATUS.

458,163. Alternating-Electric-Current Heater. Ludwig Gutmann, Pittsburg, Pa. Filed Dec. 9, 1889.

An electro-magnet in circuit with an alternating generator, a magnetic or electric substance serving as a platform for supporting cooking utensils, located within inductive relation to it, and means, such as perforations in the magnetic or electric substance, for the passage of the heated air.

458,164. Method of Operating Alternating Electric Motors. Ludwig Gutmann, Pittsburg, Pa. Filed Feb. 4, 1890.

In an electric motor, the combination of exciting coils, field-magnets therefor, secondary exciting coils, in inductive distance from the first-named coils, armature-coils provided with conductors close-circuiting themselves in groups, and means for changing the circuit connections of the secondary exciting-coils.

458,176. Art of Electric Welding. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed May 31, 1890.

An improvement in the art of electric welding, brazing, forging, shaping, etc., consisting in wetting the contact-surfaces of the conducting blocks or clamps, in which the pieces to be operated upon are held with a fluid, such as water, at or about the time of the application of the heating electric currents

PATENTS—Continued.

458,177. Adjustable Electric Clamp. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Oct. 9, 1890.

In electric clamps, the combination of holding devices for gripping the work-pieces, and adjustable contact-pieces of good conducting material for conveying current to the work-pieces.

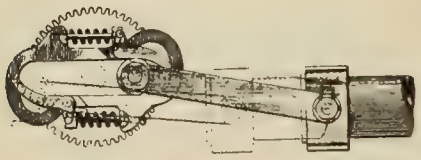
458,178. Electric Alarm-Clock. Charles Lester, Chicago, Ill., assignor to George A. Harmount, same place. Filed April 10, 1891.

An electric alarm attachment for clocks, consisting of an alarm-dial adapted to move with the hour-hand and to be adjustably turned or set in relation to it, in combination with a spring contact-finger attached to move with and be adjusted with the alarm-dial, a contact-piece in the path of the finger placed opposite the figure 12 on the clock-dial, the insulating-ring upon which the finger rides, and an electric circuit including an electric alarm device.

458,184. Electric Coal-Mining Machine. Edmund C. Morgan, Chicago, Ill. Filed Sept. 15, 1890.

In a mining-machine, the combination of an electric motor, a tubular tool-holder connected therewith, and a spring partially inclosed by the tool-holder, but longer than the same, and having bearings for its respective ends within the tool-holder and against the frame beyond the inner end of the tool-holder.





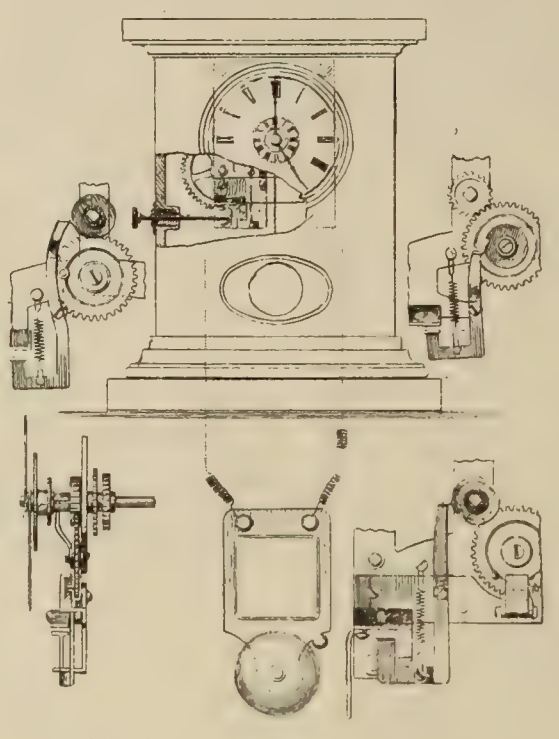
458,184—ELECTRIC COAL-MINING MACHINE.

458,188. Electric Clamp. Einer Rasmussen, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Dec. 19, 1890.

Electric clamps of welding or metal-working apparatus having the whole, or a portion of their contact-surfaces covered by a yielding conducting material.

458,206. Electric Alarm-Clock. Louis Winterhalder, Brooklyn, N. Y. Filed Dec. 4, 1890.

The combination, in an electrical alarm-clock, of ordinary clock-works having a notched disk with a lever bearing against its circumferential edge, and insulating plate with conductors and an electric alarm.



458,206—ELECTRIC ALARM CLOCK.

458,221. Insulator. Murrey C. Chase, Chicago, Ill., assignor to the Electrical Supply Company, of Illinois. Filed Nov. 14, 1890.

An insulator consisting of two projecting metallic ends with enlargements, and a cylindrical coupling-piece with inward-projecting ends within which lie the enlargements and interposed insulation.

458,236. Armature for Dynamo-Electric Machines. Laurence A. McCarthy, Brooklyn, N. Y. Filed Feb. 18, 1891.

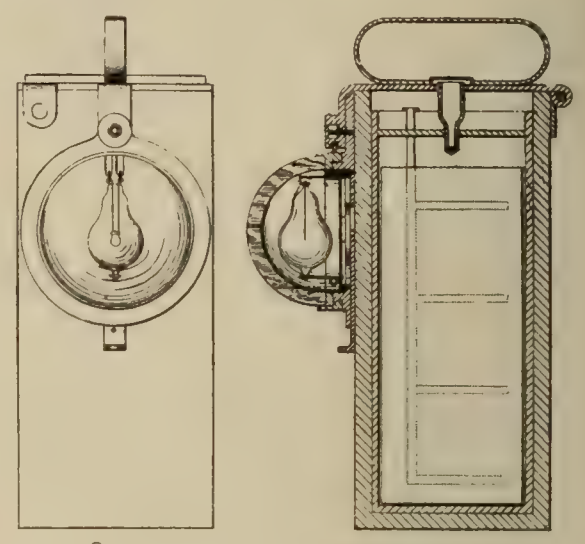
In an armature for dynamo-electric machines, the combination of a magnetic core having narrow projecting teeth with coils of wire connected together in pairs, one coil of each pair wound around the tooth on the opposite side of the core from the other coil of the pair.

458,242. Electric-Lamp Socket. Horace E. Swift, Boston, Mass. Filed March 23, 1891.

458,249. Electric Power-Brake. Clarence V. Greenamyer, San Francisco, Cal., assignor to the Verner Wrench Car Mover and Power Manufacturing Company, of California. Filed Dec. 2, 1890.

A power-brake for revolving shafts or axles, having a hinged jaw adapted to embrace the shaft, arms, or levers which are extensions of the parts of the jaw opposite a hinge, eccentrically-pivoted wheels or rollers in the jaw, and means applied to the arms or levers to draw them together and close the jaw against the shaft.

458,258. Spring-Jack Commutator for Telephone Switchboards. Louis A. Berthon, Paris, France, assignor to the Société Générale des Téléphone (Réseaux Téléphoniques et Constructions Electriques). Filed Jan. 30, 1891. Patented in England.



458,279—PORTABLE ELECTRIC LAMP.

458,278. Electric Stop Mechanism. Ernest Boening, Yonkers, N. Y., assignor of one-half to August Sundh, same place. Filed July 24, 1890.

In a stop mechanism the combination of a tappet mounted on and moving with the motive part, a pin or rod movable into the path of the tappet, an electro-magnet for moving the pin or rod, and means connected therewith, whereby the transmission of power is stopped when the magnet is energized.

458,279. Portable Electric Lamp. Lars Bristol, Bromley, England. Filed Aug. 28, 1890. Patented in England, France and Belgium.

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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

WEEKLY.

Vol. IX. NEW YORK, SEPTEMBER 12, 1891. No. 37.

WELCOME TO CANADA.

With outstretched hand Canada, this week, greets Uncle Sam and welcomes him and his people to Canadian soil.

The citizens of Montreal have vied with each other in their efforts to make the visit of the members of the National Electric Light Association and their friends as enjoyable as possible, and it needs nothing more than a glance at the programme of entertainment and the names of the various committees to convince anyone that nothing has been left undone to accomplish their purpose.



MISS CANADA WELCOMING UNCLE SAM.

A few words about the City of Montreal would not be out of place at this time.

Montreal lies at the left bank of the St. Lawrence, 600 miles from its mouth, 180 miles above Quebec, 200 below Lake Ontario and 335 from New York City. The city is situated on an island formed by the two arms through which the Ottawa enters the St. Lawrence. It derives its name from Mont Real (or Royal), which rises immediately behind to a height of 750 feet. It is a well-built city, with several elegant quarters. The largest public square is the Champ de Mars.

Of the public buildings the most remarkable are the Roman Catholic Parish Church of Notre Dame and the English Cathedral.

McGill University was founded as a college in 1811, erected a university in 1821, and reorganized and enlarged in 1852.

The harbor of Montreal extends for nearly three miles from the village of Hochelaga to the famous tubular Victoria Bridge. This bridge is two miles long and crosses the St. Lawrence River on 24 piers. It is said of Montreal that "it has the splendor of Edinburgh as well as the picturesqueness of Constantinople, all under the clear Canadian sky, as blue as that of Italy."

Montreal covers the site of the Indian village, named Hochelaga, founded by Jacques Cartier when he arrived in 1535.

Montreal has always been the entrepôt of the trade of the Northwest, from its foundation to the present time, and its growth has been in unison with the development of that trade. First it was the fur trade and the lumbering, mining, grain, and last the cattle trade followed, each contributing to the progress of the city. The site occupied by the city is not surpassed by any in the world, not even by that of Constantinople, and the people of Montreal are very proud of their city.

The city now has a population of 216,650, and is celebrated for its winter sports, ice palaces, etc.

The Lachine Rapids are nine miles distant from Montreal. "La Chine" is the French for "China." This name was bestowed 350 years ago when French sailors hoped to reach China, by passing up the St. Lawrence, which they thought offered a western route to that land.

OFFICERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

CHARLES R. HUNTLEY, PRESIDENT.

Mr. Huntley was born in Winfield, Herkimer County, N. Y., October 12, 1854. He received a good education in Utica, N. Y., and his first business venture was with the Remington Arms Company. Three years afterward he became interested in the oil business, and in 1883 was agent for the United Pipe Line. In 1888 he went to Buffalo and assumed the position of secretary and general manager of the Brush Electric Light Company of Buffalo, N. Y., which position he still holds.

Under his management the company of which he is the business head, has made material progress and been very successful. He is a very active member of the National Electric Light Association and has done much for the promotion of the objects and interests of that society.

Mr. Huntley was elected president of the Association at the Providence Convention last February, and he made the statement then that he would use every endeavor to make the Montreal convention a memorable event in the history of the Association. How far Mr. Huntley has been successful may be judged by those present at Montreal at this time.

JAMES I. AYER, 1ST VICE PRES'T.

James I. Ayer was born in 1854, at Medford, Mass, attended the public schools at Malden, Mass., until the age of eleven, then two years at military school, Nazareth, Pa., and three years at Pearl Cottage Seminary, Elizabeth, N. J. He had three years experience in Illinois on railways as a civil engineer, and from 1873 to 1875 was manager of the Pacific mills and elevators of Mattoon, Ill. From 1875 to 1885 was engaged in mercantile business. On the organization of the



M. J. FRANCISCO.

Jenney Electric Company, he entered its employ as general agent and after four years of active service with it, during which time a large portion of the construction work of that company was under his supervision, he took the position of general superintendent, with entire charge of the construction of the Municipal Electric Lighting and Power Company's plant, of St. Louis, Mo. On the completion of the plant consolidation was effected with all the arc lighting companies of St. Louis, and Mr. Ayer was appointed general manager, which position he now occupies.

In addition to the above Mr. Ayer is consulting engineer of the Benton and Belfontaine street railway, now being equipped with electrical power; also of the Citizens' Electric Light Company of East St. Louis, Ill.; a member of the American Society of Engineers, associate member of the American Institute of Electrical Engineers, and member of the Engineers Club of St. Louis.

M. J. FRANCISCO, 2D VICE PRES'T.

Mr. M. J. Francisco was born on the 5th of August, 1835, at Westhaven, Vt. In 1852 he entered Oberlin College, returning to Vermont in 1859. In 1864, with the co-operation of Gov. Geary, U.S. Senator Simon Cameron and Hugh McCulloch (who was then Secretary of the U.S. Treasury) he organized the Pennsylvania College of Trade and Finance at Harrisburg, a large and flourishing institution, over which he presided until failing health compelled him to relinquish all business, when he, to seek and find renewed health and strength, returned to his native State.



CHARLES R. HUNTLEY.

When the English fire insurance companies were negotiating for admission into the United States, Mr. Francisco assumed the general management for Vermont of the North British and Mercantile of Edinburgh, and the Liverpool and London and Globe of London, the first foreign companies that were admitted to the State. He was afterward made manager for Vermont, New Hampshire and Northern New York of several other large companies, and made a record as the most successful fire insurance manager in the State, which was fully sustained by his famous argument before the Joint Committee of the Senate and House on the "Valued Policy Bill."

Since 1884 he has been closely identified with many of the financial and manufacturing corporations, not only of the State where he now resides, but of Connecticut and New York as well; is a member of the American Institute of Electrical Engineers and Electric Club of New York City, also of the New England Electric Exchange; in 1887 he was elected president of the Rutland Electric Light Company.

At the convention in Kansas City, he was made a member of the Executive Committee of the National Electric Light Association, and at the Providence convention, last August, was elected second vice-president.

JOHN W. BEANE, SEC'Y AND TREAS.

Mr. J. W. Beane is an old-timer in the electrical fraternity, having first entered the field in 1885, connecting himself with the Mather Electric Company, and has since filled many important positions, having been general manager and treasurer of the Tucker Electric Construction Company, and also connected with the Edison Company in special work in New England.

Mr. Beane is a graduate of the United States Naval Academy and served ten years in the naval service, resigning in 1878 to enter civil life.

Much credit is due Mr. Beane for the business-like and clean-cut methods pursued in the management of the details of his office as secretary of the association and for the foresight displayed in the general plans for the coming meeting at Montreal.

ELECTROLYSIS BY ALTERNATING CURRENTS.

Dr. Guglielmo Mengarini, in an article in an English contemporary, gives the following interesting facts:

"If a platinum and acidulated water voltameter is traversed by an alternating current, which, by means of an adjustible resistance can be kept at a constant value whilst the surface of one of the electrodes is gradually diminished, a point is reached at which the current density at the movable electrode becomes so great that large bubbles of gas are evolved which for a moment insulate a portion of the electrode from the liquid. The metallic surface is then capable of igniting the bubbles of gas, producing small explosions and flashes of light in the liquid. With care it is possible to render the electrode incandescent along its whole length, so that it is covered with a sheet of flame from which dart flashes of bluish light with little explosions. At the same time on the first electrode, where the current density has remained constant, appears a copious evolution of gas, without comparison greater than it was at first, when the other electrode did not exhibit this phenomonon of recombination. This gas is found to be a mixture very rich in hydrogen. If it is a salt that is being decomposed, a considerable deposit of metal takes place on the second electrode, which is seen by simple inspection, without the necessity of weighing, to be very much greater than that which would have taken place under ordinary conditions. If on the electrode whose surface has been kept constant, the current density is so small that no trace of decomposition appears on it; still, as soon as the first electrode commences to be incandescent, the products of decomposition immediately appear on the second, which, in the case of solid ions, at once becomes covered with a metallic deposit, just as if it formed the negative



JOHN W. BEANE.

electrode of a voltameter traversed by a direct current.

"A similar result occurs if one of the electrodes, without being covered by a sheet of gas from which starts a continuous series of explosions, is surrounded by liquid in a state of strong ebullition, so that, without any luminous phenomena, the electrode gives out a feeble sound resembling the hum of a gnat. In order to carry out this experiment, it is sufficient to enclose the electrode in a porous cell immersed in the liquid. After starting the current, as soon as the density reaches a suitable value the liquid enters into ebullition.

"If a third electrode of platinum is placed in the voltameter containing the two electrodes when the above experiments are being made and a wire carried from it to one terminal of a galvanometer, the other terminal of which can be connected by

means of a key to either of the two original electrodes, it is found on suddenly breaking the alternating circuit, that whilst the electrode that became incandescent is either not polarized at all, or only very feebly so, that with the larger surface shows strong polarization, the direction of the current being the same as that from the copper pole of a volta couple.

"On inserting other voltameters containing sulphate of copper, nitrate of silver, etc., in series with the first and placing therein electrodes of such an area that decomposition does not occur when the alternating current passes through them, as soon as the above phenomenon takes place, the current remaining constant, an active electrolytic decomposition commences with deposition of copper, silver, etc., in each of the other voltameters."

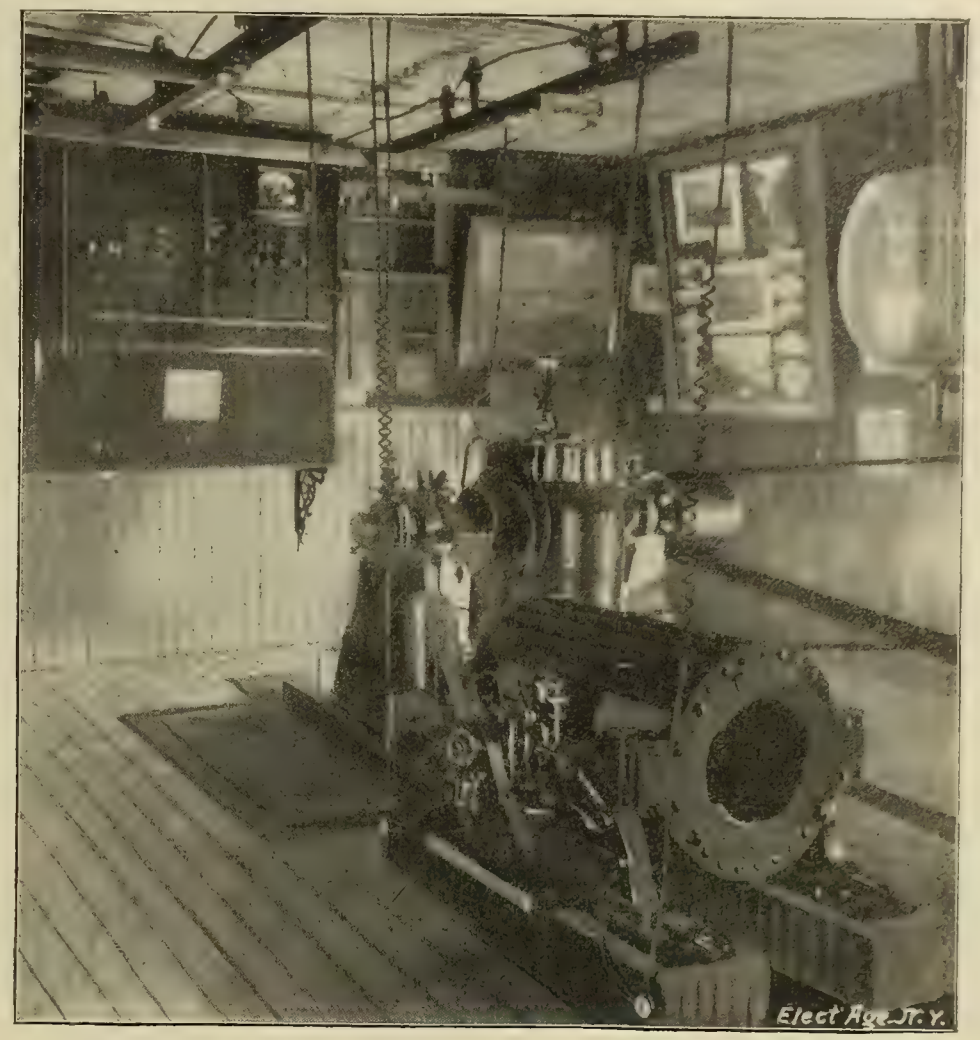
WINDSOR HOTEL ELECTRIC LIGHT PLANT.

An isolated plant which will interest the visitors of the Electric Light Convention at Montreal will be found in the Windsor Hotel, the headquarters of the delegates. The plant consists of one incandescent dynamo, with a capacity of 400 lights, an arc dynamo of twelve lights and a 65 H. P. Armington & Sims engine. The engines are belted to the dynamos by belts made by local manufacturers. The switchboard, which is handsomely designed, was built by Mr. W. Smyth, who is in charge of the plant. The engine room is 40 x 20 feet, but it can be easily enlarged.

NON-INDUCTIVE RESISTANCES.

At the meeting of the Physical Society, London, June 26, last, the following communication from Prof. W. E. Ayrton and Mr. T. Mather on the subject of the "Construction of Non-Inductive Resistances" was read:

In making some transformer tests about three years ago, the authors had occasion to consider the construction of electric conductors, the impedances of which should be practically equal to their resistances. This condition could only be fulfilled by making the inductance small in comparison with the resistance, and as the former does not depend on the material employed (excepting iron), it was important to use substances of high specific resistance. Carbon or platinoid being available, the latter was chosen on account of its low temperature co-efficient. One form of resistance exhibited consisted of strips of thin sheet platinoid about six metres long and four centimetres wide. Each was bent at the middle and doubled back on itself, thin silk being placed between the contiguous parts, and narrow ribbon used to bind the parts together. Twelve such strips arranged in series had a resistance of 2.95 ohms, and would carry a current of 15 amperes without changing its resistance more than one tenth per cent. This strip resistance was made by Messrs. C. G. Lamb and E. W. Smith, who at that time (1888) were students in the Central Institution, and to whom the authors' best thanks are due for the praiseworthy manner in which they surmounted the difficulties which presented themselves. Another form of resistance designed for portability, consisted of bare wire spirals, each length having a left-handed spiral placed within a right-handed one of slightly larger diameter, and the two being connected in parallel. This device was found to reduce the inductance to one tenth or one twentieth of that of a single spiral, according as the diameters of the spirals approach toward equality. When the spirals are made of platinoid wire, the ratio of inductance to resistance is very small, averaging about $\frac{1}{500000}$.



ELECTRIC LIGHT PLANT, WINDSOR HOTEL, MONTREAL.



PLANT OF THE ROYAL ELECTRIC CO., MONTREAL, QUE.

ROYAL ELECTRIC COMPANY'S PLANT.

We illustrate on this page the dynamo and engine plant of the Royal Electric Company, Montreal, Que. The lighting by this company is done entirely on the Thomson-Houston system, and the company's station is probably the largest electrical plant in the Dominion.

RULES FOR DETERMINING ENERGY, HEAT OR POWER.

1. To find the energy, heat or power developed in an electric circuit, multiply the square of the current by the resistance of the circuit; or

2. Divide the square of the electromotive force by the resistance; or

3. Multiply the electromotive force by the current.

These rules expressed algebraically are:

1. $H = C^2 R.$

2. $H = \frac{E^2}{R}$

3. $H = EC.$

Arc lamps usually require a current of 10 to 15 amperes and incandescent lamps ½ to ⅔ of an ampere.

The Commercial Electric Company of Detroit, has just secured contracts for an electric lighting plant at Coldwater and Pontiac, Mich., and is just completing the 200 arc light plant for J. L. Hudson's new building, that city.

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OUR HEADQUARTERS AT MONTREAL.

The headquarters of the Electrical Age during the convention, will be in parlor 104, Windsor Hotel. We extend a hearty invitation to all our friends to give us a call.

VALUABLE ELECTRICAL INFORMATION.

We present to our readers in another part of this issue some valuable and interesting electrical facts and statistics. We have taken the pains to collect this information from authoritative and reliable sources and trust that it will be of value to many. In many text books will be found a chronological record of the principal electrical discoveries and inventions. These records always stop just as the most interesting stage of electrical development is reached. Our record, however, brings us up to date, and nowhere, as far as we know, has so complete a list ever been published.

The other information will, no doubt, be found valuable for reference. The field is a very large one and to cover it exhaustively would require much more space than we have at our command; but enough is given to be of great aid and value to the practical electrician

CANADA WELCOMES UNCLE SAM.

On our first page we illustrate the exchange of international courtesies between a fair Miss, typifying Canada in her youth, and Uncle Sam, dressed up in his familiar uniform of the Stars and Stripes and beaver hat. Uncle Sam is not a handsome man and never was, but for all that Canada welcomes him with all the warmth and grace that she is capable of bestowing upon distinguished guests. While Uncle Sam may be lacking in beauty, he makes up for it in good sense and judgment. He keeps up with the times and reads the Electrical Age; he carries a copy of it in his coat tail pocket with him wherever he goes.

OUR PICTURE GALLERY.

Among the photographs we reproduce in this issue are those of two Montreal gentlemen who, among the many others, have been indefatigable workers in the interest and success of the Montreal Convention of the National Electric Light Association. These gentlemen are Prof. H. T. Bovey, Dean of the Faculty of McGill University and chairman of the citizens' Executive committee of entertainment, and Mr. A. J. Corriveau.

Both gentlemen are progressive spirits, and much of the success of the meeting and the enjoyment of the members of the Association is due to their personal interest in the matter. Others have contributed their time and efforts to the same end, and we regret that we have not the space to give all a personal reference.

A FEW TIMELY FACTS.

The International Exhibition will be open afternoon and evening, from the evening of September 7, to that of September 16, inclusive.

The daily sessions of the National Electric Light Association will be held from 10 A. M. to 2 P. M.

The significance of the different colored badges is a follows:

Red—Officers.
White—Executive Committee.
Blue—Members.
Pearl—Guests.

ELECTRICAL TRANSMISSION OF POWER.

One of the most interesting features of the International Electrical Exhibition is the practical demonstration of the electrical transmission of power from a distance in large units. The power used in operating the machinery in the exhibition hall is brought from McGill University, half a mile distant, and there is some 300 H. P. available.

THE CONVENTION.

For the first time in its history the National Electric Light Association holds, during the present week, its annual meeting outside of the borders of the United States.

The meeting is not held on foreign soil because the United States are not big enough for it, but because it has been deemed expedient to encourage our Canadian friends in a more extensive use and application of electrical apparatus, and with this end in view, a grand electrical exhibition is being held concurrently with the meetings of the association so as to enable the people of Canada to see what is being accomplished in the progressive United States by the aid of electricity.

The exhibition unquestionably will be a revelation to our neighbors. Indeed, it will likely be a revelation to many Americans, for they will have an opportunity to see and study almost every application of electricity, which they very rarely get at home. In a word, the exhibition is a sort of focussing-glass covering the entire electrical field, which concentrates its rays at one point—in this instance the Victoria Skating Rink.

There is much to be seen at the exhibition. It does not take long to develop new things in the electrical industries, and it is for this reason that one is surprised to see the materialization of so many new ideas at each exhibition held in conjunction with the meetings of the association. All electrical industries are passing through the stage of development; none have yet attained perfection, and so long as the process of evolution continues so long will these exhibitions furnish material evidence of great improvements along electric lines.

Our Canadian friends, no doubt, will be greatly inspired by the wonderful exhibition in their midst of American skill and invention, and well they may, for nowhere in the history of the world is there recorded such wonderful progress in the same space of time as has been made in the development and application of electricity to the uses of man. In the main America stands at the head in this process of development, and it is but natural that Americans should desire that other nations be enabled to see what advancement they are making.

Everything has worked in harmony for the success of the meeting and exhibition. The citizens of Montreal have prepared an extraordinary programme of entertainment for the members and their friends during their stay in Montreal, and there can be no question that the meeting of September 7, 8, 9 and 10, 1891, in Montreal, will go down on the record as far surpassing any of the preceding ones.

One of the most notable features of the meeting is the personal interest manifested in it by the Governor General of Canada. This official will, it is said, be in Montreal during the Convention, and no doubt will honor the occasion by his presence at some of the meetings.

This is a gala week for Montreal, and may everyone have an enjoyable time, is the wish of the Electrical Age.

CONVENTION PROGRAMMES.

The following is the official programme of the meetings:

The sessions of the Convention will be held from ten o'clock in the morning until two o'clock in the afternoon; final adjournment for the day being had at the latter hour.

On the 8th of September the reports of the following committees will be read and discussed:

Committee on Relations of Manufacturing and Central Station Companies, Committee on Data, Committee on World's Columbian Fair, Committee on Legislation, Committee on Underground Conduits and Conductors, Committee on Safe Wiring.

On the 9th of September the discussion of T. Carpenter Smith's paper, read at the Providence Convention, on the "Distribution and Care of Alternating Currents," will take place, and the following papers will be read and discussed:

W. C. Warner—"Various Forms of Carbons for use in Arc Lamps." Capt. Eugene Griffin—"Three Years' Developments of Electric Railways." H. Ward Leonard—"A Central Station combining the Advantages of both Continuous and Alternating Current Systems."

On the 10th of September the reading and discussion of the following papers: J. I. Ayer—"Some Details of the Care and Management of an Arc Lighting Station, as Practiced in the Municipality of St. Louis." C. J. Field—Subject to be announced. George A. Redman—"Central Station Lighting by Water Power." J. J. Burleigh—"Uniformity of Method in Keeping Central Station Accounts."

An executive session will be held on the 10th of September, to elect three new members of the Executive Committee and to name the place of the next meeting.

PROGRAMME OF ENTERTAINMENT.

The following is the programme arranged for the entertainment of the National Electric Light Association by the Citizens' Executive Committee, Montreal.

Monday, Sept. 7th, 3 P. M.—Opening proceedings of the Convention in the Windsor Hotel, address of welcome by His Worship the Mayor and other distinguished members of the Reception Committee.

8 P. M.—Formal opening of the exhibition by His Excellency the Governor General.

Tuesday, Sept. 8th, 2:30 P. M.—Drive through the city and around the mountain.

8 to 11:30 P. M.—Conversazione at Redpath Museum, Molsom Hall, McGill College.

Wednesday, Sept. 9th, 2:30 P. M.—Fire Department display on Champs de Mars.

5 to 7 P. M.—Garden Parties.

8 P. M.—Banquet at the Windsor Hotel,

Thursday, Sept. 10th, 2:30 P. M.—Through the kindness of the Harbor Commissioners, trip by boat down the St. Lawrence and the Lachine Rapids, stopping on the way at Caughnawaga.

5 to 7 P. M.—Garden parties.

Friday, Sept. 11th 3 P. M.—Lacrosse Match. In the evening, Promenade Concert at Sohmer Park, through the courtesy of Messrs. Lavigne and Lajoie.

Saturday, Sept. 12th, 7 P. M.—Excursion to Quebec at reduced rates.

In addition to the above, yachting parties are being arranged for the entertainment of the ladies.

CHRONOLOGY OF IMPORTANT ELECTRICAL DISCOVERIES, INVENTIONS AND EVENTS.

B. C.

600—Thales, of Miletus, mentioned the power developed in amber, when rubbed, of attracting light bodies.

400—Plato enunciated the first theory of electricity.

A. D.

1600—Dr. Gilbert made the discovery that other substances besides amber possessed electrical properties.

1745—Leyden jar discovered by Musschenbroek and his pupil Cuneus. The honor of the invention is also claimed for Kleist, Bishop of Pomerania.

1752—Franklin drew electricity from the clouds by means of a kite.

1775—The electrophorus devised by Volta.

1800—Volta invented the voltaic battery.

1819—Oersted discovered the electro-magnetic action of an electric current.

1827—Ohm discovered the mathematical law of electric currents.

1829—Prof. Henry proves the possibility of charging electro-magnets at distances.

1831—Faraday obtained a spark from an electro-magnet.

1832—Faraday discovered electro-dynamic induction.

" S. F. B. Morse invents the telegraph.

1833—Pixie invented the magneto-electric machine.

" Prof. Henry invented first direct rotary motion electric motor.

1837—Jacobi propelled a boat on the River Neva by an electro-magnetic engine.

" Grove's battery invented.

1838—Jacobi made experiments with his electric motor.

1841—First electric clock, invented by Bain.

1842—Grove constructed gas battery.

1844—Morse telegraph first introduced in the United States.

1845—Cook and Wheatstone, patent single needle telegraph system.

" Prof. Page invented electric engine based on the "axial force of electro-magnetism."

" J. W. Starr, Cincinnati, O., obtains a patent on an incandescent lamp with a carbon burner in a vacuum.

1846—Bain chemical telegraph invented. Also House printing telegraph.

1847—Faraday suggested the use of gutta percha as an insulator.

1851—Page propelled a car with a 16 H. P. electric motor between Washington and Bladensburg, using 100 cells of Grove battery.

1852—Reis transmitted musical tones over a wire by telephone.

" First fire alarm telegraph (Boston).

1856—Western Union Telegraph Company formed.

" Siemens invented armature, known by his name.

1857—First attempt to lay submarine cable between America and England.

1858—Atlantic Cable successfully laid, but communication destroyed in few weeks.

1859—Moses G. Farmer subdivided the electric light and lighted his house—the first private dwelling over lighted by electricity.

" Gaston Planté made storage battery with lead plates.

1860—Wheatstone automatic telegraph system patented.

1861—Pacinotti invented an electric motor.

1862—Pacinotti ring invented.

1866—Siemens described his self-exciting dynamo machine.

1868—Stearns duplex telegraph used for first time successfully.

1869—French Atlantic cable completed.

1870—Patent for Gramme's continuous current machine.

" Pacinotti ring improved by Gramme.

1873—Fontaine for first time practically applied the principle of the reversability of the dynamo.

1874—Three Atlantic cables laid.

1875—Direct United States cable laid.

" Moses G. Farmer subdivided current from a dynamo between 42 incandescent lamps.

1876—Bell telephone patented.

1878—Hughes microphone invented.

" Incandescent lamps with hard carbon burners, exhibited by Sawyer and Man.

" Edison's first patent on electric light system (Oct. 5).

" St. George Lane-Fox files provisional specification for incandescent lamp (Oct. 9).

1879—Edison's first carbonized paper burner lamp (Oct. 22).

" First commercial electric lighting plant—Edison system, on the steamer "Columbia."

1880—Camille A. Fauré constructed storage battery plates using paste.

1883—The ELECTRICAL AGE was established.

" Induced alternating current system of lighting, first introduced by Gaulard and Gibbs. They used the series method.

1885—Parallel system of distribution by induced alternating currents, first put into practical operation by William Stanley.

1887—The Westinghouse Electric Company introduced its alternating current system.

1891—The ELECTRICAL AGE enlarged.

" (July)—The STREET RAILWAY NEWS established as the railway department of the ELECTRICAL AGE.

WIRING RULES.

HOW TO SELECT PROPER SIZE WIRE TO CARRY A GIVEN CURRENT.

The following formula is given as a convenient means for determining the size wire necessary to carry a given current any distance with any loss.

To find the circular mils necessary to carry a given current any distance with a given loss, multiply the distance in feet, both ways, by current in amperes, by constant 10.7 and divide by number of volts to be lost in transmission.

$$\text{Formula: } \frac{\text{Distance or length of circuit in ft. x amperes x 10.7}}{\text{Drop of Volts.}} = \text{Circular mils}$$

Example: To find circular mils necessary to carry 56 amperes, 230 feet (both ways) with 3 volts drop

$$\frac{56 \times 230 \times 10.7}{3} = 45{,}938 \text{ circular mils (No. 3 nearest number).}$$

The same formula, with slight change, can be used to find volts lost in given length of wire of known area carrying a given current.

$$\text{Thus: } \frac{\text{Feet (Both Ways) x 10.7 x Amperes}}{\text{Circular Mils of Wire.}} = \text{Volts lost.}$$

$$\text{Example: } \frac{230 \times 10.7 \times 56}{45{,}938} = 3 \text{ Volts lost.}$$

This constant 10.7 is the number of circular mils in a copper wire of 97 per cent. purity, which would have a resistance of one ohm for one foot in length; one ampere through one ohm requires one volt.

Multiply the constant 10.7 by the length of wire and it will give the circular mils necessary for one ohm resistance; multiply this by the amperes and it gives the circular mils necessary for the loss of one volt. Divide the last result by the volts lost and it will give circular mils necessary.

To ascertain the resistance of the leads necessary to supply lamps, motors or other apparatus, for a desired drop of potential within the leads, multiply the reciprocal of the current necessary for the apparatus by the desired drop in volts.

When more than one lamp or appliance is connected in parallel, and when the E. M. F. of the main leads, the factors of the lamps or other appliances, their number and the distance from their point of connection with the main leads are given, the resistance of the leads is calculated by the above rule after the joint resistance of the divided or parallel circuits has been determined.

To ascertain the joint resistance of divided or parallel circuits when they are of uniform resistance, divide the resistance of one circuit by the number of circuits, and the result will be the resistance of the combined circuits.

In divided or parallel circuits each branch receives a portion of the current universally proportional to its resistance.

ELECTRICAL UNITS.

The VOLT (named after Alessandro Volta) is the unit of electromotive force, and is a trifle less than the electromotive force of a cell of Daniell battery, which is 1.07 volt.

The OHM (named after Dr. G. S. Ohm) is the unit of resistance, and is equal to the resistance of a column of mercury one millimeter square, and 106.24 centimeters long at 0° centigrade.

The AMPERE (named after André Ampere) is the unit of current, and corresponds to a current that will deposit in an electrolytic bath in one second .00033 grain of copper. The term ampere refers to the quantity of current without reference to time; but the Coulomb is an ampere of one second duration.

The FARAD (named after Michael Faraday) is the unit of capacity. The practical unit, however, is the microfarad (one millionth of one farad). A condenser of a microfarad capacity contains a surface of 3,600 square inches of tinfoil, $\frac{3}{5}$ of a mile of average submarine cable has a capacity of one microfarad. A Leyden jar with a total coated surface of one square meter and glass one millimeter in thickness, has a capacity of $\frac{1}{55}$ microfarad.

From the units above given, other practical units are derived.

The WATT (named after James Watt) is the unit of electric power or *rate of work*, and is equal to one volt multiplied by one ampere. Therefore the current (amperes) in a circuit multiplied by its electromotive force (in volts) gives the power of the current in watts, thus $W = E \times C$.

One watt is equal to $\frac{1}{746}$ of one horse-power, therefore 746 watts equal one horse-power.

The current consumed by incandescent lamps is measured in watts.

The AMPERE-HOUR is a unit of recent origin and represents the flow of one ampere of current for one hour, or two amperes for 30 minutes, or ½ ampere for two hours. It is used to express the capacity of batteries. Thus a battery with 360 ampere-hours capacity will give a current of one ampere for 360 hours, or 360 amperes for one hour, or two amperes for 180 hours.

In practice the application of these units is based on Ohm's law, which is the fundamental principle in nearly all electrical calculations.

OHM'S LAW.

Ohm's law is that the current (in amperes) flowing in an electric circuit is equal to the electromotive force, expressed in volts, divided by the total resistance of the circuit expressed in ohms.

The symbols used in practice to express these factors are:

C = Current (amperes).
E, or E. M. F. = Electromotive force (volts).
R = Resistance, (ohms).
W = Watts, or rate of work.

The algebraic expression of Ohm's law, as given above, is as follows:

$$C = \frac{E}{R}$$

PRACTICAL APPLICATION OF OHM'S LAW.

To find the value of the current in a given circuit, divide the electromotive force of the current by the resistance of the circuit,

$$C = \frac{E}{R}$$

To find the electromotive force, multiply the current by the resistance; $E = C \times R$.

To find the resistance of a circuit, divide the electromotive force by the current.

$$R = \frac{E}{C}$$

The current in a circuit varies directly with the electromotive force, and inversely with the resistance. Thus, if we increase or decrease the electromotive, we increase or decrease the current in proportion; and if we increase the resistance we increase the current; by decreasing the resistance we increase the current.

When it is desired to expre s a great number of electrical units, or the very small part of one, certain prefixes are used in connection with the name of the unit, thus

Kilo, means one thousand.
One *kilowatt* = 1,000 watts.
Mega, means one million.
One *megohm* = 1,000,000 ohms.
Milli, means one thousandth part.
One *millimeter* = $\frac{1}{1000}$ of a meter.
Micro, means one millionth part.
One *microfarad* = $\frac{1}{1000000}$ of a farad.

FUSIBLE ALLOYS FOR SAFETY PLUGS.

Melting at 66–71° C.—Lead, 2 parts; Tin, 4 parts; Bismuth, 7 parts; Cadmium, 1.5 parts.

Melting at 94° C.—Lead, 5 parts; Tin, 3 parts; Bismuth, 8 parts.

210° F.—tin 3; lead 5; bismuth 8 parts.
246° F.—tin 4; lead 1; bismuth 5 parts.
286° F.—tin 1; bismuth 1 part.

OCEAN CABLE SERVICE OF THE WORLD—1890.

	No.	Length in Miles
Governm't Administ'n	816	12,741
Private Companies	248	107,817
	1,064	120,558

The North Atlantic cables are eleven in number, as follows:

Anglo American	4	District United States	1
Commercial	2	French Atlantic	2
American Telegraph and Cable Companies	2		

TELEGRAPH LINES OF THE WORLD—1890.

	Length of Wire in Miles.
Europe	1,002,649
North America, Western Union	616,130
" " Other Lines	107,347
South and Central America	62,517
Australasia	71,717
Asia	128,928
Africa	12,969
Total	2,002,257

The commercial efficiency of a generator is the quotient obtained by dividing the electric energy in the outer circuit by the mechanical energy expended in turning the armature.

SOURCES OF ELECTRICITY.

Electricity is generated in various ways. They may be enumerated as follows:

1. Friction.
2. Percussion.
3. Vibration.
4. Disruption and cleavage.
5. Crystallization and solidification.
6. Combustion.
7. Evaporation (including atmospheric electricity.)
8. Pressure.
9. By heating or cooling certain crystals. This is called pyro-electricity.
10. Several species of aquatic creatures have the power of producing electric discharges. This is called animal electricity.
11. Heat applied to the junction of two dissimilar metals produces a flow of electricity. This is called thermo-electricity.
12. The contact of dissimilar metals produces electricity.
13. Moving a wire across the "field" of a magnet produces a current of electricity in the wire so moved. This is the principle of the dynamo-electric machine.

COMPARATIVE LUMINOUS VALUE OF VARIOUS SOURCES OF LIGHT.

The luminous rays from several sources of light bear but a small proportion to the obscure or non-luminous rays, the exact proportion to the former being from:

An oil flame,	3 per cent.
A gas flame,	4 "
An incandescent wire,	4–6 "
An electric-arc light,	10 "

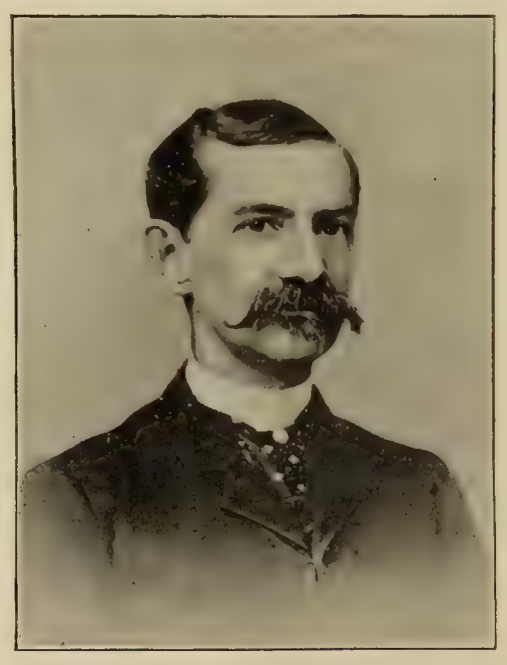
The arc light is richest in luminous rays; it is also richest in actinic or chemical rays, but the poorest in thermal or heat rays.

BIOGRAPHICAL SKETCHES.

GEORGE WORTHINGTON.

We present to our readers the features of one who is well known and held in high esteem by a large number of those engaged in electrical industries. The gentleman is so well known that it is hardly necessary to introduce him.

Mr. George Worthington, of whom the cut is an excellent likeness, was born March 18, 1844, in East Bethany, Genesee county, N. Y. His school education was attained at the Wyoming



GEORGE WORTHINGTON.

Academy in Alexander, N. Y., and when he had reached the age of eighteen years he went West to grow up with the country. In those days Milwaukee was considered far west, and here he located for the purpose of seeking his fortune. He obtained a position in a hardware store and here he acquired some valuable business experience. On the breaking out of the war he was inspired with patriotic zeal and enlisted in the 4th U. S. Infantry. He fought for his country and served until the close of the Rebellion, after which he returned to Owego, N. Y. He did not remain long in Owego, however; Milwaukee had a greater attraction for him and offered a larger field for the expansion and development of his enterprising spirit. While in Milwaukee he received an appointment as United States Consul to Ghent, Belgium. After filling this position for some time with honor and credit to himself and his country, he resigned and returned to the United States, locating in New York. Shortly after his arrival in New York he established the *Telegraph and Telephone Review*, which was the parent of our contemporary, the *Electrical Review*.

Mr. Worthington has been closely identified with the latter paper all through its career.

Mr. Worthington has for some time been seriously ill, and his many friends will regret exceedingly to learn that he is now at the home of his brother, Mr. C. G. Worthington, in Buffalo, in a very critical condition, suffering from extreme nervous prostration.

ALBERT J. CORRIVEAU.

Mr. Albert J. Corriveau, the subject of this sketch, is President and General Manager of the Canadian Electrical Construction, Manufacturing and Supply Company, of Montreal, and though his electrical career only dates back a few years, he is already well and favorably known to the electrical fraternity throughout both the United States and Canada.



ALBERT J. CORRIVEAU.

Mr. Corriveau, who is now in his thirty-ninth year, although a Canadian by birth, is of Franco-Scottish extraction. At the early age of eighteen he launched out for himself in commercial pursuits and for a few years carried on an important and successful business.

In 1878 he established a silk factory in Canada. This business was carried on with success until the time of the collapse of the Exchange Bank, of Montreal, and it with many other industrial concerns was forced into liquidation. After this Mr. Corriveau was for three years with the Royal Electric Company, of Montreal, as general agent; he succeeded in introducing and establishing electric light plants in many of the most important towns in the Province of Quebec, having always uppermost in his mind the aim to bring Canada on a level with the most advanced countries in regard to electricity. Taking a lively interest in all electrical matters, he was soon a member of the National Electric Light Association of the United States, and at once realized the benefits which would result by bringing to Canada this body of distinguished and enterprising men.

He was elected a member of the Executive Board, thus having the distinguished honor of being the first Canadian to hold office in the Association. At the Summer convention of the Association, held at Cape May, in August, 1890, he first suggested the idea of holding the next Summer convention in Montreal. The seed then planted bore fruit at the convention held in Providence, R. I., in February of the present year, when, heartily supported by his friends, Mr. Corriveau's proposal to bring the Association to Montreal was carried by an unanimous vote; consequently to him is due the credit of gathering in Canada these electrical "scientists" and "magnates," whose presence cannot fail but be of vast benefit to the advancement of electrical science in the Dominion.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, "WORLD" BUILDING,
NEW YORK, Sept. 5, 1891.

The Crocker-Wheeler Electric Motor Company, New York, is full of business. It has just furnished a ½ H. P. motor for the new Chilian cruiser being fitted out in England.

The Manhattan Electrical Supply Company, 36 Cortlandt street, this city, has secured the sole right to manufacture and sell the well known Sullivan door opener.

The International Okonite Company (Limited), New York and London, is just now paying particular attention to the manufacture of superior underground cables. It is out with a new one called The Acme Lead Cable. It has many good points which are worth while looking up.

F. Day Voorhees, general sales agent for the Norwich Insulated Wire Company, 58 Cedar street, this city, will be found at the International Electrical Exhibition hall, Montreal, September 7, explaining the virtues of the company's paper insulated wire cables. The company will have a full line of goods on exhibition.

Thompson & Robertson, 258 Broadway, New York, have secured the sole right to manufacture and sell the Fibrous Dry Battery and Fibrous Disque Leclanche porous cup (for which a patent has been allowed) heretofore made by Messrs. Taylor & Walsh. Mr. J. Hart Robertson will personally supervise the manufacture, and Mr. Louis Walsh will be manager of the sales department. Mr. Walsh will represent the firm at Montreal during the convention.

The popularity of the Weston Standard direct-reading Voltmeter and Ammeters is increasing daily. The manufacturer, the Weston Electrical Instrument Company, Newark, N. J., produces first class instruments, capable of being read to the one thousandth part of the scale from zero throughout its entire range, and with fair usage, of maintaining this degree of accuracy unimpaired. The most reliable methods of standardizing by direct comparison with certified legal standards are used, making these instruments equal not only to the demands of commercial work, but also to the more rigid requirements of laboratory standards.

In circular letters just issued, the Interior Conduit & Insulation Company, 44 Broad street, this city, sets forth the advantages of its improved speaking tubes, finishing and fitting tools for conduit tubes and the Standard Twin Conductor No. 2. The tools described consist of an outside and an inside reamer and a trimmer for metal covered conduit tubes. The speaking tubes are claimed to possess non-vibrating qualities, serving to clearly transmit sound long distances, the sound waves not being impaired by contact with resonant materials. The company's well-known Standard Twin Conductor is also illustrated and its manner of insulation described. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co.	350,000	100 00	90 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co. (Boston)	620,000	5 00	2 50
American Electric Motor Co.(N.Y.)	1,000,000	2500	5 00
American Private Phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Aut. Phon. Exh. Co	25,000		†
Averell Insulating Condnit	3,000,000	100 00	4 00
B. & S. Elec. Equipment Co. (N. Y.)	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	180 60
Bell Telephone 7's	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brunswick Elec. L. & P. (Me.)	50,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		*102
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	16 50
Brush Swan (Ithaca)	50,000	10 00	5 00
Burrell Electric Signal Co. (N.Y.)	500,000	20 00	10 00
Circleville, O., L. & P. Co, 6's	20,000		*101
Circleville, O., L. & P. Co.	100,000	100 00	105 00
City of London Elec. Ltg. Co. (Ltd.)	4,000,000	50 00	60 00
Columbia Canal 6's (Ga.)	200,000		*102
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	4 00
Cons. Gas & E. Co. Batavia, 6's	80,000		*95
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	10 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600,000		par
East River Electric Light Co.	1,000,000	100 00	40 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	20 00
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*98
Edison Elec. Ill. 6's (N. Y.)	30,000		*99
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating(N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., (Phila.)	1,000,000	100 00	80 00
Edison General	14 000,000	100 00	98 50
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	20 00
Elizabeth E. L. Co. (N. J.)	100,000	10 00	4 00
Equitable G. & E. Co. (Utica)	4,000		†
Erie Telephone	4,800,000	100 00	45 00
Essick Printing Tel.	5,000,000	100 00	35 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		*95
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co.	4,000,000	25 00	13 00
G. T. Woods Mfg. Co. (Ky.)	2,000,000	10 00	2 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	
Great Western Elec. Sup. Co.	650,000	100 00	100 00
Great Western Elec. Sup. Co., pref	350,000	100 00	104 00
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co.(Brooklyn)6's	30,000	500 00	*105
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1.000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	80 00
Kankakee Electric Co., 6's Ills.	50,000		*99
Kansas Elec. Co., 6s, Mo.	20,000		*98
Laclede Gas Co.	7,500,000	100 00	19 25
Laclede Gas, pref.	2,500,000	100 00	50 00
Laclede Gas 5s.	10,000,000		*77
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50,000		*94
Little Rock Edison E. L. & P. 6's	30,000		*95
Littleton Water & E. L. Co. 6's	75,000		*95
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5's(N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		*103
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	60 00
Morristown L. H. & P. 5s (N. J.)	17,500		*105
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g. Co. (New York)	100,000	10 00	9 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	17 00
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,800		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 25
N. Y. and N. J. Tel. and Tel 6s	1,500,000		*99
N. Y. and N. J. Telephone Stock	2,535,000	100 00	94 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark E. L. & P. Co. 6's Ohio	50,000		*95
North New York, Lighting	150,000	100 00	10 00
Northern Elec. L. & P. (Phila.)	200,000	10 00	
Northwest Elec. Co. 6's Manitoba	50,000		*95
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	90 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston	200,000	25 00	30 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6's.	500,000		*96
Railway Improvement Co.	10,000,000	100 00	100 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	60 00
Rockaway Elec. Lt. Co. 6's	75,000		*103
Russell Electric Co. (Boston)	300,000	5 00	5 75
Saginaw E. L. & P. Co. 6's Mich.	50,000		98
San Diego Gas & Elec. Co. 6's Cal.	750,000		90
Sawyer-Man Electric Light Co(N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation., N. Y.	100.000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	8 00
Sprague Elec. Motor Co.	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co (N.Y.)	1,000,000	100 00	80 00
Staten Island L., H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	40 75
Thomson-Houston Pref.	4,000,000	25 00	24 75
T.-H. Electric Co. 5's Boston.	500,000		*98
T.-H. E. L. Co. Yonkers, 6's	100.000		*99
T.-H. L. H. & P. Co. Binghamton, 6's	100,000		*99
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.)	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	50 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co.	1,500,000	100 00	25 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	7 50
Utica Elec. & Gas Co. 6's.	150,000		par
Utica Elec. Light Co. 6's.	150,000		par
Vine Street Motor Co. 6's (Colo.)	100,000		*95
Welsbach Inc. Gas.	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	83 25
Westinghouse Electric Co.	7,000,000	50 00	14 25
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			19 75
Yonkers, L. & P.	50,000	100 00	75 00

*Per cent. †Registered Stock.

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

THE WARD ARC LAMP.

The Electric Construction and Supply Company, 18 Cortlandt street, New York, the well-known manufacturer of arc lamps for incandescent and railway circuits, has just issued a catalogue of 19 pages, illustrating and describing the well-known "Ward" arc lamp, and its many applications. Many of those who had isolated incandescent plants, desired arc lights for illuminating large spaces, without being forced to install a special arc light dynamo, and it was a problem among inventors whether the two systems could be economically combined on one circuit. Until the advent of the "Ward" arc lamp the customer was compelled to either pay for installing ordinary high tension arc lamp, involving extra expense, or be satisfied with the incandescent system alone. Since its invention it has been thoroughly tested by electricians throughout the country, and it has been demonstrated that it will operate on any multiple arc circuit.

The catalogue just issued by the company fully describes its workings, application and cost, and also contains cuts illustrating the lamp with and without ornamentation, the method of connecting to railway circuits, the transformer system, as a photo-gravure lamp, as a theatrical lamp, color and lens box and as a switch light.

The bracket and stand resistance coils manufactured by the company, are also illustrated and described. A number of letters from well-known electrical firms and electricians recommending the lamp are also given.

The "Ward" arc lamp will be one of the features of the Montreal convention, and will prove of interest to our Canadian friends.

BUSINESS NOTES.

The Manhattan Electrical Supply Company, 36 Cortlandt street, New York, reports a large number of orders for its "Mesco" dry battery. Outside of the merits of the battery itself, which are sufficient to induce its use by those needing an open circuit battery, the company makes it to the interest of purchasers to use the "Mesco" dry battery by offering to replace exhausted cells with new ones for a very small sum.

Mr. Henry F. Parker, patent solicitor and expert, Mills Building, Broad street, New York, makes a specialty of rejected patent cases. Mr. Parker has been engaged in the patent business in New York for the past twelve years, and his experience in his particular line is of extreme value. He is a graduate of the State College, Amherst, Mass., and also of the New York University Law Department. Mr. Parker was formerly connected with the Whiting Machine Works, in machine construction. Anything in the patent line, in the United States or foreign countries, cannot be secured through better hands than through Mr. Parker's.

The following is a partial list of electric plants now in course of erection or construction by the Falls Rivet and Machine Company, of Cuyahoga Falls, O., for which the Akron Iron Co., 122 Liberty street, New York, is agent: Masonic Temple, Chicago, Ill.; Beaver Falls Traction Company, Beaver Falls, Pa.; Reading Electric Light & Power Company, Reading, Pa.; Davenport Gas Light Company, Davenport Iowa; Cincinnati Street Railway Company, Pendleton St. Sta., Cincinnati, O.; Louisville Electric Light & Power Company, Louisville, Ky.; Louisiana Electric Light Company, New Orleans, La.; Pulaski Electric Light Company, Pulaski, Tenn.; Wheeling Electric Light Company, Wheeling, W. Va.; Brush Electric Light Company, Cleveland, O.; Pittsburg Plate Glass Company, Ford City, Ia.; Cedar Rapids Electric Light & Power Company, Cedar Rapids, Ia.; Belt Electric Line Company, Lexington, Ky.; Covington Electric Light Company, Covington, Ky.; Indiana Electric Light Company, Indiana, Pa.; Municipal Electric Lighting Company, St. Louis, Mo., (addition).

The Hine Eliminator Company, of 106 Liberty street, New York, has a "New Salesman," inanimate yet very expressive. It consists of a neatly bound copy of Prof. R. C. Carpenter's report of the test of steam separators recently made at Cornell University, which the company will send free to all who will send their address. This report sets forth in tabulated form the relative efficiencies of six of the best known steam separators in the market with the Hine Eliminator looming up in its efficiency fully 50 per cent. over what has been considered the best. In 12 different tests the Eliminator demonstrated an average efficiency of 98 8-10 per cent. dry steam. That this test was complete and impartial goes without question and if those wishing a "steam separator" or a "grease extractor" will send for a copy they will get some points worth knowing. See ad. on page VIII of this issue.

The Bellaire Gas & Electric Light Company, of Bellaire, Ohio, is installing a 100 H. P. engine built by The Ball Engine Company, of Erie, Pa.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued August 25, 1891. (*Continued.*)

458,316. Electric Conductor. Frederick E. Degenhardt, Chicago, Ill., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed Sept. 1, 1890.

The combination of a conducting-wire, a cord wound spirally around the wire, and a perforated strip or strips applied over the cord.

458,343. Circuit-Closer. Percival D. Richards, West Medford, assignor of one-half to Charles H. Delano, Woburn, Mass. Filed March 30, 1891.

A circuit-closer fitted to be grasped by the hand, having a body formed wholly or in part of a conducting material adapted to be placed in connection with one conducting-wire, and an exterior series of flexible strips or wires adapted to be placed in connection with the other conducting wire, whereby when the circuit-closer is grasped by the hand and compressed the strips or wires are forced into contact with the body and the circuit is closed.

458,372. Electric Alarm-Clock. James O. Newton, New Haven, Conn. Filed May 25, 1891.

In an alarm-clock, the combination, with a time-movement, of an alarm mechanism comprising a cam-wheel arranged to be rotated once in twenty-four hours and carrying a sleeve releasing cam, and an arbor frictionally held against rotation and provided with a pointer and with a pin, which engages with the cam.

458,376. Arc-Lamp Electrode. Walter S. Richards, Natick, assignor of one-half to George B. James, Boston, Mass. Filed Jan. 8, 1891.

An electrode having a capillary conductor of refractory material extending along its exterior, the conductor being exposed to the atmosphere.

458,386. Electric Arc Lamp. Nathan M. Garland, New York, N. Y., assignor of one-half to Clift Wise, same place. Filed Dec. 29, 1890.

An arc light having its upper carbon provided with a movable protecting cap or hood of refractory material of the same internal diameter as the carbon, but shaped to bear against the coned end thereof, and adapted to move in the direction of the support of the carbon as it burns away.

458,387. Electric-Arc Lamp. Nathan M. Garland, New York, N. Y., assignor of one-half to Clift Wise, same place. Filed Dec. 29, 1890.

An arc-light carbon provided with a protecting cap or hood sustained in position by a spiral spring connected to a point in alignment with the carbon.

458,388. Electric-Arc Lamp. Nathan M. Garland, New York, N. Y., assignor of one-half to Clift Wise, same place. Filed Dec. 29, 1890.

An arc light having a protecting cap or hood for each carbon, the hoods being mechanically connected together by a resilient or yielding support, and provided each with one or more conductors of heat for dissipating or conducting away as far as possible the surplus heat evolved at the arc.

458,389. Electric Arc Lamp. Nathan M. Garland, Boston, Mass., assignor of one-half to Clift Wise, New York, N. Y. Filed May 18, 1891.

An apparatus for increasing the efficiency and life of an arc-light carbon, consisting of a protecting-tube having the same inner diameter as that of the carbon, in combination with one or more perforations or air-vents and groove-forming retaining devices extending into the path of the carbon near the lower end of the tube.

458,396. Cut-Out. William F. Irish, of New York, N. Y., assignor of one-half to Charles G. Perkins, Hartford, Conn. Filed Sept. 15, 1890.

458,424. Secondary Battery. Orazio Lugo, New York N. Y. Filed May 26, 1891.

A solution of borate of ammonia in combinaion with metallic or other substance for a secondary or storage battery.

458,425. Secondary Battery. Orazio Lugo, New York, N. Y. Filed May 26, 1891.

A secondary electric battery composed of a relatively positive metal or substance, such as zinc, and a relatively negative metal or substance, such as lead, both coated with oxide of lead, then suitably formed and charged, and placed in a liquid such as a solution of borate of ammonia, which will not act primarily upon either element, but will act secondarily upon both.

458,479. Telephone. Eloy Noriega, Mexico, Mex. Filed Feb. 4, 1891.

A receiving-telephone comprising a hollow handle having an enlargement at one end and provided with an ear-piece having a diaphragm and closing the enlarged end of the handle and at its opposite end with binding-posts, a permanent compound U-shaped magnet secured in the handle at its bend and provided with pole-pieces secured between the ends of each member of the compound magnet and extending in close proximity to the diaphragm, and bobbins on the pole-pieces connected with each other by one terminal and having the other terminals connected to the binding-posts.

458,486. Electric Gas-Lighter. Horace A. Pinkham, Philadelphia, Pa., assignor to George F. Pinkham, Wollaston, Mass. Filed Oct. 25, 1890.

458,489. Electric Signal and Switch Moving Mechanism. Joseph Ramsey, Jr., Edward W. Harden, and Charles M. Wilder, Cincinnati, Ohio, assignors to said Ramsey, Jr., and Frederic C. Weir, same place. Filed Feb. 5, 1891.

In combination with a motor having gyratory transmitting-links, devices for converting rotary into reciprocating movement, a crank, and a pitman connected directly to the switch-rails.

458,500. Electric-Arc Lamp. Hermann W. Sander, St. Louis, Mo., assignor of one-half to Martin D. Memmel, same place. Filed May 4, 1891.

458,536. Electric Uterine Supporter. George F. Mohn, Los Angeles, Cal. Filed March 26, 1891.

458,545. Electric Motor. Charles E. Egan, Columbus, assignor of three-fourths to William H. Weitzell, Logan, and J. F. Casey, Zanesville, Ohio. Filed Nov. 28, 1890.

458,551. Insulating Compound. James L. Marmaud, Malden, Mass. Filed May 19, 1891.

HENRY F. PARKER.

Solicitor of United States and Foreign Patents and Mechanical Engineer.

Offices, Mills Building, 35 Wall Street, New York, U. S. A. Cable Address, "Crucible, Newyork."

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On filing application for patent,	15 00	25 00
On issuing each original patent,	20 00	
On filing a disclaimer,	10 00	
On filing every application for a reissue,	30 00	
Appeal from a primary Examiner to Examiners in Chief,	10 00	
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WEEKLY.

Vol. IX. NEW YORK, SEPTEMBER 19, 1891. No. 38.

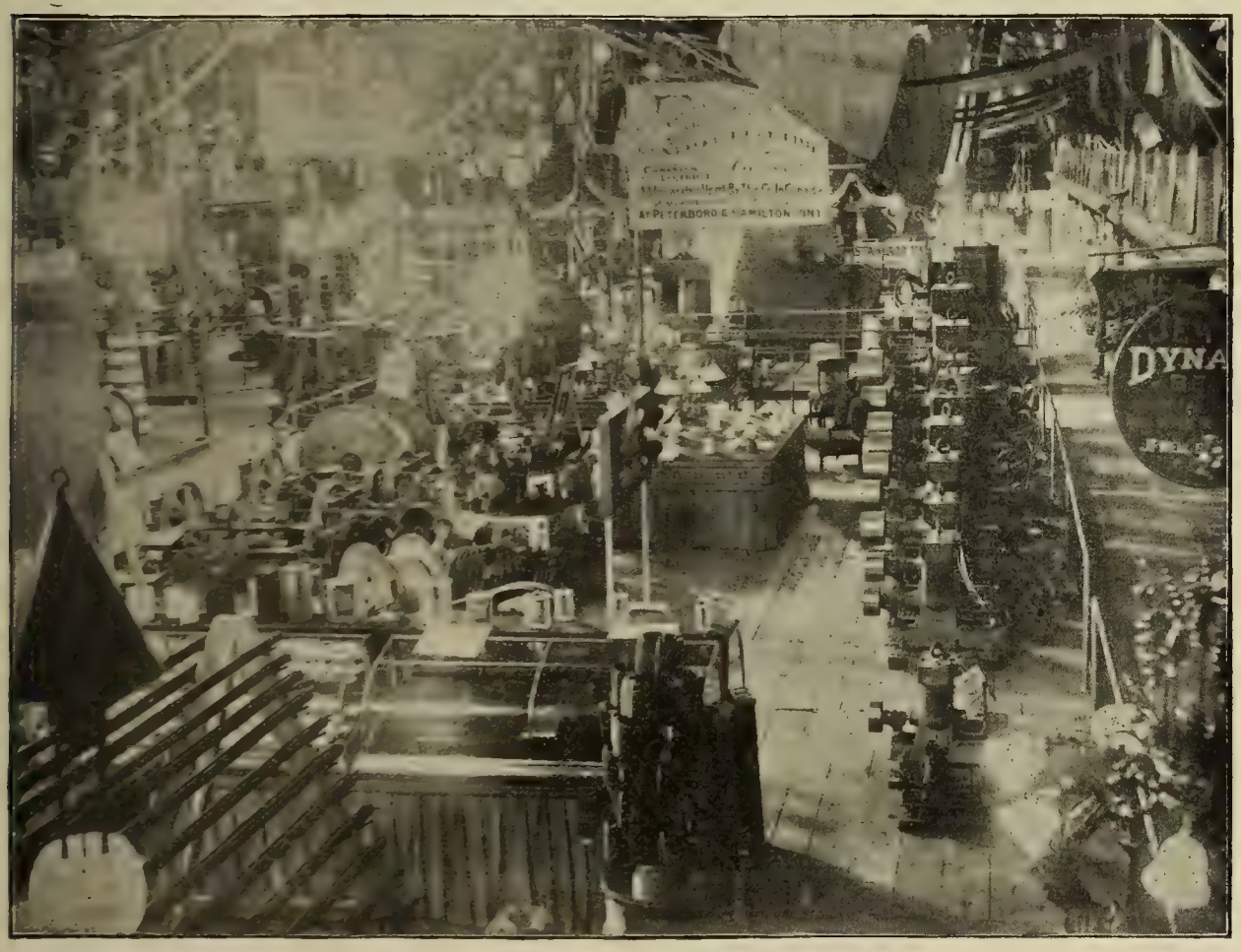


EXHIBIT OF THE EDISON GENERAL ELECTRIC CO.

EXHIBITS AT THE MONTREAL CONVENTION.

We give on this page two illustrations of exhibits at the International Electrical Exhibition held in conjunction with the convention of the National Electric Light Association in Montreal last week. The first one is a general view of the exhibit of the Edison General Electric Company, which was one of the most attractive and extensive in the building. The space occupied was greater than that covered by any other exhibit, and its completeness was remarkable.

In the picture, at the right, will be noticed a long line of Edison dynamos. These were arranged according to size and ranged from the largest size down to the smallest.

At the left hand lower corner will be seen sections of underground three-wire tubes, arranged on a frame in such a manner as to give them the best display.

Just above this portion of the exhibit is shown an electric car truck equipped with Edison motors, and on the top of the show case seen in front will be noticed samples of the well-known Edison-Lalande batteries.

In this connection it may be of interest to state right here that the printing press on which the daily edition of THE ELECTRICAL AGE was printed was located in the Edison exhibit, and was run by an Edison motor.

The second illustration is that of the exhibit of the Electric Engineering & Supply Co., of Syracuse, N. Y.

This was a very attractive and artistically arranged exhibit. The letters "E. E. S." shown on the front, were made up with incandescent lamps, which, when lighted, gave a beautiful effect.

Above each of the letters will be noticed three lamps diverging from a common centre. These lamps had globes of red, white and blue, and revolved around the axis of the common holder. The effect was very striking, and this particular exhibit attracted much attention by its brilliancy. In the show case and on the table were samples of all kinds of porcelain and other goods manufactured and handled by the company, and the display altogether reflected great credit upon those who had charge of getting it up.



EXHIBIT OF THE ELECTRIC ENGINEERING AND SUPPLY CO., SYRACUSE, N. Y.

CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The fourteenth convention of the National Electric Light Association was called to order at 3.20 P.M., September 7, Windsor Hall, Montreal, President C. R. Huntley in the chair.

In a few appropriate remarks President Huntley introduced Prof. H. T. Bovey, of McGill University, chairman of the Citizen's Executive Committee. Prof. Bovey said it devolved upon him to welcome the Association and he believed the convention would be interesting, instructive and enjoyable. He heartily welcomed them to the city.

Mayor McShane was received with applause. As mayor of the city he bade them welcome in a few words, and promised to do all he could to make their stay enjoyable.

Sir Donald Smith gave the visitors a cordial welcome. He knew of nothing more beneficial than such conventions, which could not but clear away erroneous ideas held by each people. They had received word from his Excellency the Governor-General stating that he was not able to be present, but he would be at the banquet on Thursday evening.

Sir William Dawson bade the strangers welcome, on behalf of McGill and all teaching bodies. In doing so he perceived what they were bound to recognize in the presence of so great and growing a profession, their appreciation of the stimulus they gave to physical science study. He referred to the growth of electrical science and also to the aid it had given to older professions, which were under obligations to this young and growing giant. He alluded suitably to the new appliances provided by McGill for the study of physical science, and heartily bade the visitors welcome.

Alderman Clendenneng spoke a few words of welcome, as did also Mr. Justice Wurtele; and ex-Mayor Beaugrand welcomed the convention on behalf of the French Canadians.

Mr. Richard White also briefly welcomed the visitors.

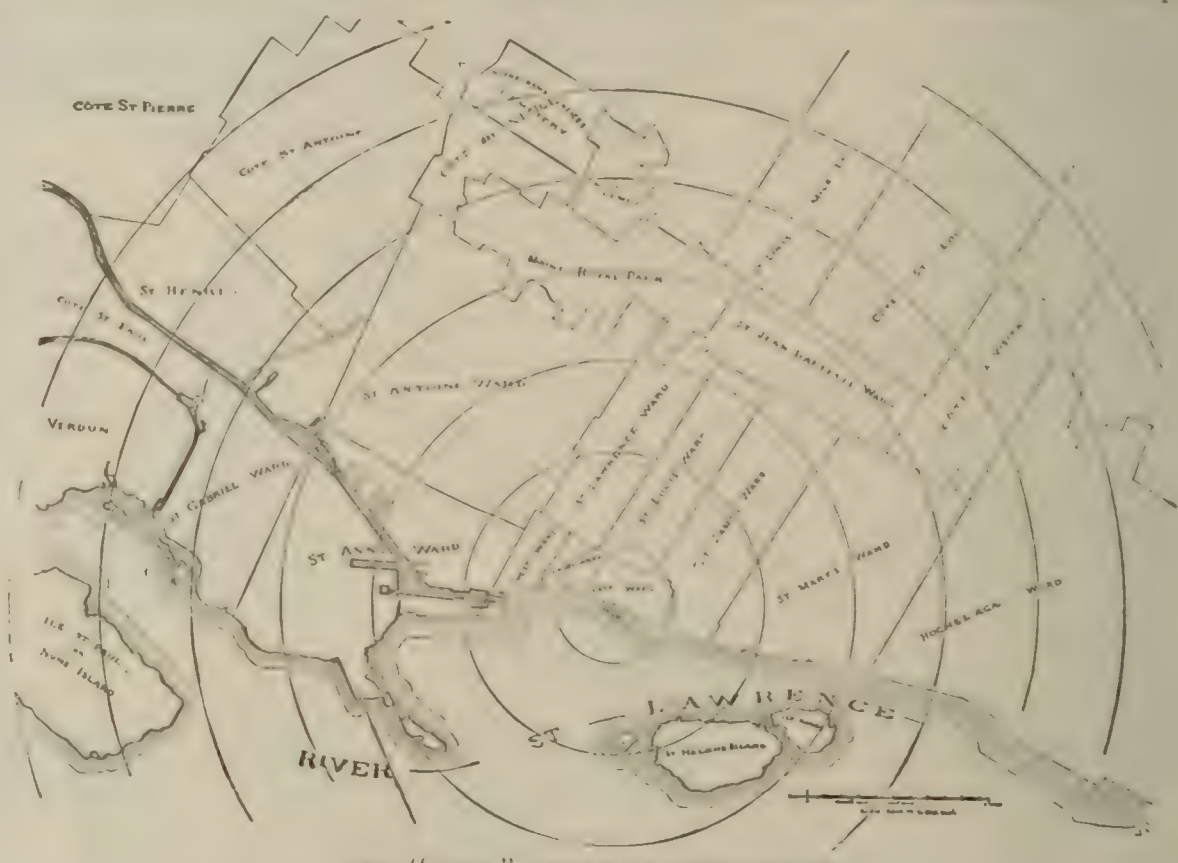
Consul General Knapp spoke a few words regarding the hospitality of Montreal, and promised the Canadians a royal welcome should they ever visit an American city. He referred to the commercial position of Montreal, and bade welcome to the ladies of the party.

Mr. Judge Armstrong, of Camden, N. J., was then called on and made a pithy and humorous speech. As he had listened to the cordial words of welcome he realized what electricity did. It had been called an annihilator of space, and now he realized it could eliminate state lines. No communities were known to it, but one great family; therefore, they appreciated the cordial welcome given them. They could not help coming when they learned to know the men sent to invite them. They promised well, but they had already given more than they even dared to conjecture.

Following Judge Armstrong, Mr. Erastus Wiman, of New York, made a speech that was full of facts and timely suggestions. He dwelt particularly upon the magnitude and importance of electrical development. Referring to telephony and telegraphy, Mr. Wiman stated that both had reached their greatest development in Canada. In Toronto and Montreal the telephone service was the most efficient in the world, and in Toronto there were a greater number of subscribers in proportion to population than in any other place on the face of the earth. There was also a greater mileage of telegraph wire in Canada in proportion to population than in any other country.

President Huntley then read his address, which was an extremely interesting document. He referred to the fact that this was the first time the convention had met elsewhere than on its native soil, and gave this as an evidence that the electrician's art was among the foremost influences tending to promote human intercourse and breaking down the walls of separation. He dealt with the lavish hospitality tendered the delegates to the convention, and said: "If the earnest and practical quality of our dealing with the great questions of electricity shall in anywise stimulate electrical work in Canada, and lead to the electrical utilization of its great water powers and coal beds in light, locomotion, power and heating, we trust it will be accepted as at least some slight acknowledgement of the manner in which we have been so generously greeted." It is now pretty well recognized among intelligent station managers that the day has passed when they can limit themselves to one class of service or apparatus, to the exclusion of all others. To obtain the fullest measure of success and the largest return from the capital invested they must be ready to supply any demand made upon them, and, as a result, the successful station, even to-day, is gradually assuming a composite character. This compositeness is manifesting itself, first, in the variety of apparatus, as a result of the selection of the machines best adapted to a given class of work, and independent of any particular system.

To reach the full limit of its usefulness the central station should avail itself of methods which, I believe, will finally resolve themselves into what may be called the 'Zone System' of distribution. The idea embodied in the zone system can best be explained, perhaps, by taking a concrete, practical example, and for this purpose the present occasion makes the selection of the city of Montreal an interesting one. Setting aside for the moment the possibility and even the probability of the transmission of electrical energy to the city from the power obtained at the Lachine rapids, we will assume a station erected at the water-front of the harbor, as indicated on my diagram. It will, I believe, be granted that up to within a distance of one-third of a mile radius.



THE "ZONE" SYSTEM OF DISTRIBUTION.

the three-wire low tension direct-current system of distribution answers fully every requirement of simplicity and economy, and hence, if, with the station as a centre, we draw a circle having a radius of one-third of a mile, we shall have a 'zone' supplied in the most economical manner for every class of light and power apparatus now familiar to us." In explaining this Mr. Huntley used a map of the city, a cut of which, with the "zones" marked will be found elsewhere. He then proceeded: "Coming to the districts beyond the first zone we are necessarily obliged to have recourse to higher potentials for the feeders, and the selection of the proper potential is a matter of simple calculation. We may, for the sake of this argument, call it 500 volts. Continuing on in this way, in steps of 500 volts, successive zones, half a mile across might extend in the aggregate to several miles without reaching the limit of potentials which have been found to be perfectly feasible in practice. In the example no reference has been made to the nature of the current employed or to the method of local distribution. Evidently we may readily resort to the alternating system, employing converters to reduce or raise the potential, or to the direct current reduced from high to low, by motor dynamos. Either one is perfectly practicable. Perhaps some of our new school of electrical engineers will show us how to use the same circuits for both alternating and direct currents. But whatever system be employed, I deem it proper to record here my conviction that the most economical way to distribute the current to consumers at the point of delivery is by low-pressure conductors, in contradistinction to the plan now generally in vogue, of giving each customer a converter of his own; or, in the direct system, a separate motor-dynamo. I need not here enlarge upon the train of reasoning which has led me to this conclusion, but I may remark that I am strengthened therein by my own experience in Buffalo, where we are now introducing gradually 200-light converters and replacing the smaller ones heretofore employed. Nor do we propose to stop there, but expect to install converters of still higher capacity, distributing the current to a number of customers by low-pressure mains centering at the large converters. The allusion made to the motor dynamo system for converting the direct current from high to low potential may to some appear nothing more than the citing of a possible method in view of the existence of the alternating system, well tried and ready at hand. But without wishing in the least to detract from the merits of this system, which has probably done more to popularize electricity than any other, I cannot, as a practical man, conceal from myself the fact that, taking everything into consideration, the low-tension direct current system of distribution is the most flexible within its area, and serves the greatest variety of purposes. I do not think that any one can successfully contradict the assertion that to-day no other system can, with equal efficiency, take care of arc and incandescent lamps, motors, large and small, storage batteries, electric heaters, etc." He referred to the present condition of the art and hoped the time would come when the same would be said of the alternating system.

In conclusion, President Huntley urged that the association determine upon meeting only once a year. "Even if it were not impossible to recover in six months from such overwhelming hospitality as we are now the recipients of, I believe that the time has gone by when half-yearly meetings were necessary. Once in twelve months is often enough for us to come together for the comparison of our experience and the report of further refinements in the detail of the industry. The mere fact that frequent reunions are no longer necessary is in itself a hopeful sign, for it tells of stable and settled conditions and of activities that now require our presence at home pretty well the year round."

A number of invitations were then read, a vote of thanks was passed to the invitors, and the meeting adjourned.

TUESDAY'S PROCEEDINGS.

The meeting was called to order at 10 A. M. by President Huntley.

The first order of business was the reading of the report of the Committee on Relations Between Central Stations and Manufacturing Companies, by Mr. E. R. Weeks, and in this connection read a paper which was not favorable to the parent companies. They were called rapacious and selfish and treacherous. It was shown that they made promises to the central station men, which they never kept; that they actually entered into a league with the gas men, the natural enemies of electricity; that they entered cities and competed against the very men who had invested $100,000,000 in apparatus from them. Mr. Weeks would combine; he would unite every central station man in the country in a league of defence! Let

them form an association to make their own apparatus; let them build factories; they had the money to do it. They had put $100,000,000 into their industries; the parent companies had only put $25,000,000. The central station men could get at any moment $12,000,000 as a commencement. He also recommended the close study of the gas question. Let them read the gas journals. Gas was to be the fuel of the future. Fuel was a necessity, while illuminants were luxuries. The gas men had allowed the electric lighting people a period of experimentation. Now they were in the field against them, frankly and boldly.

Judge Armstrong endorsed what had been said by Mr. Weeks. He did not blame the gas men. The citizens might acknowledge frankly that the electric people were giving a better light; but as a director, or manager, or stockholder, he was bound to oppose it, and he did oppose it. That was to be expected. But the conduct of the parent companies was indefensible. Let them be independent of them. Let them no longer be dependent on them.

Mr. Francisco described some of the tactics of the parent companies. They entered a municipality, and they offered lower terms for the service in opposition to the very people who had bought their apparatus from them, and who had received the franchise to supply it. Again, they contracted with a city to give an electric service, under the control of the city; the city lost money by it, but it taxed the people for the deficiency. How could central stations compete against such a system as that?

Mr. Nicholls urged that there was plenty of apparatus in the central stations and plenty more upon which the patents had expired and which could be manufactured, which would be amply sufficient for their work and if it were fully used it would teach the manufacturing companies that they must deal honorably with the station men.

The paper was ordered to be printed and circulated.

Mr. Weeks moved that the committee be instructed to formulate a definite plan of procedure for the protection of central station companies and to prepare the necessary articles of agreement and to report at the next meeting.

The report of the Committee on Data was presented. It contained a schedule of suggestions for the better collecting of statistics on the cost in different places of electric lighting, and after reading the report the motion was made that the forms presented be accepted and that the secretary be instructed to communicate with the census office and request that the office so arrange and prepare the statistics as to conform to this schedule.

Mr. J. A. Hornsby, secretary of the electrical department of the World's Fair, was then introduced. With the aid of a diagram he described the site, the extent and the character of the exposition. He particularly described the building which had been devoted to electrical exhibits. This will cost $600,000. The entire grounds will be lighted by electricity. The machinery will be run by electricity. There will be electric railways and boats, and there will be electric generators representing twenty-four thousand horses. There was talk of holding a World's Electrical Congress in 1893, in Chicago. He urged the association to participate in it. It would do great good. Deep and broad was the chasm which separated what they knew from what they wanted to know. Perhaps they were on the eve of a revolution. Perhaps it would be given to some one man to rend the veil, and discover the secrets of nature, which were at present hidden from them. At all events, the suggested congress would do great good in leading to a revision of nomenclature, a unification of standards and many other reforms of moment.

Mr. T. C. Martin urged a cordial support both of the World's Fair and World's Electrical Congress.

A vote of thanks was passed to Mr. Hornsby for his attendance and information.

Mr. Allen R. Foote briefly reviewed the electrical census work under his charge, and urged the co-operation of all concerned to attain the results desired.

The next report called for was that of the Committee on Legislation.

Judge Armstrong reported general quiet all along the line. In his State (New Jersey) nothing had been done affecting electrical industries. Mr. C. H. Wilmerding spoke for Illinois and President Huntley for New York State.

Next in order came the report of the Committee on Underground Conduits. Mr. M. J. Francisco, the chairman, reported that owing to the non-arrival of certain information on the subject of underground wires from London, the committee was not prepared to report, and asked for an extension of time, which was granted.

Judge Armstrong, in the absence of T. Carpenter Smith, then read the report of the Committee on Safe Wiring. The report was a voluminous one and of great interest. Owing to its length, it was not all read, a motion having been made and adopted to have the report printed at once and distributed among the members, and to consider the subject at Thursday's meeting. The meeting then adjourned.

WEDNESDAY'S PROCEEDINGS.

The meeting was called to order in the Ladies' Ordinary, Windsor Hall being too large and cold.

President Huntley announced that he was in possession of a letter from the Canadian Pacific Telegraph Company which offered the members of the Association free telegraph privileges for social messages by their line of telegraph. He also informed the meeting that Sir Donald A. Smith had sent a standing invitation to the members and their friends to visit him at his residence Thursday afternoon. He urged the members to attend in large numbers. On motion a vote of thanks was passed to Sir Donald Smith and the C. P. R. Telegraph Company.

A brief discussion then took place on the paper read at the last convention by Mr. T. Carpenter Smith on the subject of the distribution and care of alternating currents, among those who took part in the discussion being Messrs. Law, Burleigh, Francisco, Ayer, Smith, Brophy and others. In the course of his paper Mr. Smith touched upon underground and overhead wires, declaring that thoroughly sound overhead construction was the strongest argument which could be advanced to-day against companies being compelled to spend large sums of money on underground work. He thought that all would agree with him that those who were willing to spend the enormous sums that such work costs, had established a right to ask that they be not expected to do anything in the way of underground work until underground work had been demonstrated to possess decided advantages to compensate for the increased difficulty of locating and correcting trouble, in which respect the overhead line was undoubtedly superior. "If municipalities," said he, "wish to place themselves in the front rank of progress and at the same time encourage local industries, let them expend their energies in insisting on and compelling the proper carrying out of well tested methods of construction, rather than in demanding that untried principles and methods be experimented with, often under conditions which preclude their success."

Mr. Francisco in criticizing the paper, said that his experience had been that if the wires were put overhead in the proper way, there would be less reason for rage. Several cities declared that the electric light companies put up their wires in a slipshod way and, in many cases, without any attention to insulation. As many as thirty American cities had now insisted that the wires must go underground and yet if the companies had strung their wires properly there would have been no such trouble. He concluded with an argument in favor of meters, by which the companies could better control their business.

Mr. Smith urged that if meters were used they should be placed on the right side of the converter and the customer compelled to pay for all leakages in the converters. The paper was then accepted.

A paper on "Central Stations Operated by Water Power," was then presented by Mr. George A. Redman, superintendent Brush Electric Light Company, Rochester, N. Y.

An interesting discussion followed the reading of the paper, which was participated in by Judge Armstrong, M. J. Francisco, Chas. E. Scott, H. Ward Leonard, Smith and others. Mr. T. Carpenter Smith said the relative cost of steam and water powers had been considered by a recent meeting of the Mechanical Engineers and the opinion arrived at was that steam was produced just as cheap as water power. Besides, with steam one could tell almost to a certainty what the power would cost a year. Moreover the contingent expenses of water power would offset the cheapness of the water. The paper was then adopted.

The next paper read was by Mr. H. Ward Leonard, of New York City, and described a central station combining the advantages of both the continuous and alternating current systems.

An interesting discussion ensued, during which Mr. T. Carpenter Smith spoke in favor of the alternating as against the three-wire system. Dr. Louis Bell, Captain Brophy and others, also made some remarks on the subject.

The next business was the reading of a paper by Mr. J. J. Burleigh, of the Camden (N. J.) Lighting and Heating Company, on "Uniformity in Method of Keeping Central Station Accounts." (See abstract of this paper on another page). After a brief discussion in which Messrs. Nicholls, of Toronto, Francisco, Scott, Judge Armstrong and President Huntley took part, the meeting adjourned until Thursday.

THURSDAY'S PROCEEDINGS.

The convention was called to order at 10.20 A. M., by President Huntley. Invitations were read to hold the next meeting of the Association at Norfolk, Va., and Augusta, Ga.

The first order of business was the reading of a paper, by Captain Eugene Griffin entitled "Three Years Development in Electric Railways." The paper was an extremely interesting one, and will be found in full on another page. Captain Griffin received hearty applause at the conclusion of the reading of his paper. A brief discussion was indulged in, in which Judge Armstrong and Dr. Bell participated.

Reference was made to the suspension of the census bureau of the work connected with the electrical census, and the dropping from the roll of all names of those connected with that branch of the census bureau. The announcement gave rise to many expressions of regret at the action of the census bureau. Dr. A. F. Mason thought the Association should take positive and definite action with a view to securing a continuance of the work of the electrical section until Congress shall make an appropriation for the purpose, which it was reasonably certain could be secured at the next session.

After some discussion as to how the object sought could be obtained, a resolution was unanimously adopted providing for the appointment of a committee of five members of the Association to call on the Superintendent of the Census, the Secretary of the Interior, and if need be, the President of the United States, to urge the importance of continuing the work of collecting electrical data by the Census Bureau, under the charge of Mr. Allen R. Foote.

Another resolution, introduced by Dr. A. F. Mason, was adopted requesting the co-operation of the electrical industries in carrying forward the electrical census work.

The report of the Committee on Safe Wiring was then taken up, amended in Committee of the Whole, reported to the Convention and passed as amended.

Mr. C. J. Field then read an extremely interesting paper, entitled "Electric Railroad Construction and Operation and a Consideration of their Connection with Central Station Interests." After a short discussion, the meeting, at 1.20 P. M. adjourned till Friday.

At 2.30 P. M., the members and their friends, through the courtesy of the Harbor Commissioners, embarked on the steamer *Filgate* and took a trip up the canal then down Lachine Rapids. The day was a delightful one for the trip, and the ride was enjoyed by all to its fullest extent. The boat returned to the city at 6 P. M.

In the evening a banquet was held in honor of the Association, in Windsor Hall, at which his excellency, Lord Stanley, Governor-General of Canada, was present. Full details of the banquet are printed on another page.

FRIDAY'S PROCEEDINGS.

At 10.45 A. M., the meeting was called to order, and the first business was the reading of a paper by Mr. James I. Ayer, of the Municipal Electric Light and Power Company, of St. Louis, Mo., giving some details of the care and management of an arc lighting system as practiced in the "municipal" of St. Louis.

A brief discussion followed the reading of the paper in which Messrs. Nicholls, Francisco, Seely, Scott and Dr. Bell took part.

The paper by W. C. Warner, entitled "Different Forms of Carbons Used in Arc Lighting," which had been distributed in printed form among the members a couple of days previously, was taken as read in order to save time.

A resolution was adopted to the effect that the amended rules for safe wiring, which were adopted on Thursday, be printed and distributed among central stations and the various insurance companies.

A resolution was also adopted making Sir William Dawson, Sir F. R. Redpath and Prof. H. T. Bovey honorary members of the Association

(*Continued on page 567.*)

THE ELECTRICAL AGE
DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT

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THE MONTREAL CONVENTION.

Every hope and prediction with reference to the convention of the National Electric Light Association may truly be said to have been more than realized. The convention was an unqualified success in every particular, and it will stand on record as a memorable one in the history of the Association. There was a very large attendance and the enthusiasm was great. The delightful weather during the entire week no doubt contributed largely to the success of the meeting. Had it been otherwise than pleasant the most enjoyable part of the visit would have been spoiled. But everything passed off as if the elements and everything else considered the success of the convention and the entertainment of the visitors to Montreal as of prime importance.

The convention itself was a great success. The papers read were above the average, and their value was great.

At succeeding conventions the character of the papers read must necessarily be and are of vast more importance than any existing literature on the subjects considered, for the reason that the electric lighting industry is still in the process of development. Something new is being continually developed, and what is new to day is old to-morrow. So it is all the way through the electric light business, and for this reason each paper is really a record of the latest knowledge on the subject with which it deals.

The proceedings were begun under the most auspicious conditions, all of Montreal's most prominent citizens being present at the ceremonies. They were all in touch with the occasion; they seemed to fully realize the importance of holding the convention in their midst, and they left nothing undone that would conduce to a successful meeting.

One of the most important measures adopted by the convention was that in reference to the continuance of the gathering of electrical statistics under the auspices of the census bureau. The importance of such data to the electrical trades is too great to permit the matter to be dropped at this juncture, and it is hoped that the committee which was appointed by President Huntley to visit Washington and urge upon the authorities the extreme importance of carrying the work to a completion will succeed in its mission, and convince the "powers that be" that failure to carry out the undertaking so well begun would be little short of a disaster to all electrical industries.

The entertainment of the members of the Association and their friends was on a magnificent scale, and fully bore out the reputation the people of Montreal have for hospitality. The first citizens opened their doors and welcomed the Americans to their homes; nothing was too good for the visitors. Even the Governor-General of Canada made a special trip to Montreal to honor the occasion by his presence, and he was received with as much enthusiasm by the Americans as his own loyal subjects could display. Lord Stanley is a gentleman of refined dignity, and he gained many admirers among the Americans. The banquet, at which the Governor General was present, was an elegant affair and a remarkable success. It gave the speakers a splendid opportunity to say nice things about each other, and the whole affair was of the most enjoyable character. Many Americans brought back with them as souvenirs of the occasion the autographs of Lord Stanley and that other most distinguished gentleman who presided at the banquet, Sir Donald A. Smith.

The banquet will long be remembered by those who were fortunate enough to be present.

Montreal, like any other city of importance, takes great pride in its fire department. A display of the fire apparatus was made one afternoon, and the evolutions of the brigade called forth many hearty cheers.

The Entertainment Committee deserves unstinted praise for the most successful issue of its arduous labors, and it may be assured that in stating that its plans were arranged with great tact and judgment, and the entertainments, one and all, were thoroughly enjoyed, we voice the sentiments of every one present. Not a murmur was heard from anyone : there was no reason for any.

From a business standpoint, much good resulted on the spot, and there is no possibility of estimating the good that the future will develop through holding the convention and exhibition in the Canadian metropolis.

The daily press of Montreal deserves great credit for the able manner in which it presented the reports of the convention, and reported the exhibition to its readers. It was very creditable work.

Montreal will long live in the memory and affections of those who attended the convention of the National Electric Light Association, in September, 1891.

THE DAILY ELECTRICAL AGE.

Our readers, we know, will pardon us if we refer to what was done by the Electrical Age at the Montreal Convention. Our policy is to blow the horns of others rather than blow our own, but for certain good reasons we are constrained to say a few words with reference to our own exhibit.

It was a happy idea to characterize the convention and exhibition, particularly the latter—in a popular sense—as an educational one. The Electrical Age took a hand in this educational effort and showed the people how chromatic or varicolor printing was accomplished at one impression on the press.

During the five days of the convention a special edition of the Electrical Age was issued daily and, judging from sundry observations overheard here and there, there is only one word in the English language that will characterize the result of the undertaking, and that word is "success"—success, unqualified, pure and simple.

The compliments we received on our enterprise were indeed flattering, but they were made in a sincere spirit. The daily Electrical Age was in touch with the occasion, and it was full of matter of interest to every one present. The supply of the first day's edition soon disappeared, so eager was the crowd to learn what everybody else was doing and what they were going to do, and, incidentally, to see if their own name was in print.

The enterprise, we are glad to note, was a great success, and although the work entailed upon the staff was necessarily great the pain was more than compensated by the pleasure induced by the compliments received. Our efforts were thoroughly appreciated, and the result told its own story.

The advertising page of our daily edition was printed in many colors in plain sight of the visitors at the Victoria Rink, on a press which was driven by electric power. Beautiful effects were produced by the blending of the various colors, and the paper was indeed one of the features of the convention. It is safe to say that a greater number of those present took more interest in the daily edition of the Electrical Age than in any other one thing that brought them to Montreal.

BUFFALO'S TURN NEXT.

It has been decided to hold the next convention of the Association in Buffalo. While we freely admit that the hotel accommodations there, together with the accessibility of that beautiful city by its proximity to the greatest water power in the world, are advantages which but few cities can lay claim to, yet it must not be lost sight of that Buffalo in February or March is, generally speaking, a most charming and delightful city to leave, and while wise heads have decreed that "Buffalo it shall be," yet we are compelled to believe that we were only echoing the feelings of the majority when we said in our daily edition at Montreal that a more genial clime than that of Buffalo at that season of the year would be more liable to conduce to a large attendance. However, since the many inducements offered by the balmy South have failed to secure for it the next convention, let us all strive to make the meeting as great, if not a greater success, than its predecessors, and if the hospitable but disappointed South will but join hands with us in so doing, who can tell but what it will very soon have us within her borders, to accept of its proverbial hospitality and give new impetus to electrical matters in Dixie.

STREET RAILWAY CONVENTION.

In Street Railway News of even date we publish a *verbatim* report of the proceedings of the annual convention of the New York State Tramway Association, which was held in this city Tuesday, September 15th. This report, in conjunction with that of the Convention of the National Electric Light Association, held in Montreal last week, makes reading both interesting and instructive.

The attendance at the Street Railway Convention was good, and, although the meeting lasted but the one day, there was great enthusiasm. The papers read were of deep interest to street railway managers, and we publish them in full.

A banquet was held at the hotel in the evening, and was largely attended. Many felicitous speeches were made, and all present were deeply impressed with the wonderful development which has been, and is still going on in street railway matters, and the future of these most important interests is far beyond the human mind to contemplate. Electricity is the life-giving force of these marvellous things.

Street Railway News, fully alive to the occasion, was represented by five of its staff, and the publication of a *verbatim* report of the proceedings of the convention, etc., within 36 hours of adjournment, we are sure will be appreciated by progressive men.

(*Continued from page 565.*)

This action was afterwards confirmed in executive session. All business having been transacted, the convention, at 12.10 P. M., adjourned.

An executive session was held immediately after adjournment and the following resolution was adopted:

The National Electric Light Association, Assembled in Montreal, at the close of its session, desires to put upon record its appreciation of the distinguished honor shown it by the Dominion of Canada in the presence of his Excellency Lord Stanley of Preston, Governor-General of the Dominion; of the large-hearted hospitality of the City of Montreal, evidenced by many graceful acts, official and individual; of the tireless industry of the Citizens' Executive Committee, whose efforts have carried to completion the most successful meeting in the history of this body; of the grand work done by the Committee on Exhibits, issuing in an exhibition of rare educational value, calculated to develop a larger appreciation of the flexibility of electricity and its wide adaptation to human needs; of the gracious liberality of McGill College, which has lent the great dignity of its name and the personal influence and labor of its officials to the success of our meetings; to the press of this city, whose extensive and fair reports of our meetings have extended our influence; to the railway companies for the liberal reduction in fares, and to the Windsor Hotel management, where, as guests, we have found a home.

That the above resolution be placed on the records of the Association and certified copies sent to the different parties.

Votes of thanks were also passed to Mr. James I. Gulick, L. Stieringer and others, and the following gentlemen were elected honorary members of the Association: Sir William Dawson, Professor Henry T. Bovey, Mr. Frank R. Redpath and Mr. Thomas D. Lockwood. The following named gentlemen were elected members of the Executive Committee, in place of Messrs. Burleigh, Rollins and Robertson: M. D. Law, of Schnectady, N. Y.; Frederick Nicholls, of Toronto, and A. M. Young, of Waterbury, Conn. A resolution of a very flattering nature was next passed to Mr. John Carroll for his efforts in behalf of the visitors, and after deciding to hold the next executive session at Buffalo, the convention closed.

OPENING OF THE INTERNATIONAL ELECTRICAL EXHIBITION, MONTREAL.

At 8 P. M., Monday, September 7, the time appointed for the opening of the International Electrical Exhibition, Victoria Skating Rink was literally packed with people, young and old, male and female. The interior was profusely decorated with the flags and the coats of arms of all nations, and streamers from the centre of the roof down to the sides of the hall.

A few minutes later General Barney, of the National Electric Light Association, accompanied by a number of ladies and gentlemen, came out into the directors' box. A bell was rung and the crowd turned toward the box, jamming the passage ways almost to suffocation. In a few cordial words General Barney announced that the time had come to open the exhibition, and called upon Mr. J. I. Gulick, the chairman of the Exhibits Committee of the Association, to say a few words.

Mr. Gulick gave a little history of the electrical exhibitions held under the auspices of the association which have grown from a few scattered exhibits into the present magnificent exhibition—international in its character, and only limited in its scope by the boundaries of the electrical knowledge of the day. Mr. Gulick said some very nice things about Canada and Canada's aid in the formation of electrical knowledge, and concluded by calling upon Sir Donald Smith to open the exhibition.

Sir Donald spoke of the great progress that had been made in electrical knowledge. What had been accomplished they could see in the present exhibition, which also served to point out to them what might be accomplished in this department of science. The association had done much for it, was doing much and would continue to do more. They did it not for their own country, not for Canada, but for all mankind, who would be benefited by their exertions. Canadians should be grateful for the present visit of the association, with its great educational stimulus. After a few words descriptive of the good that would come of strengthening the fraternal bond existing between the United States and Canada by the present and similar visits, Sir Donald formally declared the exhibition open.

General Barney then introduced little Miss Bovey. In doing so he said that at their last exhibition, held last February in Providence, R. I., in connection with their annual meeting, the machinery in the exhibition had been set in motion by a young lady five and a half years old. Electrical science was now six months older, and it was in keeping with this growth that they had invited a young lady six months older to start the machinery.

The young lady touched a button and a second later there was a whir of machinery. Faster and faster it grew, until the air was filled with its cheerful hum. Then, when a sufficient current had been generated, a second button was touched and the gloom of the gas was driven away, and a dazzling light—the light of the great modern illuminator, electricity—replaced it. People gazed in wonder, and wonder well they might, for it was a picture of transcendant beauty that the touch of that little button created.

Myriads of lights were there. Lights big and little, each striving to outshine the other; lights great and small, of divers shades and colors, blazed away and turned the darkness of the night into a dazzling light that almost put to shame the glorious light of the departed day.

The attendance was very large. Every seat in the commodious galleries was occupied, while the floor was jammed, making it almost impossible to move from one place to another, except as the crowd itself willed. Fully four thousand people visited the hall during the night, and there were probably three thousand in the building at any time between 8.15 and 9.30.

THE EXHIBITS.

Mr. J. R. Phillips had a full line of productions of the Eureka Tempered Copper Company, North East, Pa. A large booth at the intersection of the back entrance and main aisle had tables on two sides covered with commutator segments and dynamo brushes for all systems, trolley-wheels, journal bearings, wire, rolled copper for dynamos, soldering copper, gear-pinions for street railways, and copper castings of every description. A novelty at this booth was the John Scott medal this company secured from Franklin Institute, Philadelphia, Pa.., for its improvements in casting and hardening copper; also a check received from The Land, Title and Trust Co., Franklin Institute, Philadelphia, extra premium for hardening copper. There were also blue prints of the work performed by this company; also letters of recommendation from large users of the goods.

G. C. McCormack, of the Dominion Wire Co., Montreal, had a handsome exhibit just at the main entrance, containing several cones; handsomely displayed around them was their galvanized telegraph, telephone wire, hard and soft drawn copper wires and stay wire, brass wire, iron and steel wire in bright, annealed, galvanized and tinned. Cards were set up in neat form with wire nails, wood screws and jack chains attached.

T. W. Ness, Montreal's popular electrical supply man, of 644 Craig street, had an excellent exhibit. Telephones were exhibited in all their most convenient forms for desks or other uses. An electric motor running a sewing machine, and all kinds of electrical supplies and novelties, were shown in most gorgeous array. Mr. Ness was there to explain the convenience of all his appliances.

An exhibit of special merit was that of H. Ward Leonard & Co., Electric Exchange Building, New York. The exhibit was intended to illustrate an entirely new principle of applying electricity for the operation of motors. The electric motor is operated in such a way that it can be run at any speed, from few revolutions a minute up to its maximum speed, and it will automatically hold any speed desired, no matter how much the load may vary, so long as it is within the capacity of a motor. A point of the greatest importance is that, while the motor is running at the lowest speed, its efficiency will be as high as when it is running at its maximum speed—that is to say, the energy of the electric current supplying the motor will automatically vary in exact proportion to the work which the motor is doing. The result is new—not only for electric motors, but for all mechanical motors. Such a result as this has never been obtained by steam, water or any other kind of power. If desired, the torque of the motor can automatically be maintained constant in amount, and the speed of the motor will be determined automatically by the work being performed. By applying this principle it is possible to obtain from any amount of energy in the electric current any desired torque with a corresponding speed. In this way it will be possible with the energy of one horse-power in the electric current to obtain a torque which will start a street car on a grade, the speed, of course, being quite slow. The speed will, however, be immediately gradually increased, and in the space of one or two seconds the car will be running at its full speed, the start having been made perfectly smoothly from dead rest, and the consumption of energy from the electric circuit being directly proportional to the increase of speed of the car. A passenger elevator will be controlled by a small electrical device in the car, consuming less than one-half ampere of current, and enabling the operator to run the elevator in either direction at any speed desired. A point of great importance in this connection is that the elevator in descending will deliver back to the electric circuit a large proportion of the electric energy previously required to raise the elevator car. By this method a street car can be taken up the steepest grade that traction will permit of, with a consumption of energy no greater than that required to move the car on a level, the speed being reduced upon the grade as the torque increases, so that their product remains the same as on a level. In operating elevators, pumps and similar work it will be absolutely impossible to burn out the armature, for the current through the armature is determined by the weight of the elevator (or the head of water in the case of a pump) and is totally independent of the speed, and therefore the current in the armature does not vary, whether the elevator or pump be running fast or slow. The application of this principle does not make it necessary to apply special devices of any kind, and standard shunt motors of any of the various makes can be operated with the greatest simplicity.

The Heisler Electric Company, of Philadelphia, exhibited under the charge of Mr. Oscar J. Hermann, a 200-light Heisler dynamo for long distance lighting, also series and alternating current lamps in circuit and one of the company's regulators.

The Canadian Pacific Railway Company had a telegraph office in one corner of the hall for the convenience of visitors.

The Canadian Electrical Construction Manufacturing and Supply Company, Montreal, exhibited a miniature model of Dansereau's electric wire subway system.

The Consolidated Electric Manufacturing Company, Boston, was ably represented by Mr. C. E. Bibber. The exhibit included a Wade dynamo register for indicating to the station manager the exact time any given circuit was or was not in operation. A flash is registered as readily and as accurately as when the current is off for longer periods. A C. E. M. Jack Knife switch was also exhibited and explained by Mr. Bibber, as was also the Davis improved arc light cut-out. Mr. Bibber distributed samples of T. J. Murphy's slate, used for switchboards, bases, etc.

The Jewell Belting Company, of Hartford, Conn., exhibited several rolls of its celebrated leather belting. A pamphlet entitled, "How Made; What It Has Done; What It Will Do," was distributed. Mr. C. L. Tolles was in charge.

Robt. Mitchell & Co., Montreal, had an exhibit of exquisitely designed electroliers, etc.

The Peru Porcelain Works, of Peru, Ind., had an exhibit of its porcelain goods, such as bases, fuse-blocks, etc.

The Peru Glass and Carbon Co., Peru, Ind., exhibited samples of battery jars, carbons, etc. All its goods are manufactured by natural gas.

The Johns-Pratt Co., Hartford Conn., had an attractive display of "Vulcabeston" goods, including moulded gaskets, packing rings, piston rod packing, etc. Some of the goods are water, fire and acid proof, and they are all water and fire proof.

The Bernstein Electric Co., Boston, had a neat exhibit of its celebrated lamps and fittings. Two lamps burned on standards, one on each of the booths, and several lamps for arc circuits were burning.

The National Carbon Co., of Cleveland, O., distributed its latest edition of its "Directory of Electric Arc Lighting Plants." This is a valuable work of reference.

The Kiosk used by Mr. Corriveau in the exhibit of his Company was made by the Simplex Electric Co., of Boston, and was a work of art. It attracted much attention and favorable comment.

The Edison-Lalande battery was included in the Edison exhibit. Samples of all types of this celebrated battery were exhibited.

Alexander, Barney & Chapin, 20 Cortlandt street, New York, had an exhibit in Room 265 in the Windsor Hotel. The company was represented by Mr. P. H. Alexander and Mr. H. G. Issertel. The exhibit consisted of lamps, sockets, switches, A, B, C incandescent lamps, Alexite cut-outs, the A, B, C dry battery, push buttons,

bells, etc. The great attraction, particularly for the younger folks, was the electric coach and yacht trumpet. This trumpet is operated by electricity and tunes can be rendered on it. The bicycle battery, made especially for use in connection with the electric trumpet on bicycles, is meeting with great success. The whole outfit is conveniently compact; it is an excellent thing for bicycle riders. A reception was held in the room one day during the week, at which 40 or 50 people were present, and on Wednesday night Mr. P. H. Alexander gave a dinner to 13 of his friends. Mr. Issertel is a hustler and made many friends for his company.

The Western Electric Co., corner of Greenwich and Thames streets, New York, had a very attractive exhibit, under the charge of Mr. Samuel A. Chase. The exhibit consisted of trunk samples of general electrical supplies, all mounted on boards. These samples included wires, cords, push buttons, all kinds of tools for linemen, all kinds of insulators, electric bells, cleats, connectors, and other line supplies. A complete set of Morse telegraph instruments were also shown, as were also a full and complete line of all kinds of gas lighting supplies and electric light supplies, such as switches, ammeters, voltmeters, cut-outs, sockets, etc.; also a line of American District apparatus. The new Phœnix Dry Battery, made by the Western Electric Co., was included in the exhibit. These are efficient batteries, as was proved by the fact that some cells had been ringing bells the entire week during the exhibit. The exhibit entire was compact, and the goods were displayed to the best advantage. Mr. Chase reported that good results had been obtained by the exhibit of his goods in a business way.

The Ball Electric Light Co., Limited, of Toronto, ran one arc and one incandescent dynamo, supplying 100 16 c. p. incandescent lamps and 15 arcs. It also had on exhibition other station apparatus. Wenstrom generators and motors were also shown.

The Hart & Hegeman Manufacturing Co., of Hartford, Conn., had an excellent display of Hart switches, celebrated throughout the land. In this switch, as is well-known, the actuating spring is a flat steel, three-leaf spring and as it is not in circuit, its temper is not affected by the current, while the make and break is instantaneous and reliable. Mr. Gerald W. Hart was in charge of the exhibit.

Robins & Sadler, Montreal, exhibited some belts made for the Royal Electric Co., of Montreal.

The Montreal Fire Brigade was represented by a chemical engine, in charge of Mr. R. Bennett.

The following named electrical journals were fully represented at the convention and exhibition : The Electrical Age, *The Electrical Engineer*, *Electrical Review*, *Electrical World*, *Electric Power*, *Electrical Industries*, *Power Steam*, *Electricity*, *Western Electrician*.

The Electrical Age had one of the most interesting exhibits in the hall. It consisted of a printing press operated by an Edison electric motor, on which the advertising pages of the daily bulletin of The Electrical Age were printed in many colors. By a new process several colors can be run on a press and printed at one impression. The various colors of ink blend beautifully and the result is beautiful in the extreme. This feature of the daily bulletin attracted a great deal of attention, and the compliments The Electrical Age staff received for their enterprise was extremely gratifying. Each day's edition of the bulletin was eagerly looked for, and when the papers appeared they were snatched up on short notice.

The following-named electrical journals had headquarters in the parlors of the hotel: The Electrical Age, *The Electrical Engineer*, *The Electrical Review*, *The Electrical World*, *Electricity*, *The Western Electrician*.

Fitzgerald's Combination Gas and Electric Universal Bracket attracted the attention of the station men and representatives of construction companies or its uniqueness. It can be turned in all directions, which is a great advantage, with the use of the incandescent lamp, in offices, stores, educational institutions, surgical and optical. The bracket is solid metal throughout. The action of the bracket is in the joint, which is just as is described—universal.

Snowy White was the exhibit of the Asbestos Steam Pipe Covering, made by Wm. Schlater & Co., of Montreal. Sections of covering for steam pipes, valves, joints, etc., were piled above each other in the booth in most appropriate manner, and attracted the eye from all parts of the exhibition.

The Toronto Construction and Electrical Supply Co., 63-69 Front street West, Toronto, Canada, was represented by Mr. Fred'k Nicholls, Manager of the Company, assisted by Mr. G. C. Stannard and A. J. Christie. A sign over the exhibit called immediate attention to the fact that they were from Toronto. On the front of the table in their double booth was a Partrick and Carter sample board of Monitor and wooden box bells, four-number annunciator, push buttons in various styles, bell pull, window springs, etc., all arranged on a handsome oak board 14x28 inches; these goods were all in operation; also a fine line of highly ornamental porcelain goods in cut-outs, switches, etc. The end of the booth was fitted out with a full line of incandescent system switches, fusible blocks, cut-outs, porcelain insulators, interior tubing, etc., Bernstien supplies, Eddy Motors, C. C. motor, Standard thermometers, Grimshaw white core wire, Standard Paint Co.'s P. & B. compounds, Ward arc lamps, etc.

The Crocker-Wheeler Electric Motor Co., of New York, had, under the charge of Mr. George W. La Rue, secretary of the Company, an exhibit of its well-known motors, including a reversible motor with automatic governor; several fan motors were also exhibited, and the smooth running and excellent appearance of the machines attracted considerable attention. Mr. La Rue during the week sold several motors and fan outfits to the McGill University, which speaks volumes in favor of this celebrated apparatus.

The New York Insulated Wire Co., 644–651 Broadway, New York, was represented by Mr. J. W. Godfrey, the general manager, and Mr. Augustus Noll, the electrician of the company. The exhibit consisted of Grimshaw white core wire, tapes, cables and compound, and "Vulca" wire ducts, single and double junction, angle and distributing boxes for complete fishing system of interior conduit, using cut-outs mounted on porcelain bases. In this system provision is made for inserting the tubes in the junction-boxes, so that the joints are rendered water tight. The ducts are hard and will not soften or collapse when placed in plaster or cement. They are absolutely moisture-proof and practically fire-proof. The tubing has a hard and even surface, making the insertion and withdrawal of wires a matter of easy accomplishment. It can be placed in plaster or cement, and will neither strain nor exude. It is made in sizes from ¼ to 1½ inches inside diameter. The duplex tube is made in sizes from ¼ to ½ inch inside diameter, and will readily take paint; it can be japanned, silvered or bronzed, and will also take a high polish, similar to hard rubber. It can be drilled or tapped, and its tensile strength is very high; it has sufficient rigidity to withstand the blow of a hammer. In connection with the display of tubes was a line of angles and "S" offsets. The boxes are finished in various colors and stained to match the surrounding woodwork. The tubes are made in 10-foot lengths, and the insulation resistance of the material compares favorably with high-grade rubber wires in the market. The Chicago house of this company is at 78, 80 and 82 Franklin street. Both Messrs. Godfrey and Noll gave the exhibit close attention and spoke decidedly hopeful concerning the future of their business.

The Union Electric Manufacturing Co. (J. M. Orford, president; H. T. Clark, vice-president; J. C. English, secretary and treasurer), manufacturers of electrical specialties, Bridgeport, Conn., U. S. A., exhibited its sockets and switches in the Toronto Electrical Supply Company's porcelain, guaranteed indestructible.

Amber mica, from Lake Girard mine, Wakefield, P. Q., Canada, used by the Edison Co., was exhibited in different sizes, set on a backboard and neatly framed. The frame was about 5x8 feet; at its base was a large section of the mica, five feet square.

Mr. Albert H. Mills, representing Steele & Johnson Manufacturing Company, Waterbury, Conn., and New York, made things pretty lively by his presence, and what Montrealers and the visitors do not know concerning the goods manufactured by this well-known house is not worth finding out.

"Oh, how beautiful those fans look!" was a remark frequently heard from the visitors as they passed by the exhibit of the Electrical Engineering and Supply Company, of Syracuse. The fans referred to consisted of three Packard lamps—red, white and blue—100 volts and 20 c. p., set on a spindle running through the exhibit-board, equipped with pulleys on the back, and revolved by a small Edison motor. Below the fans were 30 ground glass Packard incandescent lamps, artistically arranged to form the initials "E. E. S "—the initial letters of the firm. The company had one of its new 300 ampere switches mounted upon a white marble base. One of its double pole switches was mounted upon a white marble base on the board with the Packard lamps. In the way of Electric Railway supplies, of which the company makes a great specialty, trolley insulators were shown mounted on porcelain and with a special wire-locking device. The metal part of this insulator is malleable, to permit it to grasp the wire firmly, thus insuring perfect contact. There were also a number of pole tops, pull-offs, straight lines, railbond of galvanized iron, etc. The company also exhibited a 7½ H.-P. Jenny motor, for which it is agent in the States of New York, Pennsylvania and other Eastern States, as well as in the maritime provinces and Canada. Frank H. Leonard, Jr., vice-president, F. M. Hawkins, electrician, and J. L. Hinds, represented the company at the convention, and made a superb team. Mr. Leonard was accompanied by his wife.

E. P. Gleason Manufacturing Co. had an exhibit at the Windsor, Room 158, making a display of glassware for both gas and electric lighting, together with a complete line of electric light appliances. A special feature of the exhibit was an Iron Insulated Joint for gas and electric wires. Mr. Wm. F. Cullen represented the company.

F. Day Voorhees, the Norwich Insulated Wire Company's representative, after three days' search secured his exhibits and set them up in his handsomely-decorated booth. There were large reels of lead, covered underground wires and cables covered with the company's special paper insulator, fire and water-proof house and office wire, line and water proof wire, new arc-light connector for splicing wire. This takes the place of wiped joints, and one can test the wire at all times without disturbing the connector, by removing a screw-nut on top and forcing in a needle.

The Russell Electric Company, of Boston, had several Russell arc lamps in circuit to show the efficiency of the carbon disc. These lamps are in daily service in a number of stations and the reports from customers are of a gratifying character, the claims for perfect distribution of light, for economy in cost of trimming and in the consumption of carbon as well as current are very satisfactory.

Mr. Frank P Wisner, the quiet and gentlemanly representative of the Consolidated Fruit Jar Co., of New York, made many friends among the buyers of his goods. Mr. Wisner is a constant attendant of conventions and is extremely popular with all.

Mr. W. J. Morrison was there, representing the Fort Wayne Electric Company, the exhibit being located in the main Exhibition hall, near the rear entrance, and embraced a 750-light, compound wound alternator, and a 15-light arc machine—the one presented to the McGill University. The machines were operated by power furnished by the Windsor Hotel, where the company had the use of two boilers, and placed two Armington and Sims 50 H. P. engines, run by C. A. Schieren's Electric Perforated Belt (one of which was also used to run the machines exhibited.) It also furnished 20 H. P. to actuate the motor and dynamos in the Exhibition. Mr. R. L. Denis was in attendance. "Okonite"—never very far behind in the race for popularity, showed up a superb display of wires, cables, flexible cords—overhead, submarine, underground, aerial—in great reels which arrested one's progress through Victoria Rink. The exhibit was located to the right of the main entrance. All the wires were for incandescent lighting and power use, ranging from 1,000 to 7,000 megohms per mile after a week's rest in water. Great credit is due to Mr. George S. Manson and his associate, Mr. Jean A. Wetmore, for the prompt and able manner in which they worked away at their exhibit until they got it ready.

The Phœnix Glass Company, of Pittsburg, Pa., and New York, was well represented by General Manager A. H. Patterson, assisted by Mr. E. H. Peck, commonly known as "The Invincible." The company's exhibit was an extremely handsome one, and contained specimens of cut glass shades and incandescent bulbs of every imaginable form, including the beautiful cone and pear shaped stalactites; they had a full line of incandescent shades and bulbs in gorgeous array. A large, rich cut glass globe was suspended in front, in which was an 100 c. p. lamp in full blaze.

Among the beautiful lines of porcelain electrical specialties exhibited in the booth with the Electrical Engineering and Supply Co., of Syracuse, N. Y., and represented by the manufacturers (Messrs. Pass & Seymour, of Syracuse, N. Y.), was a rich set of china made by themselves and exhibited as a sample of their chinaware. This firm also displayed a full line of its porcelain electrical specialties, which are so well and favorably known throughout the country.

The Globe Electric Cordage Works, of Philadelphia, Pa., exhibited its latest improved lamp cord, which, it claims, is both fire and water-proof. Their cord has been tested by Mr. McDevitt, chief of the electrical department of the Board of Fire Underwriters of Philadelphia, Pa., who testifies to its fire proof qualities. The company had some

of its cord supplying current in its exhibit run through water in a glass jar. It also exhibited some of its rubber lamp cord, for which it makes the highest claims.

Heisler Electric Light Co., of Philadelphia, Pa., had a neat exhibit, consisting of one of its 200-light incandescent dynamos of 32 c. p. capacity, in conjunction with its automatic regulator and amperemeters, mounted in a case. This exhibit was arranged and supervised by Mr. Oscar Hermann.

The Standard Underground Cable Company exhibited sample goods of each kind and size of electric light cable just sold to the Minnesota Brush Co., of Minneapolis, the largest sale of cable on record.

Mr. W. W. Castle, so well known to every one in the electrical field, was on hand, as usual, booming P. & B. conduit, compounds, etc. Mr. Castle's rooster, which he got up for the Standard Paint Co., whose interest he jointly represents with the P. & B. Conduit Co., was admired by all.

The Norwich Insulated Wire Company, of New York, had an attractive display of its well-known insulated wires and cables. Mr. F. Day Voorhees had the booth elaborately decorated with bunting and Turkish rugs and held a continuous reception.

Royal Electric Company, of Montreal, supplied the current for the exhibits of the Electric Engineering and Supply Company, of Syracuse; the E. S. Greeley Company, New York; Ft. Wayne Company, Phœnix Glass Company, and Germania Company. The company kindly furnished men to help out the installation.

Toronto Construction and Supply Company had three Ward arc lamps in its exhibit in operation, and they spoke for themselves. They run on incandescent, alternating and railway circuits.

Miller Brothers & Toms, 110 to 122 King street, Montreal, headquarters for split-wood pulleys and bushings, furnished the split-wood pulley and bushing for the shafting used in running the electrical printing press at the Exposition.

The Engineering Equipment Company, 143 Liberty street, New York, and 126 Pearl street, Boston, showed samples of a new style trolley wire hanger.

Mr. James Partridge, representing the Partridge Carbon Company, of Sandusky, O., was on hand explaining the merits of his carbon brushes, which are now used so extensively throughout the States.

One of the most novel and interesting, as well as one of the most valuable of the many electrical exhibits at the Windsor Rink, was that of the Ries Electric Specialty Company, of Baltimore, Md. This company, which was represented by its President, Elias E. Ries, assisted by Lewis S. Greensfelder, showed an attractive line of its new regulating sockets for alternating current incandescent lamps, brought for the first time to the attention of the electrical fraternity. By means of this socket an incandescent lamp can be readily turned up or down like an ordinary gas jet, and made to burn at any desired degree of brilliancy, from a barely perceptible glow, consuming but one-tenth the normal current, up to the full candle-power of the lamp. The socket—which, by the way, has no wasteful resistance to consume the current—is adapted to lamps of any voltage and candle-power within its range, and for the first time in the history of electric lighting, places the incandescent lamp on a par with gas, and it affords a successful, practical and economical method of controlling the amount of light given by the lamps, and to effect a material saving both in the cost of current and in the life of the lamps. Mr. Ries certainly struck a popular chord when he produced that regulating socket, and his company has undoubtedly a future before it as brilliant as the glow of a 60 c.p. lamp.

Among the firms who distributed literature of an interesting character were: The D. Frisbie Company, L. J. Wing Company, the C. & C. Motor Co., New York Belting & Packing Co., H. A. Rogers, Gould & Eberhart, Newark and Fishkill Landing, and Abendroth & Root Mfg. Company, New York.

The Bryant Electric Company, Bridgeport, Conn., had a full line of specialties arranged in attractive form upon a handsome sample board, affording a striking appearance and attracting attention very quickly. Half the work of securing a customer is performed in having a magnetic exhibit; surely the Bryant company must have had that proverb in mind when preparing their display, well knowing that the self evident merits of its specialties would hold the customer once he purchased from the company.

The Weston Electrical Instrument Company, of Newark, N. J., had a large and varied display of Weston standard instruments arranged on a cabinet, covered with silk plush, including direct reading station ammeters ranging up to 1500 amperes; direct reading standard voltmeters with scales ranging from a fractional part of a volt to a full volt and then by uniform gradations up to 600 volts. Standard Weston multipliers were shown that increase the capacity of the voltmeters many fold. Weston's low reading ammeters and milli-ampere meters were also shown.

The Delaware Hard Fibre Company, of Wilmington, Del., gave out a convenient little piece of hard fibre as a souvenir and sample of the high quality of material it ships out on the orders that have been coming in every mail since it started in business. To manufacturers of specialties requiring the employment of hard fibre this exhibit contained much of interest.

Fibrone was one of the handsomest exhibits in the rink. The fair sex, as well as the supply dealer and the electrical manufacturer, were attracted to this exhibit. Every conceivable device used in electrical work was shown. The Fibrone Company's exhibit was a success.

The Thompson & Robertson Company, of New York, had the genial Louis Walsh, manager of the sales department, present to talk up the merits of the Fibrous dry battery it has lately placed on the market, as well as the Fibrous disque Leclanché cell it now supplies for open circuit work. Mr. Walsh's wide experience in batteries will insure a welcome to this new comer.

The Ferracute Machine Company, of Bridgeton, N. J., had an attractive exhibit on the side aisle near the rear of the rink. They expected to show some presses running with dies for setting armature discs, etc., but could not arrange for power to run them. They had an array of photographs of presses, dies and other sheet metal machinery and a large collection of samples of metal work in various forms used in electrical apparatus, such as armature discs, electrolier work, bells, etc. It showed a photograph of an immense press just built at the Edison factory.

Mr. H. W. Seller, of the Seller Water Tube Boiler Company, Electrical Exchange Building, 136 Liberty street, New York, was in attendance in the interest of his company. He exhibited a framed illustration of his new boiler, which attracted considerable attention.

The Thomson-Houston International Electric Company's exhibit was divided into two parts—one consisting of primary generating apparatus at McGill University, and another consisting of motors and the various electrical generators which they propelled at the exhibition hall. The engine at the McGill University was one of McIntosh-Seymour make, belted to two 50 H. P. series wound 500 volt T.-H. railway generators. The wires between the University and the rink consisted of three No. 0 wires for positive, and three of the same for negative. The wire was of the well-known Simplex brand. In the rink the exhibit included Crocker-Wheeler motors, a Robinson radial car truck, electric hoist, rock drill, and various motors and generators. The belting used at rink and University was supplied by the Page Belting Company, of Boston, and the J. C. McLaren Oak-tanned Belting, Montreal, Canada. The exhibit was planned by J. A. Waterman, chief engineer, assisted by J. W. Kirkland.

The exhibit of the Canadian District of the Edison General Electric Company was installed under the supervision of M. F. Barr, of Montreal. It consisted of miniature central station plant, including a complete sample of the underground system, two small 1,000 kilowatt dynamos operated on the three-wire system, all set up on a board and connected to Edison rheostats, ampere and volt meters. Other things exhibited by this company were three New England Butt Company's braiding machines, operated by an Edison motor; an electric flower stand with brilliantly-colored lights; a diamond drill; a coal-cutting machine; an electric percussion drill; central station switchboard; a 150 H. P. Edison motor and several smaller motors—all in the first section. In the second section were a new Edison arc dynamo; lamp fixtures; incandescent dynamos; a 150 H. P. Jumbo motor; a Bemis truck; cables of all kinds, and various other devices and apparatus which, with our limited space, it is not possible to mention in detail. The press on which the daily edition of THE ELECTRICAL AGE was printed was in this exhibit and was operated by a ½ H. P. Edison motor and J. C. McLaren's Oak-tanned Belting. These belts were used throughout in the Edison exhibit. Mr. Barr was assisted by W. W. Brenner, District Engineer of the Canadian District of the Edison company, and by Mr. W. R. Rosenstengle. The exhibit was a very complete and attractive one.

The Eugene Phillips Electrical Works, of Montreal, Canada, corner of Canal and Shearer streets, had a handsome exhibit of various makes of insulated wires and cables. The supervision of the construction of this neat exhibit was under Mr. John Carroll, the manager of the Phillips Electrical Works. The exhibit was canopied with a handsome sign composed of 16 candle power incandescent lamps, forming the name Phillips emblazoned in electric light, which called to mind the world famed Barnum (Phillips). The large number of reels of flexible wires and cables, magnet and annunciator wires and lamp cords dazzled the eye with their varigated colors.

An admirable piece of work was an elegant Moorish booth, about twenty-five feet high, and made of wrought iron. It was neatly covered with artificial vines. At the base were flowers. The interior contained interior and exterior views of the buildings of the McGill University, literature showing its growth, and statistics relative to the course of study pursued in the different departments. This booth was erected under the supervision of Mr. F. A. Barr, and designed by the combined ideas of General C. H. Barney, the general manager of the International Electrical Exhibition, and Mr. F. A. Barr, and developed on paper by Mr. F. W. H. Pointer, General Barney's secretary.

G. W. Hutchinson, of the Standard Electric Time Company, 739 Chapel street, New Haven, Conn., was found in one of the booths to the right of the entrance talking up the great advantages of Warner's pocket electrical gauges and electric time system and other wonders of the East, while surrounding him on all sides were all kinds of times waiting to be regulated by the Warner system.

The Standard Paint Company, 2 Liberty street, New York, were at the exhibition in full force and fully represented by its hustler, Mr. Frank S. DeRonde. He displayed in his tastily designed exhibit in a booth to the left of the main entrance a full line of its well-known P. and B. compounds, tapes, armature varnish, etc. Samples were arranged on tables; two of the tables represented the letters P. and B., with a realistic rooster mounted between them. Mr. DeRonde said the rooster crowed every time he made a sale. This design represents the well-known trade-mark of the Standard Paint Company.

The Electric Merchandise Company, of Chicago, had a display in parlors 14 and 16 in the hotel of a line of railway supplies and a Burton heater. Messrs. D. B. Dean and W. B. B. Wilcox, of the company, entertained their many callers and explained all the details of the Burton heater and other apparatus. The exhibit was neatly arranged.

Mr. Charles A. Schieren, Jr., of Charles A. Schieren & Co., Ferry and Cliff streets, New York, had a booth for an exhibit, but at last reports the goods had not reached the hall. Mr. Schieren was accompanied by Mr. G. H. Hamblet, the company's Boston agent.

The phonograph exhibit at the main entrance attracted a great deal of attention and delighted the crowds of visitors.

The E. S. Greeley & Co., 5 and 7 Dey street, New York, exhibited a full line of their well-known telegraph apparatus, including Morse instruments, testing sets, etc. Their stall was at the rear entrance of the hall, and Mr. C. P. Frey, chief electrician of the company, explained to all inquirers the uses of the various instruments. Mr. T. J. Smith, the manager, was also present and worked hard to make the exhibit a successful and attractive one.

The International Okonite Company, Limited, New York and London, as usual, was represented by a superb display of wire, flexible cords, overhead, submarine and underground cables on great reels. The exhibition was located at the right of the entrance. Great credit is due to Mr. George T. Manson and his associate, Mr. Jean A. Wetmore, for the excellence of the exhibit. It was very attractive and complete, and Okonite made a great name for itself in the Dominion. Capt. W. L. Candee was also present in the interest of the company.

The Shultz Belting Company, of St. Louis, was represented by Vice-President William P. Mullen, of Boston, who had samples of the leather belt links manufactured by his company.

J. W. Queen & Company, of Philadelphia, represented by Mr. E. G. Willyoung, had a small exhibit. This included a new design of Siemens'

electro-dynamometer and various other testing apparatus.

A Wing ventilating fan run by an electric motor, in the Edison Exhibit, attracted a good deal of attention; the fan was decorated with red, white and blue ribbons which fluttered violently in the current of air.

The California arc lamp, manufactured by the Interior Conduit and Insulation Co., 44 Broad street, New York, is of 100 volts and guaranteed to burn 90 hours. There is no shadow cast below the lamp. The lamp is 14 inches in size, over all, and on account of its smallness can be used in situations where the use of ordinary arc lamps would be impracticable. The company's automatic switch for operating incandescent circuits from any distant point, is also shown. It had also a large display of the celebrated interior tubing covered with cold rolled steel. In future the company will cover its tubing in this manner for ornamentation and exposed wiring. The new Johnson ampere meter, the new automatic cut-out to use with the automatic switch, and the new Johnson vice lock switch were also shown.

"Cyclone" and "Tornado" are the names used for the new oscillating and revolving motor and fan combination, shown by the La Boiteaux Electric Motor and Fan Co., of 375 Walnut street, Cincinnati, Ohio. The outfit consisted of a La Boiteaux motor, mounted on an upright spindle, and operated by the motion of the fans. The spindle extends through the back of the bearing, and slides over a tension segment spring, passing over and under the spring at every other vibration. The revolving fan motor "Tornado" revolves entirely by the action of the fan on the air, and was quite a novelty and well worth seeing.

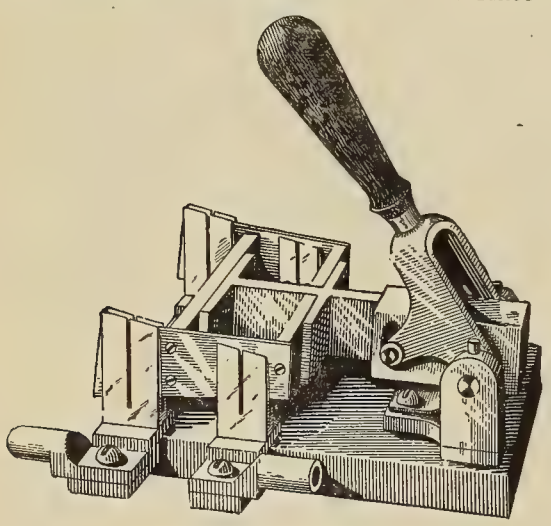
Germania Electric Co., of Boston, Mass., had an elegant exhibit of its incandescent lamps in all colors displayed on drop leaves set in rows on the face of an upright case, and arranged so that when the leaves were turned down the current was turned on, thus lighting the lamp. The lamps were fitted with the Germania bases and sockets. The exhibit also included a number of new Germania shade holders. Mr. O. K. Stewart, president of the company, looked after the exhibit.

NEW DOUBLE POLE SWITCH.

A new double pole quick breaking switch has just been patented and brought out by the Hunt Engineering Company, of Brooklyn, and is the climax of workmanship and efficiency.

The mechanical devices used for releasing the knives from the brushes and making a quick break are entirely original with the Hunt Engineering Company, and while they are extremely simple, they are most effective and satisfactory.

The whole switch is mounted on a slate base



DOUBLE POLE SWITCH.

with the terminals on the side, and a pair of knives insulated from each other and carried on a highly polished bar make and break the contact.

By an ingenious device, a fuse block is attached to the slate base of the switch and one terminal, so that at a slight cost fuse attachments can be added to the same.

The whole switch is compact, not liable to get out of order, and is intended to be used in all grades of electrical work or for lighting and power stations. The switches are made in four different sizes, carrying one, two, three and four hundred amperes; special sizes made to order.

THE BANQUET.

The crowning feature of the long series of entertainments provided for the Association and friends, took place Thursday night in the form of a most elegant banquet, in Windsor Hall. The occasion was honored by the presence of His Excellency Lord Stanley of Preston, Governor-General of Canada. At 9 P. M., to the music of the bagpipes, between 400 and 500 guests filed in the spacious hall and took their seats at the long rows of tables. The hall was exquisitely decorated with the American, Canadian and English flags, and long streamers depended from the ceiling down the side walls. The decorations were magnificent in the extreme, and elicited many complimentary remarks. The stage was covered with palms, ferns and other plants, behind which was an orchestra which alternated with the bagpipes at the opposite end of the hall in discoursing music. The instrumental music was enjoyed. Over the stage, stretched across the entire width of the hall, was a red streamer on which were the words, in gold letters, "Welcome to the Electrical Fraternity," and on the tables were placed potted plants. A long table ran completely along the length of the hall, at which the chairman, Sir Donald Smith, and the guests of the evening were seated. On the right of Sir Donald Smith were His Excellency the Governor-General, Judge Armstrong, Consul-General Knapp, Messrs. J. Francisco, W. C. McDonald, Justice Doherty, G. W. Phelps, Justice Mathieu, John Seely, C. F. Sise, Sir Henry Edwards, Gen. C. H. Barney, F. Nicholls, J. Hodgson. W. J. Johnson, A. J. Corriveau, ex-Mayor Beaugrand, Dr. Mason, D. Rice, J. I. Gulick, T. A. Redpath and J. W. Beane. On the left were Messrs. Peter Redpath, C. R. Huntley, T. C. Martin, John Molson, Hon. Mr. Laviolette, H. McLennan, E. F. Phillips, Justice Wurtele, J. J. Burleigh, Justice Cross, T. D. Lockwood, Sir Wm. Dawson, Justice Baby, Mayor McShane, J. I. Ayer, Lord Kilcoursie, A. D. C. to the Governor-General, and Professor Bovey. The menu was an elaborate one, and the viands were greatly relished by all. After cigars were lighted, speechmaking was indulged in.

At 10.30 Sir Donald Smith rose, and before commencing the toast list called on Mr. T. C. Martin to speak.

Mr. Martin made a neat speech, dealing with the hospitality of Montrealers and extolling the exertions of Professor Bovey, chairman of the reception committee. In recognition of their appreciation he asked him to accept a handsomely mounted phonograph, dwelling neatly on the enjoyment he might derive from it and the various uses he might put it to.

Professor Bovey was much moved by this unexpected gift, and replied in feeling and felicitous terms. He dwelt on the educational standing of Montreal and the facilities of McGill.

Sir Donald proposed the toast of "The Queen," which was enthusiastically drunk and greeted with the hearty singing of "God Save the Queen," and then proposed "The President of the United States," which was received with hearty and rousing American cheers.

Consul-General Knapp was loudly cheered on rising to respond, and he returned thanks for the hearty way in which the toast was honored.

The next toast appealed to every Canadian who knows Lord Stanley of Preston, and Sir Donald proposed it in a most happy way. The toast was received with prolonged cheers, and the company singing "For He's a Jolly Good Fellow," the band following with "Vive la Canadienne."

His Excellency made a felicitous speech in reply. It was, he said, a pleasure for him to be present and place himself in line with the citizens of Montreal and of the Dominion to welcome those who came over the border on this occasion. He was deeply grateful to them for bringing their exposition into a neighboring and friendly state. Their ability demanded, and they had a right to expect, a welcome at the hands of any nation on earth.

Sir Donald then called on ex-Mayor Beaugrand to propose "Our Guests, the N. E. L. A.," which he did in a most appropriate manner, the band playing "Yankee Doodle," and the audience singing "For They Are Jolly Good Fellows."

Mr. Huntley, in reply, after returning thanks for the reception that had been accorded to the Association, and noting the success of its first meeting on foreign soil, referred to the broadness of electrical science, which recognized no nationality. The glory of the discoverers and inventors was a common heritage the world over. The Association represented one of the largest industries in the United States. There were now about 2,000 central station plants and some 6,000 or 7,000 isolated plants operating half a million arc lamps and not far short of five or six million incandescent lamps. The investments reached $150,000,000. Besides this, there were 400 electric railways, representing an outlay of $50,000,000 and carrying 750,000,000 passengers a year. There was a grand field for development in the electrical field in Canada, where it could expand and develop with the country. Mr. Huntley closed by extending an invitation to Canadians to attend the Chicago meeting in 1893.

At this point Sir Donald Smith presented Mr. Huntley with a handsome souvenir, an elegant gold-mounted ebony gavel, in recognition of his popularity, and Mr. Huntley replied in fitting terms.

Judge Armstrong in an eloquent speech proposed "The City of Montreal," to which Mayor McShane and others responded.

Gen. Barney then proposed "McGill University," coupling with the toast the name of Sir William Dawson.

Sir William's reply was characteristic. He spoke of the pioneers in electrical science who knew not of the practical possibilities of that which they barely comprehended, of the present state of the science, and prophesied that the future meant an electrical age with the new great power as the most potent factor of the age, a factor which would eliminate the boundaries of the city from those of the country.

Mr. John Carroll read letters of regret from Mr. Thomas A. Edison, Lord Lathom, Sir Joseph Hickson, Hon. A. W. Ogilvie, Messrs. Richard White, R. B. Angus, W. W. Ogilvie, Mr. Archambault and T. G. Shaughnessy.

Mr. J. I. Ayer proposed "The Citizens' Committee," which was responded to by Mr. John Kennedy, Mr. A. J. Corriveau, Mr. J. Carroll and others.

"The Ladies," "The Electrical Press" and "Electrical Science," the "Local Press," were suitably honored, and the banquet broke up at an advanced hour.

The arrangements were all perfect and reflected great credit on the committee, consisting of Messrs. John Carroll, chairman; W. E. Christie, John Kennedy, S. C. Stevenson, A. J. Corriveau and G. B. McFarlane.

THE ATTENDANCE.

The following is a complete list of those present at the Convention:

Abell, C. L. and wife, Thomson-Houston E. L. & Power Co., Buffalo.
Abell, Miss, Buffalo.
Ackerman, P. C., American Electrical Works, New York.
Ayer, James I., Municipal E. L. & P. Co., St. Louis.
Alexander, P. H., A. B. C. Co., New York.
Adams, M. F., New York.
Armstrong, E. A., Camb., N. J., H. R. R. Co.
Armstrong, Miss E. W., Camden, N. J.
Austin, G. L. and wife, Boston.
Adams, Milton F., New York.
Anderson, J. C., Toronto.
Babcock, W. R., C. Vt. R. R.
Bailey, G. C., J. A. Roebling Sons, Chicago, Ill.
Baker, Jr., C. O. and wife, Baker & Co., New York.
Baker, Thomas, Peru, Ind.
Barberie, E. T., Safety Insulated Wire Co., New York.
Barney, C. H.
Barney, Mrs. C. H.
Barney, Miss Estella J.
Barr, F. A., Toronto.
Bartlett, E. E. and wife, New York.
Beane, J. W., Syracuse, N. Y.
Beardsley, W. H. and wife, Standard Oil Co.
Belknap, C., T.-H. Elec. Co., Boston.
Bell, Dr. Louis, New York.
Bibber, C. E. and wife, Can. Elec. Mfg. Co., Boston.
Bishop, G. W. and wife, Boston.
Blaxter, G. H., Alleghany County Light Co., Pittsburg.
Bournonville, A., Alfred F. Moore, Philadelphia.
Bovey, H. T., Montreal.
Bowman, Fred. A., New York.
Braddell, Alfred E., Insurance Inspector, Philadelphia.
Brophy, Capt. Wm., Boston.
Brown, Maybin W. and wife, Boston.
Bryant, W. C., Bryant Elec. Co., Hartford, Conn.
Burdick, J. R., H. W. Johns Co., New York.
Burghardt, G. H., Boston.
Blackwell, E., Montpelier, Vt.
Baker, J. L., *Western Electrician*, Chicago.
Barker, F. E., Boston.
Ball, G. M., Pitts. West. Elec. Co.
Boulton, W. H., Buffalo, Al. Carbon Co.
Bogart, A. L. and wife, New York.
Barnes, C. R., City Electrician, Rochester, N. Y.
Baird, M. E., Eddy El. Co., Windsor, Conn.
Baird, N. E., Windsor, Conn.
Beggs, J. I., Edison Co., Chicago.
Burns, P. C., Peru, Ind.
Brownlowe, J. and wife, Tuxedo, N. Y.
Buell, A. A. Burlington, Vt.
Barker, T., Manchester, N. H.
Babcock, E. L., Cuyahoga Falls, Ohio.
Bradley, W. G., Ottawa.
Bigelow, Charles H., Boston.
Bissell, J. N., Brooklyn, N. Y.
Bottomley, H., Germania Elec. Co., Lynn, Mass.
Barr, M. D., Toronto.
Barnes, C. R., Rochester, N. Y.
Burleigh, John J., Camden, N. J.
Burleigh, Miss Retta, Camden, N. J.
Crouse, J. B., Cleveland, O.
Corriveau, A. J., Montreal.
Corbett, M. W., Edison Gen. Elec. Co., Montreal.
Candee, John N., Poughkeepsie.
Currier, C. W., Boston.
Coggshall, Henry F., Fitchburg, Mass.
Churchill, W. H., Edison Gen. Elec. Co., New York.
Coleman, S. G., Milwaukee, Wis.
Colvin, F. R., *Electrical Engineer*, New York.
Cleveland, W. B., Cleveland, O.
Cram, H. B., Bernstein Elec. Co., Boston.
Crandell, A. B., Boston.
Corey, R. B., Ward Arc Lamp, New York.
Clower, D. M., Dallas, Tex.
Cavell, E. V., Street Railway News, New York.
Cutter, George H. and wife, Chicago.
Crandell, C. D.
Clark, C. A., R. S. Hale & Son, Malden, Mass.
Currier, Miss E. T.
Colbeer, John, San Francisco.
Currier, J. W., Troy, N. Y.
Chenowith, A. C., New York.
Clark, A. T., Boston.
Caldwell, E., *Electrical World*, New York.
Candee, W. L. and wife, International Okonite Co.
Carroll, John, Montreal.
Caruthers, J., Rutland, Vt.
Castle, W. W. and wife, P. & B. Conduit, New York.
Chase, Samuel A., Western Electric Co., New York.
Childs, A. E., Montreal.
Chinnock, F. R., Edison General Electric Co., New York.
Christie, A. J., St. John, N. B.
Church, J. H. C., Richmond Iron Works, Great Barrington, Vt.
Clark, C. A., Boston.
Clark, Miss E., Buffalo.
Close, A. T., Boston.
Clower, D. M., Boston.
Cole, Stephen L., New York.
Craig, J. H., Holtzer Cabot Co., Boston.
Crane, W. F. D., Engineering Equipment Co., New York.
Crosby, E. H., *Post*, Boston.
Cullen, Wm. F., E. P. Gleason Co., New York.
Daggett, H. M. and wife, Boston.
Dallon, F. L. and wife, Police Department, Brooklyn.
Davenport, G. W., Boston.
Davis, A. E., New York.
Davis, E. T., New York.
De Land, F., New York.
De Ronde, F. S., New York.
Dillont, C. J. F., New York.

electro-dynamometer and various other testing apparatus.

A Wing ventilating fan run by an electric motor, in the Edison Exhibit, attracted a good deal of attention; the fan was decorated with red, white and blue ribbons which fluttered violently in the current of air.

The California arc lamp, manufactured by the Interior Conduit and Insulation Co., 44 Broad street, New York, is of 100 volts and guaranteed to burn 90 hours. There is no shadow cast below the lamp. The lamp is 14 inches in size, over all, and on account of its smallness can be used in situations where the use of ordinary arc lamps would be impracticable. The company's automatic switch for operating incandescent circuits from any distant point, is also shown. It had also a large display of the celebrated interior tubing covered with cold rolled steel. In future the company will cover its tubing in this manner for ornamentation and exposed wiring. The new Johnson ampere meter, the new automatic cut-out to use with the automatic switch, and the new Johnson vice lock switch were also shown.

"Cyclone" and "Tornado" are the names used for the new oscillating and revolving motor and fan combination, shown by the La Boiteaux Electric Motor and Fan Co., of 375 Walnut street, Cincinnati, Ohio. The outfit consisted of a La Boiteaux motor, mounted on an upright spindle, and operated by the motion of the fans. The spindle extends through the back of the bearing, and slides over a tension segment spring, passing over and under the spring at every other vibration. The revolving fan motor "Tornado" revolves entirely by the action of the fan on the air, and was quite a novelty and well worth seeing.

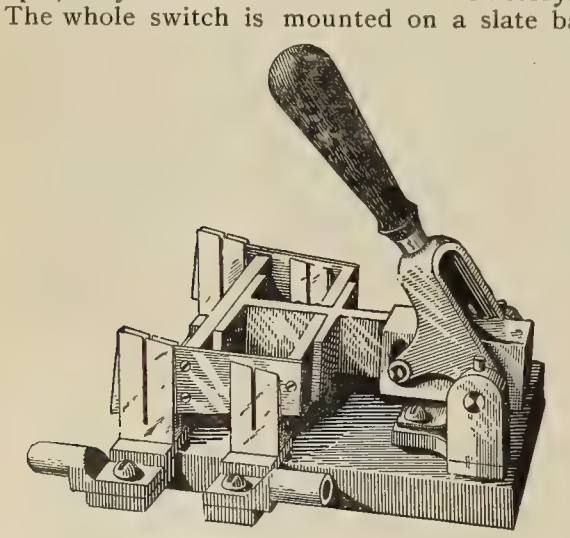
Germania Electric Co., of Boston, Mass., had an elegant exhibit of its incandescent lamps in all colors displayed on drop leaves set in rows on the face of an upright case, and arranged so that when the leaves were turned down the current was turned on, thus lighting the lamp. The lamps were fitted with the Germania bases and sockets. The exhibit also included a number of new Germania shade holders. Mr. O. K. Stewart, president of the company, looked after the exhibit.

NEW DOUBLE POLE SWITCH.

A new double pole quick breaking switch has just been patented and brought out by the Hunt Engineering Company, of Brooklyn, and is the climax of workmanship and efficiency.

The mechanical devices used for releasing the knives from the brushes and making a quick break are entirely original with the Hunt Engineering Company, and while they are extremely simple, they are most effective and satisfactory.

The whole switch is mounted on a slate base



DOUBLE POLE SWITCH.

with the terminals on the side, and a pair of knives insulated from each other and carried on a highly polished bar make and break the contact.

By an ingenious device, a fuse block is attached to the slate base of the switch and one terminal, so that at a slight cost fuse attachments can be added to the same.

The whole switch is compact, not liable to get out of order, and is intended to be used in all grades of electrical work or for lighting and power stations. The switches are made in four different sizes, carrying one, two, three and four hundred amperes; special sizes made to order.

THE BANQUET.

The crowning feature of the long series of entertainments provided for the Association and friends, took place Thursday night in the form of a most elegant banquet, in Windsor Hall. The occasion was honored by the presence of His Excellency Lord Stanley of Preston, Governor-General of Canada. At 9 P. M., to the music of the bagpipes, between 400 and 500 guests filed in the spacious hall and took their seats at the long rows of tables. The hall was exquisitely decorated with the American, Canadian and English flags, and long streamers depended from the ceiling down the side walls. The decorations were magnificent in the extreme, and elicited many complimentary remarks. The stage was covered with palms, ferns and other plants, behind which was an orchestra which alternated with the bagpipes at the opposite end of the hall in discoursing music. The instrumental music was enjoyed. Over the stage, stretched across the entire width of the hall, was a red streamer on which were the words, in gold letters, "Welcome to the Electrical Fraternity," and on the tables were placed potted plants. A long table ran completely along the length of the hall, at which the chairman, Sir Donald Smith, and the guests of the evening were seated. On the right of Sir Donald Smith were His Excellency the Governor-General, Judge Armstrong, Consul-General Knapp, Messrs. J. Francisco, W. C. McDonald, Justice Doherty, G. W. Phelps, Justice Mathieu, John Seely, C. F. Sise, Sir Henry Edwards, Gen. C. H. Barney, F. Nicholls, J. Hodgson. W. J. Johnson, A. J. Corriveau, ex-Mayor Beaugrand, Dr. Mason, D. Rice, J. I. Gulick, T. A. Redpath and J. W. Beane. On the left were Messrs. Peter Redpath, C. R. Huntley, T. C. Martin, John Molson, Hon. Mr. Laviolette, H. McLennan, E. F. Phillips, Justice Wurtele, J. J. Burleigh, Justice Cross, T. D. Lockwood, Sir Wm. Dawson, Justice Baby, Mayor McShane, J. I. Ayer, Lord Kilcoursie, A. D. C. to the Governor-General, and Professor Bovey. The menu was an elaborate one, and the viands were greatly relished by all. After cigars were lighted, speechmaking was indulged in.

At 10.30 Sir Donald Smith rose, and before commencing the toast list called on Mr. T. C. Martin to speak.

Mr. Martin made a neat speech, dealing with the hospitality of Montrealers and extolling the exertions of Professor Bovey, chairman of the reception committee. In recognition of their appreciation he asked him to accept a handsomely mounted phonograph, dwelling neatly on the enjoyment he might derive from it and the various uses he might put it to.

Professor Bovey was much moved by this unexpected gift, and replied in feeling and felicitous terms. He dwelt on the educational standing of Montreal and the facilities of McGill.

Sir Donald proposed the toast of "The Queen," which was enthusiastically drunk and greeted with the hearty singing of "God Save the Queen," and then proposed "The President of the United States," which was received with hearty and rousing American cheers.

Consul-General Knapp was loudly cheered on rising to respond, and he returned thanks for the hearty way in which the toast was honored.

The next toast appealed to every Canadian who knows Lord Stanley of Preston, and Sir Donald proposed it in a most happy way. The toast was received with prolonged cheers, and the company singing "For He's a Jolly Good Fellow," the band following with "Vive la Canadienne."

His Excellency made a felicitous speech in reply. It was, he said, a pleasure for him to be present and place himself in line with the citizens of Montreal and of the Dominion to welcome those who came over the border on this occasion. He was deeply grateful to them for bringing their exposition into a neighboring and friendly state. Their ability demanded, and they had a right to expect, a welcome at the hands of any nation on earth.

Sir Donald then called on ex-Mayor Beaugrand to propose "Our Guests, the N. E. L. A.," which he did in a most appropriate manner, the band playing "Yankee Doodle," and the audience singing "For They Are Jolly Good Fellows."

Mr. Huntley, in reply, after returning thanks for the reception that had been accorded to the Association, and noting the success of its first meeting on foreign soil, referred to the broadness of electrical science, which recognized no nationality. The glory of the discoverers and inventors was a common heritage the world over. The Association represented one of the largest industries in the United States. There were now about 2,000 central station plants and some 6,000 or 7,000 isolated plants operating half a million arc lamps and not far short of five or six million incandescent lamps. The investments reached $150,000,000. Besides this, there were 400 electric railways, representing an outlay of $50,000,000 and carrying 750,000,000 passengers a year. There was a grand field for development in the electrical field in Canada, where it could expand and develop with the country. Mr. Huntley closed by extending an invitation to Canadians to attend the Chicago meeting in 1893.

At this point Sir Donald Smith presented Mr. Huntley with a handsome souvenir, an elegant gold-mounted ebony gavel, in recognition of his popularity, and Mr. Huntley replied in fitting terms.

Judge Armstrong in an eloquent speech proposed "The City of Montreal," to which Mayor McShane and others responded.

Gen. Barney then proposed "McGill University," coupling with the toast the name of Sir William Dawson.

Sir William's reply was characteristic. He spoke of the pioneers in electrical science who knew not of the practical possibilities of that which they barely comprehended, of the present state of the science, and prophesied that the future meant an electrical age with the new great power as the most potent factor of the age, a factor which would eliminate the boundaries of the city from those of the country.

Mr. John Carroll read letters of regret from Mr. Thomas A. Edison, Lord Lathom, Sir Joseph Hickson, Hon. A. W. Ogilvie, Messrs. Richard White, R. B. Angus, W. W. Ogilvie, Mr. Archambault and T. G. Shaughnessy.

Mr. J. I. Ayer proposed "The Citizens' Committee," which was responded to by Mr. John Kennedy, Mr. A. J. Corriveau, Mr. J. Carroll and others.

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Churchill, W. H., Edison Gen. Elec. Co., New York.
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Currier, J. W., Troy, N. Y.
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Church, J. H. C., Richmond Iron Works, Great Barrington, Vt.
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Clark, Miss E,, Buffalo.
Close, A. T., Boston.
Clower, D. M., Boston.
Cole, Stephen L., New York.
Craig, J. H., Holtzer Cabot Co., Boston.
Crane, W. F. D., Engineering Equipment Co., New York.
Crosby, E. H., *Post*, Boston.
Cullen, Wm. F., E. P. Gleason Co., New York.
Daggett, H. M. and wife, Boston.
Dallon, F. L. and wife, Police Department, Brooklyn.
Davenport, G. W., Boston.
Davis, A. E., New York.
Davis, E. T., New York.
De Land, F., New York.
De Ronde, F. S., New York.
Dillont, C. J. F., New York.

Dickerson, J. W., *Electricity*, Chicago.
Donnelly, W. T., Universal Loom Co., Taunton, Mass.
Donohue, F. E. and wife, Boston.
Donohue, Miss.
Dow, C. T., Electric Light Co., Somerville, Mass.
Doying, W. D. E., Summit, N. J.
Dunham, S. E., Danbury, Conn.
Dowse, W. F., Boston.
Dean, D. B., Elec. Mer. Co., Chicago.
Daggett, H. M. Jr., Attleboro, Mass.
Dee, J. R., Penin. E. L. & C. Co., Haughton, Mich.
Dolbeer, Miss Susan, Short Falls, New York.
Dolbeer, Miss Bertha, San Francisco.
Estabrook, R. I., Cambridge, Mass.
Evarts, O., New York.
Eaton, L. W., Bridgeport.
Field, C. J., New York.
Ford, A. W., Brooklyn.
Freet, A. W., Canal Boat P., New York.
French, H. M. and wife, Boston.
Fairbanks, H. H. and wife, Boston.
Ferguson, C. G., New York City Press Association, New York.
Findley, J. H., Gas and Electric Co., Ogdensburg, N. Y.
Fish, H. C., St. Johns.
Foote, Allen R., Washington, D. C.
Foster, Horatio A., Special Census Agent, New York.
Francisco, M. J., Rutland, Vt.
Francisco, Mrs. M. J., Rutland, Vt.
Francisco, Master, D. C., Rutland, Vt.
Francisco, J. H., Rutland, Vt.
Freidley, J. H., Ogdensburgh, N. Y.
Faunce, A. B. Quincy, Ill.
Fry, C. C., Page Belting Co., Boston.
Frey, C. P.. E. S. Greeley & Co., New York.
Fuld, A. B., Boston.
Godfrey, J. W., New York Insulated Wire Co., New York.
Gordon, W. H., W. H. Gordon & Co., New York.
Greene, S. D., New York.
Greenfelder, Lewis L., Baltimore.
Guild, C. T., North Attleboro, Mass.
Gard, T. W. and wife, New London, Ct.
Gulick, J. I., New York.
Guy, G. H., *Electricity*, New York.
Hornesby, J. A., World's Col'n. Ex., Chic.
Hale, W. S., New York.
Hamblet, G. H., C. A. Schieren & Co.. Boston.
Hamilton, B. F. and wife, Sawyer-Man Electric Co., New York.
Hale, J. V., Boston.
Hammer, William J., New York.
Hanley, A. T., Boston, Passenger Agent, Cent. Vt. R. R.
Harrington, F. W., Trop. American Telephone Co.
Hart, L. H., *Electrical World*, New York.
Hatch, E. B., Johns-Pratt, Hartford, Conn.
Hawkins, F. M., Syracuse Elec. Eng. & Sup. Co.
Haywood, Miss L.
Hazeltine, C. W., Parker-Russell M. & M., St. Louis.
Hill, F. T. G., Boston.
Hinds, J. L., Syracuse Elec. Eng. & Sup. Co.
Hunt, W. T., wife and child, ELECTRICAL AGE, New York.
Hammell, Miss E., Philadelphia.
Hart, G. W., Hartford, Conn.
Hayes, Henry, Newark, N. J.
Hathaway, W. A., Providence, R. I.
Hunter, D., Jr., City Lighting Station, Alleghany, Pa.
Hunter, R. J., Patterson, Godfried & Hunter, New York.
Huntley, C. R., Prest. N. E. L. A., Buffalo, N. Y.
Hutchinson, G. W. and wife, New Haven, Conn.
Haveland, J. W., Brooklyn.
Hall, C. S. and wife, Short Falls, N. Y.
Hayward, Mr. and wife, New York.
Herman, J. F. and wife, Boston.
Herman, H. N., Boston.
Issertel, Henry G., Alexander, Barney & Chapin, New York.
Johnston. Albert Edward.
Johnston, Master Franklin Allen.
Johnston, W. J., wife, child and maid, New York.
Johnson, P., Toronto Ball E. L. Co.
Johnson, W. H., Toronto.
Knudson, A. A., St. John, N. B.
Keefer, E. S., Western Electric Co., New York.
Kelly, James F., Edison Gen. Elec. Co.
Kirkland, J. W., T.-H. Co., Boston.
Knight, J. C., New York.
Kreidler, W. A., *Western Electrician*, Chicago.
LaRue, G. W. and wife, Crocker Wheeler Motor Co., New York.
Law, M. D., Schenectady. N. Y.
Lean, G. R., Bernstein Co., Boston.
Leonard, F. H., Jr., Elec. Eng. & Sup. Co., Syracuse, N. Y.
Leonard, H. Ward, H. Ward Leonard & Co., New York.
Linnill, H. M., Montreal.
Lockwood, T. D., Bell Telephone Co., Boston.
Lowrie, S. N.
Lufkin, H. L. and wife, C. & C. Motor Co., New York.
Lynch, William A. and wife, Canton E. L. & Power Co., Canton, O.
Little, E. W., Interior Conduit Co., New York.
Lesasge, L. I., Dep. Rys. and Canals, Montreal.
Luncy, C. F. and wife, Chicago.
Long, J. A., Cuyahoga Falls, Ohio.
La Boiteau, F. M.,Cincinnati, O.
Mortimer, C. H., Toronto.
Myerson, E., New York.
Munger, A. S., Woodhaven, L. I.
Moore, A. P. Syracuse, N. Y.
Middleditch, Rev. Robert Henry, Brooklyn.
Middleditch, Miss Marguerite, Brooklyn.
McHaffie, Mr. and Mrs. Robert, Cohoes, N. Y.
McDavitt, William, Philadelphia, Pa.
McDonald, Mrs. S. B.
McFarlane, L. B., Montreal.
McIntire, C. H., Copper Joints, Newark, N. J.
McIntyre, J. D.
McLaren, D. W.
McLaughlin, J. R., Detroit, Mich.
McMullen, R. H., Lafayette, Ind.
McQuaide, J. P., National Conduit Co., New York.
McShain, Mrs. J., Montreal.
Meyers, J. L., New York.
Moore, W. H., Weston Elec. Inst. Co., Newark, N. J.
Magee, F. A., Eng. Equip. Co., Boston.
Monroe, P. G., Stationary Engineer, &c., Chicago.
Meeker, G. A., Grimshaw Wire, New York.
Muir, John, Edison Co., New York.
Maher, E. W. and wife, Albany, N. Y.
Manwaren, A. H., Brush Elec. Light Co., Philadelphia.
Manson, George T. and wife, Okonite Co., New York.
Marsh, J. W., Pittsburg, Pa.
Martin, T. C., *Electrical Engineer*, New York.
Mason, A. F. and wife, Boston.
Mason, F. C. and wife, Fire Tel. Dept., Brooklyn.
Miller, J. C., Buffalo.
Mills, A. H., Steele & Johnson Manufacturing Company, Waterbury, Conn.
Moore, W. H. and wife.
Morrison, W. J., Woodstock E. L. & Street Ry. Co., Toronto.
Myerson, E., Stenographer, New York.
Newton, A. D., Hartford.
Nicholls, C. M., Providence, R. I.
Nicholls, F. and wife, Toronto.
Nicholls, Master H., Toronto.
Naughton, J. W., Brooklyn, N. Y.
Ness, T. W., Montreal.
Noll, Augustus, New York Insulated Wire Co., New York.
O'Day, Charles, Buffalo.
O'Neil, William G., Montreal.
Odell, H. B. and wife, Newburgh, N. Y.
Ogden, S. R.
Ogle, G. Everett, Woolen Co., Great Barrington, Vt.
Orford, J. M. and wife, Bridgeport, Conn.
Oscanyan, P. C., New York.
O'Hara, John B., *Western Elec.*, Chicago.
Outcault, R. F., New York.
Possons, N. S., Eur. Tem., Cop. Co., Cleveland, O.
Platt, J. B., Augusta.
Porter, G. F., Philadelphia.
Palmer, F. S., Ellsworth, Me.
Parker, C. A., Boston.
Parker, G. W., St. Louis.
Partridge, James, Sandusky, O.
Paine, C. McL., *Electricity*, New York.
Pass, James, Pass & Seymour, Syracuse.
Patterson, A. H. and wife, Phœnix Glass Co., New York.
Pearce, Frederick and wife, Pearce & Jones, New York.
Pearson, W. B., Pearson & Co., Chicago.
Peck, E. F. and wife, Citizen's Illuminating Co., Brooklyn.
Peck, E. H., New York.
Perrine, F. A. C., J. A. Roebling's Sons, Trenton, N. J.
Phelps, G. M., *The Electrical Engineer*, New York.
Phillips, Eugene F., American Electrical Works, Providence, R. I.
Phillips, J. J., North East Pa.
Phillips, E. Rowland, Providence, R. I.
Phillips, J. R., Eureka Tempered Copper Co., North East Pa.
Pierrez, J. C., Goodrich Hard Rubber Co., New York.
Platt, J. B., Augusta, Ga.
Price, C. B., Boston.
Price, C. W. and wife.
Reade, R. P., Rome, Mich.
Richards, H. T., *Electrical Review*, New York.
Richmond, C. T. and wife, T.-H. Carbon Co., Fremont, O.
Ri Dall, J. E., Brush Electric Co., Pittsburg, Pa.
Ries, Elias E., Ries Electric Co., Baltimore.
Roach, M. C., Agent N. Y. C. R. R.
Rodman, Chas. L., Globe Carbon Co., Cleveland, O.
Rosenstengel, W. R., Edison General Electric Co., Toronto.
Royce, F. W., Washington.
Russell. J. L., Everett Woolen Co., Great Barrington, Vt.
Ryan, R. W., Stenographer, New York.
Ryckman, J. W., Augusta, Ga.
Rosenstamm, S., New York.
Redman, G. A. and wife, Rochester, N. Y.
Rollins, E. W., Denver, Col.
Sutphen, E. W., New York.
Street, A. W., New York.
Sunderlin, L. Rochester, N. Y.
Sullivan, M. J., New York.
Stanhope, W. H., Del. Hard Fibre, Wilmington, Del.
Smith, C. D., National Carbon Co., Cleveland, O.
Sheehy, R. J. and wife, New York.
Smiley, H. G., Globe Electric Cordage, Chicago.
Stannard, G. C., Toronto Con. & E. S. Co., Toronto, Ont.
Swain, E. D. and wife, Chicago.
Sunderlin, Rochester, N. Y.
Slater, C. E., Asbestos, Montreal.
Sanderson, M. B. & S. H. Thomson Co., Montreal.
Schieren, C. A. Jr., Belting, New York, N. Y.
Scott, C. E., Bristol, Pa.
Seely, J. A. and wife, Com. Elec. Con. Co., New York.
Seller, H. W., Seller Water Tube Boiler Co., New York.
Seymour, A. P., Syracuse Electric Light and Power Co.
Shain, Chas. D., Edison Co., New York.
Shainwald, Ralph L., President Standard Paint Co., New York.
Shaw, A. C., *Electric Engineer*, Boston.
Shippy, H. L., The John A. Roebling's Sons & Co., New York.
Smith, Miss Emily.
Smith, Fred. F., Ferracute Machine Co., Bridgeton, N. J.
Smith, J. K. and wife, Waterbury, Conn.
Smith, W. D., Nat. Carbon Co., Cleveland, O.
Smith, H. J., New York.
Smith, T. J. and wife, The E. S. Greeley & Co., New York.
Smith, Master Albert H.
Stanley, Hy. D.. Bridgeport Brass and Copper Co.
Starr, C. C., Halifax, N. S.
Steinberger, Jos., Fibrone Co., New York.
Steiringer, L., New York.
Stewart, O. K. and wife, Boston.
Stillwell, L. B., Westinghouse Elec. & Mfg. Co., Pittsburg.
Stiness, S. and wife, Pawtucket, R. I.
Stump, C. E. and wife, *Street Railway Journal.*
Steinburger, J.
Sullivan, M. C., Edison Co., New York.
Sweeten, F. D., Wilmington, Del.
Swetland, H. M. and wife, *Power and Steam*, New York.
Smith, T. Carp, Philadelphia.
Tyson, F. C., Wilmington, Del.
Taltavall, J. B., ELECTRICAL AGE, New York.
Taltavall, T. R., ELECTRICAL AGE, New York.
Taylor, S. F., Bryant Elec. Co., Bridgeport, Conn.
Taylor, William, Elec. Sup. Co., Chicago.
Tudor, H. C., Baltimore.
Tolles, C. L., Jewell Belting Co., Hartford.
Toms, L. W., Montreal.
Try, Mr., Boston.
Tyson, F. C., Washington, D. C.
Urquhart, D. F., Boston.
Vallee, G. A., Vallee Bros., Philadelphia.
Vance, A. S., H. W. Leonard & Co., New York.
Voorhees, F. Day, Norwich Ins. Wire Co., New York.
Vanderweyde, Prof. P. H., New York.
Wiman, Hon. Erastus, New York.
Woodward, W. C., Boston.
Wilcox, W. R. B., Elec. Mer. Co., Chicago.
Washington, J., Chicago.
Weir, F. W., Chicago.
Willyoung, E. L., Philadelphia, Pa.
Warner, E. M., N. H. Conn. Time Co.
Wilson, J. S., *Electrical Enterprise*, Boston.
Walsh, Louis, Thompson & Robertson, Express Building, New York.
Walters, W. R., Chicago.
Waterman, J. A., Boston.
Western, Benjamin R. and wife, Manufacturers' Advertising Bureau, New York.
Western, Percy.
Wetmore, Jean A., Okonite Co., New York.
Wheeler, Dr. S. S. and wife, Crocker-Wheeler Elec. Motor Co., New York.
Whitney, L. C., New Britain, Conn.
Whitney, Mr., Boston.
Weeks, E. R., Kansas City, Mo.
Warner, C. D. and wife, New Haven, Conn.
Watson, William, Bay Shore, L. I.
Wilhelmi, E. A., New York.
Wetzler, Joseph, *Electrical Engineer*, New York.
Whittier, R. N., Boston.
Wightman, E. T., Danbury, Conn.
Wiley, George L., Stand. Underground Cable Co., New York.
Wilmerding, C. H., Chic. Arc Light & Power Co., Chicago.
Winston, H. S., Ill. Elec. Mat. Co., Chicago.
Wisner, F. P., Con. Fruit Jar Co., New York.
Wood, E. E., *Electrical Industries*, New York.
Wightman, E. F., Danbury, Conn.
Young, Mr. A. M. and wife, Waterbury, Conn.
Young, E. P., Sewickley, Pa., Elec. Co.

MONTREAL ECHOES.

The gavel presented to President Huntley of the National Electric Light Association, by Sir Donald Smith at the banquet on Thursday night, Sept. 10, is made of ebony. Around the handle is a gold band on which is engraved the name "Huntley," and around the head, at the centre, is another gold band. To the right and left of this, on the top of the head, gold shields are set, one bearing the coat of arms of the city of Montreal. The gavel is a work of art, and was highly appreciated by President Huntley.

The entertainment programme provided for the members of the Electric Light Association was carried out to the letter. The drive through the city and around the mountain, on Wednesday, the 9th, was a great success. There were 150 carriages in line, and the trip was very greatly enjoyed by all hands. The conversazione at Redpath Museum, McGill College, Tuesday night, was well attended and was an enjoyable affair. On Tuesday afternoon, the fire department display on Champs de Mars, called out a great number of visitors, and it was a fine one. The garden parties on the same evening were largely attended and greatly enjoyed. The La Crosse match on Friday was largely attended. The game was an excellent one, and the Americans seemed to derive great enjoyment from it. The yachting excursion on Saturday was largely attended, and the sail was a delightful one. A trip was made to Iberville, Mr. A. J. Corriveau being at the head of the arrangements. On Saturday evening a party left for Quebec, while many others departed for their respective homes.

An impromptu ball was given at the Windsor Hotel Wednesday evening, and was a very pleasant and successful affair. Messrs. Carroll, McLaren, Hager and others worked hard to make it a success, and their efforts resulted in much enjoyment to those who participated in the festivities.

Mayor McShane, of Montreal, popularly known as "the People's Jimmie," became a bosom companion of the electrical fraternity. He made many friends among them, and he will be long remembered by his American visitors.

Fred. W. Royce, of the firm of Royce & Marean, Washington, D. C., went hunting on Thursday and shot the rapids.

General C. H. Barney, manager of the International Exhibition, made an excellent success of the undertaking. Everything went off smoothly and without any hitch whatever. His long experience in this direction fits him for the undertaking of such tasks.

Mr. J. I. Gulick, Chairman of the Exhibit Committee, was a hard worker, but he accomplished a great deal, and much of the success of the exhibition was due to his efforts.

The Card Electric Motor and Dynamo Company, of Cincinnati, O., distributed a handsome catalogue of its machines.

The daily papers of Montreal did remarkably well in reporting the proceedings of the convention and the exhibition. Much of the popular enthusiasm over the exhibition, undoubtedly, was due directly to the publicity given it by the daily press. They made a special effort to report everything correctly, and the results of their work was very commendable.

The P. & B. Invincible cigars, distributed by Mr. Frank S. DeRonde, of the Standard Paint Co., New York, were thoroughly enjoyed by those fortunate enough to secure a sample. They were good cigars.

The Eddy Motor Company, of Windsor, Conn., was represented by Messrs. M. E. Baird and A. B. Newton.

As the steamboat with the Lachine Excursionists passed by the factories of the Eugene Phillips Electrical Works on its way to the Rapids, on Thursday, three hearty cheers were given in honor of the head of the concern. The buildings were profusely decorated with bunting, and the employés stood in the windows and doorways greeting the passengers.

Mr. C. O. Baker, Jr., who had charge of the special train from New York to Montreal, on Sunday, September 6, deserves a great deal of praise for the manner in which he conducted the affair. Nothing was left undone for the comfort of the passengers, and there was no hitch whatever from the beginning of the trip to the end. Everybody enjoyed it and Mr. Baker received many compliments. Although the train broke down in the mountainous region of Vermont, delaying it for nearly two hours, there was not the slightest indication of displeasure thereat. Montreal was reached at half past eleven instead of 9 o'clock, and the party marched up to the Windsor Hotel, double file, headed by two bagpipers, who played as sweet music as they possibly could get out of their pipes.

Mr. Wm. Beatty, the head waiter at the Windsor hotel, made many friends by his uniform courtesy and attention to the members of the Association and their friends.

The Thomson-Houston International Electric Co., of Montreal, and the Crocker-Wheeler Electric Motor Co., of New York, have recently effected an agreement between them whereby all the foreign business of the latter is to be handled by the International Company. The Crocker Wheeler exhibit at the Montreal convention was held under the auspices of the T.-H. Company.

THE S. & S. PRIMARY BATTERY.

A new primary battery is being placed on the market by the S. & S. Electric Company, 156 West 43d street, New York, which is claimed to give better results than any other battery made. It is said that there is three times the quantity of current, and a steady voltage under all conditions. The weight of the zinc used is but three-quarters of a pound, and it is said that it will last for 210 working hours at a discharge of four amperes per hour. This requires seven charges at the small cost of 10 cents per charge. In a recent test a cell gave 35 amperes at a pressure of 1.6 volts, and ran a small motor two weeks, 10 hours per day, and then a turntable one week, 10 hours per day; and was still in good working order. Several experts say that the capacity of the cell is as represented. The cell is so constructed as to give the greatest possible current with the highest electro-motive force and the least internal resistance, and it is said to be entirely different from any other cell on the market. The manufacturer says that the battery is to be sold on its merits alone, as the cost of running is but one-fifth of that of other makes. This firm manufactures and deals in all makes of motors, batteries, electric fans, novelties and general supplies, and carries a well assorted line of goods in stock.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electric securities in New York, as quoted by Geo. B. Ellery, Financial Editor, Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co.	350,000	100 00	90 00
American Dist. Tel (N. Y.)	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co. (N. Y.)	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co. (Boston)	620,000	5 00	2 50
American Electric Motor Co.(N.Y.)	1,000,000	2500	5 00
American Private T'phone (N. Y.)	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Asbury Park L. & P. (N. J.)	50,000	10 00	
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	4 00
B. & S. Elec. Equipment Co. (N. Y.)	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co. (N. Y.)	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	178 00
Bell Telephone 7's	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co. (Mo.)	100,000	100 00	100 00
Brunswick Elec. L. & P. (Me.)	50,000	100 00	100 00
Brush Electric Light Co. (Balto.)	650,000	100 00	
Brush Elec. Lt. Co. pref. (Balto.)	600,000	100 00	80 00
Brush Elec. Lt. Co. (Balto.) 5s	200,000		*105
Brush Elec. Co. (Cleveland) Pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co. (N.Y.)	10,000	100 00	†60 00
Brush Illuminating (N. Y.)	1 000,000	100 00	50 00
Brush Illuminating (N. Y.) 6's	300,000		*102
Brush Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush Swan (Ithaca)	50,000	10 00	5 00
Burrell Electric Signal Co. (N.Y.)	500,000	20 00	10 00
Circleville, O., L. & P. Co., 6's	20,000		*102
Circleville, O., L. & P. Co.	100,000	100 00	105 00
City of London Elec. Ltg. Co. (Ltd.)	4,000,000	50 00	60 00
Columbia Canal 6's (Ga.)	200,000		*111
Commercial Cable Co.	7,716,000	100 00	104 50
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co. (N. Y.)	2,500,000	100 00	50 00
Cons. Elec. Storage Co.(N.Y.)	3,000,000	25 00	4 00
Cons. Gas & E. Co. Batavia, 6's	80 000		*95
Cons. Gas Co. Batavia, (N. Y.)	100,000		
Cons. Subway Co. (N. Y.)	3,000,000	100 00	25 00
Day Ry. Const. Co. Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co. (N. Y.)	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6's	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	12 50
Direct U. S. Cable Co. (Ltd.)	6,400,000	100 00	50 00
East River E. L. Co. 6's	600.000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co. (N. Y.)	1,000,000	100 00	20 00
Economic Lt. & P. Co. (S. C.)	100,000	100 00	100 00
Edison Elec. Ill 5s (N. Y.)	5,000 000		*96
Edison Elec. Ill. 6's (N. Y.)	30,000		*99
Edison Elec. Ill., Lebanon (Pa.)	80,000	10 00	10 50
Edison Illuminating(N. Y.)	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., (Phila.)	1,000 000	100 00	80 00
Edison General	14 000 000	100 00	102 00
Elec. Sup. & Con. Co. (N. Y.)	120 000	15 00	20 00
Elizabeth E. L. Co. (N. J.)	100,000	10 00	4 00
Equitable G. & E. Co. (Utica)	4,000		†
Erie Telephone	4,800,000	100 00	45 50
Essick Printing Tel.	5,000,000	100 00	35 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co., 6's (N. Y.)	300,000		par
Fargo Gas & Elec. Co. 6's (Dak.)	100,000		*95
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec Co.	4,000,000	25 00	13 50
G. T. Woods Mfg. Co. (Ky.)	2,000,000	10 00	2 50
Gloucester Elec. Co. (Mass.)	20,000	20 00	
Great Western Elec. Sup. Co.	650,000	10 00	10 50
Great W'st'n Elec. Sup. Co., pref 8s	350,000	10 00	14 50
Hackettstown Elec. Light (N. J.)	25,000	20 00	30 00
Harlem Electric Light Co.	250,000	100 00	20 00
Hudson Electric Light (N. J.)	100,000	100 00	
Hunt Engineering Co. (Brooklyn) 6's	30,000	500 00	*105
Hunt Engineering Co. (Brooklyn)	30,000	100 00	140 00
Interior Conduit and Ins. Co. (N. Y.)	1,000,000	100 00	75 00
Int. Okonite, Limited.	1,700,000	50 00	47 50
Jamaica Gas and Elec. Light (N.Y.)	60,000	100 00	80 00
Kankakee Electric Co., 6's Ills.	50,000		*99
Kansas Elec. Co., 6s, Mo.	20,000		*98
Laclede Gas Co.	7,500,000	100 00	19 25
Laclede Gas. pref.	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*78
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co. (Ills) 5s	50.000		*94
Little Rock Edison E. L. & P. 6's	30,000		*95
Littleton Water & E. L. Co. 6's	75,000		*95
Livingston E. Lt. Co. (Mont.) 6s	30 000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5's (N.Y.)	1,000,000		par
Marysville L. & W. Co. 6's (Ohio)	60,000		*103
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5's (N. Y.)	2,300,000		*95
Mount Morris Electric Light (N.Y.)	1,000,000	100 00	60 00
Morristown L. H. & P. 5s (N. J.)	17,500		*104
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g. Co. (New York)	100,000	10 00	9 00
Nat'l Aut. Fire Alarm, (L. I.)	150,000	100 00	100 00
Nat'l Lead Trust.	9,000,000	100 00	16 75
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. and Tel. Co.	10,394,600	100 00	50 25
N. Y. and N. J. Tel. and Tel 6s	1,500,000		*99
N. Y. and N. J. Telephone Stock	2,535,000	100 00	94 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt.	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150.000	100 00	85 00
Newark E. L. & P. Co. 6's Ohio	50,000		*95
North New York, Lighting	150,000	100 00	10 00
Northern Elec. L. & P. (Phila.)	200,000	10 00	
Northwest Elec. Co. 6's Manitoba	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Passaic, Electric Light	15,000	100 00	90 00
Paterson, Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co. Ills.	500,000	1 00	3 00
Peoples' Elec. Light (Trenton)	100,000	100 00	90 00
Peoples St. Ry. & E. L. & P. Co. 6's	800,000		par
People's St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co. Boston	200,000	25 00	30 00
Pittsburg Reduct. Co. (Aluminum)	1,000,000	100 00	105 00
Plainfield, Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6's	500,000		96
Railway Improvement Co.	10,000,000	100 00	100 00
Ry. T. Dis. Elec. Signal Co. (N. Y.)	200 000	100 00	60 00
Richmond L. H. & P. (S. I.)	150,000	100 00	
Richmond L. H. & P. 5's	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	55 00
Rockaway Elec. Lt. Co. 6's	75,000		*94
Russell Electric Co. (Boston)	300.000	5 00	6 00
Saginaw E. L. & P. Co. 6's Mich.	50,000		98
San Diego Gas & Elec. Co. 6's Cal.	750,000		90
Sawyer-Man Electric Light Co (N.Y.)	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation., N. Y.	100.000	1 00	8 00
Short Elec. Ry. Co. Cleveland, (O.)	5,000,000	10 00	8 00
Sprague Elec. Motor Co.	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	10 00
Standard Ug'd Cable Co (N. Y.)	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co. (N. Y.)	900,000	100 00	100 00
The Hall Signal Co. pref. (N. Y.)	100,000	100 00	105 00
Thomson-Houston Electric Co.	6,000,000	25 00	47 50
Thomson-Houston Pref.	4,000,000	25 00	25 50
T.-H. Electric Co. 5's Boston.	500,000		*98
T.-H. E. L. Co. Yonkers 6's.	100.000		*99
T.-H. L.H.&P. Co. Binghamton, 6's	100,000		*99
Tucker Elec. Const. Co. (N. Y.)	50,000	100 00	100 00
Twin City Rapid Transit, (N. J.)	20,000,000	100 00	100 00
Union Switch & Signal Co (Pa.)	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co.	1,500,000	100 00	25 00
United States Illuminating (N. Y.)	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000 000	10 00	
Utica Elec. & Gas Co. 6's	150,000		par
Utica Elec. Light Co. 6's	150,000		par
Vine Street Motor Co. 6's (Colo.)	100,000		*95
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas, of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	83 50
Westinghouse Electric Co.	7,000,000	50 00	14 50
Westinghouse Elec. Co. Pref.	3,000,000	50 00	50 00
West End, L. (Boston)			18 75
Yonkers, L. & P.	50,000	100 00	75 00

*Per cent. †Registered Stock.

As very few electrical securities are dealt in on the stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The electric stock market has settled quietly down since the United States Courts rendered the two famous decisions, as will be seen at a glance by referring to the quotations, but lively times may be looked for before the end of this month. The days are getting so much shorter that business requires more light to finish out the allotted hours, which means more hours of labor to the producers and more expense to the corporations, with increased incomes. That portion of the public who, as consumers, are paying the bills now realize that an industry using so much capital must have a commercial profit if not something better, and consequently many of them are investing quietly in the particular company which serves them. This will increase and a boom is not far off which will enable those first in the field to take, if they so desire, a large profit, and later on—say next April or May—buy in again. This buoyant feeling exists all over the country and in all classes of electrics. A great many patents for new and novel applications of the newly employed servant have been granted this year and there is no reason to expect loss in introducing them to the general public. Many young corporations are offering irresistable inducements which improve on critical examination and money to exploit is found easier and easier as each successful investor receives his quarterly or annual check. Now is the time to choose the bond or stock you want and secure the quantity you can carry; the whole list is a purchase.

At the meeting of the stockholders of the National Lead Trust, held on the 27th of August, President Thompson in the chair, it was decided to reorganize under the laws of New Jersey with a capital of $30,000,000—$15,000,000 common $15,000,000 cumulative preferred seven per cent.; also to issue $3,300,000 debenture bonds of 6 per cent. The assets were stated to be, as per last report, $9,721,072 with liabilities amounting to $3,491,721. The business of the company is flourishing but, like a great many others, they seem to be hampered for means with which to fill orders. In this respect they are not alone; we know of quite a number of corporations in the same fix. Business for the next six months is assured, and activity is to be the order of the day the whole length of the list.

The Tuscarawas Electric Company, Canal Dover, O., has ordered a 100 H. P. engine from the Ball Engine Company, Erie, Pa.

Mr. N. L. Teeple, formerly with the Empire City Electric Co., is now connected with the Tucker Electrical Construction Co., agent for Perkins' Lamp.

ELECTRIC PUMPS.

Possibly one of the first applications of electricity as a means of power was its use in pumping machinery. Electric pumps have been improved to such an extent, both in capacity and size, that efficient ones can be had from the smallest sizes to those for large water-works run by electricity more economically than the old method of steam.

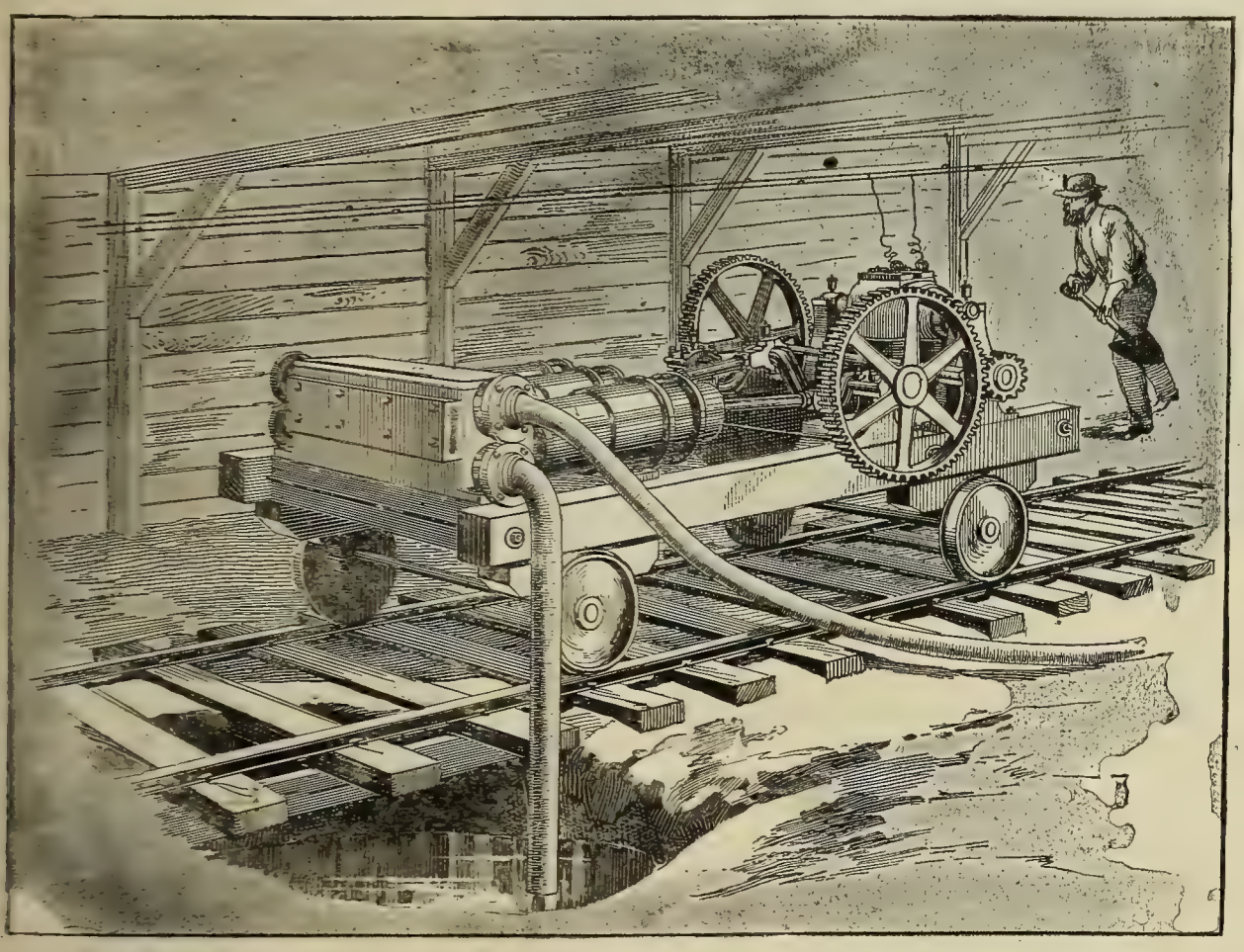


FIG. 1—HORIZONTAL TRIPLEX ELECTRIC MINE PUMP

We illustrate and describe herewith a triplex electric pump as designed for all pumping purposes, and adapted equally to filling the small tanks in the house or running a complete water-works installation. The main casting consists of three independent single acting cylinders accurately bored, reamed and polished, with outwardly extending supporting arms with crank shaft, which runs in babbitted boxes.

The crank shaft is of steel and is adequately heavy, and has journals 120 degrees apart in the circles it describes, to which are connected the plunger rods with babbitted boxes and caps. The plungers are of the outside packed type, and reciprocate through carefully fitted glands, and, it is claimed, will move water no matter how dirty or gritty, semi-fluids and the like.

The construction is especially designed for heavy and continuous service, and it is said that the slippage or leakage of water around the plungers is reduced to a minimum, and also provides ready means of tightening the packings by securing down the glands when necessary. The outside packed plunger is a tell-tale water alarm giving immediate notice of any leakage, however small. It is said that the resulting action of the three cylinders in combination with the three-throw crank shaft, produces a continuous discharge without hitching, jerking or hammering, affords absolutely even and unvarying resistance to the motor under all loads, and contributes to supreme efficiency of applied power.

Fig. 2 represents a special type Triplex electric pump, with extension bed-plate to receive motor, and especially designed to meet the requirements of mine pumping. It is built with phosphor-bronze bushed cylinders, with glands and solid plungers of the same metal to resist the action of sulphuric acid, so often encountered in mine pumping. The connecting rods are tied to the crank shaft by solid bronze bushed strap ends having adjustment for wear. The bronze suction and discharge valves on either side of the cylinders are of a simple yet substantial pattern, adapted for severe and continuous service. The construction of the pump will admit its being taken apart when carried into the mine, and as readily put together for service.

Fig. 1 represents the horizontal triplex electric mine pump built on the same lines as the vertical pump, but proportioned and designed to be placed upon a truck and run into shallow drift of mine. Fig. 3 shows the application of the pump for water-works stations.

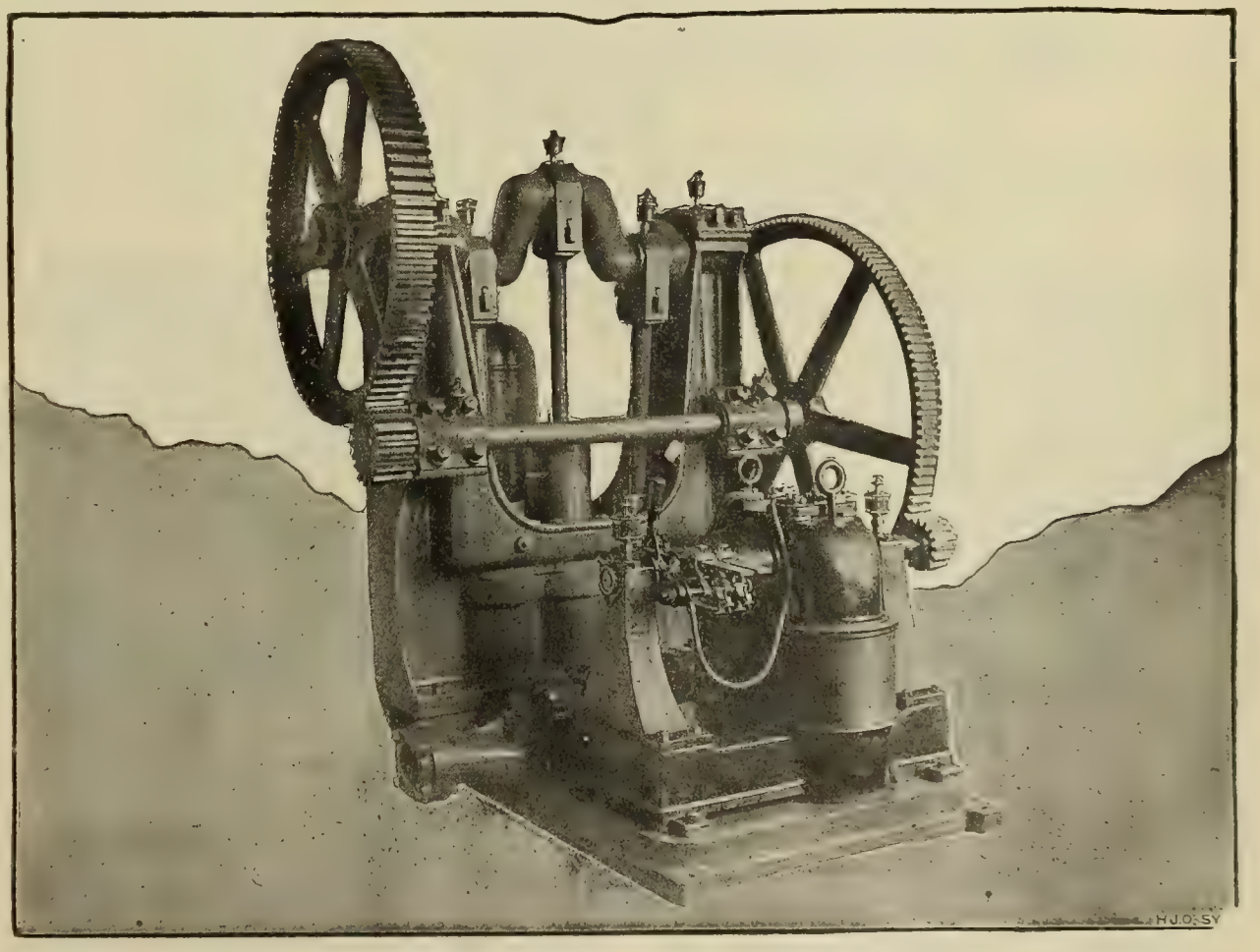


FIG. 2—TRIPLEX ELECTRIC PUMP.

These pumps are manufactured by the Goulds Mfg. Co., of Seneca Falls, N. Y., whose offices are at 16 Murray street, New York.

In arc lamps using direct current, the positive or upper carbon is consumed twice as fast as the negative carbon; but with the alternating current both carbons are consumed at an equal rate and both become pointed.

DECREMENT OF ELECTRIC OSCILLATIONS.*

BY M. V. BJERKNESS.

The law of damping, governing the oscillations of electricity in a Hertz vibrator, can be determined in a simple manner when the two following suppositions are made:

1. The movement of electricity in the resonator is of a simple harmonic character, like that of the bob of a pendulum when under the action of a periodic force.

2. The decrement of the oscillations in the vibrator is considerably greater than that in the resonator.

On these assumptions, the intensity of the oscillations in the resonator can be calculated as a function of the ratio of the periods of the vibrator and resonator. Sufficient indication of the method of calculation will be found in Note 5, of the recent work of M. Poincaré, entitled, "Electricité et Optique." In the formula there exists only one unknown quantity—the decrement of the oscillations aroused by the vibrator—and this constant has been determined by M. Bjerkness with the aid of a series of nine resonators, whose periods varied between 0.87 and 1.13 times the period of the vibrator.

The chief result of the research is as follows: A vibrator producing oscillations having a wave length of 4.5 metres had a logarithmic decrement equal to 0.26, so that the ratio of the amplitudes of two successive elongations in the positive direction was equal to 0.77. After 20 oscillations the electrical movements were thus negligibly small, and the phenomenon could not last longer than about a millionth of a second. The spark gap was from 1 to 2mm. in length. If it was increased the decrement was found to increase, and analogous effects could be obtained experimentally by various arrangements of the apparatus, so that the decrement could not be regarded as a constant quantity.

The value found for the logarithmic decrement of the resonator was 0.002. This number must only be regarded as a rough approximation, as the properties of the secondary spark are not well enough known for accurate calculation. A comparison of this quantity, with the corresponding

* *Comptes Rendus.*

number found for the vibrator, affords, however, a satisfactory confirmation of supposition (2.) given above.

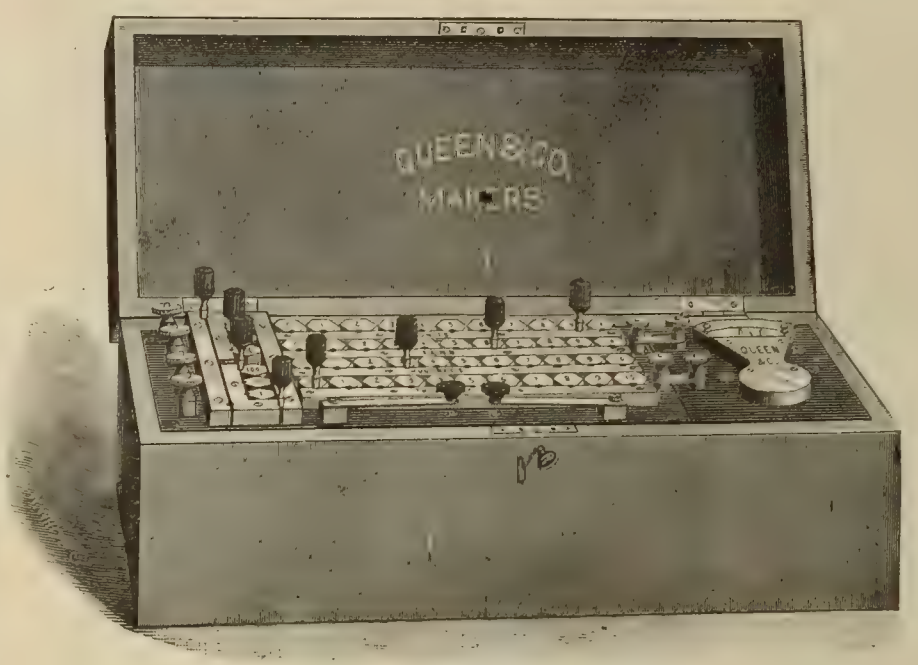
The decrement of the oscillations emitted by the vibrator is so rapid that some important conclusions necessarily follow. If the waves are reflected perpendicularly at a surface, so as to retrace their former course, the interference which takes place will be the result of superposing a weak wave on a more powerful one. There will not be nodes and loops in the ordinary sense, and at a distance of some wave lengths from the mirror the difference between the maxima and minima become insensible.

Elementary reasoning shows that a resonator, placed in the field of the interfering waves, is submitted to the action of oscillating forces whose amplitude varies periodically with the distance from the mirror. In the mathematical expression for the amplitude of the oscillations set up in the resonator two wave lengths will appear, the first corresponding with the waves emitted by the exciter, and the second with the waves which correspond with the oscillations to which the resonator naturally gives rise. If the values just given for the logarithmic decrement are approximately correct, the first set of maxima and minima positions will be completely masked by the second after about a dozen oscillations have passed away. If the spark in the resonator does not take place until this effect occurs, the nodes and internodes detected by the resonator will correspond with the second system, and not with the first, and it is thus possible to account for the phenomenon known by the name of multiple resonance, without the necessity of the hypothesis by means of which MM. Sarasin and De La Rive have explained their results.

M. Bjerkness acknowledges that the explanation here given was originally given by M. Poincaré, who arrived at it on purely theoretical grounds.

QUEEN'S IMPROVED PORTABLE TESTING SET.

Something over a year and a half ago Messrs. Queen & Co., Philadelphia, brought out their now well-known series of portable testing and resistance sets, which have been used very largely for all classes of resistance work throughout the country. Extensive experience with these sets seems to have developed very few possibilities of improvement. Almost the only feature which has been suggested as capable of improvement for use under certain conditions has been the galvanometer forming a part of these sets. As heretofore made this galvanometer has been of the astatic type, fibre suspended, and arranged to automatically take the weight of the needle from the fibre when the lid of the case was closed. A



QUEEN'S IMPROVED PORTABLE TESTING SET.

control magnet enabled the needle to be still more astatic. The sensibility of this galvanometer was very great, and it has been found possible to make very accurate determinations of resistance by its use together with the set. Its astaticism, however, rendered it very susceptible to magnetic disturbances and mechanical vibrations.

With a view to doing away with this susceptibility without detracting from the efficiency of the set, Messrs. Queen & Co. have been devoting considerable attention to the designing of a new galvanometer for use with their sets. The galvanometer finally devised, and shown as part of the set in the cut, is of the D'Arsonval type, very dead beat in its action, and remaining almost absolutely steady during all mechanical and magnetic disturbances. The set fitted with this new galvanometer may be used in factories where there is great mechanical vibration, or in central stations, and in the vicinity of dynamo machinery where the magnetic field is very intense. In some recent tests made by Mr. Willyoung, of Queen & Co., this set was placed upon one large running dynamo while used to measure the insulation and resistance of another dynamo not running. In some other tests of the set it was placed upon a table and measurements made while the table was violently shaken. Under both conditions measurements were easily and quickly made within an accuracy of 1-5 of 1 per cent.

The set with new galvanometer is particularly adapted for use in marine work, as the pitch and roll of the vessel will not appreciably affect the stability of the needle.

This new galvanometer is, like the astatic form, removable from the set, and may be used separately for any kind of work desired. This galvanometer cannot of course be made quite as sensitive as the astatic form; it is, however, sensitive enough for all but work of the very highest accuracy. To accommodate those doing the most accurate work the set will still be sold with the astatic galvanometer, which has also been improved by making the control magnet larger and completely removable from the galvanometer if desired. When the control magnet is to be used it is removed from its fitting in the lid of the instrument, and can be instantly slipped into position over the galvanometer by means of a pair of spring catches. This galvanometer has also been so modified that it is practically impossible to break the glass covering the dial, a mishap sometimes occurring with the old type.

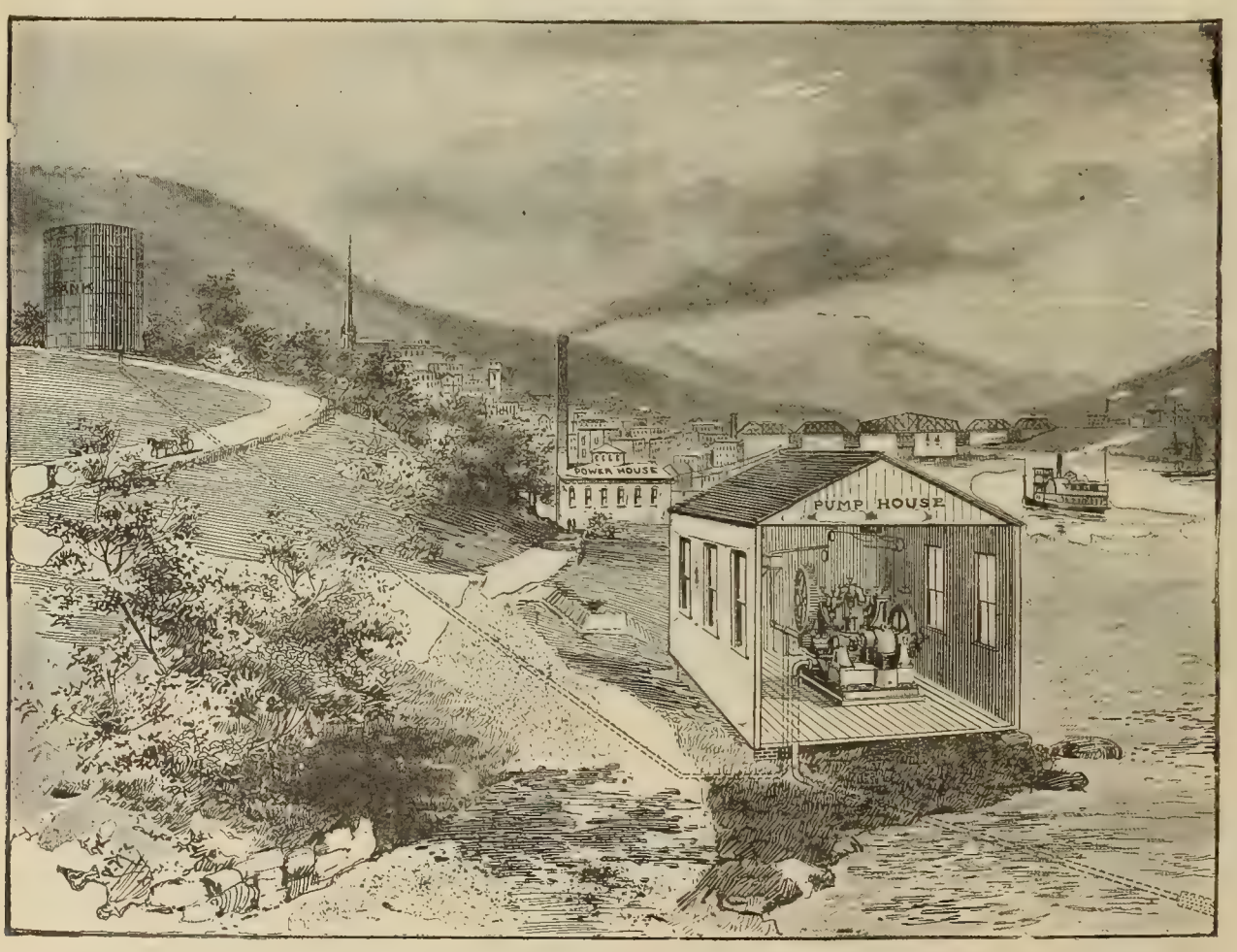


FIG. 3—TRIPLEX PUMP FOR WATER-WORKS.

NEW ELECTRIC RAILWAY.

Mr. William Rumble, C. E., of Bayonne, N. J., has applied for a patent on a system of running street cars by electricity entirely different from anything heretofore proposed. It is so arranged that while the conductor is thoroughly protected and insulated, it is also perfectly safe, so that no man or horse can receive a shock from it under any circumstances.

From the perfect insulation of the conductor no loss of electricity can occur, and the insulation is so arranged that there will be very little or no induced currents. The invention consists in a main conductor laid below the surface of roadway, in the centre of the track, and protected by insulation in pipes. At proper intervals, service boxes of cast iron are placed in the ground between the tracks, and the main conductor is run through them, with apparatus for making the connections between the main conductor and the motor which drives the car. The apparatus consists in a mechanical movement combined with a magnetic force, each acting independently of the other, but requiring both to make the connection. They are both simple, sure to operate and have no electro-magnets. The service boxes are at such distances apart that the electrical conductor attached to the car shall reach from one to the other. It is said the cost of the necessary attachments to the car will be about $25, and that of conductor and service boxes put in place about $5,000 per mile.

For street illumination, in streets clear of trees, an arc lamp of 2,000 c. p. (or 450 watts) will effectively light an area having a radius of 400 feet when placed between 30 and 35 feet above the ground. Suspended over the crossings of two streets, it will light better than gas one block in each direction and thus each arc lamp will replace ten gas lights. An incandescent lamp of 10 c. p. will light the streets as well as ordinary gas burners usually used for that purpose.

AN IMPROVED ARC INDICATOR.

The manufacturer of the arc indicator illustrated herewith informs us that during the past six months its sales have been very large and everyone using the indicator is well satisfied. This arc indicator has been on the market for upward of two years, but it has been improved since to such an extent, and made so thoroughly reliable, that every engineer now recognizes its value in the engine room. The arc indicator is constructed on scientific principles and in the simplest possible manner, and is adapted for high speed engines used in electric light plants.

A card taken with the indicator shows the admission line to be curved, but by drawing the arc line beside it when on the drum, by raising the pencil arm with the finger, the engineer has the card as if squared and, with this arc, can note all the points he desires more readily. For instance, whether the admission line is parallel with the arc or not, it will indicate if the valve is late or early, and the point where compression commences is noted by the distance from the arc line.



IMPROVED ARC INDICATOR.

The theoretical expansion line is laid out by striking arcs with the dividers instead of drawing straight lines with a straight edge and square.

The area of the card from which the power is measured is not affected by the arc motion as all horizontal distances are just the same as in a straight line card, depending for its area only upon the length of base and altitude.

The drum, which has a bearing at both ends, is made as light as possible. The drum spring is ground, concaving on the side to avoid all frictional resistance in the drum. The groove for the cord is so arranged that there is but one turn of the cord on the drum, preventing the distortion caused when the cord runs double. The tension of the spring can be changed for any speed without in any way affecting the number of the spring.

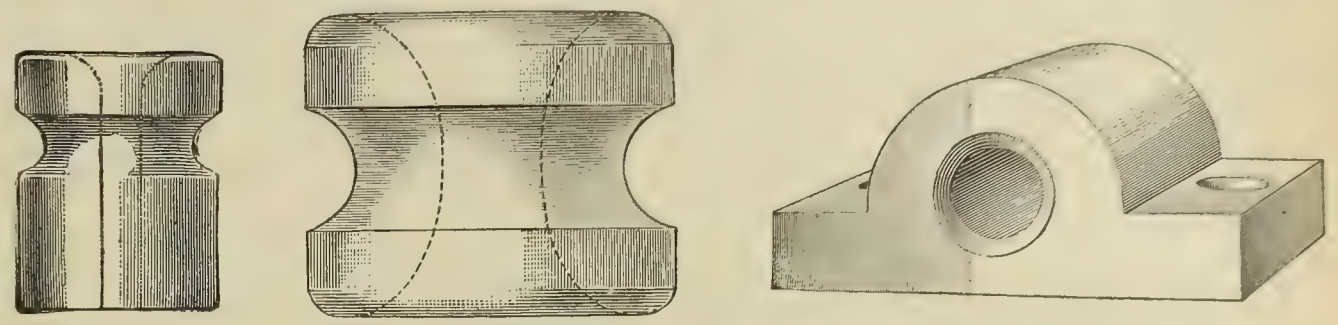
Scales, cords, leads, cards, etc., with a treatise containing complete directions for attaching and using the instrument, are furnished with the indicator.

Every instrument is full nickel plated, handsome in appearance and packed in an attractive cedar case.

Hine & Robertson, 45 Cortlandt street, New York, are sales agents for this improved indicator, and they will give any desired particulars.

PORCELAIN INSULATION.

Nothing in electrical work is of more importance than insulation; the more perfectly conductor and conducting parts of electrical machinery are insulated, the better the efficiency of any installation. Among the best known commercial articles used for this purpose we find porcelain. This material is used for bushing, plugs, cleats, holders, ceiling-blocks, rosettes and numerous other similar devices. But many articles on the market supposed to be porcelain are made of pottery, having a glazing made of a very fusible metallic oxide that yields to sparks of electricity, exposing the porous body which retains moisture and forms a circuit where none is wanted. Genuine porcelain has none of these features, but it is said that its production is attended with so many difficulties, as compared with the making of other kinds of pottery, that very few have made a success of its production.



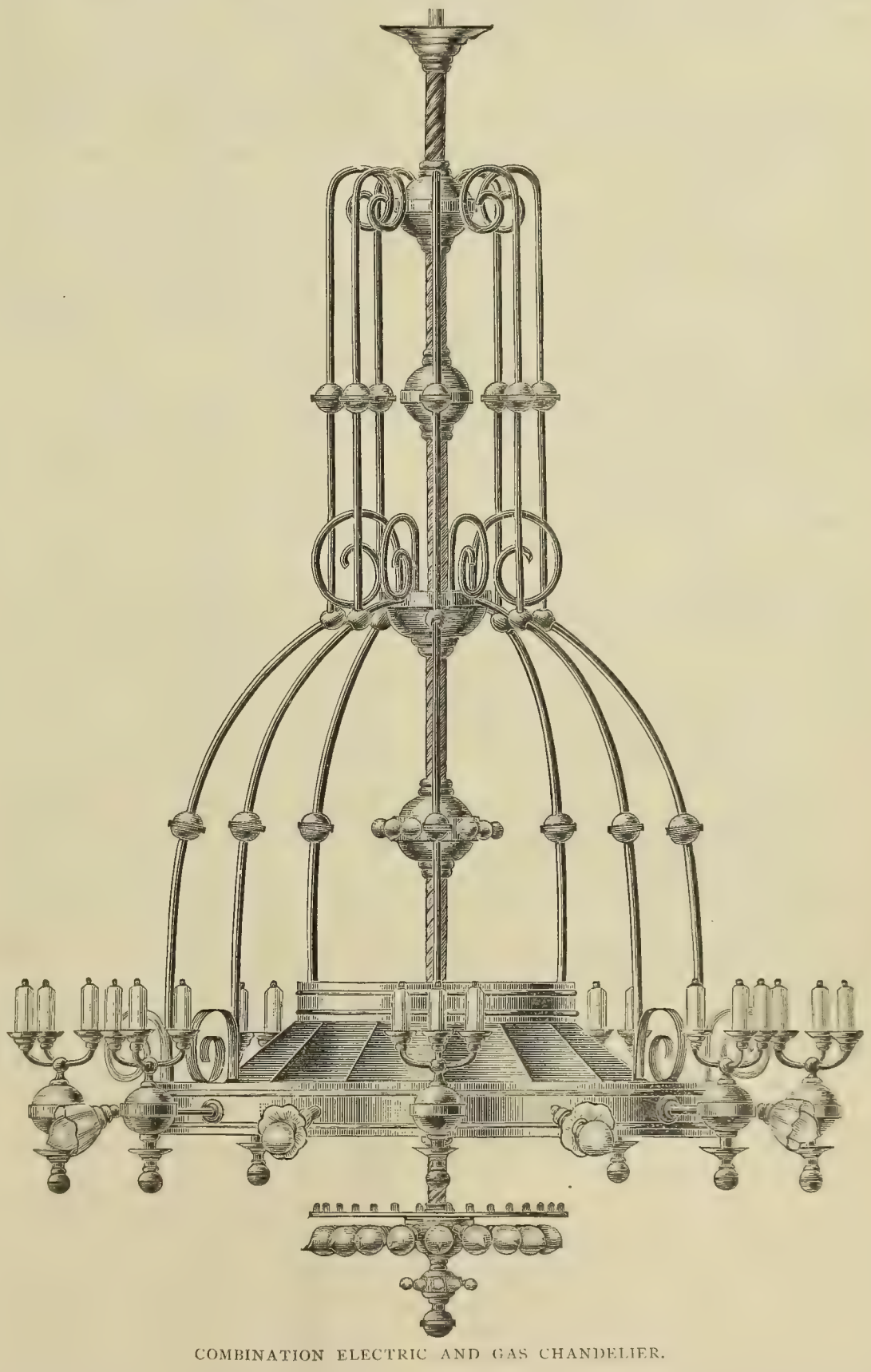
PORCELAIN INSULATORS AND HOLDERS.

One of the firms who have been successful in producing hard porcelain electrical supplies is the Empire China Works, 144–156 Green street, Greenpoint, Brooklyn, N. Y., whose goods have been admitted by all who have given them a practical test, to be the equal of anything on the market. The firm manufactures every form of porcelain insulator known to the trade.

REFLECTING ELECTROLIERS.

Some very pretty effects can be made in illuminating large places by incandescent electric lights, by arranging lamps in groups from the centre of the ceiling. Electroliers can be made in a large variety of designs and arranged not only to hold the lamps to give the best display, but also to reflect the light to the best advantage. The majority of halls, theatres and other public buildings and many churches are now being lighted by electricity, but the lamps are not always placed so that all the light can be utilized.

We illustrate in this issue a reflecting chandelier made with special regard to the requirements of combination electric and gas lighting. It is suitable for use wherever a reflector of this kind is needed. Although not elaborate it is tasty. The design we illustrate is but one of many, the manufacturer, I. P. Frink, 551 Pearl street, New York, making them in all styles and sizes to suit the purchaser.



COMBINATION ELECTRIC AND GAS CHANDELIER.

Mr. Frink makes reflectors for every conceivable use, including the lighting of art galleries and for use on centre poles in electric street railway construction. He also makes special fixtures for electric lighting alone.

New Incorporations.

The East Side Land Company, of Goshen, Va., was incorporated August 26, with a capital stock of $25,000, to carry on an electrical business among other pursuits. Incorporators: J. R. Jones, C. W. Jones, A. D. Smith, Jr., A. Alexander and T. A. Browning.

The Jenney Star Electric Company, of Portland, Me., was incorporated August 25, with a capital stock of $50,000, to manufacture and sell electric motors, dynamos, batteries, etc. Incorporators: Edward E. Bowker, New Bedford, Mass.; James A. Tenny, New Haven, Conn.

The Red Oak Electric Company, of Red Oak, Ia., was incorporated August 27, with a capital stock of $20,000, to construct and operate electric light and power plants. Incorporators: W. H. Blood, Kansas City, Mo.; A. M. Miller, F. H. Hutchinson, Red Oak, Ia.

The Electrical Engineering Company, of Chicago, Ill., was incorporated August 29, with a capital stock of $50,000, to operate steam and electrical construction business and deal in steam and electrical machinery, appliances, material and supplies. Incorporators: Richard H. Pierce, George W. Seymour and Frank K. Biggs.

The Paxton Electric Company, of Paxton, Ill., was incorporated August 29, with a capital stock of $24,000, to furnish electric light and power. Incorporators: C. H. Langford, H. H. Henderson and J. L. Larkin.

The Mascoutah Electric Light Company, of Mascoutah, Ill., was incorporated September 1, with a capital stock of $5,000. Incorporators: George Postel, Fred. Dilg and E. P. Hagist.

The Defiance Light and Power Company, of Defiance, Ohio, was incorporated September 4, with a capital stock of $100,000. Incorporators: E. N. Lewis, C. P. Harley, H. P. Miller, Henry J. Smith, Henry Fosz, Orlando Dyarman and R. H. Gleason.

The Orne Electric Construction Company, of Chicago, Ill., was incorporated September 3, with a capital stock of $11,000. Incorporators: Edward T. Orne, William E. Duncombe and William N. Wegg.

The Ford & Washburn Electric Company, of Cleveland, O., was incorporated Aug. 31, with a capital stock of $200,000, to manufacture electrical instruments, machinery, cars, boats, engines, etc., propelled by electricity. Incorporators: Lester A. Cobb, George A. Ford, Edward S. Ford, George A. Washburn and George Hoyt.

The Carthage Electric Light and Power Company, of Carthage, Ill., was incorporated September 5, with a capital stock of $10,000. Incorporators: Thomas F. Dunn, Junius C. Ferris and Charles S. De Hart.

The Dow Adjustable Light Company, of Boston, Mass., was incorporated September 3, with a capital stock of $5,000. Incorporators: Willard E. Dow, Charles F. Morrill and Arthur C. Smith.

The Rowe Manufacturing Company, of Portland, Me., was incorporated September 3, with a capital stock of $500,000, to manufacture and deal in electric lamps. Incorporators: John W. Fletcher and Charles E. Rowe, of Chelsea, Mass.

The Circleville Light & Power Company, of Circleville, O., was incorporated August 26, with a capital stock of $100,000, to generate electricity for light, heat and power, and carry on a number of other businesses. Incorporators: Charles J. Delaplane, Howard Jones, N. E. Jones, Fannie M. Moore and J. L. Stribling.

The Piedmont Spring Water and Power Company, of Oakland, Cal., was incorporated August 21, with a capital stock of $1,000,000 to construct and operate electric light and power plants together with a complete water-works system. Incorporators: E. H. Benjamin, W. F. Boardman, E. G. Vinzent, W. J. Dingee, all of Oakland, Cal.; George D. Metcalf, Berkeley, Cal.

The McCook Electric Light Company, of McCook, Neb., was incorporated August 31, with a capital stock of $30,000. Incorporators: Frank Canuth, S. W. Huddleston, George Hukhell and A. Campbell, of McCook, Neb.

The Oklahoma Water and Light Company, of Chicago, Ill., was incorporated September 2, with a capital stock of $300,000. Incorporators: Charles B. Wood, Horace S. Oakley and J. Gibson.

The Imperial Electric Company, Camden, N. J., was incorporated September 1, with a capital stock of $25,000. Incorporators: J. S, Spruance, J. C. Dorphley, of Camden, N. J., and J. Mustard, Philadelphia, Pa.

Harry Alexander, the well-known electrical expert, 126 Liberty street, city, reports a largely increasing business. He has recently made a large number of contracts for electrical installations in private houses, a class of work which he makes a specialty. He is a contractor for all kinds of electrical work, installing both light and power plants, paying special attention to the wiring of buildings, and giving all such contracts his personal supervision. It is said he recently successfully converted an arc plant into an incandescent plant without altering the dynamo in any way.

Everybody is anxiously looking forward to the appearance of the new push button switch, which is being brought out by a prominent Philadelphia electrician, in conjunction with two or three more specialties.

Electric Light Notes.

The Vincennes Electric Light and Power Company, of Vincennes, Ind., will make extensive additions to its electric light plant shortly. Address H. W. Frund, secretary and general manager.

The Florida Electric Company, of Tampa (Fla.), expects to make an extensive addition to its electric light plant soon. Address W. A. Green, manager.

The Valparaiso Gas and Electric Light Company, Valparaiso, Ind., will add a complete incandescent installation to its present arc plant. Address J. W. Stratton, superintendent.

The Cedar Falls Electric Light and Power Company will need additional equipment shortly. Address B. L. Wilder, proprietor.

The Thomson-Houston Electric Light Company, of Augusta, Ga., expects to secure the contract to furnish the city of Augusta with 300 arc lights. The contract will be awarded during October. E. A. Sweet is the manager of the company.

The Brush Electric Light and Power Company, Columbus, Ga., will make extensive additions to its plant shortly. Address W. B. Brown, president.

The State Electric Company, of Clinton, Iowa, will make extensive additions to its plant shortly. Address E. C. Walsh, president.

The Beaumont Ice, Light and Refrigerating Company, of Beaumont, Tex., is to increase its power and incandescent light plant shortly. Address E. L. Bacon, superintendent.

The Piozzak Electric Company, of Valley Falls, Kan., contemplates additional equipment for its electric light plant shortly. Address D. F. Piozzak, superintendent.

The Elkhart Electric and Railway Company, of Elkhart, Ind., expects to get a contract for lighting the city of Elkhart, when it will need additional equipment. Address J. W. Ellis, superintendent.

The Electric Light and Power Company, of Burlington, Ia., contemplates several additions to its plant in the near future. Address J. W. Burdette, superintendent.

The Clarinda Electric Light and Power Company, of Clarinda, Ia., has just added a 250-light dynamo to its incandescent plant.

The Edison Electric Illuminating Company, of Topeka, Kan., will make several additions to its plant shortly. Address W. W. King, superintendent.

The Kankakee Electric Company, of Kankakee, Ill., will need additional equipment shortly. Address J. B. Reed, superintendent.

The Franklin Water, Light and Power Company, of Franklin, Ind., contemplates the purchase of additional equipment soon. Address W. G. Reeve, president.

The Athens Gas Light Company, of Athens, Ga., will buy additional electrical equipment shortly. Address J. T. Robinson, superintendent.

The La Porte Electric Company, La Porte, Ind., has been making extensive additions to its plant. The company use T.-H. and the Van Depoele arc systems.

The Adrian Electric Light and Power Works (private corporation), Adrian, Mich., expects to put in an incandescent system shortly. It is supplying power for an electric street railway. Address J. H. Fee, superintendent.

The William A. Hunter Electric Company, Belle Plaine, Ia., contemplates increasing its electric light plant shortly. Address William A. Hunter, president.

The People's Electric Light Company, of Greenburg, Pa., is contemplating additional equipment for its plant in the near future. Address George F. Hoff, president.

The Lee Electric Company, of Lee, Mass., will make extensive additions to its plant in the near future. Address F. M. Pease, superintendent.

The Marietta Electric Light Company, of Marietta, Ga., is to add a 650-light incandescent plant to its equipment. Address John B. Barnes, superintendent.

The Whitman Electric Company, of Whitman, Mass., will need additional equipment for its plant shortly. Address W. A. Harris, superintendent.

The Middleboro Gas and Electric Company, Middleboro, Mass., may require additional equipment. Address Charles B. Davis, president.

J. H. & G. W. Ruch, using Ft. Wayne Jenney arc and Slattery induction incandescent systems, Columbia City, Ind., will need additional equipment next year.

The Connorsville Gas Light Manufacturing Company, Connorsville, Ind., will need additional equipment for its electric light plant shortly. Address Anthony Watt, superintendent.

The Shippensburg Electric Light, Heat and Power Company, Shippensburg, Pa., has just finished an arc plant for city lighting. The company has made a contract to furnish 17 arc lamps to the city for three years, beginning October 1.

Meetings of Societies.

The 59th meeting of the American Institute of Electrical Engineers will be held at 12 West 31st street, New York, Tuesday evening Sept. 22, at eight o'clock, at which a paper will be presented by Professor Harris J. Ryan of Cornell University "On the Relation of the Air Gap and the Shape of the Poles to the Performance of Dynamo Electric Machinery."

New Books and Catalogues.

Mr. Allen R. Foote and Charles E. Everett, a member of the Cincinnati bar, have a work now in press that will be valuable to every lawyer and every one having any connection whatever with incorporated companies. The title of the work is "Economic Legislation of All States, Relating to Incorporated Companies Operating Under Municipal Franchises." It will include such incorporations as illuminating gas, fuel gas, electric central station, telephone, street, railroad and water companies. Those who have read Mr. Foote's work on "Economic Value of Electric Light and Power," will, no doubt, be anxious to see the forthcoming book, and we think it will be equally as interesting to every one who makes a study of economic legislation. No expense or labor has been spared to make it accurate and complete, and in every respect the best possible work on the subject. The book will be divided into two division—the first, a discussion of economic principles involved in the legislation under consideration, by Allen E. Foote, and the second the economic legislation of all the States and territories. The second division is under the personal supervision of Mr. Charles E. Everett, every page of manuscript being critically examined by him, and after being arranged and classified, returned to the author for revision, correction and final approval. The work will embody the experience and careful thought of forty-six experienced and able attorneys, each of whom writes the section relating to his State. The subscription price of the book will be $10 per copy. Those who would like to subscribe prior to the publication, address Allen R. Foote, P.O. Box 432, Washington, D. C., for subscription blanks, etc.

The Electrical Supply Company, Randolph street and Michigan avenue, Chicago, Ill., has just issued a little pamphlet entitled, "The Reason Why It Does It," giving the many reasons why the Wirt lightning arrester protects electric installations against lightning. The pamphlet is tastefully gotten up, both the style of print and the illustrations being unique.

The Electric Engineering and Supply Company, Syracuse, N. Y., has just issued a neat catalogue illustrating and describing the material in its electric railway department. The pamphlet contains the description of a general line of electric railway supplies, as well as a number of new trolley insulators adapted for use with either cross suspension or bracket lines. Several other new devices are also illustrated, as well as many more familiar with the electrical trade.

Electric Coal Mining Machines.

Electric coal mining machines were introduced in the Monongahela coal fields nearly two years ago, since which time they have been rapidly adopted in that region.

One of the latest mines to be operated with these machines is the O'Niel & Peterson mine at Bunola, on the Pittsburg and Belle Vernon Railroad, on the Monongahela River. The contract for equipping the Bunola mine was made with the Michaels Electric Coal Mining Machine Company, of Pittsburg. The plant consists of one 50 H. P. steam engine, one 30 H. P. Westinghouse alternating current generator and eight mining machines, with the Tesla motor of the Westinghouse Electric and Manufacturing Company attached to each.

The success of the Michaels coal mining machine has long passed the experimental stage, as it has been in practical operation for fifteen months. The capacity of each machine per day is 65 tons of coal, or about one square foot of undercut per minute for ten hours each day. The machine requires very little attention, only one man being necessary to attend to it.

BUSINESS NOTES.

Messrs. Jerome and Harvey Redding have retired from the Redding Electric Company, Boston, and resumed their old business of manufacturing electrical specialties, under the firm name of Jerome Redding & Co., at 48 Hanover street, Boston, where they will keep in stock a full line of electrical goods.

C. B. Osgood, manager of the railway department for the Southern district of the Westinghouse Electric and Manufacturing Company, Atlanta, Ga., writes:

"... I have received several copies of the STREET RAILWAY NEWS and am very much pleased with its make-up. It is quite evident to me that its success is assured."

The Hine Eliminator Company, of 106 Liberty street, New York, has a "New Salesman," inanimate yet very expressive. It consists of a neatly bound copy of Prof. R. C. Carpenter's report of the test of steam separators recently made at Cornell University, which the company will send free to all who will send their address. This report sets forth in tabulated form the relative efficiencies of six of the best known steam separators in the market with the Hine Eliminator looming up in its efficiency fully 50 per cent. over what has been considered the best. In 12 different tests the Eliminator demonstrated an average efficiency of 98 8-10 per cent. dry steam. That this test was complete and impartial goes without question and if those wishing a "steam separator" or a "grease extractor" will send for a copy they will get some points worth knowing. See ad. on page viii of this issue.

The Bloomington Electric Light Company, Bloomington, Ind., is about to install a 150 H. P. engine, manufactured by the Ball Engine Company, Erie, Pa. The Ball Engine Company, through its New York agent, E. T. Copeland & Company, 106 Liberty street, also recently furnished an 80 H. P. engine to the Hebrew Institute, New York City.

The Dubois Traction Passenger Railway Co., Dubois, Pa., is installing a 100 H. P. engine, manufactured by the Ball Engine Co., Erie, Pa., and sold them by Dravo & Black, Pittsburg representatives of the Ball Engine Company.

The Empire China Works, of Greenpoint, Brooklyn, N.Y. (established in 1868), one of the oldest producers of genuine porcelain, are extensively engaged in the manufacture of switch bases, cut-outs, insulators, etc. Their ware is acknowledged to be of superior grade and gives entire satisfaction.

"IT EFFECTED WONDERS."

The following is a copy of a letter received by the Jerome Kidder Manufacturing Company, 220 Broadway, New York, from Henry Gerard, of the *Manufacturer and Builder*, of New York City:

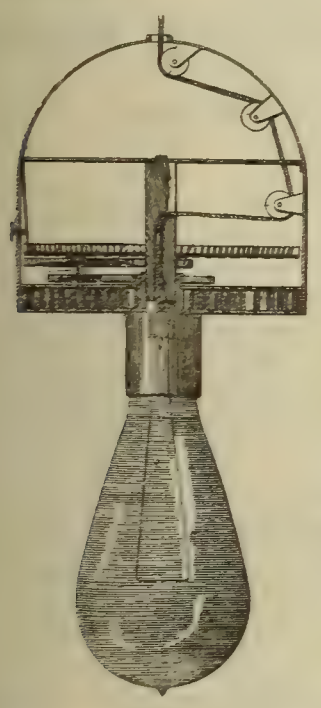
"I was taken in October last with a severe nervous disorder characterized by my physician as a depression of the sensory nerves. I tried medicine, the application of iodine to the spine as a counter-irritant, and rubbing. These benefited me only partially. My physician advised me to get a medical electric battery, and I ordered one of your $27 machines. It effected wonders, and I improved rapidly under its use until I am now in perfect physical health. My observation, however, leads me to say that the battery should be used daily (I used it five minutes each day just before retiring) until a cure is effected, otherwise it cannot be fully effective. I found the best application to be to the hands; and at the base of the brain or back of the neck. In the latter case the positive pole at the neck and the negative at the feet; running the sponge down the spine was not necessary."

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued September 1 and 8, 1891. (*Continued.*)

459,213. Telegraphic Transmitting Apparatus. Morris Martin, Malden, Mass., assignor, by direct and mesne assignments, to the United States Electric Fire Signal Company of Maine. Filed July 14, 1890.

459,070. Electrically-Heated Wristband-Ironer. Willis Mitchell, Malden, Mass., assignor to the Butterfield-Mitchell Electric Heating Company. Filed Nov. 29, 1890.



458,769—ELECTRIC LIGHT FIXTURE.

459,088. Electric Light Fixture. Edwin T. Greenfield, New York, N. Y. Filed May 11, 1891.

459,100. Incandescent Electric Lamp. Edward P. Roberts, Cleveland, Ohio, assignor to the Swan Lamp Manufacturing Company, same place. Filed July 15, 1891.

459,127. Electrode for Chairs. George W. Overall, Memphis, Tenn. Filed July 8, 1891.

459,143. Electro-Therapeutic Truss. Hugh W. Matthews, Chicago, Ill. Filed June 26, 1891.

459,144. Electro Therapeutic Belt. Hugh W. Matthews, Chicago, Ill. Filed June 26, 1891.

459,168. Support for Electric Conductors. George H. Winslow, Pittsburg, Pa. Filed May 19, 1891.

459,205. Telephone Receiver. James H. Howard, Medford, Mass. Filed March 3, 1891.

459,213. Hook or Crotch for Telephone Receivers. James H. Howard, Medford, Mass. Filed March 3, 1891.

459,214. Telephone. James H. Howard, Medford, Mass. Filed March 3, 1891.

459,219. Electric Switch. Lewis D. Castor, Philadelphia, Pa., assignor to William H. Weston & Co., same place. Filed May 20, 1891.

459,222. Electrically Operated Brush. Frederick A. Lehmann, Washington, D. C. Filed Oct. 25, 1890.

459,229. Electric Elevator. Harry H. Blades, Detroit, Mich. Filed Sept. 19, 1890.

459,266. Hanger for Incandescent Lamps. Paul J. Chassagne, Akron, Ohio. Filed Jan. 16, 1891.

459,323. Electric Contact Apparatus. Christian Weuste, Duisburg, Germany. Filed June 12, 1890. Patented in Germany, France and Switzerland.

459,366. Armature for Dynamo Electric Machines or Motors. Robert Lundell, Brooklyn, assignor of one half to Edward H. Johnson, New York, N. Y. Filed Nov. 24, 1890.

459,367. Commutator Brush and Holder. Robert Lundell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed April 4, 1891.

459,368. Commutator Cylinder and Method of Making the Same. Robert Lundell, New York, N. Y., assignor of one half to Edward H. Johnson, same place. Filed April 4, 1891.

459,378. Electric Conductor. Edwin D. McCracken, Alpine, N. J., assignor to the Norwich Insulated Wire Company, New York, N. Y. Filed March 5, 1891.

458,585. Telegraphy. David Kunhardt, Aachen, Germany. Filed March 26, 1891.

458,603. Fusible Cut-Out. Charles S. Van Nuis, New Brunswick, N. J., and Jonathan H. Vail, New York, N. Y. Filed Oct. 16, 1890.

458,617. Regulator for Constant-Current Dynamos. Ernest P. Clark, New York, N. Y., assignor to the Clark Electric Company, same place. Filed Oct. 4, 1890.

458,618. Constant-Current Dynamo. Ernest P. Clark, New York, N. Y., assignor to the Clark Electric Company, same place. Filed Oct. 4, 1890.

458,625. Electro-Therapeutic Apparatus. William J. Herdman, Ann Arbor, Mich. Filed Dec. 27, 1890.

458,645. Electric Motor. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb, 2, 1887.

458,652. Electro-Chemical Transformer. Turner D. Bottome, Hoosick, N. Y. Filed Jan. 28, 1890.

458,656. Lightning Arrester. James P. Freeman, Washington, D. C., assignor of two-thirds to Marvin C. Stone and Philip T. Dodge, same place. Filed April 23, 1891.

458,666. Automatic Cut-Out for Dynamo-Electric Machines. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed Oct. 29, 1889.

458,702. Electric Generator. John C. Henderson, New York, and Frederick Sargent, New Rochelle, assignors to the Edison General Electric Company, New York, N. Y. Filed June 21, 1890.

458,718. Carbon-Clamp for Electric Arc Lamps. Albert P. Seymour, Syracuse, N. Y. Filed Jan. 3, 1889.

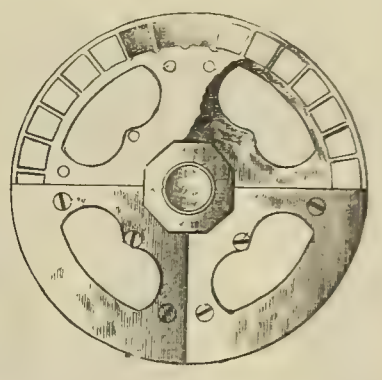
458,719. Duplex Arc Lamp. Barton B. Ward, New York, N. Y. Filed Dec. 31, 1890.

458,753. Protective Fuse. Hammond V. Hayes, Cambridge, and Anthony C. White, Boston, assignors to the American Bell Telephone Company, Boston, Mass. Filed May 25, 1891.

458,755. Electric Meter. Maurice Koechlin, Belfort, France. Filed Oct. 16, 1890.

458,769. Electric Light Fixture. Fred. H. Aldrich, Cadillac, Mich. Filed April 17, 1890.

458,778. Electric Subway. John C. Reilly, Brooklyn, N. Y. Filed May 19, 1891.



458,856—ARMATURE FOR ELECTRIC MOTORS OR GENERATORS.

458,784. Method of and Apparatus for Determining the Temper of Steel. Carl A. Caspersson Forsbacka, Marzretchill, Sweden. Filed Oct. 7, 1890.

458,856. Armature for Electric Motors or Generators. James F. McLaughlin, Philadelphia, Pa. Filed May 26, 1891.

458,868. Electric Coal-Mining Machine. Charles J. Van Depoele, Lynn, Mass. Filed Oct. 3, 1890.

458,869. Circuit Controller for Electro-Magnetic Engines. Charles J. Van Depoele, Lynn, Mass. Filed Feb. 3, 1891.

458,870. System of Supplying Current to Reciprocating Electric Engines. Charles J. Van Depoele, Lynn, Mass. Filed Feb. 26, 1891.

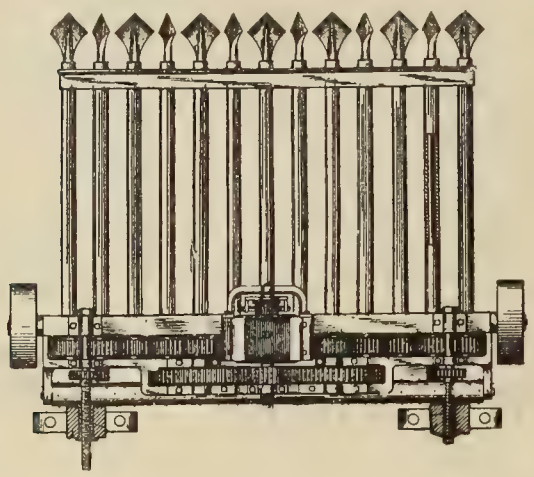
458,871. Telpher System. Charles J. Van Depoele, Lynn, Mass. Filed Feb. 28, 1891.

458,872 Electro-Magnetic Reciprocating Engine. Charles J. Van Depoele, Lynn, Mass. Filed March 19, 1891.

ELECTRICAL PATENTS—Continued.

458,873. Combined Electric Engine and Pump. Charles J. Van Depoele, Lynn, Mass. Filed March 27, 1891.

458,874. Reciprocating Electric Engine. Charles J. Van Depoele, Lynn, Mass. Filed April 7, 1891.



458,868—ELECTRIC COAL MINING MACHINE.

458,876. Electric Arc Lamp. Barton B. Ward, New York, N. Y., assignor to the Scott Electrical Manufacturing Company of New Jersey. Filed Jan. 30, 1890.

458,879. Electric Switch. Adolph Wissler, St. Louis, Mo. Filed June, 22, 1891.

458,880. Casing for Electric Switches. Adolph Wissler, St. Louis, Mo. Filed June 22, 1891.

458,947. Annunciator. William C. Dillman, Brooklyn, assignor to Owen Walsh, New York, N. Y. Filed May 6, 1891.

458,952. Electric Comb. John M. Riley, Newark, N. J., assignor to Margaret A. Riley, same place. Filed May 1, 1891.

458,953. Electric Comb. John M. Riley, Kearney, N. J., assignor to Margaret A. Riley, same place. Filed June 22, 1891.

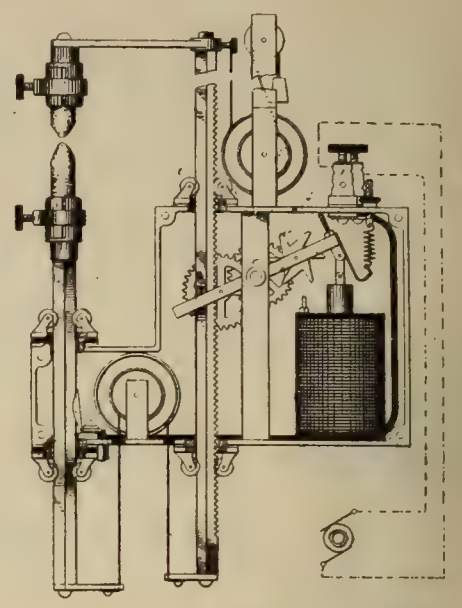
458,954. System of Reciprocating Electric Engines. Charles J. Van Depoele, Lynn, Mass. Filed Sept. 19, 1890.

458,956. Controlling Dynamo Electric Machines for Electric Railways. Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Company, same place. Filed April 30, 1890.

458,961. Testing Switch for Electric Circuits. Rudolph C. Smith, Yonkers, N. Y., assignor, by mesne assignments, to the National Company, of Illinois. Filed Dec. 10, 1890.

458,964. Cleat for Electric Wires. Henry P. Ball, Brooklyn, N. Y. Filed April 17, 1891.

458,976. Electric Motor. Norton P. Otis and Rudolph C. Smith, Yonkers; said Smith assignor to the Otis Brothers & Co., New York, N. Y. Filed July 31, 1890.



458,876—ELECTRIC ARC LAMP.

458,977. Safety Device for Electric Elevators. Norton P. Otis and Rudolph C. Smith, Yonkers, N. Y., assignors, by mesne assignments, to the National Company, of Illinois. Filed Dec. 31, 1890.

458,987. Electric Arc Lamp. William A. Turbayne, Toronto, Canada. Filed April 14, 1891.

HENRY F. PARKER.

Solicitor of United States and Foreign Patents and Mechanical Engineer

Offices, Mills Building, 35 Wall Street, New York, U. S. A. Cable Address, "Crucible, Newyork."

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Design patent for 7 years,	15 00	15 00
Design patent for 14 years,	30 00	15 00
On filing every caveat,	10 00	15 00
On filing application for patent,	15 00	25 00
On issuing each original patent,	20 00	
On filing a disclaimer,	10 00	
On filing every application for a reissue,	30 00	
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Austria, according to term: minimum,	90 00	Australia, important provinces of, each,	85 00
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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

Vol. IX. NEW YORK, SEPTEMBER 26, 1891. No. 39.

"VULCA" TUBES OR CONDUITS.

These tubes are made in sizes ranging from ¼ inch to 1¼ inches inside diameter for single tubes. The double tubes are made in sizes ranging from ¼ to ½ inch. They are moisture-proof and practically fire-proof, have great tensile strength and are made in ten-foot lengths. Angles and "S" off-sets are made of all sizes for the single and double conduits. They will neither stain nor exude when placed in wet plaster or cement, making it a very desirable article in places where the ceiling and side walls are to be highly decorated. They can be placed directly in cement without any extra protection. As the surface is hard and smooth it is an easy matter to insert or withdraw wires. The material admits of being painted, stained or japanned, bronzed or silvered, as shown by the line of samples exhibited at Montreal, where pieces of the single and double conduit were stained to match and imitate cherry, mahogany, ash, oak and black walnut. It will admit of a very high polish similar to hard rubber, and it can be drilled and tapped. It will not collapse when placed in wet plaster or cement. As an insulator it is of the highest order, as shown by tests which compare favorably with the high-grade insulated wires now on the market. It is a very excellent tube to be used in connection with electric gas-lighting and where Ruhmkorff coils and friction machines are used. It can be filled and handled similar to hard wood and rubber. Instead of using the crimping machine to join two tubes, the joint is made by squaring the ends of the tubing and slipping them into a thin brass coupling, so that one tube abuts the other, and over all is placed two wrappings of rubber tape, making it absolutely water-proof, and maintaining the same kind of insulation as the other portions of the line of tubing. Only a single wire in each tube is advocated, and the wire to be covered with a high-grade moisture-proof insulation. In connection with the conduits is manufactured a full line of conduit wiring appliances, such as distribution boxes, main line double branch cut-outs, main line single branch cut-outs, straightaway cut-out and fishing boxes and angle boxes for turning corners. These appliances are fitted for two and three wire systems. All the appliances are mounted on porcelain bases and are made in accordance with the rules and regulations of the Board of Fire Underwriters. The main floor cut-out is placed at every floor from which the different feeders run, which supply current to the different circuits on that floor, and all the vertical main conduits and wires are placed in a separate recess provided for that purpose (as shown in Fig. 3). Fig. 1 shows the circuit on side wall near the ceiling, with the angle box, junction box and cut-outs located in the cornice. Fig. 2 shows practically the same, but with the angle box, junction box and cut-outs located behind the base-board at the floor. These tubes or ducts are manufactured solely by the New York Insulated Wire Co., 649 and 651 Broadway, New York. This company also manufactures the well-known line of Grimshaw white core wires, cables, insulating tapes and splicing compounds.

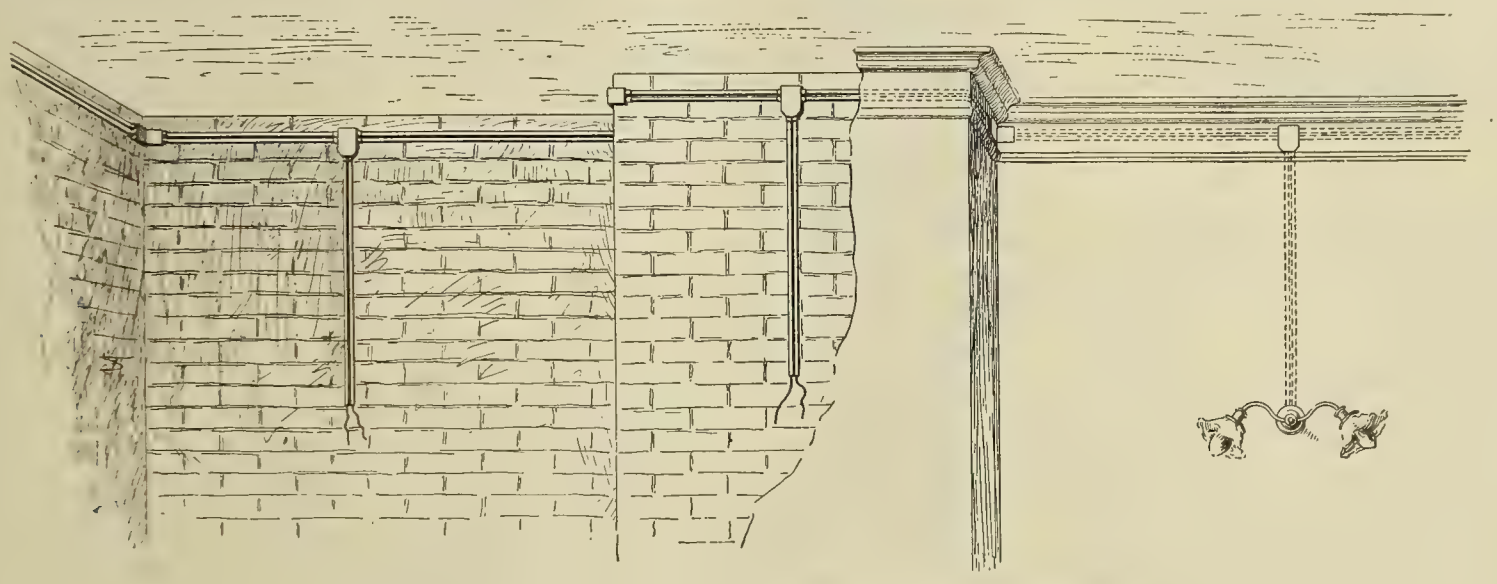


FIG. 1.—"VULCA" TUBES RUN ALONG TOP OF SIDE WALLS.

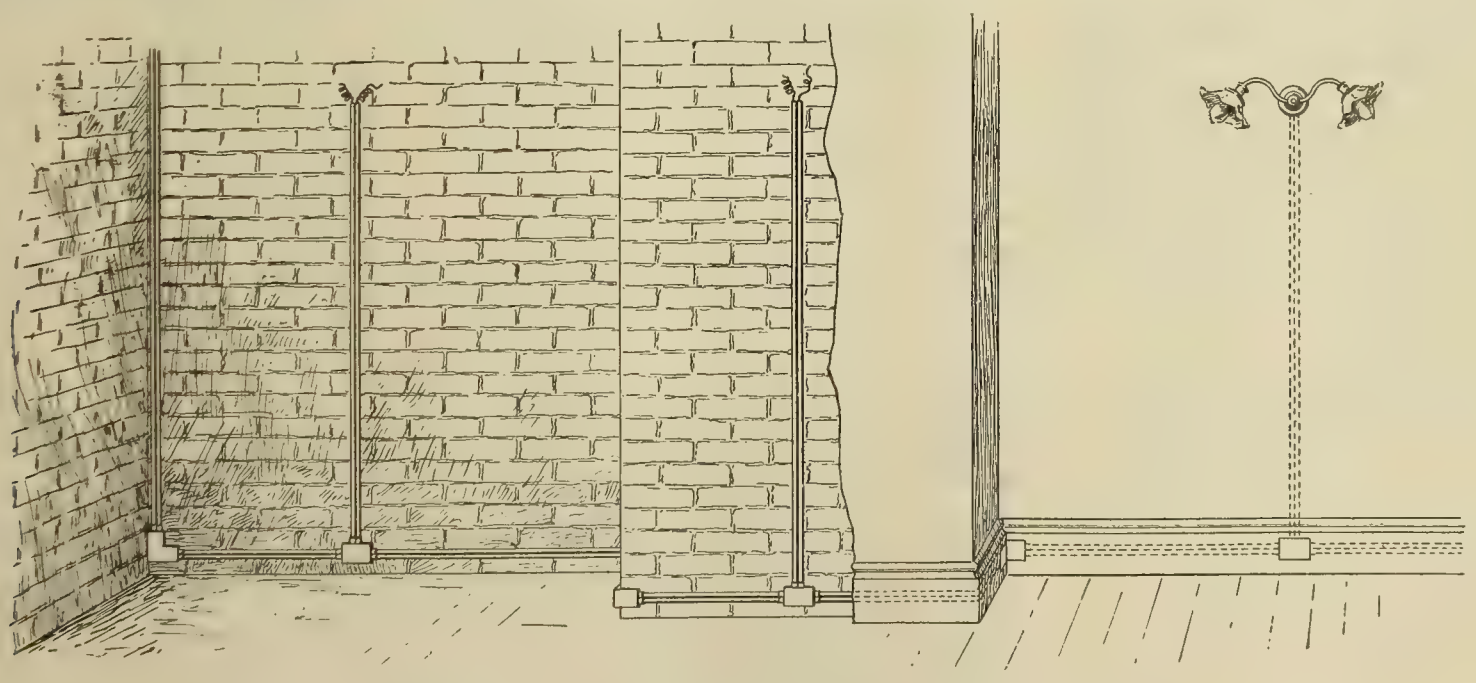


FIG. 2.—"VULCA" TUBES BEHIND BASE-BOARD.

ELECTRICAL RÉSUMÉ.

The Montreal *Herald* of September 14 prints a column-and-a-half interview with Mr. Allen R. Foote, who gives a *résumé* of the state of the electrical art at the present time, and refers to the future possibilities in a wider application of electric power. Among other things Mr. Foote said:

"The value of the exhibit made at this convention exceeds the combined value of the exhibits of the seven preceding ones. To indicate the progress made in electrical education, it may be mentioned that a resolution was adopted at the convention held in New York City in August, 1888, appointing a committee to call the attention of educational institutions to the desirability of adding a course of electrical engineering to their curriculum. Since that date not less than fourteen of the leading educational institutes of the United States have added a course of technical training in electrical engineering, and equipped quite extensive laboratories for the

purpose. They are now beginning to send their graduates into practical work; and they are proving to be among the brightest and most capable experts now employed in the development of the electrical industries.

"The changes in the practical application of electric energy to commercial uses are very rapid and almost entirely in the direction of greater reliability, efficiency and economy. In no instance has an electrical central station been planned for the purpose of supplying a lighting and power service to a city in which the power provided has been greater than the demand to be supplied. In less than a year it has been found necessary to increase the equipment in some or all directions in order to keep up with the demand. The greatest hindrance to the growth of the business has been ill-advised legislation induced by an uninformed public opinion. At first people had their fears worked upon by various interests, but a greater familiarity with electrical service and the fact that the statistics of its few years' existence show that in no case has the use of electrical energy for lighting or transmission of power been as destructive to life as were the agencies it has displaced.

"This fact has removed all undue idea of danger from the public mind. At the present time but little opposition is felt on the ground of danger. The popular demand for placing the wires underground is based entirely upon a misconception of the causes of the troubles which have annoyed the public."

A CENTRAL STATION COMBINING THE ADVANTAGES OF BOTH THE CONTINUOUS AND ALTERNATING CURRENT SYSTEMS.*

BY H. WARD LEONARD, NEW YORK CITY.

We are all well aware of the fact that the greatest strength of the three-wire system is due to features, the lack of which constitutes the greatest weakness of the alternating system, and that the reverse of this statement is equally as true.

The high efficiency, reliability, safety and adaptability to supply almost any requirements for electric energy which are the features of strength of the three-wire system, are the very points upon which the alternating system suffers by comparison, for its efficiency is much lower, its reliability is less due to the fact that its machines are not practically operated in multiple arc, its safety is necessarily less due to the existence of the high primary pressure, and its current is not adaptable to commercial use for motors, charging storage batteries, electro-deposition, and so forth.

On the other hand, the low first cost of an alternating system, the simplicity of its circuits and of the operation of the central station and its ability to reach with moderate expenditure of capital, lighting at any practical distance, make it the only possible pioneer in new and untried territory without great risk and almost the certainty of expending capital which will never be remunerative.

Hence it is that we find the three-wire system in possession of the densely settled centres of cities and towns, and not extending to the outskirts because of the uncertainty of a sufficient return upon the necessary capital, and both the central-station manager and the distant would-be consumers anxiously awaiting the development of improvements which will enable the three-wire central station to supply such distant consumers. And hence it is that the manager and consumers of an alternating system anxiously await the day when motors can be operated and a more economical, safe and reliable current than the present alternating current can be furnished by such a station to supply the imperative wants of the heart of a busy city.

If the above statement of the present existing conditions be a fair one, it will be evident that if we could only in some way secure the advantages of both systems in a common distribution, we should greatly improve matters. The object of this paper is to point out what appears to the writer to be a step forward in that direction.

The following conditions seem to be necessary:

1. We must supply a continuous current for the central portion of a town during the day-time when power is required.

2. We must supply the outlying districts with an alternating current during the night-time when lighting is required.

3. We must not operate the alternating system under conditions of light load when its efficiency is very low.

4. We must be able to supply current for lighting continuously throughout the 24 hours of the day.

5. We must have but one set of conductors in any consumer's place.

In order to meet the above conditions I propose the following:

1. Wire all consumers upon the standard three-wire systems.

2. Connect all consumers upon standard three-wire mains.

3. Arrange the network of mains so that the central section of the network can be disconnected from the outlying sections through the agency of switches.

4. Install three-wire feeders to supply the central portion of the systems at full load, and install 1,000-volt primary wires and alternating current converters with a three-wire secondary circuit to supply the outlying section at full load.

Let us see how we will operate the station. Suppose it is eight o'clock in the evening. The switches which serve to connect the central and outlying sections are open, and our three-wire plant is supplying the full load of the central portion of the city. The alternating plant in the same central station is supplying the converters of the outlying section, which convert from 1,000 volts primary to 220 volts in the secondary, and the secondary coil has a connection at the centre which is led off to supply the central wire of the three-wire system of the outlying

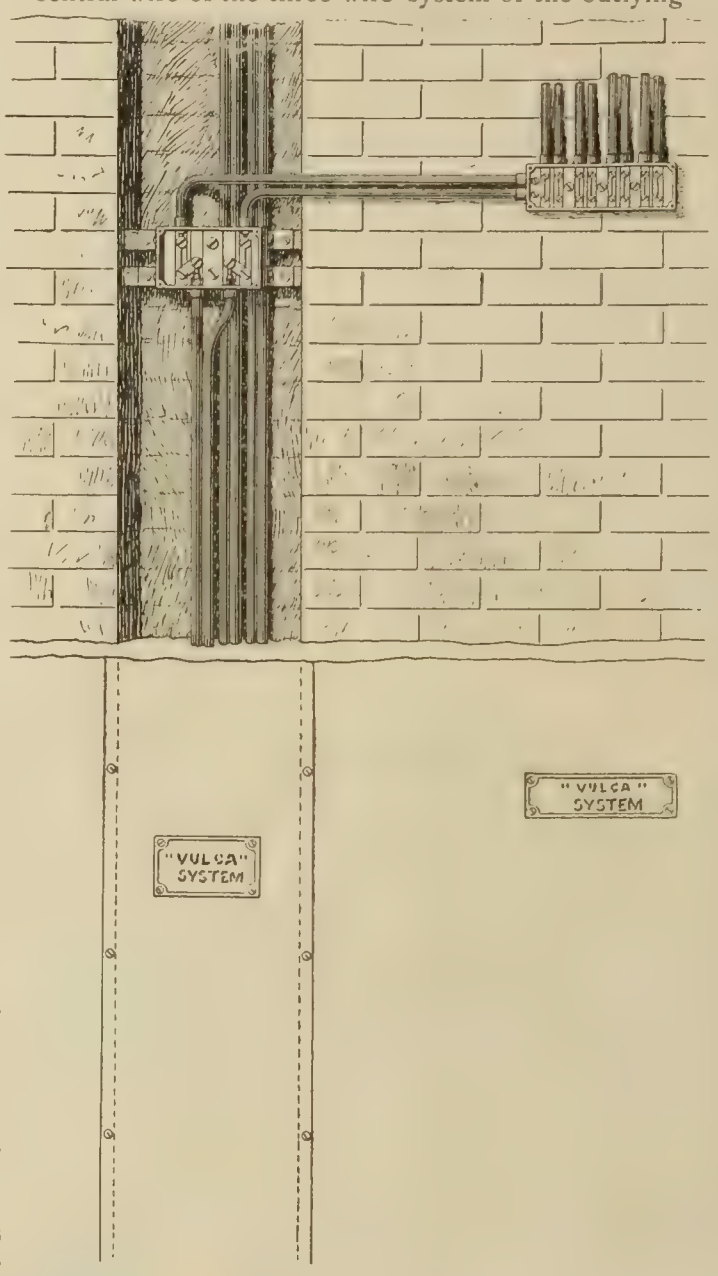


FIG. 3.—RECESS IN WALL FOR VULCA FEEDER TUBES.

section, the outside terminals of the secondary being connected to the outside wire of the three-wire system. It will be noticed that both plants are being operated at full load.

Now, suppose it to be eleven o'clock. The load has gone off rapidly, so that the alternating plant is now operating under the worst possible conditions, and these conditions will continue for the outlying district until dusk the next day—that is, for probably 18 hours. An operator is now sent out who goes to each section supplied by a converter, and by throwing a switch transfers the secondary wiring from the alternating system to the three-wire mains. In this way the small remaining load is gradually transferred to the three-wire plant and then the alternating plant is shut down. The three-wire plant continues in operation all night and all the next day, supplying all devices with a continuous current. Motors can be operated in all portions of the system, even for domestic purposes in the distant residences, and all consumers get the opportunity of the use of the continuous current for any purpose desired for 18 hours out of the 24.

Dusk now arrives and soon the heavy lighting load will rapidly come on, and in such case the outlying section could not be supplied by the small wires feeding the distant three-wire section during the day, which are only about one-tenth the size which would be necessary to supply the full load.

The operator again goes round the circuit and now transfers the load of the outlying section from the three-wire plant to the alternating plant, and this condition prevails again until eleven o'clock arrives, when the operation is repeated, as before described.

The switches for transferring the load of the outlying section from one system to the other can readily be controlled by simple means from the central station itself, if desired.

Now let us look at some of the advantages we have gained.

All of our inside wiring is done on the three-wire systems for use of a lamp of 110 volts. This means that for the same distances and loss in conductors we will save eleven-twelfths of the cost of copper which would be required by a secondary using 55-volt lamps upon a two-wire system; or to put it another way, we can supply 110-volt lamps upon a three-wire system with the same cost of copper and the same percentage of loss in conductors at three and a half times the distance which would be permissible for 55-volt lamps on a two-wire circuit.

We all know the great desirability of using large converters on account of their cheaper first cost per lamp and their higher efficiency, and also because a far more perfect regulation of pressure can be obtained upon a lot of lamps scattered in different kinds of stores throughout a block, if they be supplied from one converter, than can ever be obtained by supplying these lamps by a lot of small converters loaded differently in almost every case, and consequently supplying a different pressure at the secondary terminals of each converter.

Under the system proposed by me one converter would ordinarily supply the entire lighting of a block, resulting in less first cost, higher efficiency of conversion, longer life of lamps, greater reliability and greater simplicity of plant.

A point worthy of notice is that for 18 hours out of the 24 an absolutely safe current is in use throughout the entire system, and that during all daylight hours, when the greatest liability to accident from contact with high pressure wires exists, no high pressure is in use.

With such a system no consumer need be turned away.

The consumer who wants to charge storage batteries and also make electric welds by electricity can do so upon the same day and from the same wires that supply his incandescent lamps.

The factory upon the outskirts of town which runs its isolated plant and must to-day either use storage batteries or run machinery all night to supply a few watchmen's lights, can now switch on to the central station at six o'clock and operate the few lamps it may need until dusk next day, when heretofore the alternating system, which was the only one which could reach it, did not run after midnight, or possibly after daybreak, because of the loss of money in so doing.

With this system the outlying districts can be pioneered with the least first cost and least risk. Any outlying section in which, for any cause, the demand increases greatly beyond that originally anticipated, can be supplied permanently by the three-wire system by merely running the necessary feeders to supply the already existing mains, and in such case the switches and converters would be moved out further or transferred to some new section ready for pioneer work.

The combination of a storage-battery system and an alternating system also presents peculiar advantages. The storage battery is at its best when supplying a small steady load, such as we have for at least 16 hours out of the 24. The alternating is at its best when supplying the full load possible only during the remaining eight hours. The average electrical load on a general system is only about 12 per cent. of the maximum, consequently we are entirely safe in the statement that the greatest load during the 16 hours of light load is not more than 10 per cent. of the maximum load for the 24 hours.

If we were to attempt to operate the heavy load by storage batteries we must either make an enormous investment or, what is even worse, operate storage batteries at a disastrous overload. On the other hand, if we try to operate the 16-hours light load with converters, our efficiency, when operating at ten per cent. of our converter capacity, would be unmentionably low. But reverse the case and everything works at its maximum efficiency. During the eight hours of possible heavy load we operate all devices by the alternating system. At the same time a continuous-current dynamo charges our storage batteries located either in the central station or, if more desirable, at different centres in the system of distribution. At the end of the eight hours' run we shut down the plant, lock up the station and leave it for 16 hours, the storage batteries meantime supplying all devices.

* Paper read at the Convention of the National Electric Light Association, Montreal, September 9, 1891.

If, for extraordinary reasons, we have not capacity sufficient in the storage batteries to supply the demand, we run the continuous-current plant to assist it; and if that should fail or prove insufficient, we start up our alternating and supply all or a disconnected part of the system with it.

With this plant distances are of no consequence; we can use 1,000 volts for the continuous-current plant as well as for the alternating, and the single two-wire distribution is all that is necessary for perfect results. The weak spots of this latter arrangement will, no doubt, be thought to be the storage battery, but my experience with this device is that if you use it properly under suitable conditions and do not attempt to squeeze impossible results out of it, economical and satisfactory service can be obtained from it, and certainly no better conditions could be obtained for it than those described above.

Up to this time a bitter fight has waged between those believing that the alternating, the direct, or the storage battery system, respectively, was the only suitable one.

I believe in them all, each operated so as to be used under the best conditions for its use, and I trust that the suggestions given above may lead to our being better able to meet and overcome our common enemies—High First Cost, Low Efficiency, Danger, Unreliability and the Inflexible Conditions of the existing demand.

DEVELOPMENT OF FLOWERS AND PLANTS BY ELECTRIC LIGHT.

The Agricultural Experiment Station of Cornell University, Ithaca, N. Y., has just issued an extremely interesting bulletin relating to experiments made with a view to determining what influence the electric arc light exerts upon plants in green-houses. The experiments were begun in the winter of 1889–90, and for the purpose a forcing-house 20 x 60 feet was used. The house was divided into two nearly equal portions for the experiment by a tight board partition. One compartment was treated to ordinary conditions—sunlight by day and darkness by night—and the other had sunlight during the day and electric light during a part or the whole of the night. In all the experiments the lamps were suspended from the peak of the house, the arc being 2½ feet above the soil of the bench over which it was placed.

During the first winter (from January to April, 1890) a 10-ampère 45-volt Brush arc lamp of 2000 nominal candle-power was used. This was run all night during the period named, and the light was shut down as soon as daybreak appeared. For the first six weeks the light was naked, but during the remainder of the time an ordinary white opal globe was used. The general effect of the light was to greatly hasten maturity, and the nearer the plants grew to the light the greater was the acceleration.

The accompanying illustrations show in Fig. 1 a bench of lettuce grown under normal conditions, and in Fig. 2 another bench of the same vegetable is shown, having been grown in the electric-light house. The lettuce proved to be greatly benefited by the electric light. The plants grown under the influence of the electric light were sold two weeks earlier than those grown in the ordinary way. Practically the same results were obtained in cases of all other vegetables experimented on, and in conclusion the bulletin states that if the electric light enables plants to assimilate during the night and does not interfere with growth, it must produce plants of great size and marked precocity.

No definite conclusions, however, can yet be drawn from the experiments so far carried on; yet a few points have been proved, and these are that the electric light promotes assimilation; it often hastens growth and maturity; it is capable of producing natural flavors and colors in fruits, and it often intensifies the colors of flowers and sometimes increases the production of flowers. There is every reason, therefore, to suppose that the electric light can be profitably used in the growing of plants.



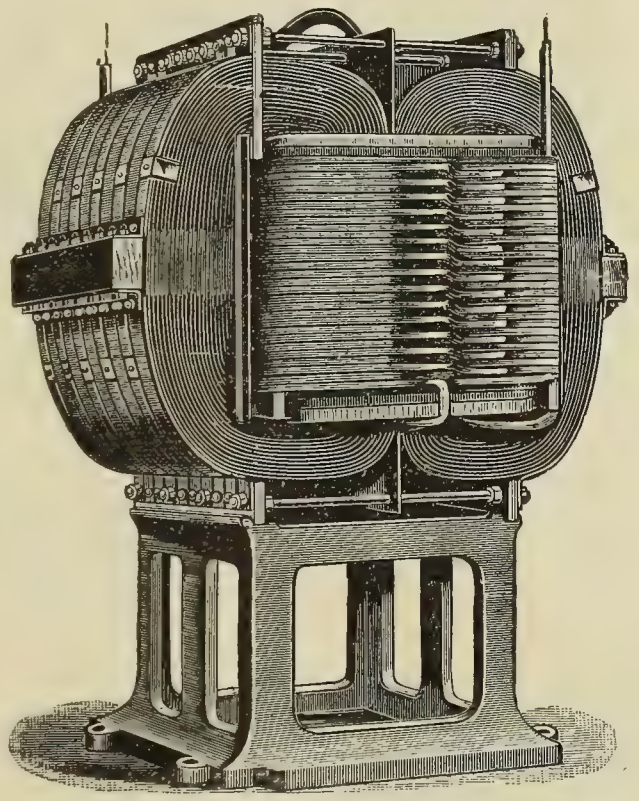
FIG. 2.—LETTUCE GROWN WITH AID OF ELECTRIC LIGHT.

FERRANTI SUB-STATION TRANSFORMER.*

The accompanying figure shows one of the Ferranti 150 H. P. transformers, specially designed as a sub-station instrument for reducing pressure from 10,000 or 5,000 to 2,400 or 2,000 volts. The transformer consists of three coils—viz., of one high-pressure coil, which is sandwiched in between two low-pressure coils. Each of these coils is composed of a copper strip separated by a strip of vulcanized fibre and wound over with shellacked cloth and vulcanized fibre. In forming these coils a number of separate flat coils are built up one over the other and connected together in series, insulating material being placed between every elementary coil. The high-pressure and low-pressure coils are separated from one another by sheets of ebonite, with a considerable air-space between. The iron cores are exceedingly massive and formed of flat bands bent over in opposite directions to form closed magnetic circuits; the various layers of iron bands are separated from one another by an air-space of half an inch, to provide for ventilation, or in cases where the transformer is placed in oil, to allow a free circulation to the oil. It is advantageous to immerse these high-tension transformers under the surface of an insulating fluid, diminishing thereby the liability to electrical discharge between the high-pressure coil and the iron frame, or the low-pressure coil which exists in virtue of the powerful electrostatic field in the neighborhood of the high potential end of the high-pressure coil.



FIG. 1.—LETTUCE GROWN UNDER NORMAL CONDITIONS.



150 E.H.P. FERRANTI TRANSFORMER AS USED AT THE LONDON TRANSFORMER SUB-STATIONS.

* *Electrical Review*, London.

ELECTRIC LIGHT NOTES.

The Wellsburg Electric Light and Power Company, of Wellsburg, W. Va., will require additional equipment soon. Address Robert Scott, President.

J. T. Staff, of Kansas, Ill., using 500 incandescent lamps on the Royal Electric Company's system (Peoria, Ill.), will need additional equipment shortly. Address Harry F. Staff, Superintendent.

The Hammond Electric Light Company, of Hammond, Ind., will need additional equipment shortly. Address Frank J. Baker, Manager.

The Germania Electric Company, of Boston, on September 3 contracted with the Portland Electric Light Co., of Portland, Conn., to install a 35 T.-H. arc and a 750 National incandescent alternating plant. The contract also calls for a 150 H. P. boiler and engine. The installation will be completed December 1 next.

The Reading Electric Light and Power Company, Reading, Pa., is erecting a 750 H. P. Hamilton-Corliss engine and 105 feet of shafting in its power-house. With the 450 H. P. Ide engine now in use the company will have 1,200 H. P. at its disposal.

The Lyons Electric Light and Power Company, of Lyons, Kan., is installing a 750-light National incandescent alternating system, to be used in conjunction with its Ft. Wayne Jenney arc-light plant.

The Rock Hill Electric Light Company, of Rock Hill, S. C., is to increase its plant by an arc and an incandescent machine. Address J. M. Cherry, President.

The Willimantic Electric Light Company, Willimantic, Conn., is erecting a brick station 100 by 40 feet, to be occupied by November 1. An incandescent system will be added to the plant during the coming winter. A. Lynch is Superintendent.

The Edison Electric Light Company of Grand Rapids, Grand Rapids, Mich., is to construct additional boiler room and install two 200 H. P. boilers.

The Powelton Electric Company, of Philadelphia, Pa., using 300 arc and 3,400 incandescent lamps on the Ft. Wayne system, is to double its capacity in the near future.

NEW INCORPORATIONS.

The Peninsular Electric Light and Power Company, of Newport News, Va., was incorporated September 9, with a capital stock of $100,000. Incorporators: E. C. Hillyer, L. P. Stearnes, G. A. Schmelz, W. W. Archibold and T. H. Gordon.

The J. C. Chambers Electric Sanitarium and Supply Company, Detroit, Mich., was incorporated September 14, with a capital stock of $50,000, to manufacture and sell electrical medical and surgical supplies and appliances. Incorporators: Josephus C. Chambers, Thomas Rollinson and Charles C. Wilmot, all of Detroit, Mich.

The Thomson-Houston Electric Light and Power Company, Sharon, Mercer County, Pa., has been incorporated, with a capital stock of $30,000. Incorporators: D.W. Dunn, Allegheny; Edward G. Waters, A. W. Williams, of Pittsburg, Pa.

The Harvard Electric Light and Power Company, of Harvard, Ill., was incorporated September 12, with a capital stock of $15,000. Incorporators: James E. Keelyn, E. L. Church and A. W. Young.

The Algiers Ice Manufacturing Company, New Orleans, La., was incorporated September 12, with a capital stock of $50,000, to carry on an electric-lighting business among other pursuits. Incorporators: William Wenzel, Peter Blaise and George D. Hite, all of New Orleans, La.

The Shawnee and Straitsville Electric Light Company, Shawnee, Ohio, was incorporated September 14, with a capital stock of $25,000. Incorporators: David L. Sleeper, A. S. Bethel, E. McLellan, William L. Kessinger and Herbert S. Burson.

THE ELECTRICAL AGE
DEVOTED TO ELECTRIC LIGHTING AND POWER, TELEGRAPHY, TELEPHONY, AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

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TO CHANGE ITS NAME.

The proposition to amend the constitution of the National Electric Light Association so that its title shall be changed to read "The International Electric Light Association" is a good one, we think. The term "National" is altogether too narrow in its application to such a body as this. There are many stations in Canada, some of which are already members of the Association, and yet the name of the Association implies that none other than American stations can become members. The word "National," therefore, is a misnomer, and to be consistent with its composition the Association should be international in name, as well as in character. Another thing: to call it an international Association would undoubtedly promote greater interest in its objects on the part of Canadian station managers. They would then feel that it was as much their society as Americans', and the results would be advantageous on both sides of the border line.

PARCEL EXCHANGE.

There is apparently no limit to the application of electricity, in one form or another, to useful purposes. Mr. A. R. Bennett, in a paper read before the British Association of Sciences at Cardiff, in August last, described an electrical parcel-exchange system which appears to have a considerable degree of merit.

Mr. Bennett's plan is to construct underground passages diverging from a central point to distributing points, and through these passages to run electric carriers for packages. The plans are well developed, and there seems to be no reason why the scheme would not work in practice. No doubt the plant would cost a great deal, and the commercial success of the system might be questioned; but there is one thing certain—it would be greatly appreciated by business men in large cities who are sorely vexed at times as to how they can deliver goods promptly. The congested state of traffic in the streets of such cities as London, Paris and New York is a difficulty that cannot easily be overcome when goods must be delivered expeditiously, and it is principally to avoid such delays that Mr. Bennett developed this system. We give an illustration and a general description of it on another page in this issue.

ANNUAL MEETINGS.

The suggestion of President C. R. Huntley, of the National Electric Light Association, that meetings be held hereafter once a year, instead of twice a year, as heretofore, is a healthy sign. At the time of the organization of the Association the developments in electric-lighting were so rapid and important that it was necessary to hold two meetings a year in order that all the members might be better kept posted on the improvements being made. The semi-annual meetings have been continued, but it is likely that the Buffalo convention next February will be the last one of these to be held.

The discontinuance of the semi-annual meetings means that the electric-light business is now on a healthy and sound foundation, and that the gathering of the members once a year will be sufficient for the purposes for which they meet. There will, of course, always be something new to be considered at the annual meetings, as electric-lighting cannot be said to be so perfect as to be unimprovable. When that time comes there will be no need of holding any conventions at all.

EFFECT OF THE ELECTRIC LIGHT ON GROWING VEGETABLES AND PLANTS.

Some months ago a story went the rounds of the daily press stating that a farmer in New York State had raised immense cabbages and other vegetables by the aid of the electric light. Since then other reports have been printed with reference to the benefit of electric light on the growth of vegetables, and it is but a few weeks ago that we read of the arrival of plants in New York from the West Indies which had been kept alive on board by means of electric light, but which previously had defied every attempt at preservation through a sea-voyage.

The most authentic record of the value of electric light in the growth of plants has just been issued by the Agricultural Department of Cornell University, Ithaca, N. Y. Elaborate experiments have been made there to determine the influence of the electric light on growing plants, and the result was an earlier and more vigorous crop of the plants experimented on than could have been obtained under ordinary conditions, thus proving that the electric light is healthful to vegetable life.

We give on another page some facts concerning these experiments, and also a couple of illustrations showing the difference between certain vegetables grown under normal conditions and by the aid of the electric light.

UNIFORMITY IN KEEPING ACCOUNTS.

The importance of uniformity in the methods of keeping accounts in central stations was ably set forth in the paper read by Mr. J. J. Burleigh at the recent convention at Montreal of the National Electric Light Association. What is particularly needed in this direction is a system that will show the exact cost per unit of the output, and one which will be kept uniformly by all so that managers may make comparisons. At the present time such comparisons are out of the question, for the reason that no two stations keep their accounts alike. Of course, all that the Association can do is to formulate a system and recommend its adoption by the members of the same. Every station manager will have the right to accept or decline the adoption of any newly suggested method, but it is safe to presume that the majority would adopt any new system that would work the greatest benefit to the greatest number.

No one can question the importance of uniformity in this direction after reading Mr. Burleigh's paper, and station managers would be best serving their own interests to co-operate for the attainment of this much-desired result.

DELIRIUM FURIOTUM.

Capt. Eugene Griffin, in his paper read before the National Electric Light Association at the recent convention in Montreal, referred to the alarm created in the minds of the doctors of the Royal College of Bavaria when the proposition was made in the early days of the railroad to build such a road in that country. One of the reasons given by this interesting body of profound thinkers was that the rapid movement of the train would not "fail to produce among the passengers the mental affection known as *Delirium Furiotum*." It is well that these wise men lived in their own generation; could they but see how railroading is accomplished these days, they themselves might suffer from a very severe attack of *Delirium Furiotum*.

MONTREAL'S WATER-POWER.

In his address at the opening exercises of the National Electric Light Association Convention in Montreal, on the 7th instant, Mr. Erastus Wiman called particular attention to the fine water-power of Montreal, which could be utilized for the production of electric power, but which was now running to waste.

"The transmission of power through electricity by a single delicate wire," he said; "was one of the greatest phenomena of the age. That forces could be commanded at the river bank of almost untold amount and transmitted to any portion of the city by electrical machinery was an advantage which Montreal should not be slow in availing itself of. There was an enormous force in the great rapids above, behind and below the city, and electricity could be brought and distributed to every house in Montreal. Power that could be constant, that could be intermittent, power that was forceful or power that was delicate, could be transmitted everywhere, for running sewing-machines in private residences for great factories, for running lathes, for grinding glasses by opticians, for feed-mills, for fans to stir the heavy air in the sick-room or to move a ponderous trip-hammer, to run elevators or to hoist cargoes out of vessels, for running fans or even rocking cradles, the mighty power of the combined St. Lawrence and Ottawa rivers can be made your willing servant. No tongue can tell what an enormous revolution impends for this city and this country when once there dawns upon the minds of your people the enormous potentialities that lay at your feet."

Montreal has at her disposal the natural forces which, if utilized in the manner suggested by Mr. Wiman, would place that city in the front ranks in the matter of electrical development. Very few cities in the world are so generously favored with water-power, and if the enterprising citizens of Montreal had their eyes opened to this important fact through the instrumentality of the International Electrical Exhibition, then one of the objects of the meeting of the Association in Montreal will have been accomplished.

After what has been seen in that city recently in the way of electrical appliances, it can hardly be possible that there was not awakened in the bosoms of those interested a desire to take advantage of the forces which nature has so beneficently bestowed.

AN ATTRACTIVE EXHIBIT.

At the official opening of the International Electrical Exhibition in Montreal, on the night of September 7, one of the most conspicuous exhibits which was revealed when little Miss Bovey touched the button and turned on the electric lights in the hall was that of the Eugene Phillips Electrical Works, of Montreal. Over the exhibit was a sign with the word "Phillips," the letters of which were made up of incandescent lamps. As the current was turned on the word "Phillips" blazed forth and stood out against the dark background in a very effective manner.



EXHIBIT OF THE EUGENE PHILLIPS ELECTRICAL WORKS AT THE MONTREAL EXHIBITION.

This exhibit is shown in the accompanying illustration, which is made from a photograph taken by our special artist.

The display of goods included electrical conductors insulated by the company at its factory, reels and coils of Faraday cables, rubber-covered conductors, and all kinds of wire. At the front of the space stood a stack of reels of wire, which formed a conspicuous object of attraction. Above the sign referred to was the well-known trade-mark of the company, viz.: a clenched hand, out of which bolts of lightning proceeded in every direction. The exhibit was a complete and exceedingly attractive one.

ELECTRICAL HAULAGE PLANT.

An electrical haulage plant was recently installed at Abercanaid Colliery, in New South Wales, by Messrs. Crompton & Co., Chelmsford, Eng. This plant displaces 27 horses, many haulers and a number of door boys, and enables the output to be increased by 100 tons a day.

The plant is very compact. The winding gear is of the form usually employed in the main and tail rope system, and works very satisfactorily.

The following data and the illustration are taken from the *Electrical Review*, of London:

"The motor is a Crompton patent series-wound machine built to run at 600 revolutions per minute and take 80 ampères at 450 volts at starting; when a heavier current is required it will take 160 ampères without harm. The motor is placed horizontally at one end of a wrought-iron frame which forms the bed for the drum and spur-wheel. The drum-shaft, which is of steel, is driven from a countershaft by means of spur gearing, and the motor drives the countershaft by means of six one-inch ropes. The haulage engine is fitted with two drums 3 feet 6 inches diameter and one foot wide, which are controlled by clutch and foot-brake. This plant will haul coal from three different parts of the pit, and although these are not far from the motor at the present time, it is expected that coal will have to be dealt with nearly a mile distant. The generating plant comprises a Crompton dynamo, horizontal pattern, built on a wrought-iron bed-plate. It is compound wound and will give out 160 ampères at 500 volts, running at 550 revolutions. The cable connecting the dynamo with the haulage plant is 3,200 yards long and composed of 37 strand, No. 14 high-conductivity copper wire highly insulated with vulcanized bitumen, double taped and served with two layers of jute yarn compounded between each. It is protected by a double sheath of No. 8 steel wire, the first stranding being of 30 wires and the second 36 wires laid in reverse directions. The current density is 870 ampères per square inch and resistance of cable 0.3192 ohms, allowing a loss of potential of 51 volts or 10 per cent.

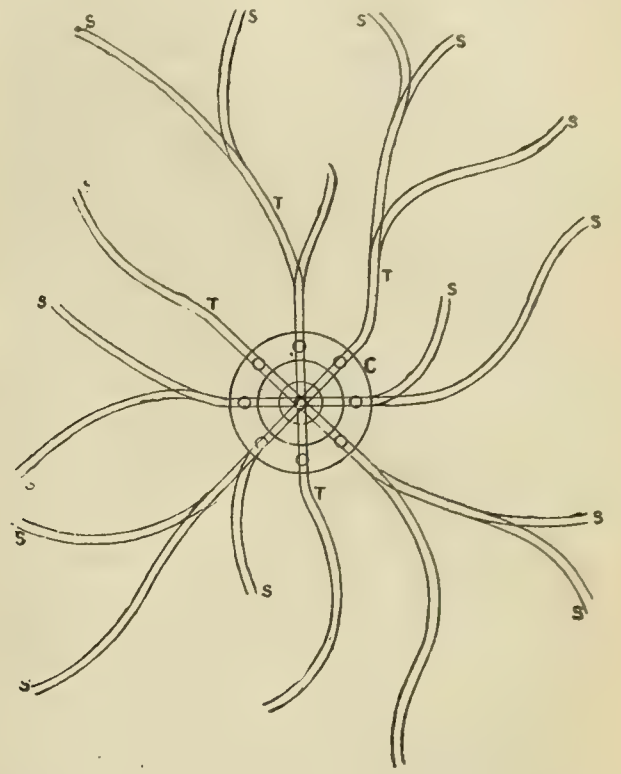
"From the generating plant the cable is carried down the level by the side of the shaft, and between the hauling engines it is fixed on each side of the roadway, and in case of 'falls' the cable has been constructed so that it can stand a shearing strain of 10 tons per square inch."

ELECTRICAL PARCEL-EXCHANGE SYSTEM.

At the recent meeting in Cardiff of the British Association for the Advancement of Science, Mr. A. R. Bennett presented a paper describing an electrical parcel-exchange system, laid down on lines somewhat similar to the telephone-exchange system. The following abstracts from the paper, taken from a London contemporary, will give a general idea of what Mr. Bennett proposes.

The congested state of the streets in many of the large towns, says Mr. Bennett, notably in the city of London, invites reflection as to whether it is not possible to devise means by which vehicular traffic may, to a certain extent, be diminished. To avoid absolute blocking of the thoroughfares, it is now necessary to forbid the collection or delivery of goods in certain localities during business hours, and trade suffers under such restrictions, while warehouses have to be of larger capacity than would be needed were the free receipt and dispatch of goods permissible.

Even if a means could be found for the handling at all times of comparatively small packages the boon would be no inconsiderable one; and with the view of breaking ground in this direction I have worked out a scheme, founded on the telephone exchange idea, whereby parcels can be freely interchanged between any number of buildings, no matter how widely apart they may be situated.

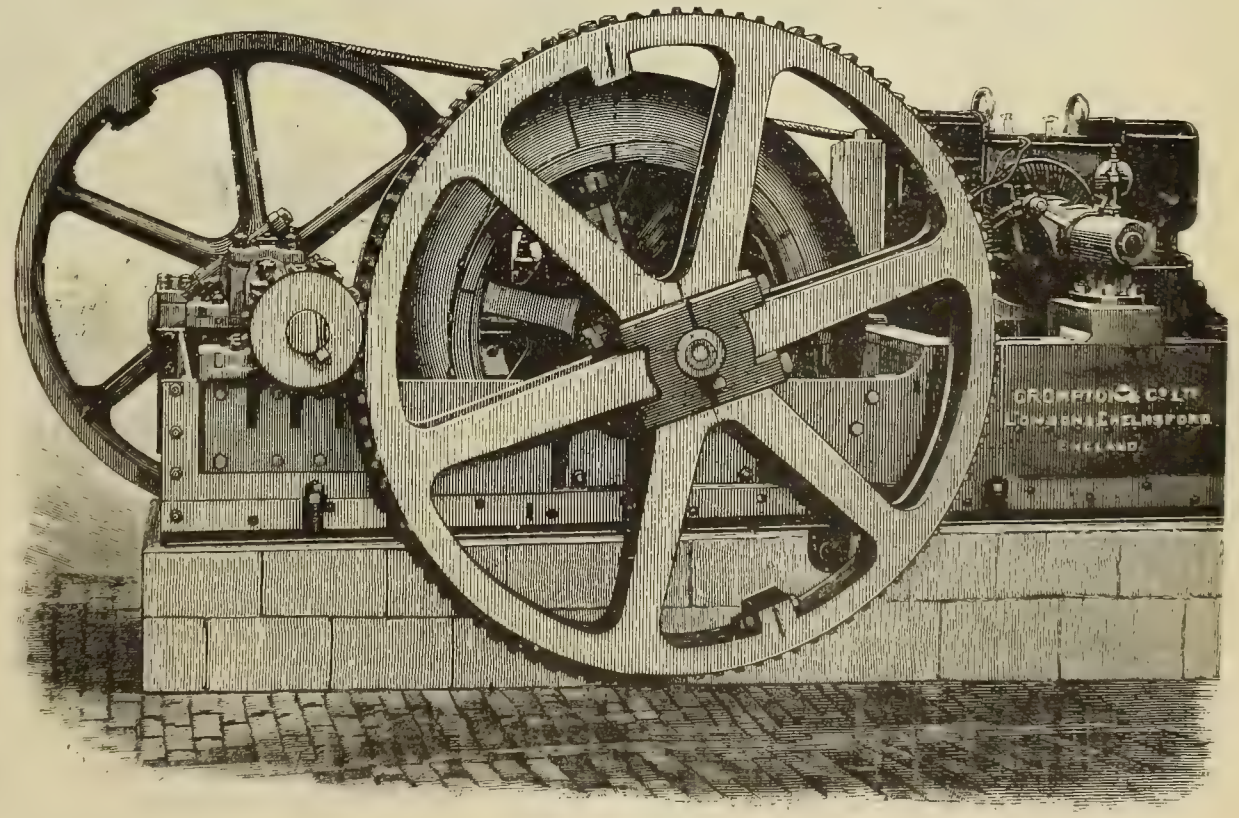


ELECTRICAL PARCEL EXCHANGE SYSTEM.

I propose to effect this by means of a number of miniature electric railways, radiating from a central station and having branches or sidings into all the buildings to be served. The general plan of such a system is shown by the accompanying diagram.

The railways would be laid in tubes of a rectangular section, and so arranged that the down track would occupy the lower and the up track the upper portion of the tube. To permit of examination and repairs, the tube should be large enough to allow of a man or boy creeping through, and in order to afford space for this the rails are laid, not on cross-sleepers, but on brackets fastened to the walls of the tube. During idle hours the full height of the tube would thus be available for the passage of workmen. In order to render the rails useful as conductors they are insulated.

On the rails would run trucks propelled by electromotors deriving their current either from one of the



ELECTRICAL HAULAGE PLANT.

rails or from a separate parallel conductor. On the down journey a truck would gather current by a collector pressing on the under, and on the up journey by one pressing against the upper, surface of this conductor, separate collectors being provided and connected to the motor in such a way that a truck could not be made to travel in the wrong direction. If on the down track, it could only obtain current through its upper collector, which would propel it always away from the central; if on the up track, its lower collector would only be operative, and this would always move it towards the central. There are several ways of attaining this end. Collisions between meeting trucks would consequently be impossible.

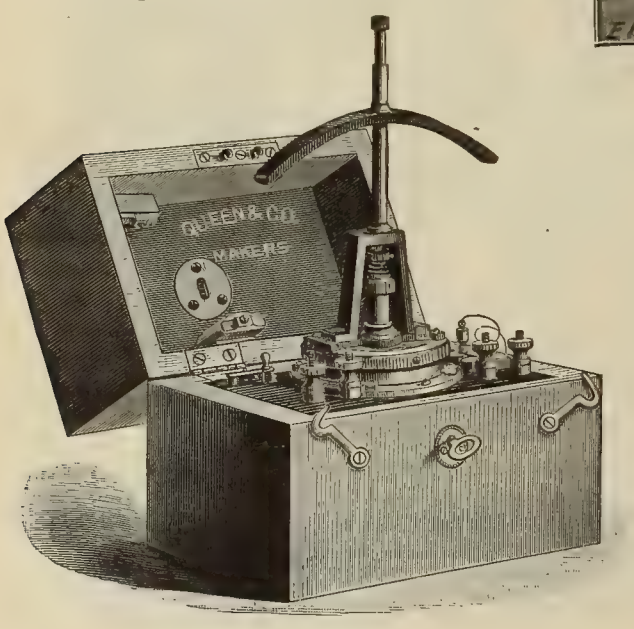
The central station would be established in a suitable locality. In a large town there might be several stations, connected with each other by one or more sets of tracks, just as telephonic switch-rooms are connected by junction wires. The central station would contain the engines and dynamos for generating the electricity required for working the system, and it might also be utilized as an electric-light-generating station or a telephone exchange, since the tubes laid for the parcel-exchange service would serve admirably forcontaining and distributing conductors and wires.

At the central station a turn-table or other device for the interchange of trains between the tubes would be provided for each tube. These turn-tables would communicate with each other, either direct or by means of a central turn-table, so that a free interchange of trains between the tubes would be secured. Each tube and turn-table would be worked by an operator. The turn-tables would be in two stages, to accommodate the down and up tracks, between which traffic would be exchanged by altering the level of the tables by means of hydraulic jacks. Empty or lying trucks would be stored in siding tracks, built one above the other, and reached by altering the level of the turn-tables.

Connection with the premises of subscribers to the system would be made by short spurs or sidings diverging from the nearest main tube. At the junction of the branches with the main tracks switches similar to ordinary railway switches would be placed, and controlled by the operator at the central by means of electro-magnets. These switches may be arranged in various ways. They may be kept in position for through main-line traffic by means of springs or permanent magnets, and be shifted to connect with the sidings by a current sent from the central, resuming their normal position as soon as the current ceases; or they may be wrought entirely by electricity, a current of one sign shifting and one of the opposite sign replacing them.

NEW PORTABLE GALVANOMETERS.

Electricians in all classes of work are in constant need of a sensitive galvanometer for various purposes. Now there are cir-



PORTABLE GALVANOMETER.

cuits to pick out and identify ; again there are leaks and grounds to seek for or the continuity of circuits to be determined; or again a fault is to be located in a cable or wire, or an accurate measurement of resistance to be made by one method or another.

To meet these demands Messrs. Queen & Co., Philadelphia, have brought out several new types of galvanometers. The instrument shown in the cut is one of them. The galvanometer itself is an astatic one, fibre-suspended, of which the needle is automatically lowered and its weight taken from the fibre by simple closing of the lid. The galvanometer is set in such a way that it can be rotated about its vertical axis so as to bring the plane of the coils in the plane of the magnetic meridian. The control magnet, seen in the cut, is adjustable in the length of its supporting tube and can also be rotated about it. If it is not desired to use the magnet it can easily be removed, being held only by two spring clips to the galvanometer proper, and held in the fittings placed in the lid for that purpose. In the bottom of the containing box are placed six chloride-of-silver cells connecting with a series of small blocks on the right; a plug allows these blocks to be connected so as to use one or any number of these cells in series. By means of a small switch, seen at the left and back, the galvanometer and batteries can be thrown into the same circuit or, by changing the position of the switch, into different circuits. In the latter case we have a galvanometer and battery which can be used in the ordinary way for ordinary Wheatstone's Bridge work, while in the former arrangement by applying two of the four terminals seen to a circuit an immediate deflection of the needle will be the result of a complete circuit.

This galvanometer is also furnished mounted exactly as shown, but without the switch and battery cells, and hence becomes simply a portable galvanometer for use in the orthodox way.



THE THOMAS MAST-ARM.

The special D'Arsonval galvanometer described as a part of Queen's latest model of their portable testing and resistance sets is also mounted in the form as above described, both with and without the batteries.

The case containing these galvanometers is of polished mahogany, with leather handle, and can be easily carried about.

THE THOMAS MAST-ARM.

We illustrate herewith a mast-arm, on the market but a short time, yet better known than many of the older inventions of that class. Experience has shown that the mast-arm is the best method of street-lighting, and the more perfect the mast-arm the better the service. The Thomas mast-arm is shown in its practical application in the illustration. It is simple in construction, strong and durable.

The conductors and the track to carry the lamp over the street are made of double L iron. The tracks with the supporting braces are insulated from the pole, dispensing with the cable, which has been found to be a source of continual expense. A switch is placed on the pole to cut out the lamp circuit while being trimmed.

The manufacturer thinks that for durability, practicability, simplicity, economy and perfect service it is the best in the market.

The Thomas mast-arm is manufactured by the Electrical Specialty Co., of Pawtucket, R. I.

MEETINGS OF SOCIETIES.

THE ELECTRIC CLUB.

Mr. Allen R. Foote, the special agent for the collection of the statistics of electrical industry for the eleventh census, will read a paper on "The Making of a Model New York City" at the Electric Club, New York, at 8 P.M. September 24.

This paper will deal in an original manner with the industrial and social needs of the city, the problems of rapid transit and workingmen's homes, and the relation borne by electricity to the evolution of a perfected New York.

The prospectus of the Brooklyn Institute for 1891–92 is just out. A very complete and extremely interesting course of lectures in science and art is provided, and in the department of electricity there is every promise that the lectures will be of greater interest and importance than any yet given. The special committee on exhibition will arrange for a large exhibit of electrical machinery, apparatus and appliances to be given in the spring months.

NEW YORK NOTES.

Offices of the Electrical Age and Street Railway News, First Floor World Building, New York, Sept. 19, 1891.

On Friday, September 18, the new Jewish temple Beth-el was dedicated. A stained-glass skylight in the arched ceiling will be illuminated by seventy-two incandescent lamps, and besides these the auditorium will be lighted by 1,000 incandescents distributed around the arches and columns.

Mr. Peter Claus, formerly representing the celebrated Continental dynamo, has been representing the Germania Electric Company, of Boston, Mass, in this section for some time, with office and salesroom at 63 Broadway, this city. Mr. Claus has been most successful in the introduction of the Germania incandescent lamps and the company's other specialties, and has just closed a contract with the company for his services for a term of years. Some time since he arranged with his company to manufacture the Continental dynamo as well as his recently-invented automatic dynamo. These machines will be placed on the market very shortly. Mr. Claus will be pleased to see his friends at his Broadway office. Mr. Claus has met with his usual success and has been able to place large orders for the company. He has just closed a contract for between 2,000 and 3,000 lamps on one order.

C. S. Van Nuis, consulting electrical engineer and manufacturer of the noted Ajax switches, 136 Liberty street, this city, lately shipped one of his new 500-volt switches, with a capacity of 1,500 ampères, to the Electric Merchandise Company, of Chicago. This switch is operating on a 1,000-horse-power circuit under the most favorable circumstances, and particular attention is called to this fact, as it is said that this is the largest switch ever made in the States.

The Pelton Water-Wheel Company, 225 Central Building, Liberty and West streets, this city, the Atlantic department of the company, begs to call attention to the fact that it has completed factory arrangements and is manufacturing a full line of water-wheels in Hoboken, N. J. The company is now fully equipped and prepared to ship for immediate delivery any size water-wheels and motors, together with water-pipe, shafting, pulleys and other machinery connected with the development of power by the Pelton system. The advantages offered are favorable freight rates as well as rapid and frequent communication with all parts of the world. Full information is afforded in regard to all propositions, either by personal interview or application by letter at the company's salesroom in the Central Building. The company will shortly have a full line of wheels and motors on exhibition.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York. as quoted by Geo. B. Ellery, financial editor Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	92 00
Am. Elec Exercise Mach Co., N.Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone N.Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	81 00
Asbury Park L. & P., N. J.	50,000	10 00	
Aut. Phon. Exb. Co	25,000		4
Averell Insulating Conduit	3,000,000	100 00	4 00
B. & S. Elec. Equipment Co., N Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	179 00
Bell Telephone 7s	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y	10,000	100 00	†60 00
Brush Illuminating, N. Y	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Brush-Swan, Ithaca	50,000	10 00	5 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102

Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*111
Commercial Cable Co	7,716,000	100 00	122 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Gas Co., Batavia, N. Y.	100,000		
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Day Ry. Const. Co., Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	12 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.	5,000,000		*96
Edison Elec. Ill. 6s, N. Y.	30,000		*99
Edison Elec. Ill., Lebanon, Pa.	80,000	10 00	10 50
Edison Illuminating, N. Y.	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	476 00
Edison Elec. Ill. Convt. Certs.	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	101 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	20 00
Elizabeth E. L. Co., N. J.	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	45 00
Essick Printing Tel.	5,000,000	100 00	35 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak.	100,000		*95
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co.	4,000,000	25 00	14 50
G. T. Woods Mfg. Co., Ky.	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co.	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	14 50
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co.	250,000	100 00	20 00
Hudson Electric Light, N. J.	100,000	100 00	
Hunt Engineering Co., Brooklyn, 6s	30,000	500 00	*105
Hunt Engineering Co., Brooklyn.	30,000	100 00	140 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill.	50,000		*99
Kansas Elec. Co. 6s, Mo.	20,000		*98
Laclede Gas Co.	7,500,000	100 00	19 50
Laclede Gas pref.	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*78
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*103
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co.	3,500,000	100 00	100 00
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N. Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J.	17,500		*104
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	9 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	16 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. & Tel. Co	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel. 6s.	1,500,000		*99
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Elec. Const. Co.	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio.	50,000		*95
North New York Lighting	150,000	100 00	10 00
Northern Elec. L. & P., Phila.	200,000	10 00	
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Passaic Electric Light	15,000	100 00	90 00
Paterson Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P. Co. 6s	800,000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I.	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	55 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	6 00
Saginaw E. L. & P. Co. 6s, Mich.	50,000		98
San Diego Gas & Elec. Co. 6s. Cal.	750,000		90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	480 00
Swan Incandescent	800,000	100 00	10 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co.	6,000,000	25 00	48 00
Thomson-Houston pref.	4,000,000	25 00	26 00
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50,000	100 00	100 00
Twin City Rapid Transit, N. J.	20,000,000	100 00	100 00
Union Switch & Signal Co., Pa.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co.	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2,000,000	10 00	
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas of N. Y.	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	84 75
Westinghouse Electric Co.	7,000,000	50 00	14 00
Westinghouse Elec. Co. pref.	3,000,000	50 00	50 00
West End L., Boston			19 00
Yonkers L. & P.	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

SATISFIED WITH IT.

GLOVERSVILLE, N. Y., Aug. 24, 1891.

Jerome Kidder Manufacturing Company.

SIRS: Enclosed find P. O. order for one of your new milliampere meters. It will be used principally with the Cabinet apparatus I had of you. The apparatus works like a charm so far as I have tested it, and your explanation as to the changes made are more than satisfactory. Very truly,

GEO. J. CANHAM.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued September 15, 1891.

459,422. Dynamo-Electric Machine and Motor. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Oct. 31, 1885.

An armature-core provided with narrow slots lying beneath the inner side of the coil and extending longitudinally or parallel to its axis and radial towards the centre of the armature-core, such slots passing only part way through the iron of the core, leaving that portion of the iron close to the shaft continuous and unslotted.

459,423. System of Electrical Distribution. Elihu Thomson, Swamscott, Mass. Filed Dec. 19, 1890.

A method of regulating a continuous-current transformer, consisting in subjecting a separate armature-conductor in circuit with a main winding of the transformer to the action of an auxiliary magnetic field acting only on the separate conductor and varying the strength of the auxiliary field.

459,442. Till-Alarm. Henry Garrett, Dallas, Tex. Filed Nov. 13, 1890.

A till provided with a battery and electric bell inclosed within its walls, one or more bolts for locking the till, the bolts lying in the path of a stop, connections between the bolts, and finger-pieces on the outside of the till, and a circuit-closer operated by the bolts and stops if the till be pulled before being unlocked.

459,447. Fibrous-Carbon Battery. James H. Robertson, Rutherford, N. J., assignor of two-thirds to Charles G. Taylor, Montclair, N. J., and John B. Campbell, Brooklyn, and Roscoe H. Thompson, New York, N. Y. Filed Nov. 17, 1890.

A primary battery the negative element of which consists of fibrous carbon made from rattan.

459,448. Telegraphic Apparatus. William E. Sloan, John E. Hughes and Orrin S. Reed, Chicago, Ill., assignors to the Vibro Telegraph Company, same place. Filed July 5, 1890.

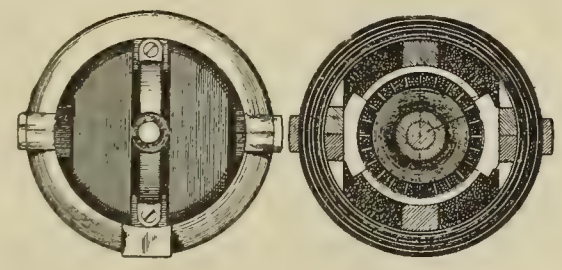
A telegraphic system comprising a tube extending between two or more stations and sending and receiving apparatus at each station, severally consisting of a closed compressible chamber, means for maintaining the chamber normally expanded, and a closed chamber provided with an elastic vibrating wall or diaphragm, branch tubes connecting both chambers with the tube, and a receiving device embracing an electric circuit which is controlled by the movements of the elastic wall or diaphragm, and a telegraphic sounder or recording mechanism operated by the circuit.

459,465. Electric Switch. Boyd W. Allen, Boston Mass. Filed Nov. 6, 1890.

A drum of non-conducting material upon which is wound or wrapped lengthwise or otherwise properly applied a serrated plate of conducting metal, together with several individual switches, which complete the contact with the metal plate on the drum, the surface of the plate being cylindrically continuous with the remaining surface of the drum so that its motion in either direction shall be unlimited.

459,491. Method of Making Plates for Secondary Batteries. Stanley C. C. Currie, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed Jan. 24, 1891.

A method of making a battery plate or element, consisting in subjecting in a suitable solution of a chloride of a metal lead enveloped or incased in woven or braided fibrous

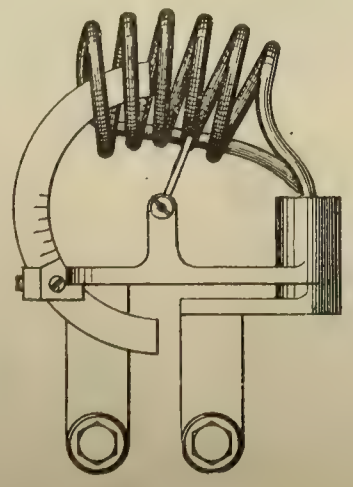


459,423- SYSTEM OF ELECTRICAL DISTRIBUTION.

material to electrolytic action to cause a partial penetration and conversion of the lead to a state or condition of a salt of lead, and then reducing the same to a soft, spongy, or porous metallic state or condition.

459,508. Dynamo-Electric Generator or Motor. John Hoduit, St. Louis, Mo., assignor of one-half to Carl Rueter, same place. Filed May 25, 1891.

A cylindrical shell divided horizontally and having pole-



459,560. CUT-OUT.

points coincident with the division-lines, and longitudinal field-coils mounted on a frame secured to the pole-points, and an armature operating within the field-coils.

459,509. Conduit for Electric Wires. Henry W. Johns, New York, N. Y. Filed April 27, 1891.

A seamless woven, knitted, or braided tube or conduit made from fire-proof strands or yarns of fibrous material, the same being waterproofed and made in continuous lengths and having a coating of surfacing material.

459,510. Electric-Arc Lamp. Edward R. Knowles, Brooklyn, N. Y. Filed May 25, 1891.

In an electric lamp having a low-resistance magnet arranged in the main circuit and a high-resistance magnet arranged in a derived circuit, the combination of an inner frame carrying the carbon-feeding mechanism and adapted to be actuated by the high-resistance magnet to operate the mechanism, and an outer frame pivotally connected to the inner frame and adapted to be actuated by the low-resistance magnet to stop the motion of the mechanism, whereby the feeding mechanism will be automatically set in operation as the current increases in strength in the high-resistance magnet and automatically stopped when these conditions are reversed.

459,514. Incandescent Electric-Lamp Socket. John O. Phillips, New York, N. Y., assignor to McCreary Electrical Specialty Company.

In combination with an incandescent lamp and socket, a pair of electrical conductors movable longitudinally within the socket and insulated from each other, a pair of springs electrically connected to the conductors and the terminals of the line-wire and arranged to actuate the conductors towards and hold them in contact with the poles of the lamp.

459,523. Cable-Box for Electric Wires. Jasper N. Keller, Newton, and John A. McCoy, Somerville, assignors to the New England Telephone and Telegraph Company, Boston, Mass. Filed May 23, 1891.

The combination of two or more sections of main multiple-conductor cable, one or more lateral branch cables, and a combination connection-box located at the junction of the cable-sections and the branch cable, having two chambers divided from each other by an impervious partition, but capable of being electrically connected by insulated connection-bolts passing through the partition, independent covers being provided for the chambers, the consecutive sections of main cable being connected by air and water tight entering-joints with one chamber and the branch cable being similarly connected with the other chamber.

459,535. Secondary Battery. William L. Silvey, Lima, Ohio, assignor to Catharine P. Silvey and Frank Silvey, Castleton, Ind., and Mary Silvey, Dayton, Ohio. Filed June 27, 1891.

The process of initially preparing secondary-battery plates, which consists in mixing a suitable metallic oxide with water, placing the resulting paste on a suitable support, and then pickling the whole in an acid solution.

ELECTRICAL PATENTS—Continued.

459,556. Process of Electrolytically Obtaining Zinc. Alexander Watt, London, England. Filed March 22, 1889. Patented in England.

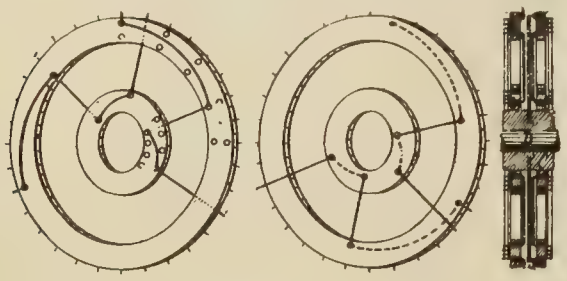
The art of preparing zinc-bearing ores for electrolysis, consisting in digesting the powdered ore in acetic and sulphuric acids to form an electrolyte.

459,560. Cut-Out. Frank Bryan, London, England, assignor to Woodhouse & Rawson United, Limited, same place. Filed March 11, 1891.

An appliance for cutting out an electric circuit when the current exceeds a certain strength, comprising a pivoted wire coil inclosing an adjustable magnetic core which forms part of the circuit while it is in a certain position, the coil being pivoted so that when the strength of current causes a certain amount of mutual attraction between it and the core the coil is made to move out of position and so to open the circuit.

459,572. Commutator-Turning Device. Arthur K. Bonta, Hoboken, N. J. Filed Oct. 16, 1890.

A commutator-turning device for dynamo-electric machines, consisting of a bracket having a pin, clamping-screw,



459,610.—DYNAMO-ELECTRIC MACHINE.

side-bar, and a block having a tool-post fitted to the bar, and means for feeding the block along the bars.

459,591. Electrical Alarm System. John P. McMahon, Jersey City, N. J. Filed Jan. 24, 1891.

The combination of a main circuit, a ground branch, a transmitting device having a series of breakers, a controlling-magnet therefor, a connection between one side of all of the breakers and the circuit, the connection including the magnet, a separate ground branch from the other side of the breakers, and a circuit-controller in each of the ground branches.

459,605. Electric Push. John F. Wollensak, Chicago, Ill. Filed Jan. 28, 1891.

In electric pushes, the combination of a plate of insulating material, binding-screws for holding both ends of the circuit-wires, arranged on the outside and both extending through into the interior to operate as contact-points, and a face having a loose button which completes the circuit as it is pressed in through the direct instrumentality of both binding-screws.

459,610. Dynamo-Electric Machine. Edmond Desroziers, Paris, France. Filed June 17, 1887. Patented in France, Belgium and England.

An armature composed of two coaxial parts similar in form, having their adjacent parts parallel one with the other, these two coaxial parts being armed with like elements arranged and classed symmetrically and formed of short conductors not cutting each other, the conductors of one part being placed side by side with those of the other part, these conductors having their extremities electrically connected, so as to form a continuous circuit, the extremities of each of the conductors or elements of one of the parts being joined to the extremities of a preceding element and of a following element placed on the other of the two parts, so that the elements are connected in continuous series.

459,615. Annunciator. Foster Ritchie, Highland Park, assignor to Myron A. Knapp, Chicago, Ill. Filed Dec. 29, 1890.

A sliding rotatable shaft carrying the armature for the magnet and an indicator and means for imparting an endwise and a rotary movement to the shaft.

459,633. Railway-Signal. Henry C. Horstmann, Naperville, Ill. Filed May 15, 1891.

An electric signal for railway block systems.

459,678. Electric Motor. John W. Davis and John B. Farrington, New York, N. Y. Filed May 5, 1891.

In an electric motor, an electrically-rotated disc having insulated bearings, a hub concentric with the axis of the disc and having radial arms provided at their outer ends with pairs of combs between which the disc revolves and a contact plate or strip resting on the hub.

459,681. Electric Belt. Christian H. Dorenwend, Toronto, Canada. Filed Sept. 16, 1890.

In an electric belt, the combination, with an electrode provided upon its outer side, at diametrically-opposite points, with eyes, of a chamois covering for the electrode, provided with slits or openings for the reception of the eyes, a tightening-string passing through suitable slits therefor in the cover, and a clasp having a central coil and hooked ends engaging the eyes of the electrode.

459,686. Insulator. Clarence L. Gerrard, Columbus, Neb. Filed April 3, 1891.

An insulating-body having independent parallel apertures or bores with a sustaining rod or bolt secured in one of the apertures or bores and projecting from one end of the body, and a trolley-wire-supporting rod or bolt secured in the other aperture or bore and projecting from the opposite end of the body.

459,704. Electrical Fixture. Edwin T. Greenfield, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed Dec. 31, 1890.

A ceiling or switch-block made in two parts, each having a pair of conducting parts cast into non-conducting supports and provided with means for electrically uniting the conducting parts.

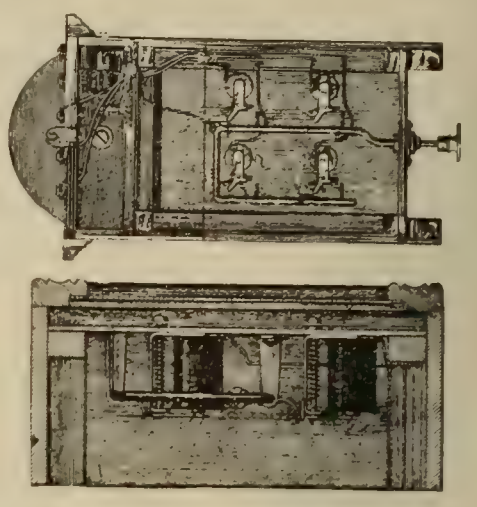
459,705. Electric-Light Fixture. Edwin T. Greenfield, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed Dec. 31, 1890.

An incandescent electric lamp having a pair of flexible conductors insulated from each other and connected each directly to one of the leading-in wires of an incandescent lamp, the conductors being attached at their upper ends electrically and mechanically to a switch inaccessible to the user, all of the electrical conducting parts being inclosed in an insulating casing or ceiling-block.

459,706. Electric Snap-Switch. Gerald W. Hart, Kansas City, Mo., assignor of one-half to George S. Hegeman, Hartford, Conn. Filed June 22, 1891.

A snap-switch, consisting of a stop-plate having stop-shoulders, a central hub, an operating-handle, an eccentric moving with the hub, a switch-plate, a spring-plate, a spring, and a catch operated by the eccentric for releasing and stopping the switch-plate.

459,711. Fastener for Spring-Jacks of Switch-Boards. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 7, 1891.



459,615.—ANNUNCIATOR.

The combination, with strips of spring-jacks arranged in panels in a switch-board, of a partition separating adjacent panels furnished with perforations through the partition, with pins extending through the perforations and projecting on both sides of the pin into recesses in the ends of the strips of spring-jacks.



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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, OCTOBER 3, 1891. No. 40.

A MODEL ELECTRIC LIGHTING STATION.

As may be judged from our description the municipal electric lighting station of Allegheny City, Pa., an illustration of which we give herewith, is a model plant in every respect.

The machinery is so compactly arranged that the entire 1,000 horse power, with a capacity for 4,500 incandescent and 540 arc lamps, occupies a floor space of but 56 x 57 feet.

In detail, the machinery consists of three 13 and 22 x 13 Westinghouse compound engines, belted direct to three 1,500-light Westinghouse alternating current incandescent dynamos, of which two are in general use, while the third is alternately used as reserve; four 13 and 22 x 13 and one 10 and 18 x 10 Westinghouse compound engines, belted to nine 65-light Westinghouse alternating current arc dynamos, of which four units are sufficient for the service, and the fifth acts as relay, and two 6½ x 6 Westinghouse standard engines, belted to two 100-light Westinghouse direct current dynamos for use as exciters of the field magnets of the alternating generators.

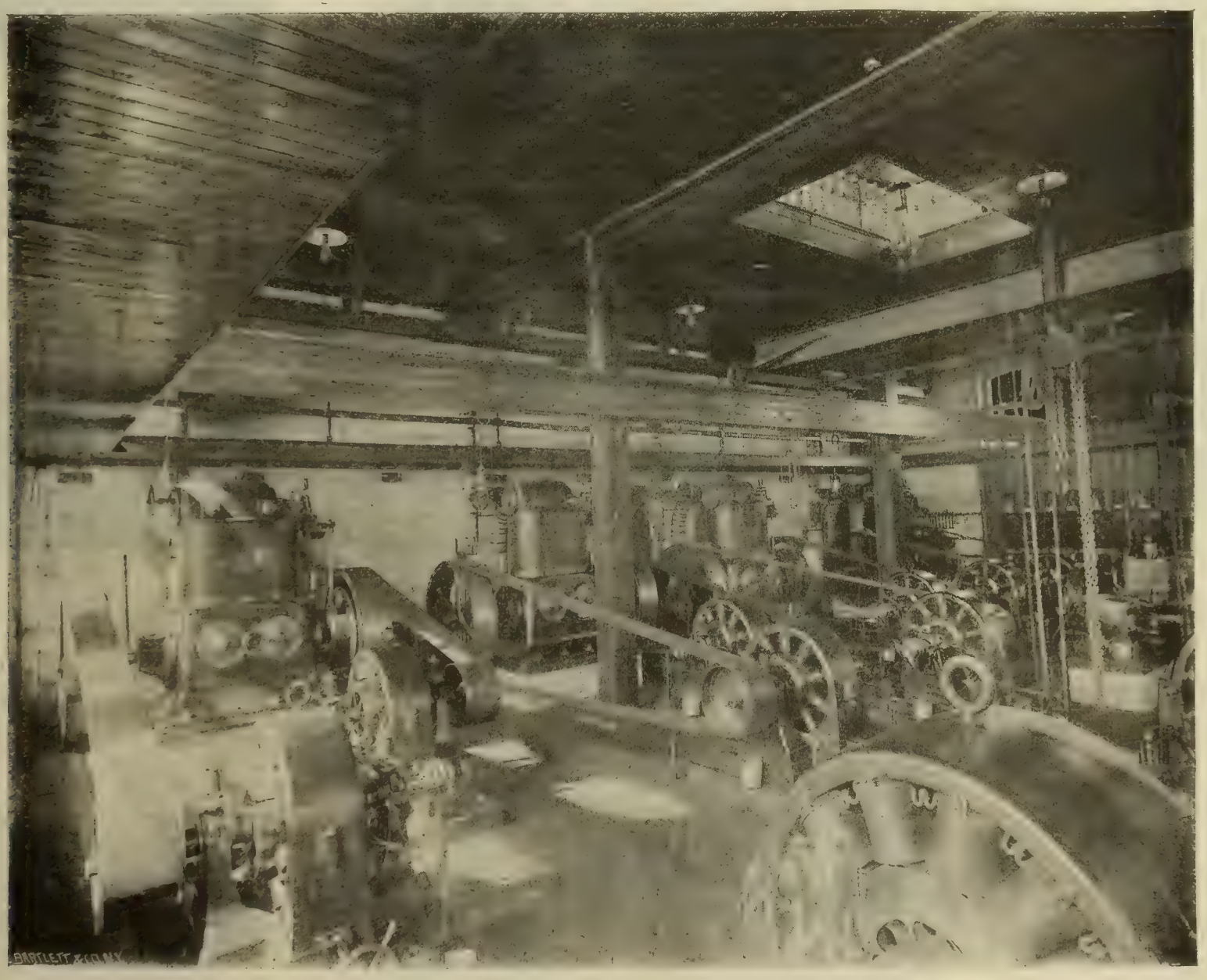
The engines are ranged in rows on each side of the room, and are belted to the dynamos in the centre.

A 6-ton crane over the dynamos and a 2-ton traveller over each row of engines insures promptness in shifting or repairing.

In the boiler-room the same careful attention to details is shown. Six 100 H. P. Erie boilers, of which one acts as reserve, are fitted with Roney stokers, and the coal is loaded direct from the car into a tank travelling on an overhead rail, so hung as to empty the coal into the hoppers of the stokers.

Two pairs of duplex pumps and three injectors, either of which is sufficient for the purpose intended, are guarantees against accident to the feed-water supply.

The stokers are operated by a 4½ x 4 Westinghouse standard engine, whose motion is reduced through a screw gear, and a second engine duplicates the first, and is for use in case of accident.



ALLEGHENY CITY LIGHT PLANT, ALLEGHENY, PA.

The steam pipe is continuous, and any portion may be disconnected without interfering with the rest of the plant.

On the whole, this station is well designed and well lighted, and, with its interior finish of natural wood, always kept carefully clean, it presents an air of neatness in striking contrast to many larger and more pretentious stations.

CHEMICAL ELECTRO-MOTIVE FORCE.

Whenever an electrolyte is decomposed by a current, the resolved ions have a tendency to reunite, that tendency being commonly termed "chemical affinity." Thus when zinc sulphate ($ZnSO_4$) is split up into Zn and SO_4 the zinc tends to dissolve again into the solution by reason of its "affinity" for oxygen and for sulphuric acid. But zinc dissolving into sulphuric acid sets up an electromotive force of definite amount; and to tear the zinc away from the sulphuric acid requires an electromotive force at least as great as this, and in an opposite direction to it. So, again, when acidulated water is decomposed in a voltameter, the separated hydrogen and oxygen tend to reunite and set up an opposing electromotive force of no less than 1.47 volts. This opposing electromotive force, which is in fact the measure of their "chemical affinity," is termed the electromotive force of polarization. It can be observed in any water-voltameter by simply disconnecting the wires from the battery and joining them to a galvanometer, when a current will be observed flowing back through the voltameter from the hydrogen electrode toward the oxygen electrode. The polarization in a voltaic cell produces an opposing electromotive force in a perfectly similar way.

Now, since the affinity of hydrogen for oxygen is represented by an electromotive force of 1.47 volts, it is clear that no cell of battery can decompose water unless it has an electromotive force at least of 1.47 volts. With every electrolyte there is a similar minimum electromotive force necessary to produce complete continuous decomposition.

—The Gregg Electric Cure Company, of Chicago, Ill., was incorporated September 22, with a capital stock of $50,000. Incorporators: Arthur W. Underwood, Edwin T. Coman and Chas. Shackleford.

THE BINSWANGER-COATES MICROPHONE.*

Messrs. Binswanger and Coates, of the General Electric Company, have recently brought out a microphone which, they claim, possesses the advantage of the vertical form of diaphragm, and also that of

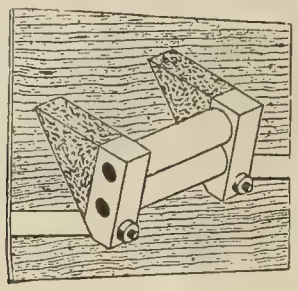


FIG. 1.

being worked best by a single cell. The diaphragm is clamped to the box by means of two brass clamps without the use of india-rubber. The carbon tension regulators consist of two blocks and two pencils; the blocks are so made that they are clamped to the diaphragm by one screw only and yet present an angle of about 45° to the vertical form of the diaphragm, as shown in Fig. 1. The space between the carbon blocks and the diaphragm is filled by cork, and forms a damping arrangement not influenced by atmospheric changes nor by vibrations—such as, for instance, passing trains in a railway station. Owing to the disposition of the carbon pencils upon the blocks, the vibrations of the diaphragm are transmitted in such a manner that the loose carbon pencils are influenced by gravity alone, and the rolling effect of the pencils, causing that burring and indistinct articulation of pencils in a vertical position alone, is obviated. This position of the cork damper, together with the fact that the vibrations are transmitted from the diaphragm to the carbons by means of two screws only, fixed almost in the centre of the diaphragm, allows the vibration of the diaphragm

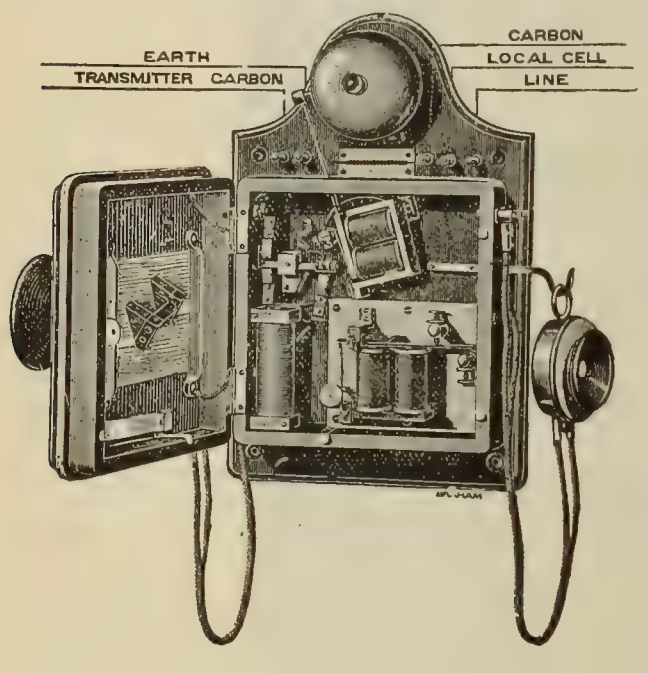


FIG. 2.

ample play and full force, so that speech is reproduced not only very clearly, but with increasing loudness.

A number of railway companies have found these advantages suitable for their purposes, and we illustrate in Fig. 2 a set specially designed with long-distance relay for the bells for use in signalling on railways.

THE EDISON PRESSURE INDICATOR.

Electrical development has in the last few years grown to such proportions and engrossed the attention of so many inventors and engineers, that the number of instruments and devices brought out can be numbered only by the thousands.

Being a new field of industry, however, and subject to such rapid changes, few of the instruments and appliances known a few years ago have stood the test of time so as to be of service to-day. Consequently any instrument that has lived through the early years of experiment and severe tests, and still remains standard, must be considered of especial interest. Of such a character is the Edison pressure indicator, which has, indeed, a history.

In 1884 engine-room indicators were commercially made and used, in which changes in resistance of carbon filaments, caused by variations in the pressure, were made to measure and indicate those changes. During the seven years which have since elapsed various forms of indicators have been made, tested and tried, but none have been found to equal the carbon-resistance indicator in accuracy, convenience and permanence, in ability to stand a long, rough journey and be in perfect order at its end; in the ease with which any one who will read the directions can set the instrument up and get accurate results from it, and above all, in regard to the large movement of the pointer produced by a small change of pressure, the arrangement of scale and pointer which enables the attendant to see small movements of the pointer at a distance, and the fact that the instrument contains means whereby its readings may be checked at any time, each instrument being in fact two indicators, one of which is always held in reserve to be used occasionally in calibrating the working indicator and correcting any change which may have taken place in it.

The Edison Indicator, as it stands to-day, is the result of seven years' experience and experiments with all kinds of indicators, including various forms of carbon-resistance indicators; and for the work for which it is intended, it is practically a perfect instrument. It is an engine-room indicator, and a very efficient guide and monitor to the engineer or attendant in charge of dynamos.



EDISON PRESSURE INDICATOR.

The proper operation of an incandescent electric light plant demands good regulation, the pressure must be uniform and must be right or the plant will not give the best results. Uniformity in the pressure is very necessary. Lamps operated on a circuit, the pressure of which is sometimes above and sometimes below normal, never give satisfaction, while lamps operated on a circuit with uniform pressure are more satisfactory, and give a better light and life, even though the pressure averages several volts higher than the normal.

A uniform incandescent light causes no comment; it simply does its work, and as it never attracts attention, it is not subject to adverse criticism.

Good results demand not only uniform pressure, but correct pressure. Dim lamps can never be satisfactory; neither will lamps operated at a high pressure, as they deteriorate and break. This is especially true regarding high-efficiency lamps, so that to secure good results the resistance of a good, reliable and convenient indicator is an absolute necessity.

The result of the whole experience of the Edison Company is that the Pressure Indicator, shown in illustration, is by far the best indicator that has ever been produced. There is no other indicator the movements of whose pointer can be readily seen across an ordinary room, or which contains within itself the means for calibration or checking, which are so simple that they can be used by any one.

The very large number of these instruments in use, the small number which get out of repair, and the almost total absence of complaints regarding them, are the most substantial indorsements of the instrument.

SAFETY MINING CABLE.

The following illustrations and description of a safety mining cable invented by Mr. L. B. Atkinson are taken from a London contemporary. The cable

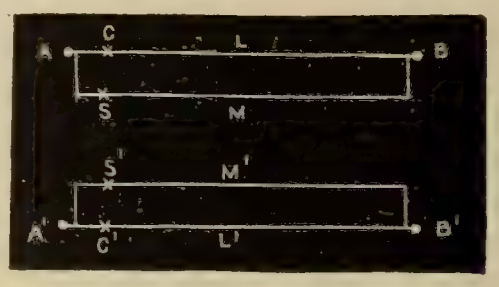


FIG. 1.

is being introduced by Messrs. W. T. Goolden & Co., of London, Eng., and possesses special merits.

The diagrams and figures show the principles on which the cable is constructed. In Fig. 1 A A′ are the two poles, say, of the generating dynamo, and B B′ are the two poles of the motor or lamps. These are connected each by two wires, a main conductor, L L′, and a subsidiary conductor, M M′. These wires will, of course, carry current simply in proportion to their areas, being of the same length. Now, in each main

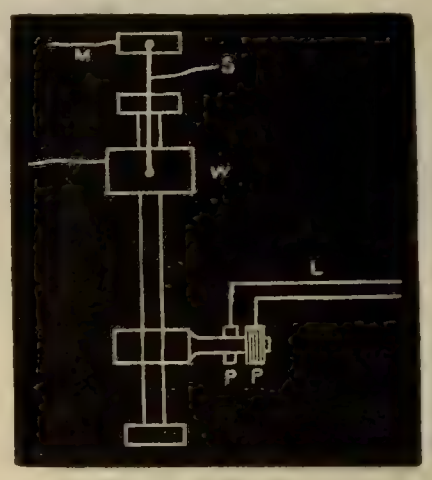


FIG. 2.

and each subsidiary conductor are arranged cut-outs proportioned to the carrying capacity of each wire. Suppose the main conductor, L, be broken, provided that the subsidiary conductor, M, is not broken, no spark will result at breaking, as the circuit is still closed, but the whole current now traverses the subsidiary conductor, and the fuse at once melts. This



FIG. 3.

fuse allows a weight to fall (see Fig. 2 where W is the weight and P P the switch), and this instantly disconnects the whole circuit. This, then, is the principle.

The practical form of cable to carry this into effect is shown at Fig. 3. A close wound spiral of tinned copper wire, several wires being for preference arranged in parallel, is braided over, but not heavily insulated. Over this is laid a stranded conductor of the required area, and this in turn properly insulated in any of the usual manners. If the cable is torn down from the roof or broken in any way in tension,



FIG. 4.

this inner conductor extends to an indefinite extent, for as it gets drawn out the diameter of the spiral decreases, and hence it becomes quite loose in its tube. This spiral conductor carries the current for an instant till the fuse breaks, when the whole conductor is disconnected from the supply.

It sometimes, however, happens that a cable may be cut in two by a falling stone, or even by a sharp instrument like a knife or axe.

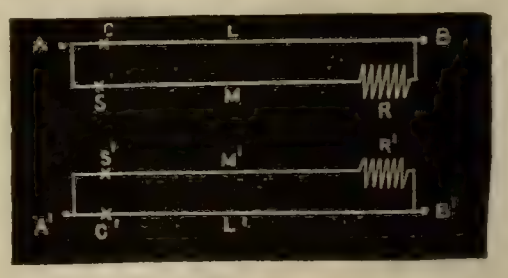


FIG. 5.

By a small addition to the arrangements already provided this also leads to an instant disconnection of the circuit before it finally breaks, and hence without spark at the point of rupture.

Fig. 4 shows the cable thus broken and extended. Fig. 5 shows an arrangement similar to Fig. 1, except that at the further end of the cable from the generator is a resistance, R, in the circuit of the subsidiary conductor. The effect of this is that the fall of potential along the subsidiary conductor is less than along the main conductor, and that, therefore, a difference of potential exists between them. If, therefore, the cable is damaged by falling stone bringing the inner and outer conductors into contact, or if the cable be cut by a metallic instrument effecting the same result, there is an immediate increase of current in the subsidiary conductor, thus

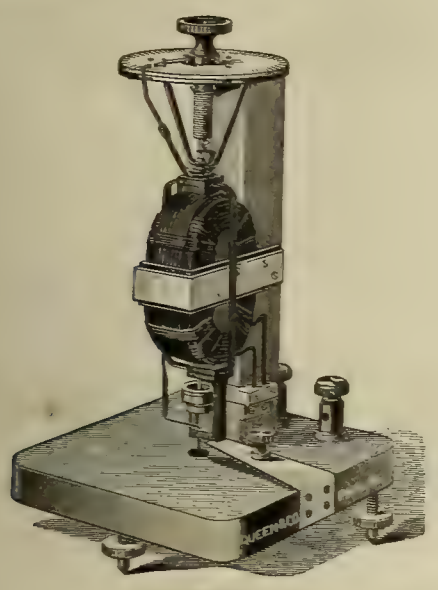
* *Electrician*, London.

melting its fuse and disconnecting the cable as before. This cable, therefore, really acts by transferring the electrical rupture of the cable to some point such as the switchboard at the top of the pit where it is unimportant, thus making its use safe under all circumstances.

Apart from colliery work, the use of this cable would be desirable for overhead high tension wires, as if broken the broken ends would not be left in the road with the current on, and thus would not be left a source of danger to persons and animals in the street.

NEW TYPE OF SIEMENS' ELECTRO-DYNAMOMETER.

Siemens' Electro-Dynamometer is an instrument too well known to electricians to require any descrip-



DYNAMOMETER.

tion. The ease with which it may be standardized, even by those not familiar with instrumental work, its constancy and freedom from variable elements, and its immediate applicability to the measurement of either direct or alternating currents has placed it in the hands of all those requiring to make accurate measurements of such currents. With a view to improving certain weak points in the type commonly made as well as to producing a more convenient and perfect instrument Queen & Co., of Philadelphia, have designed a form of Electro-Dynamometer, a cut of which is shown.

The principal change made in this form is the suspending of the movable coil by means of a polished agate centre instead of by a coarse fibre. On account of the variable absorption of moisture by the fibre and the mechanical constitution of the fibre itself a certain sluggishness and insensitiveness of action has always characterized the instrument. In Queen & Co.'s type the coil hangs by a small hardened steel centre in a cup centre of highly polished agate. The coil, hung in this way, is absolutely free from any perceptible friction and the sensitiveness of the instrument is very greatly increased. To reduce the moment of inertia of the suspended coil an index made of light aluminum wire has been used instead of the usual heavy brass index. Just below the agate a small brass pin extends downward and fits into a cylindrical opening a trifle larger, in a rubber block clamped to the upper part of the movable coil; hence by releasing the spring shown on the base the coil is lifted from its agate and held tightly, so that despite the roughest handling in transportation, the jewel cannot be broken, while the steel centre will accurately reseat itself in the agate owing to the guidance of the pin, when the spring is depressed by means of its screw. Instead of two uprights as in the Siemens' made type Queen's design employs but one, thus considerably lightening the instrument as well as making its working parts more accessible. The binding posts are placed at the rear of the instrument instead of in front, thus getting the connecting wires out of the way.

The instrument is thus far wound to but two ranges, viz., from $\frac{2}{10}$ to 20 ampères and from 1 to 60 amperes. Other sizes will be made for higher and lower ranges of current as soon as possible. Each instrument is furnished with two sets of windings; thus in the 20 ampère type one set allows measurements to be made varying from $\frac{2}{10}$ to about 4 ampères, while with the other set, the range extends from about 1 to 20 ampères.

The whole instrument is finished in polished mahogany and lacquered brass and copper. The dial is of opal glass and graduated in 400 equal divisions. These instruments are also being made enclosed in glass cylinders and with a brass instead of wood support, a silvered instead of opal dial, and otherwise more handsomely finished; they will be described in later issues.

ELECTRIC ELEVATOR.

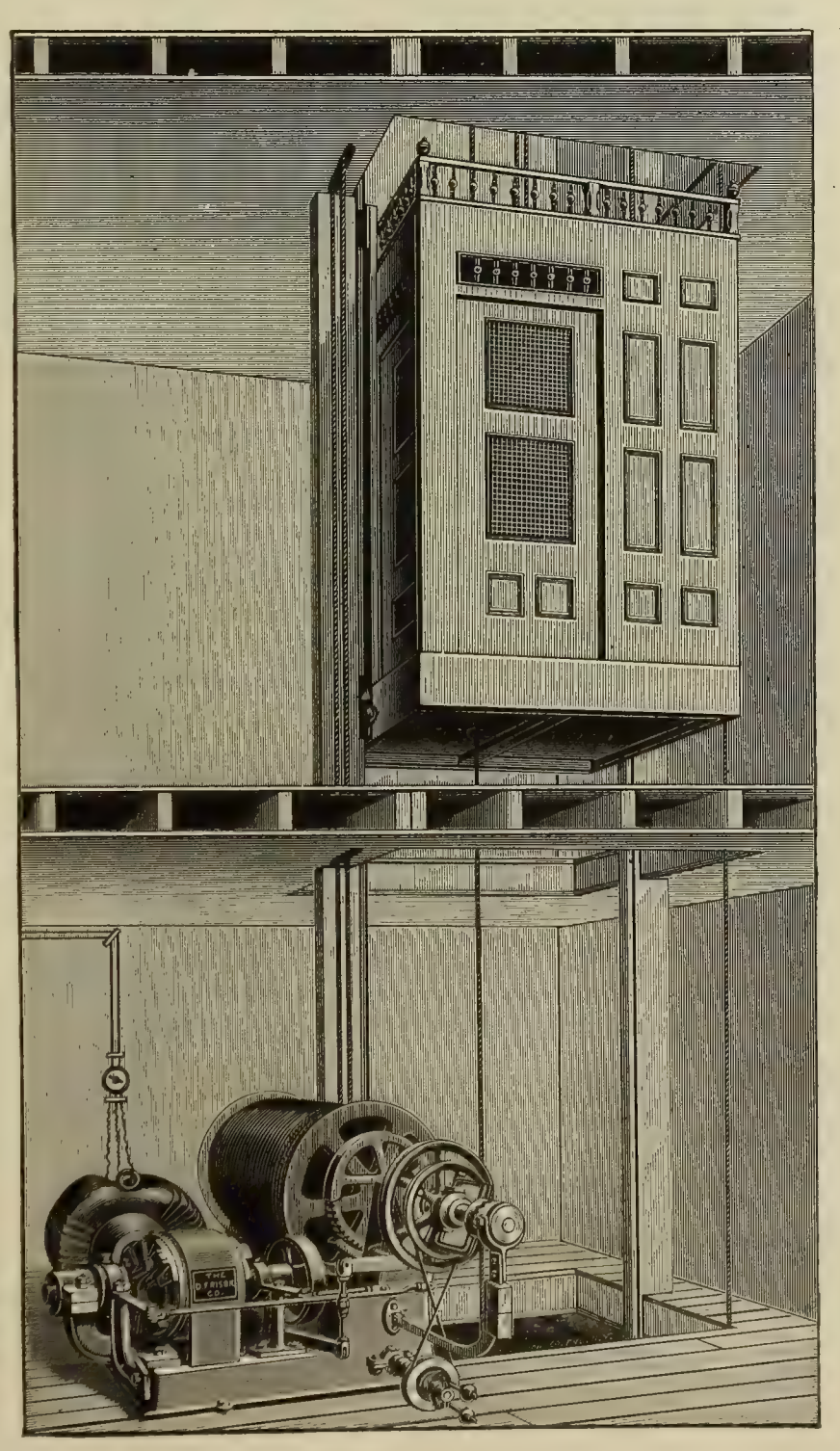
We present herewith an illustration and description of the Direct Electric Elevator manufactured by the D. Frisbie Company, of New Haven, Conn. The machinery is shown as located in the basement and with the passenger car attached. It will be seen that the motor used is one of the well-known C. & C. Electric Motor Company's make, which gives a great amount of power with a small consumption of current. The company's new self-oiling bearings and carbon brushes are used.

The power is transmitted from the motor to the screw-shaft by means of noiseless frictional gearing. Two of the Frisbie patent friction clutches, one for hoisting and the other for lowering, are used, giving the operator in the car perfect control over the machine, enabling him to start, stop and reverse it at will, moving the car to such a nicety that it can be raised or lowered the fractional part of an inch. The stop motion in the machine enables the car to be run at full speed and stop automatically at the extreme travel of the run.

In the event of the car meeting an obstruction in its descent a slack cable stop engages a clutch at the end of the drum shaft, locks the automatic stop, shutting off the machine instantly and preventing the cable from leaving the drum. In the event of the current becoming impaired from any cause while the car is descending, a centrifugal safety governor disengages the friction clutch and automatically applies a powerful brake, stopping the machine.

The worm wheel is extra heavy and cast of phosphor bronze, and is bolted directly to the arms of the drum near the rim, making it perfectly rigid and preventing any torsion of the drum shaft. The worm is cut from steel of selected stock. The drum is of a large size, turned and grooved to receive the wire cable.

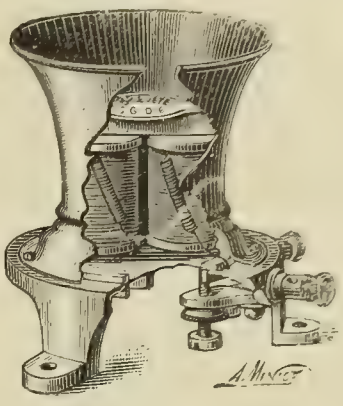
The motor runs continuously, as by actual tests made by the Frisbie Company it was found that this consumed a less amount of current than would be used by starting the armature at intervals from a stand-still under a load. It also obviates the necessity of having switch boxes and rheostats. The floor space required is only from four to eight feet square. The car can be run at a high rate of speed and be started and stopped very smoothly.



ELECTRIC ELEVATOR.

ELECTRIC TRUMPET.

One of the attractions in the exhibits at Montreal during the late convention, of Alexander, Barney & Chapin, 20 Cortlandt Street, New York, was an electric coach and yachting trumpet. Mr. H. G. Issertel, who had charge of the exhibit, arranged this trumpet in such a way that he could produce music in its operation. The trumpet was a source



ELECTRIC COACH AND YACHTING TRUMPET.

of great amusement and entertainment to the children, who were specially invited to the parlors to hear it.

The accompanying cut illustrates the mechanism of the trumpet. The rapid vibration of the diaphragm, which is located at the base of the trumpet, is caused by the rapid make and break of the current as in electric bells. The sound is amplified by a horn which is placed over the instrument, and the result is a musical tone which may be varied in pitch at will by means of the adjusting screw. These instruments make a very loud noise and are excellently adapted to yacht, coach and bicycle signalling purposes.

The battery used in connection with the trumpet is a diminutive cell of A B C dry battery. It is remarkably powerful and has long life.

FOREIGN NOTES OF INTEREST.

On August 25 last the electric lamps in the exhibition of Frankfort-on-the-Main were lighted for the first time by the current transmitted from the generating centre at the Lauffen Falls of the Neckar, over 100 miles distant from the city. At eight o'clock in the evening the electrical current was transmitted from Lauffen along the cable, and was found that the precautionary measures adopted along the cable line to insure the safe transmission of the electric current were faultless. The transmission of the electric current derived from water power over a distance of 100 miles is, therefore, an accomplished fact.

L'Electricité describes an electric ventilator for supplying a building with fresh air, either cold or warmed, as desired. An electric motor sets the ventilator revolving and the revolution sucks cool air in. When warm air is desired, a current is sent into a network of fine wire possessing a high resistance, and through the network the air is obliged to pass; the current heats the wires and the air necessarily becomes heated. The movement of a commutator is sufficient to change the character of the air supplied by the ventilator. This system is capable of considerable adaptation, and it is stated that the hygienic results are uniformly good.

The streets of Rome will be lighted by electricity at the end of the present year. The motor power will be transmitted by electric wire from Tivoli, a town about thirty kilometres from Rome. The Via Nazionale will be the first street to which the electric light will be applied.

THE ELECTRICAL AGE
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SAFETY TABLES FOR MINES.

While the use of electricity for light and power purposes in mines has greatly reduced the dangers attending the work, there is one element of danger which at first escaped attention, but which later on revealed itself as one of the most insidious of all, that has yet to be eliminated before the practice of carrying electric conductors into mines can be considered absolutely safe. We refer to the danger of explosion by electric spark of fire-damp or other gases in case of accidental rupture of the electric circuit within the mine.

It is easy to carry electric conductors into mines, but in case of a fall of mineral there is always danger of damaging the conductors, and in case of an actual break the resulting spark might cause fatal results.

In order to eliminate this dangerous element, an English electrician named L. B. Atkinson, has invented a safety mining cable which is designed to meet such emergencies as those above referred to.

The principle is simple. It consists simply of conveying the current from the source of supply to where the light or work is required over two conductors. These carry current in proportion to their areas, or resistance, and each is provided with a cut-out proportioned to the carrying capacity of the branch wire to which it is connected. It is evident, therefore, that in case one of the wires should become accidentally broken there would be no spark, because the circuit would still remain intact through the other wire. It remains so, however, only until the fuse is melted by the whole current passing through it, and then the two circuits are disconnected from the source of supply.

The practical form of this idea consists of a cable whose core is made up of a closely wound spiral copper wire, braided over, and on top of this braiding is laid a stranded conductor of the required area; then comes the usual outside insulation. Should the cable be torn or broken away through any cause, the inner or spiral conductor will be stretched out to an indefinite extent, and will carry the current until its fuse melts, when the whole cable becomes disconnected with the source of supply, without generating any sparks in the mine. The idea is a capital one, and should meet with extensive use in practice.

A description and illustrations of this safety cable are given on another page in this issue.

THE ELECTRICAL CENSUS.

We have received from Mr. Allen R. Foote, special agent, Eleventh Census, a bound volume of the schedules prepared by himself for the collection of electrical statistics for the eleventh census.

Mr. Foote has spent much time and labor in the preparation of these lists, as their completeness testify, and every department of applied electricity has been thoroughly covered. Every fact of value and interest to those engaged in the electrical industries has been provided for in the schedules, and when the results of the electrical census are compiled the information will be of inestimable value to every one engaged in electrical pursuits.

Some idea of the magnitude of this vast undertaking may be obtained by a glance at the titles of the special schedules prepared for the collection of the necessary data. These titles are given as follows:

Special schedule for educational institutions giving a course of instruction in electrical engineering.

Electric light and power stations.

Manufactures of electrical apparatus, instruments and supplies.

Isolated electric light and power plants.

Commercial telegraph companies.

Commercial telephone companies.

Steamboat electric light and power plants.

Municipal electric light and power stations.

Uses of electricity in medicine and surgery—manufacture of electrical apparatus.

Uses of electricity in medicine and surgery—medical colleges.

Uses of electricity in medicine and surgery—hospitals.

Uses of electricity in medicine and surgery—physicians.

Municipal fire-alarm telegraphs.

Municipal police-patrol telegraphs.

District messenger companies.

Uses of electricity in mining.

Telegraph lines used by steam railroad companies.

Electric railways.

The uses of electricity in metallurgy.

It will be seen that every department of electrical industry is provided for. Each schedule is remarkable for its completeness, and there is no doubt that should the work of collecting electrical statistics as provided for by these schedules ever be completed, the results would be of inestimable value to the electrical industries. These at the present time occupy a most remarkable position as regards statistics of the same. There is not another line of industrial activity in existence, that we know of, that cannot be backed up by statistics and data, and yet here is the electrical department of the world's progress, one of the most important of all, without a single statistical fact that can be relied upon.

No time should be lost by the government to carry forward and complete this valuable work, so well begun, and it is to be greatly regretted that the work of collecting statistics has been temporarily suspended. We say "temporarily," because we cannot believe that the next Congress will not appreciate the importance and value of the electrical census and fail to appropriate sufficient funds to complete the work. This should be one of the first acts of the new Congress.

YOUNG ELECTRICIANS.

The most noticeable feature of any body or society of electricians is the youthfulness of its members, and when the wonderful vigor and magnitude of electrical industries in this country are considered it is not surprising that outsiders should comment on the fact that the business is in the hands of young men. Expressions of this character were heard in Montreal during the recent convention of the National Electric Light Association. That body was a representative one, and the citizens of Montreal marvelled at the youthful appearance of its members. They could not understand that so important an industry should be carried on by boys in years, comparatively speaking. The fact is, however, that while a great majority of those intimately connected with this industry are young, they really stand at the head of their profession in theoretical and practical knowledge of electricity. Various colleges are now turning out electrical engineers who naturally seek and obtain the positions in the business which require the application of scientific knowledge. Ten years ago the business was in the hands of the investigators and pioneers, who in many cases had spent most of their lives in experimenting. After electric lighting had become a practical success and the rapid expansion of the business set in, young blood, full of life and vigor, was necessary to keep up the pace, and it came in from all directions. The pioneers were then compelled to stand aside to make room for the young men; and since these things have taken place in the past ten years it is easy to understand why there should be at this time so many young men engaged in the business. The time will come, of course, when many more gray heads will be seen at the meetings than are noticed now.

NOVEL DANGER WARNING.

A novel expedient has been resorted to to keep inquisitive people and meddlers at a safe distance from the pole line conveying the conductors between Lauffen Falls and the exposition grounds at Frankfort-on-the-Main. As is well known, the water-power of Lauffen Falls is used to operate powerful dynamos, the current from which (20,000 volts) is conveyed by means of overhead wires to the Frankfort exhibition, a distance of over 100 miles. The poles along the route are decorated with skull and cross-bones, to convey the idea that there is great danger and perhaps sure death should they be touched.

This warning may be sufficient for the simple peasants in that country, but if such a line existed in America every one would have an irresistible desire to touch a pole to see if it would give a shock, for the same reason they would put their fingers on new paint to see if it was fresh.

POLE CLIMBERS' CONTEST.

A pole climbing contest took place at Seattle, Wash., on Sept. 17. The second prize was a copy of The Electrical Age and Street Railway News for one year. The prize was carried off by Mr. Frank Boules; time 10½ seconds, 30 foot pole. Mr. Boules has our congratulations.

MEETINGS OF SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The first meeting of the present season of the American Institute of Electrical Engineers was held at the Society's rooms, 12 West 31st street, this city, Tuesday evening, September 22.

A paper was read by Professor Harris J. Ryan, of Cornell University, "On the Relation of the Air Gap and the Shape of the Poles to the Performance of Dynamo Electric Machinery."

A MONTREAL EXHIBIT.

We give an illustration of the exhibit of the Germania Electric Co., of Boston, Mass., at the recent International Electrical Exhibition in Montreal.

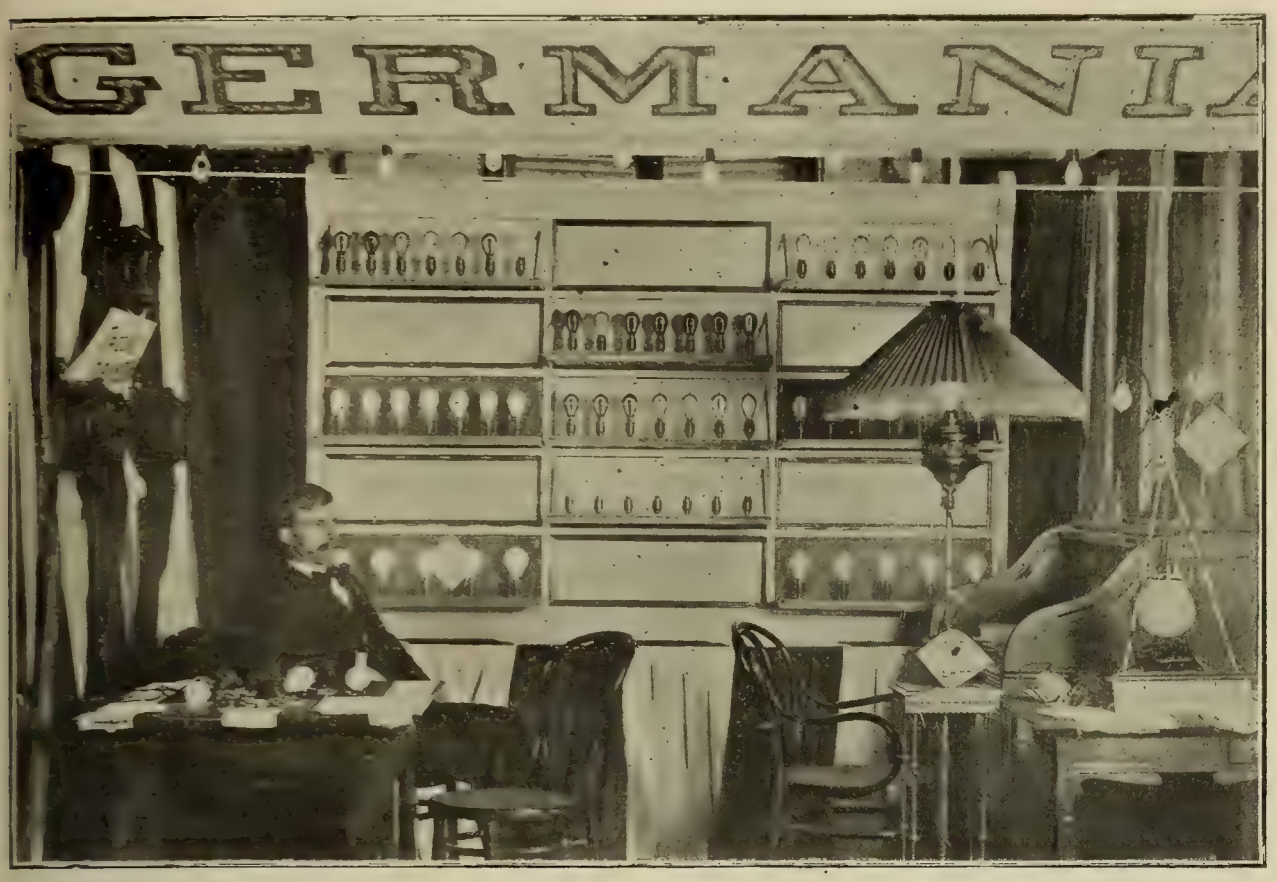


EXHIBIT OF THE GERMANIA ELECTRIC CO., OF BOSTON, AT THE MONTREAL EXHIBITION.

This company's display was arranged with great taste and the effect was both beautiful and unique. Novelty as well as attractiveness was desired and in both respects the designers of the exhibit were entirely successful.

The exhibit consisted of incandescent lamps in all colors displayed on hinged drop leaves set in rows on the face of an upright case, and arranged so that when the leaves were opened, or dropped down, the current was turned and all the lamps on the leaf were brilliantly lighted. The lamps were fitted with the Germania bases and sockets.

The exhibit also included several samples of the new Germania shade holders which are meeting with so much favor among dealers and users.

Mr. O. K. Stewart, treasurer, and Mr. H. Bottomley represented the company at the exhibition and they made many friends.

ASSOCIATE MEMBERS.

The following-named persons were elected associate members of the American Institute of Electrical Engineers, September 22 last:

Fordyce S. Caldwell, proprietor Western Electric Construction Co., 503 Delaware St., Kansas City, Mo., and 150 West 82d St., New York City.

Frederick G. Cartwright, electrical engineer and agent Fort Wayne Electric Co., 35 New Montgomery St., San Francisco, Cal.

W. C. Cheney, electrical engineer, Willamette Falls Electric Co., Portland, Oregon.

Charles W. Foote, agent railway department, Thomson-Houston Elec. Co., Society for Savings Bldg., Cleveland, O.

John L. Hall, manager Western Union Telegraph Co., 300 Market St., Wilmington, Del.

William H. Hamilton, dealer in electrical supplies, 200 State St., Albany, N. Y.

Henry S. Hosford, electrical engineer, 1009 Society for Savings Bldg., Cleveland, O.

Frank Land, 606 Salina St., Syracuse, N. Y.

Robert Heath MacMullan, treasurer and general manager Brush Electric Lighting Co., Lafayette, Ind.

Lucius E. Marple, electrician, United Electric Railway, Nashville, Tenn., and Wollaston, Mass.

William Morris Mordey, electrician, Brush Electrical Engineering Co., 34 Montserrat Road, Putney, London, Eng.

Everett Morss, electrician, Simplex Electrical Co., 297 Beacon St., Boston, Mass.

Frank A. Pattison, firm of Pattison Bros., consulting and constructing electrical engineers, 135 Broadway, New York City.

Edward H. Rogers, patent lawyer, firm of Pope & Rogers, 15 Wall St., New York City.

W. M. Rutherford, electrical engineer, Thomson-Houston International Electric Co., 620 Atlantic Ave., Boston, Mass.

Fred G. Schlosser, superintendent of electric department Laclede Gas Light Co., 1801 Washington St., St. Louis, Mo.

George Montagu White, agent for West Indies, Thomson-Houston International Electric Co., Kingston, Jamaica, W. I.

ELECTRIC LIGHT NOTES.

The plant owned by A. Grove, Fergus, Ont., will require additional equipment in the near future.

The Public Works Company, Bangor, Me., has just completed the construction of a large station.

The Covington Electric Light Company, Covington, Ky., is now making several additions to its plant.

The Edison Electric Illuminating Company, of Westchester, Pa., will install additional arc equipment shortly.

The Tuscola Electric Light & Power Co., Tuscola, Ill., is to add a new dynamo to its incandescent plant shortly.

The Neenah & Menasha Gas and Electric Co., Neenah, Wis., will add a larger engine to its power plant in the near future.

The Perth Electric Light Company, of Perth, Ont., is installing a large incandescent system. The company is now supplying 57 arc lights.

Extensive additions are to be made to the electric-lighting plant controlled by the city of Lyons, Iowa, in the near future. Chas. Borrell is Superintendent.

The New Ulm Electric Light Company, of New Ulm, Minn., may require additional power within the next six months. Address William E. Koch, Superintendent.

The Hudson Electric Light Company, of Hudson, Mich., with 78 arc lamps on the Schuyler system, is to add an incandescent plant shortly. Address D. H. Carpenter, President.

The electric-lighting plant of the Independence Electric Light Company, Independence, Ia., will require additional supplies in the near future. Address J. L. Smeally, Superintendent.

The Rochester Electric Light Company, of Rochester, Ind., will need additional equipment shortly. The company uses the T.-H. arc system. Address O. D. Ross, Superintendent.

The Taylorville Electric Company, Taylorville, Ill., intends to make several additions to its plant in the near future. The Thomson-Houston alternating incandescent system is used. J. N. C. Shumway is Superintendent.

The Alexandria Electric Light and Water-works plant, of Alexandria, Minn., expects to put in a 1,000-light dynamo shortly. The Thomson-Houston system is used and the plant is owned by the village of Alexandria. N. P. Ward is President.

The Edison Light Company, Jackson, Mich., has nearly 1,600 incandescent lamps in use at present. The power plant consists of two 135 H. P. Armington & Sims engines. The company also has one 40-light Vandepoele arc dynamo and one 65 H. P. New York Safety engine not in use.

The Toronto Incandescent Electric Light Company, Toronto, Ont., is supplying 12,000 incandescent lamps on the Edison underground system and will make extensive additions to its plant in the near future. W. D. Mathews is the President of the Company and Frederick Nicholls Secretary.

The Calgary Electric Light Company, N. W. T., is putting in a 1,000-light National alternating-current dynamo for long-distance lighting. The company is now supplying 1,600 incandescent lamps on the Edison system. The power plant consists of three Armington & Sims engines, of 40, 50 and 125 H. P.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE AND STREET RAILWAY NEWS, FIRST FLOOR, WORLD BUILDING, NEW YORK, Sept. 26, 1891.

G. C. Baillard, of Alexander, Barney & Chapin, 20 Cortlandt street, this city, is now travelling for that house in the territory within 100 miles of New York City.

William Courtenay, president of the Vulcanized Fibre Company of Wilmington, Del., and 14 Dey street, New York, arrived on the steamer Britannic, September 25, after an extended tour of the continent.

The firm of Alexander, Barney & Chapin, 20 Cortlandt street, this city, report a very active mail, or out-of-town trade. The concern is getting out a new circular, publishing testimonials from many of its customers throughout the country.

Mr. W. H. Bogert, formerly with the T. J. Murray Co., Electrical Exchange, this city, has become connected with Schneider, Campbell & Co., manufacturers and importers of artistic gas fixtures, 7 and 9 Union Square and 20 East 15th street, this city. His friends will be pleased to hear of his new connection.

The Hubbell Portable Electric Lamp and Power Company has removed its offices from 35 to 61 Broadway, this city, where it has just furnished an excellent suite of rooms, consisting of mechanical department, laboratory, reception room and private offices. On Saturday, October 3, the company will hold a reception in its new quarters.

Mr. Charles A. Schieren, Jr., has fully recovered from the labors of his Montreal experience during the National Electric Light Association meetings in searching for his goods to display at the International Electrical Exhibition. As in the case with many other exhibitors the goods never came to light during the term of the exhibition. The patience of many of the exhibitors was sorely tried in searching for their goods.

It may be of interest to many of the readers of the ELECTRICAL AGE who attended the National Electric Light Association meetings in Montreal during the week of Sept. 7th to 12th, to know that those who were photographed in the several groups taken in front of the Windsor Hotel can see finished photographs at the office of the ELECTRICAL AGE at any time, where orders for copies of the same will be received. The photographs are $1 each.

Stanley & Hall, 32 Frankfort street, city, manufacturers of electrical household specialties, are as usual selling large quantities of their noted S.-H. Monogram bells. It is not fully understood by the trade that this house will manufacture in quantities its special bells and place on the box monagrams, names, or designs, as required by customers. The great feature of this bell is the solid armature and hammer combined. With this arrangement there is no arm to become loose and the hammer is always permanently in position. This firm manufactures large quantities at the lowest marked prices, annunciators, burglar alarms and household electrical specialties in general. It also undertakes all classes of special work to order, such as models, tools, light machinery, etc., work for inventors, patentees and electricians generally.

H. Ward Leonard & Co., Electrical Exchange Building, this city, are doing a very satisfactory business with their variable speed motor system which was fully described in the ELECTRICAL AGE and STREET RAILWAY NEWS of September 12. They are introducing the system in the factory of the Otis Brothers, manufacturers of elevators, and will give an exhibition of the same in a few days. They also expect to apply the system to the operation of a travelling crane in an iron works in this city, and also at Morse and Williams to run elevators. The firm has developed something new in electrical engineering which will likely prove of great value and meet with extensive use. By the application of this new system it will be possible to run any prime motor at any desired speed, and through their motor arrangement operate an electric motor at a constant speed automatically. The intelligence business of this firm is already meeting with excellent success. It seems to be exactly what has been looked for and wanted, and the business that is coming in daily shows that the firm has the confidence of a large portion of the electrical fraternity throughout the country. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
Asbury Park L. & P., N. J.	50,000	10 00	
Aut. Phon. Exb. Co	25,000		4
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	185 00
Bell Telephone 7s	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y.	10,000	100 00	160 00
Brush Illuminating, N. Y.	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Brush-Swan, Ithaca	50,000	10 00	5 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00

Columbia Canal 6s, Ga	200,000		*111
Commercial Cable Co	7,716,000	100 00	121 00
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Gas Co., Batavia, N. Y	100,000		
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Day Ry. Const. Co., Chicago	10,000,000	100 00	60 00
Desant Elec. and Sig. Co., N. Y	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	26 00
Detroit Electrical Works	1,000,000	10 00	12 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*97
Edison Elec. Ill. 6s, N. Y	30,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	10 50
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., Phila	1,000,000	100 00	80 00
Edison General	14,000,600	100 00	100 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	18 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	45 00
Essick Printing Tel	5,000,000	100 00	35 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co	4,000,000	25 00	14 50
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	14 50
Guthrie Elec. Lt. Co., O.K., 7s	15,000		*98
Hackettstown Elec. Light, N. J	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hudson Electric Light, N. J	100,000	100 00	
Hunt Engineering Co., Brooklyn, 6s	30,000	500 00	*105
Hunt Engineering Co., Brooklyn	30,000	100 00	140 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	20 75
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*78
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio	60,000		*103
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co	3,500,000	100 00	100 00
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N. Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J	17,500		*104
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	8 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	16 75
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500		†
N. E. Tel. & Tel. Co	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel. 6s	1,500,000		*99
N. Y. and N. J. Telephone Stock	2,535,000	100 00	94 00
N. Y. Elec. Const. Co	100,000	100 00	110 00
N. Y. G. & E. Co. Certs. of Indebt	100,000		†
N. Y. Phonograph Co	20,000		†
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50,000		*95
North New York Lighting	150,000	100 00	10 00
Northern Elec. L. & P., Phila	200,000	10 00	
Northwest Elec. Co. 6s, Manitoba	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Passaic Electric Light	15,000	100 00	90 00
Paterson Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P. Co. 6s	800,000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	56 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	6 50
Saginaw E. L. & P. Co. 6s, Mich	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	8 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100,000	100 00	105 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	48 00
Thomson-Houston pref	4,000,000	25 00	26 00
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
Twin City Rapid Transit, N. J	20,000,000	100 00	100 00
Union Switch & Signal Co., Pa	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo	100,000		*95
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas of N. Y	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	83 00
Westinghouse Electric Co	7,000,000	50 00	14 00
Westinghouse Elec. Co. pref	3,000,000	50 00	50 00
West End L., Boston			18 75
Yonkers L. & P	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

A most important suit, in which all manufacturers and users of incandescent lamps are interested, has been commenced by the Edison Company against the Mount Morris Electric Light Company, in the United States Circuit Court, for infringement of Edison patents in incandescent lamps, and asking for an accounting of all profits made by the Mount Morris Company, and for an injunction restraining them from using the alleged infringed improvements. Possibly this may be made a test case by some arrangement of all the defendants. We suggest a generous and lenient action so far as the small dealers and public are concerned. It is business among the giants.

The gold which Europe obtained from us has served its purpose on that side of the Atlantic and is engaging return passage among the great mass of globe-trotters. We hope the voyage has rejuvenated it as much as the other travellers, and feel certain it will be met on arrival, if not by government boats at quarantine, at the pier by its Treasury friends, with as much pleasure as any other passenger. The State of New York has arisen in its glory and tendered it the sole power of exchange for all securities within its jurisdiction, calling on its humble constituents to ratify the action, lest a portion of the family take umbrage and settle down abroad. The royal metal will find business active with us, caused principally by nature favoring our soil while chastening the others; giving us peace, while the war-clouds seem to hover incessantly over them. It will find the plans all drawn and the business in progress, and the chance of another racket in Europe not to be thought of for some time to come.

The Secretary of the Treasury has issued the following circular, which sets at rest all speculation as to the future of the past-due 4½ per cents: "Public notice is hereby given to the holders of registered and coupon bonds of the 4½ per cent. loan, acts of July 14, 1870, and January 26, 1871, that the time within which such bonds will be received for continuance with interest at 2 per cent. per annum will expire on the 30th day of September, 1891. Bonds received at the department after that date will be redeemed and not continued. Notice is also given that coupon 4½ per cent. bonds will not be received for payment at the office of the United States Assistant Treasurer, at New York, after September 30, 1891, and that thereafter registered and coupon 4½ per cent. bonds will be received for redemption only at the office of the Secretary of the Treasury, in the city of Washington, D. C. The circulars of August 24 and September 2, 1891, are hereby modified in accordance with the foregoing." Only one other item remains to be published—that is, the total amount continued at 2 per cent. The 4½ per cents., interest having ceased, are no longer available as security for the circulation of national banks.

I am pleased to be able to congratulate the standing member and to announce that Edison General has declared its eighth quarterly dividend of two per cent., payable November 2. There can be no doubt of the quality of this security. It is a good thing to lay aside, and better still, it will grow in the dark vaults of your strong box.

PERSONAL.

Mr. D. A. Tompkins, who has been long connected with the Westinghouse Electric and Manufacturing Company as general district agent for that territory, is still located at Charlotte, N. C., and is devoting his attention almost exclusively to the mining interests, while Mr. C. B. Osgood booms the electric-railway system.

The Franklin Electric Company, 126 Liberty street, New York, has just issued a circular describing the Ben Franklin primary battery which it manufactures. The circular shows the strong points of the battery, points out where they differ from other cells, and describes the different uses to which the cells may be put.

Mr. Richard D. McCartie has resigned the management of the *Electrical World* and resumed his old profession of expert accountant, with office at 10 Spruce street, New York. Mr. McCartie will be pleased to arrange with firms to open and close books and adjust accounts.

J. A. McLure has resigned his position as secretary of the Thomas Murray Company, the well-known firm of engineers, contractors and builders of electricrl, steam and cable railways, New York, and disposed of his interest in the company.

IMPROVING ITS FACILITIES.

The W. C. Vosburgh Manufacturing Co., Limited, of Brooklyn, well known as the oldest established house engaged in the manufacture of gas and electric light fixtures in that city, has within a few days sold the handsome premises at present occupied by it as warerooms and offices, at Nos. 418 and 420 Fulton street, Brooklyn, and is now erecting a fine building for these purposes adjoining its factory on State street. It expects to occupy the new building about the first of February next. The office and warerooms will have a frontage of fifty feet, connecting directly with the factory, and the warerooms will be five stories in height. The front of the new building will be a handsome design of red and buff brick. The interior will be fitted up in the most approved style, all the appointments being arranged with a view to an easy and satisfactory selection of the goods exhibited.

Mr. H. C. Beck, the president of the company, states that the reasons for this change are: First, that the management may be in more direct and immediate contact with the factory; and, second, to reduce the cost of manufacturing, which, of course, controls the selling price. The business of the company is largely wholesale, and this change will no doubt enable it to greatly increase this trade, but also to do an even larger business at retail.

WESTERN NOTES.

—The Minnesota State Board of Equalization has fixed the rate of assessment on telegraph and telephone wires at 21 mills on the dollar, 1-6 of a mill less than for 1890. The value of the Western Union wires is placed at $500,000 and those of the North American at $50,000.

—The Central Electric Company has just completed arrangements for the exclusive handling of the Gladiator Dry Battery. This arrangement was arrived at only after the most exhaustive tests of the Gladiator, and the Central people are confident that they have the very best dry battery now on the market. A series of curve cards showing the characteristics of this battery will appear in a future issue.

—The offices of The United Press in the new *Herald* building in this city are to be the most complete and handsome offices of the kind in the country. The telegraph department will in itself comprise a large telegraph office, the instruments being of the most modern pattern, highly finished, and beautiful specimens of the most skilled labor. These instruments were purchased from the Central Electric Company, and are on exhibition in the salesroom of that company.

BUSINESS NOTES.

The following letters are self-explanatory:

Hotel Marlborough, New York, Sept. 12, 1891.
Alexander, Barney & Chapin.

Gentlemen: As per your request, I hereby give you an account of the A B C lamps which you sold us last March. They have given us the utmost satisfaction, giving an average life of 2,000 hours and maintaining their candle-power admirably. We have found them far superior to any we have tried up to the present day. Yours truly,

B. L. Maccabe, *Electrician.*

1 W. 30th Street, New York, Sept. 14, 1891.
Messrs. Alexander, Barney & Chapin.

Gentlemen: It gives me great pleasure to be able to state that the lamps you sold us have given us the utmost satisfaction—in fact, are so far superior to any other we have tried that we will use no other in our building, No. 1 West 30th street. The average life of the A B C lamp has been 4,000 hours, and some going up to 6,000 hours; they retain their candle-power very well; and though they take a trifle over half an ampère, we find them more economical in the long run. The glass certainly is superior, not smoking to any degree. Yours truly,

H. S. Cranson, *Chief Engineer.*

—Some of the mechanical and electrical papers have published a copy of what purports to be an extract of a paper read before the California Electrical Society, referring to a test alleged to have been made on a new wheel, showing unusual efficiency, accompanied by diagrams, illustration, etc. We have reliable information to the effect that no such test was ever made on the wheel referred to, but that it was in fact made on a Pelton Water Wheel, which was running the electrical station at the Geysers Hotel, the place where the reported test was claimed to have been made, the results of which were boldly appropriated by the parties concerned. The California Electrical Society has evidently been made use of by some wily schemers to promote an invention which, it would appear, has not sufficient merit to advance itself by legitimate business methods. The reputation of the Pelton Water Wheel is too well established to be injured by falsehood or misrepresentation from any source.

—Charles A. Schieren & Co., manufacturers of electric and perforated leather belting, 45–51 Ferry street, New York, have recently taken an order from the Davenport Gas Co., Davenport, Ia., for about 110 feet of 48″ double belt and necessary dynamo belts; also one from the South Bend Electric Co., South Bend, Ind., for about 110 feet of 48″ double belt, about 100 feet of 20″ double belt, and all the necessary dynamo belts.

The Ajax Lead Coating Company, of Philadelphia, uses a process whereby metallic surfaces are coated with pure lead by immersion in a molten bath, adding strength and pliability instead of weakening. It is said that articles coated by this company's process may be heated to almost a cherry-red and subjected to ordinary wear and tear without injury to the coating. As the alkali and acid in water have no effect on the lead coating, it can be used for covering boiler plates and tubes (before the boiler is put together), preventing the formation of scales, so detrimental to the efficiency of a boiler plant. Pipes for gas, water, alkalies, weak solutions of acids, etc., if lead coated are said to be as durable as lead pipe, and cheaper. This coating is claimed to be unaffected either by water or atmosphere, making it invaluable for a great variety of uses around steam plants.

J. Jones & Son, 602 and 604 West 22d street, New York, manufacturers of electrical apparatus and special machinery, are at present pushing an order for time stamps. This apparatus, which we described and illustrated in one of our recent issues, is a very reliable and valuable piece of mechanism wherever time stamps can be used.

The Ries Electric Specialty Company, of Baltimore, Md., reports being very busy supplying the demand for its new Regulating Socket for alternating current incandescent lamps. This company is about completing a large plant that will be ready in a few weeks to turn out these goods at the rate of 1,500 per day in the Regulating Socket department alone.

PREFERRED TO OTHERS.

Ogden, Utah, Aug. 17, 1891.

J. Kidder Manfg. Co., New York:

Dear Sirs: I enclose you draft * * * I have bought —— Battery, also the —— make. The last I exchanged for a second-hand No. 4 of your make, which gives me better satisfaction. Resp'y yours,

B. P. Cutchins.

Mr. P. Claus, 68 Broadway, this city, has made arrangements with the Germania Electric Company, 53 State street, Boston, to resume building the well-known "Continental" dynamo.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

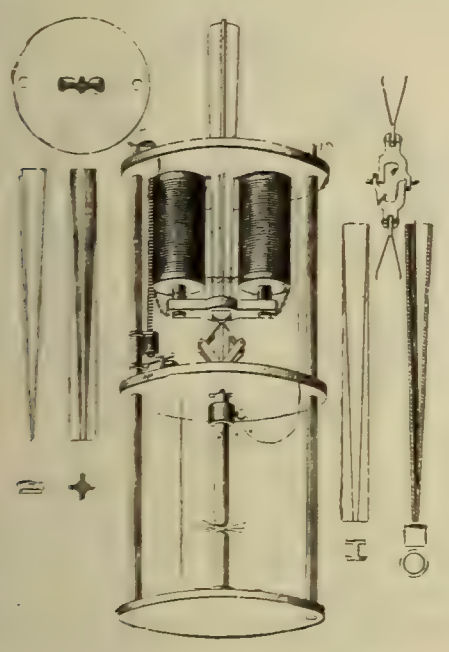
Issued September 22, 1891.

459,739. Commutator Brush-Holder. Harry H. Blades, Detroit, Mich. Filed June 12, 1890.

The combination, with a shaft and a rotatable block having a set-screw and attached leaf spring, of a brush-holder block journalled on the shaft at opposite sides of the rotatable block and having a plain surfaced upper side provided with a bridge-piece and lug, each having a screw-socket, a set-screw passing through the lug to bear against one extremity of the carbon to serve as an abutment therefor and to feed it forward.

459,749. Guard for Incandescent Lamps. Harry H. Hipwell, Allegheny, Pa. Filed Oct. 20, 1890.

A guard-cage for incandescent lamps having a series of arms extending up from the cage and sleeves slipping over them and adapted to contract the same around the bulb and provided with lugs at their lower ends to bear upon the bulb-holder.



459,757. ELECTRIC ARC LAMP.

459,757. Electric Arc-Lamp. Maurice S. Logan, Otterville, and James H. Barley, Sedalia, Mo. Filed Jan. 19, 1891.

An electric arc-lamp provided with a carbon-rod having longitudinally-diverging surface or surfaces, and having a suitable feed mechanism adapted to engage with the diverging surface or surfaces of the rod.

459,772. Electro-Magnetic Motor. Nikola Tesla, New York, N. Y., assignor to the Tesla Electric Company, same place. Filed April 6, 1889.

An alternating-current non-synchronizing electric motor coupled with a synchronizing alternating-current motor whereby the former starts the latter and throws it into synchronism with its actuating-current, and switch mechanism for directing the current through either or both of the motors.

459,786. Electro-Magnetic Device. George R. Lean, Boston, Mass. Filed April 11, 1891.

The combination of a coil moving an armature and a ratchet-wheel, a switch governed by the ratchet-wheel, another coil controlling an armature and pawl which rotates the ratchet-wheel.

459,800. Rheostat. Henry E. Waite, New York, N. Y. Filed Dec. 23, 1890.

A rheostat consisting of a body of non-conducting material, supporting at its ends caps of conducting material and containing a mass of powdered or granulated conducting material, a plunger-rod sliding in one of the caps, and a plunger having vertical laterally-projecting blades, so as to readily pass through the conducting material without compacting it.

459,810. Governor for Dynamos. Mahlon S. Conly, Chicago, Ill., assignor of two-thirds to Edwin O. Abbott and Frederick H. Kilbourn, same place, Filed Dec. 23, 1890.

A governor comprising a series of electro-magnets included in the dynamo-circuit or a shunt thereof, and an armature common to all of the magnets, one of the organisms being normally stationary but rotatable and the other continuously rotating, whereby with every change of current strength the voltage or electro-motive force of the current produced by the dynamo will be correspondingly altered.

459,811. Governor for Dynamos. Mahlon S. Conly, Chicago, Ill., assignor of two-thirds to Edwin O. Abbott and Frederick H. Kilbourn, same place. Filed Aug. 25, 1890. Renewed May 29, 1891.

A governor comprising a wheel connected with the brushes, but loosely journalled upon the armature-shaft and carrying a circumferential series of electro-magnets included in the line-circuit of the dynamo, and a revolving armature mounted upon and carried by the armature-shaft, the armature working within and being common to all of the magnets of the series.

459,820. Conductor-Fastening for Commutators. Sidney H. Short, Cleveland, Ohio. Filed May 26, 1891.

A commutator-bar having an opening formed in its flange for the reception of a cable conductor, a countersink formed in one face of the flange around the opening or passage, a cable conductor extending through the opening and having the free ends of its strands projecting into the countersink, and a tack driven between the free ends of the strands, the point of the tack extending into the opening.

459,835. Manufacture of Incandescent Electric Lamps. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Jan. 22, 1883.

The method of obtaining a dry nitrogen atmosphere at a definite pressure in the inclosing globe of an incandescing electric lamp, consisting in producing an air-pressure in the globe slightly above the pressure of nitrogen desired, decomposing the air left in the globe, retaining the nitrogen in the globe, removing the oxygen by putting a receptacle containing a substance having affinity for oxygen into communication with the globe, and removing the moisture from the nitrogen.

459,839. Automatic Disconnector for Overhead Conductors. Andrew L. Johnston, Richmond, Va. Filed Jan. 19, 1891.

A pair of hollow metallic sections containing springs and insulated from each other, in combination with a pair of switches electrically connected with each other with line-wires and push-rods secured to move with their free ends, whereby the switches are pushed open upon the slackening of the wires.

459,843. Insulator. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross, same place. Filed Nov. 22, 1890.

A tree-iron having a yielding yoke or base, a movable insulator carrying stem or pin, and a stop for limiting the movement of the stem.

459,844. Detachable Step for Poles. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross, same place. Filed Dec. 27, 1890.

A step for electric-light poles, consisting of a base or plate adapted to be secured to the pole, provided on its front or outer face with upper and lower sockets, and a step or bracket having an end arranged to enter and interlock with each of the sockets.

459,845. Carbon-Clamp for Arc Lights. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross, same place. Filed Dec. 27, 1890.

A carbon clamp consisting of a normally-stationary jaw member adapted to be secured to a carrier-rod, a movable slotted jaw member jointed to the other jaw, the two jaws being arranged to receive and hold a carbon, and a collared clamping-screw tapped into the stationary jaw and having the slotted portion of the movable jaw in engagement with the collared part of the screw.

459,846. Attachment for Electric Arc-Lamps. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross, same place. Filed Jan. 8, 1891.

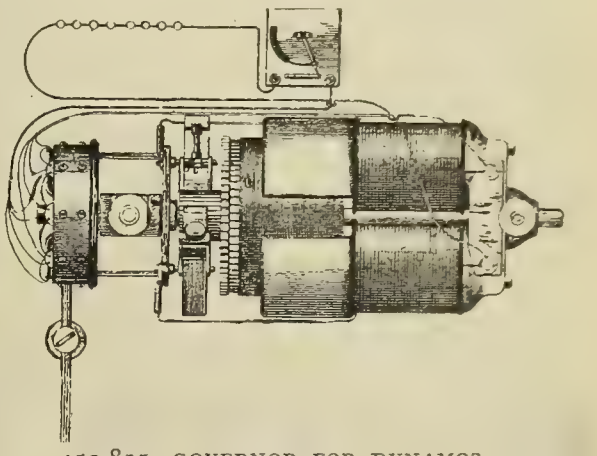
An insulating or non-conducting hood having open ends and fastening devices at one end, by which it is adapted to be removably secured to the base or lower portion of an arc lamp.

459,852. Electro-Therapeutic Bath. Charles P. Hoffman, Utica, N. Y., and Willard B. Van Houten, Belleville, N. J., assignors to Cornelius Van Houten, Belleville, N. J. Filed March 16, 1891.

The combination, in an electro-therapeutic bath, with the case or cabinet, of a seat within the case and means for adjusting it vertically, and an actuating device outside of the case.

459,863. Electrical Recorder for Voltmeters, Thermometers, etc. Charles W. Ayton, St. Louis, Mo. Filed March 23, 1891.

An electric recorder having a dial or gage carrying metallic contacts, a rotating metallic needle or a needle provided with a metallic armature, a source of electricity and a magnet located in the dial under the needle, the magnet being adapted to attract the needle to a certain metallic contact, thereby completing a circuit from the needle through its contact to and through a corresponding magnet and back to the original source of electricity.



459,811. GOVERNOR FOR DYNAMOS.

459,872. Electric Lamp. Donato Tommasi, Paris, France. Filed Jan. 14, 1891.

The combination, with a bellows located intermediate the lamp and electrical source, and adapted to make and break the electrical communication between the two when expanded or contracted.

459,917. Contact for Electric Programme-Clocks. Frank E. Smith, San José, Cal., assignor to The E. Howard Watch and Clock Company, Boston, Mass. Filed Feb. 21, 1891.

The combination, with a clock mechanism, of metallic rings insulated from each other, the one being connected with one pole and the other with the other pole of an electric battery, one ring supported by and having metallic connection with another ring, and means whereby the hour and minute hands of the clock may be simultaneously caused to make electrical connection with the rings respectively, thereby closing the electric circuit.

459,923. Armature for Dynamo-Electric Machines and Motors. John Beattie, Jr., Fall River, Mass. Filed Dec. 9, 1890.

An armature for dynamo-electric machines or motors, consisting of an iron core having grooves in its periphery parallel to the axle of the armature and in which the armature-conductors are deposited, in combination with iron wire and insulating material wound or placed upon the surface of the armature at substantially right angles with the armature-conductors, the convolutions or turns of the iron wire alternating with the evolutions or turns of the insulating material.

459,930. Duplex Telegraphy. John J. Ghegan, Newark, N. J. Filed Nov. 5, 1889.

A duplex-telegraphic system having two sets of transmitters and receivers at each station of the line, in combination with a transmitting battery located at one station only,

ELECTRICAL PATENTS—Continued.

and shunts, including resistances around the transmitters, whereby two messages may be sent in the same direction or in opposite directions at the will of the operators without interrupting the line-circuit.

459,941. Electric Cable. David Brooks, Jr., Philadelphia, Pa. Filed Jan. 14, 1891.

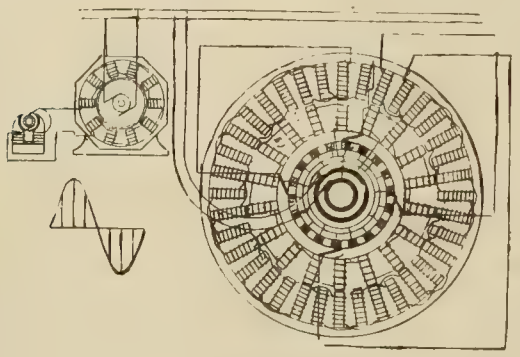
A cable having the sections of its covering connected by strips of tin-foil and rubber, forming a flexible connection.

459,984. Burglar-Alarm. Homer T. Wilson, Harrodsburg, Ky. Filed Feb. 3, 1891.

The combination of a series of metallic strips secured upon the floor and electrically secured together, a second series of strips above the former at right angles thereto and out of contact therewith, a stop which holds one end of each of the strips of the second series in position, a bar to which the opposite ends of the strips are secured and means for moving the bar to adjust the strips.

460,019. Electric Show-Case Alarm. Rudolph C. Kruschke, Duluth, Minn. Filed Dec. 1, 1890.

Two similar spring-clips oppositely arranged with respect to each other and supports adapted to hold articles for display and constructed to form an electrical contact with each other when the articles are removed from the clips.



460,046. ALTERNATING CURRENT CONVERTERS.

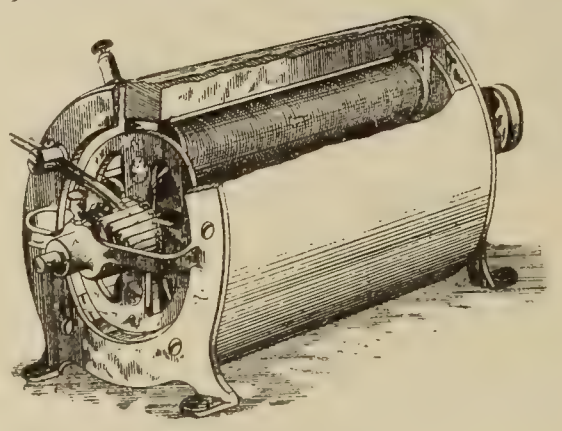
460,046. Method of and Apparatus for Converting the Electrical Energy of Alternating Currents into Mechanical Motion. Charles S. Bradley, Avon, N. Y. Filed Nov. 8, 1890.

The method of converting the electrical energy of an alternating current into mechanical motion, which consists in leading the current through an electric motor and raising the effective counter electro-motive force developed by the rotation of the motor relatively to the self-induction by cutting the field of force rapidly relatively to the period of the propelling-current.

460,048. Electric Coupling. Frank M. Farwell, Minneapolis, Minn. Filed Jan. 27, 1891.

A coupling consisting of two separable duplicate parts, each provided with one or more coupling-arms, a casing in which a portion of each coupling-arm is insulated, a chamber in the casing provided with a spring-arm to engage with the coupling-arm, an electric conductor connected with the casing and electrically connected with the coupling-arm and a coiled spring in circuit secured to the conductor.

460,059. Electric Regulator. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car-Heating Company, same place. Filed Feb. 11, 1891.



460,087. ELECTRIC MOTOR.

The combination, with a dynamo-electric generator and its working circuit, of a loop in the circuit, two motor-magnets in normally-open branches of the loop, an armature adapted to be oppositely actuated by the motor-magnets and connected to the dynamo-regulating devices, means operated by changes of current in the working circuit of the dynamo for closing the circuit through either of the motor-magnets, a retracting mechanism for the armature of the motor-magnets, and a make-and-break mechanism in the loop actuated by the retracting mechanism.

460,071. Electrical Transmission of Power. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Original application filed Nov. 9, 1887. Divided and application filed Aug. 1, 1890. Again divided and this application filed Nov. 24, 1890.

The method of transmitting electric energy, consisting in generating by induction currents of low intensity and of alternately increasing and decreasing potential, then converting them by induction into currents of high intensity, transmitting the induced currents of high intensity by a line-circuit to a distant place, and then reconverting by induction back again into low-intensity currents and supplying to one or more local circuits containing translating or current-consuming devices.

460,076. Controlling-Switch for Electric Motors. Schuyler S. Wheeler, New York, N. Y., assignor to the Crocker-Wheeler Electric Motor Company, same place. Filed Sept. 13, 1890.

An electric motor having its armature connected in series with its field-magnets, there being one coil for each field-magnet, in combination with a switch having four fixed terminals connected, respectively, to the ends of the two field-magnet coils, and two movable terminals located in the path of the free ends of the fixed terminals and carried by a rotary switch-handle.

460,081. Automatic Electro-Pneumatic-Tube System. William G. Collins, New York, N. Y., assignor, by direct and mesne assignments, to Maggie U. Collins and Hugo J. Weber, both of same place. Filed Nov. 7, 1889.

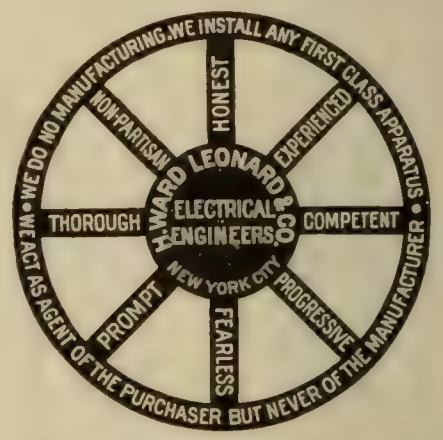
The combination, in an electro-pneumatic tube or carrier system, of a main and branch tubes, carriers adapted to pass through the tubes, and magnets in circuits automatically controlled by the carriers to divert each carrier to its own branch tube.

460,087. Electric Motor. Ernest M. G. Hewett, Boston, assignor to George L. Weil, North Andover, Mass. Filed April 2, 1891.

A rotating element consisting of a series of straight-bar electro-magnets mounted upon a common shaft, with their like poles at one end, in combination with a stationary magnetic enveloping-shell serving as an armature to the rotating element.

460,095. Combination-Fittings for Gas and Electric Lights. Olaf Strom, Brooklyn, N. Y., assignor of one-half to George Angell, same place. Filed Dec. 27, 1890.

Two offsets arranged on the axis with a space between the electric arm below and the gas-arm above such offset, giving an independent bearing to each.



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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, OCTOBER 10, 1891. No. 41.

LONG-DISTANCE TRANSMISSION OF POWER.

In view of the great interest taken in the power-transmission plant between Lauffen and the exhibition now in progress at Frankfort-on-the-Main, the following description and illustrations of the same, communicated to the London *Electrician* by Mr. Gisbert Kapp, will be of value to electricians:

The distance between the generating station at Lauffen and the receiving stations in the Frankfort Electrical Exhibition is 175 kilometres, or about 110 miles. Power was transmitted over this distance for the first time on August 25, when the current was supplied to about 900 16 c. p. lamps in the Exhibition, and a few days later the output was increased to 1,100 lamps. There are in the exhibition two receiving stations, side by side, one for the production of power and the other for the production of light, both being connected in such a way that either power or light, or both together, may be obtained at will. The generator at Lauffen is a Brown "three-phaser," made and supplied by the Oerlikon works, and the line consists of three hard-drawn copper wires of 160 mils diameter, supported on oil insulators fixed to wooden poles 26 feet high. There have been erected in all about 3,000 poles, at an average distance of 200 feet, and the total weight of copper in the line is 60 tons. At Lauffen there are three transformers. One of these has been made by the Oerlikon works and the two others by the Berlin Electricity works. At Frankfort there are also three transformers. The transforming ratio of all the six transformers is 1-160, and they are oil insulated. In the power station at Frankfort, which was fitted up by the Berlin works, the current is used for working a 100 H.P. three-phase motor, designed by Herr von Dolivo-Dobrowolsky. The motor is coupled direct to a centrifugal pump, which supplies water to an artificial cascade 30 feet high. The lighting station at Frankfort has been fitted up by the Oerlikon works, and the lamps are arranged partly on a large signboard of ornamental design in the exhibition grounds and partly on lamp-boards in the exhibition building, which serve for varying the load within certain limits.

The general arrangement of the circuits from the generating station at Lauffen up to the branches which lead to the power and lighting stations in the Exhibition may best be described by means of the annexed sketch, Fig. 1.

In this sketch G represents the generator or "threephaser," the three sets of coils being diagrammatically indicated by the three thick lines O I, O II and O III, forming angles of 120° with each other. The primary or low-pressure coils of the transformer T, are similarly represented by thick lines, and the three thin dotted lines o 1, o 2, o 3 represent the high-pressure or secondary coils of the transformer.

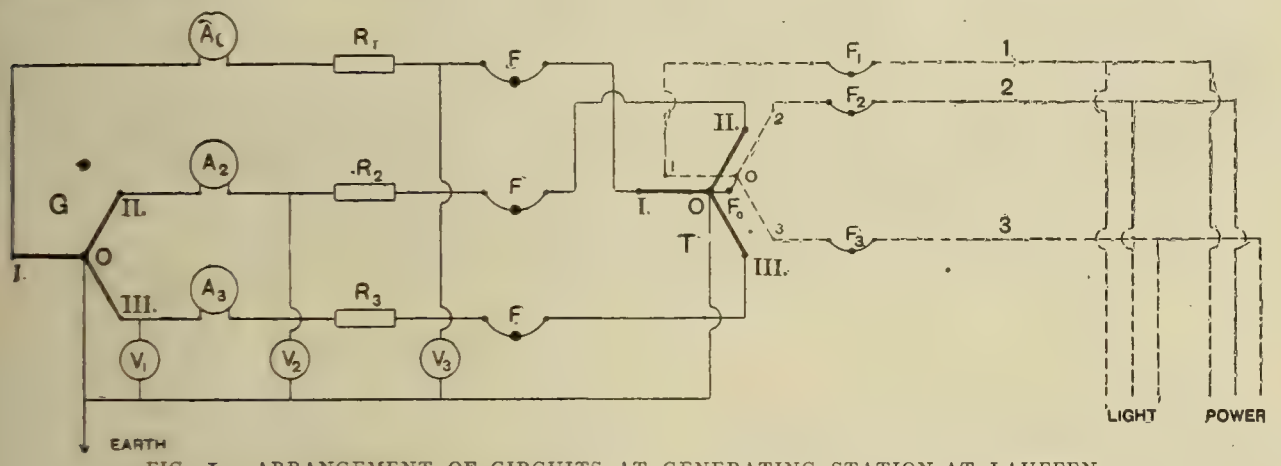


FIG. 1.—ARRANGEMENT OF CIRCUITS AT GENERATING STATION AT LAUFFEN.

The generator coil O I is connected with the transformer coil O I, first by the earthed wire O O, as already mentioned, and also by an insulated circuit which contains an alternate current ampere meter A_1, a relay magnet R_1, and a fuse, F. The other two sets of coils on the threephaser and transformer respectively are similarly connected. The voltage in the three branches is indicated by the three voltmeters V_1, V_2, V_3. The relay magnets are arranged for minimum and maximum current, and if the current in any of the three branches of the three-phaser should fall short of the minimum or pass beyond the maximum value for which the relays are set, the relay in that branch cuts off the exciting current from the field of the three-phaser. The voltage obtained then in the low-pressure circuit at the generating station is simply that due to the residual magnetism in the three-phaser and therefore perfectly safe even in case of a short-circuit in the primary wires.

It will be seen that the arrangements of switchboard and instruments at the generating station are of the simplest possible character. In the high-pressure or secondary circuit there are no switches, but merely three fuses, F_1, F_2, F_3, as shown in the diagram. To make a fuse for 10,000 volts is not an easy problem, but it has been solved by Ferranti and others, and any of the existing forms of fuses might have been accepted for Lauffen. Since it is, however, the intention of the two firms who have carried out this transmission plant to work later on at double the present pressure (by using two transformers at each end with their thick wire coils in parallel and their thin wire coils in series) it was thought safest to arrange the fuses in such a way that there can be absolutely no doubt as to their satisfactory working even at 20,000 or 30,000 volts. The method of mounting fuses on a board inside the station has, therefore, been abandoned, and the fuses have been placed outside, where they form part of the line.

It remains yet to describe the provision made to guard against accidental injury to life or property in case one of the line wires should break and fall to the ground, or an earth should occur on the line through some other cause. As will be seen from the sketch, the common junction O of the thick-wire coils of the transformer at Lauffen is joined by means of a fuse F_0 with the common junction O of the thin-wire coils. The electrical centre of the whole system is, therefore, permanently connected to earth. Suppose now that the line wire 1 should break at any point between Lauffen and Frankfort and fall to the ground, the broken end will make earth, and the corresponding fuse F_1 in the line at Lauffen will go. Possibly the junction fuse F_0 will go. The line 1 is thus cut out. In all probability the fuse in the low-pressure circuit I will also melt; but should this not be the case, the current in this branch will be very much reduced, and set the relay R_1 in action, whereby, as already explained, the excitation is cut off, and the dangerous pressure is immediately taken off all the three line wires.

We have yet to describe the general arrangement of the circuits in the power station at Frankfort (Fig. 2). The primary and secondary of the transformers (of which only one is shown, the other being a spare transformer at present) are again earthed at their electrical centre, and the same remark holds good for the field and armature of the motor. The latter is shown diagrammatically in the same way as if it were a transformer, though this representation is not quite correct. The armature and field coils do, of course, not remain in the same relative positions to each other, but for the sake of simplicity the diagram may be accepted as sufficient for our purpose. In reality, the field revolves with a greater speed than the armature, the difference in speed or magnetic slip producing the E. M. F. in the armature. Now the torque of the motor is proportional to the strength of the field and to the armature current, which latter increases with the E. M. F., and, therefore, with the magnetic slip. If the magnetic slip were zero, that is, if the armature revolved with the same speed as the field, there would be no E. M. F. in the armature coils, and, therefore, no current and no torque. A motor of this class can, therefore, not run synchronously, but must run the slower the more the load is increased. The variation in speed between full load and no load can, however, be made as small as desired by the simple expedient of using an armature of low resistance, so that even a slip of 5 per cent. or 10 per cent. shall produce the maximum current required at maximum load. In this respect the three-phase motor is identical with an ordinary continuous-current motor with constant field, since also in this case the speed of the armature decreases as the load increases. To obtain more or less uniformity of speed is, therefore, simply a question of the amount of iron and copper which the designer chooses to employ for a given output; but it should be remarked that by increasing the section of the armature conductors so as to get very little magnetic slip, there is danger of producing a machine which will not readily start at full load. The reason is obvious. A very low armature resistance means an enormous armature current at the moment of starting when the magnetic slip is 100 per cent. Now, this enormous

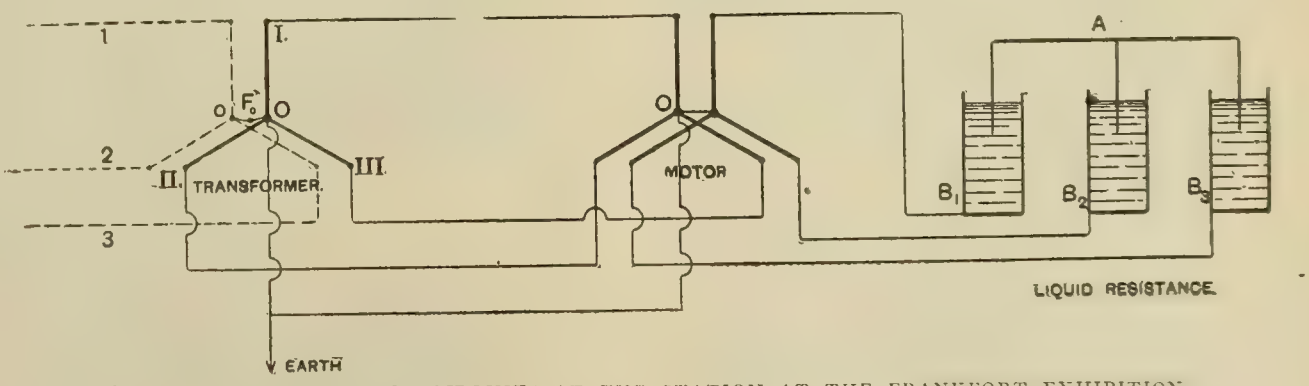
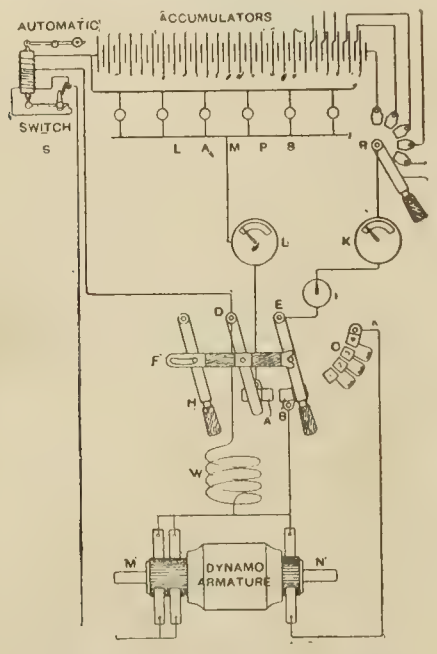


FIG. 2.—ARRANGEMENT OF CIRCUITS AT THE STATION AT THE FRANKFORT EXHIBITION.

armature current reacts very strongly on the revolving field, which is, so to speak, blown aside by the ampère turns in the armature. This may, at first sight, seem a very serious drawback to the three-phase motor, but Herr von Dobrowolsky has hit upon a very simple and ingenious remedy. Instead of short-circuiting the armature coils at starting, he inserts into each of the three branches a liquid resistance, consisting of an iron vessel filled with an alkaline solution, into which an iron plate can be dipped to a greater or lesser depth. The three vessels, B_1, B_2, B_3, are insulated from each other, but the three iron plates are joined by a metallic bridge, A. At starting, the plates are immersed only slightly, and the resistance which is thereby interposed in each of the three armature circuits prevents the creation of abnormally strong armature currents, which would otherwise blow the field aside. As the motor gathers speed the plates are more and more lowered until the whole of the liquid resistance is short-circuited, and the motor works without external waste of energy. As regards the question of efficiency, no definite data are, as yet, available, since the Commission has not yet begun to make its measurements. If we may judge from the absence of heating, vibration, noise, and the general sweetness of the running of this motor, there is every reason to hope that the efficiency will be as high as with a direct-current motor of the same size. A rough test, which the writer was permitted to make on a three-phase motor of 2 H. P., gave an efficiency of 82 per cent.

SMALL ELECTRIC LIGHT PLANT.

Messrs. W. B. Sisling and W. H. Scott, two English electricians, have devised a system of electric lighting by a small plant which possesses some ad-



CONNECTIONS FOR SMALL PLANT.

vantageous features, a description of which we find in a London contemporary.

Usually small plants for private lighting involve the use of accumulators, and to charge these it is often necessary to run the charging dynamo above its normal voltage in order to charge the accumulators and feed the lamps at the same time, which is wasteful.

The arrangement of Messrs. Sisling and Scott may be described as a compound dynamo, with a small supplementary winding on its armature, connected to an extra commutator, which gives a voltage usually about one-quarter of that given by the main commutator. A branch is taken from the main circuit and connected so that the extra commutator raises its voltage by about 25 per cent. This forms the charging circuit. The dynamo can thus be driven at constant speed, and will supply constant voltage to the lamps from its main circuit, undisturbed by the increasing voltage from the cells during charging.

The whole of the cells can be charged by a large current supplied to the lamps at the same time, as this does not pass through the regulating cells. The charging can, therefore, be accomplished during the hours of lighting, instead of the dynamo having to be run specially during the day.

The diagram shows the general arrangement. The dynamo armature has a main commutator M, and an extra commutator N. These two commutators are connected in series, either directly or through the dynamo series winding W. The switchboard contains two switches, viz.: the dynamo switch D, which connects the dynamo to the lamps and the accumulator switch E, which connects the accumulators in either of three different ways, viz.:

A to the lamps alone, or B to the lamps and dynamo, or C to the charging circuit.

These two switches are of the lever pattern, and are interlocked by the thrust rod F. The handle H acts on the thrust rod so that it can only put the dynamo switch "on." To take it "off" the accumulator switch must be moved so that the accumulators are connected to the lamps alone.

When the dynamo switch is put "on," the thrust rod moves the accumulator switch from A to B, thus connecting the accumulators to the dynamo in such a way that they are in readiness to assist the dynamo in supplying current to the lamps, without risk of weakening or reversing its magnetism.

If the dynamo does not need assistance and spare power is available, the accumulator switch may be moved further from B to C, when the dynamo will begin to charge the cells by means of its extra commutator N, without interfering with the constant voltage which is supplied to the lamps from its main commutator M. An index I shows whether the accumulators are being charged or discharged, while an ammeter K indicates the *amount* of the charging or discharging current. A second ammeter L shows the current taken by the lamps. A pilot lamp on the switchboard lights when the dynamo starts up.

An automatic switch S, having shunt and series coils, may be used to disconnect the dynamo when its speed slackens, and will connect it again when the proper speed is recovered.

SIMULTANEOUS TELEGRAPHY AND TELEPHONY.

The following description of a new system of simultaneous telegraphy and telephony, developed by M. Pierre Picard, of the French telegraphs, will be of interest to American electricians:

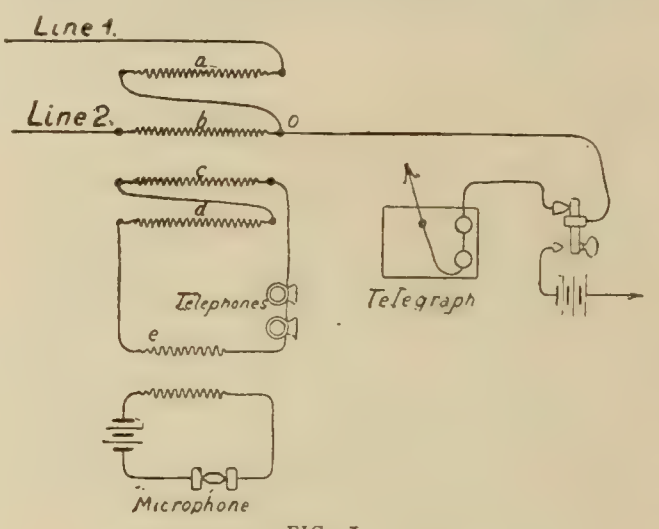


FIG. 1.

M. Picard employs a device which he calls a "differential transformer," which is nothing more than a cylindrical induction coil with four wires of equal resistance and the same dimensions wound together

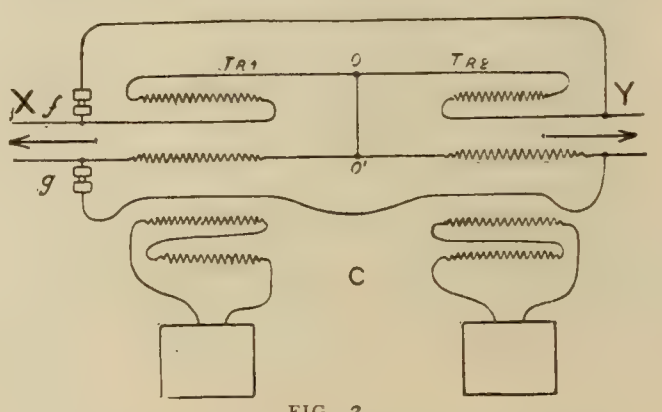


FIG. 2.

on a soft iron core. The coil is provided with four terminals, by means of which the four coils are connected to the line and to the local circuit, as shown diagrammatically in the accompanying figures:

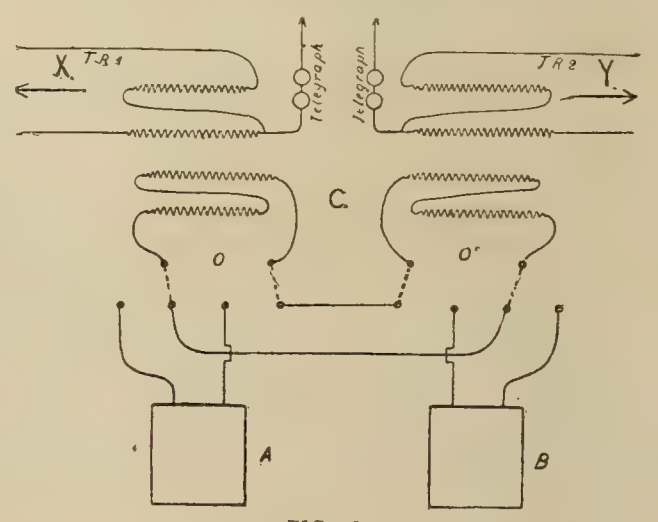


FIG. 3.

In Fig. 1 we have a diagram of the simplest arrangement. The opposite ends of the coils *a b* are joined together. To each of their other extremities one of the line wires is attached. The two line wires are thus looped together for telephony, and are at the same time connected in parallel for telegraphy. The ends of the other two coils *c* and *d* of the "transformer" are similarly connected, a local telephone circuit taking the place of the line.

In Fig. 1 the *telegraphic* currents divide equally between the two coils *a* and *b*, and while they go along the two line conductors in the same direction traverse the coils *a* and *b* in opposite senses. In Fig. 2 the *main telephonic* currents, which take opposite directions along the line, traverse the transformer coils in the same sense; and in Fig. 3 the *local telephonic* currents traverse the coils *c* and *d* in the same direction. The result of all this is that telegraphic currents, whether they bifurcate at O on going to line or unite at this point on going to the receiving instrument, have an equal and opposite inductive influence when traversing the coils *a* and *b*, and the telephone consequently remains silent. When the microphone is spoken to, the induction currents developed in *e* traverse the coils *c* and *d* in the same direction, and induce currents in the coils *a* and *b*, which actuate the telephone at the far end of the line.

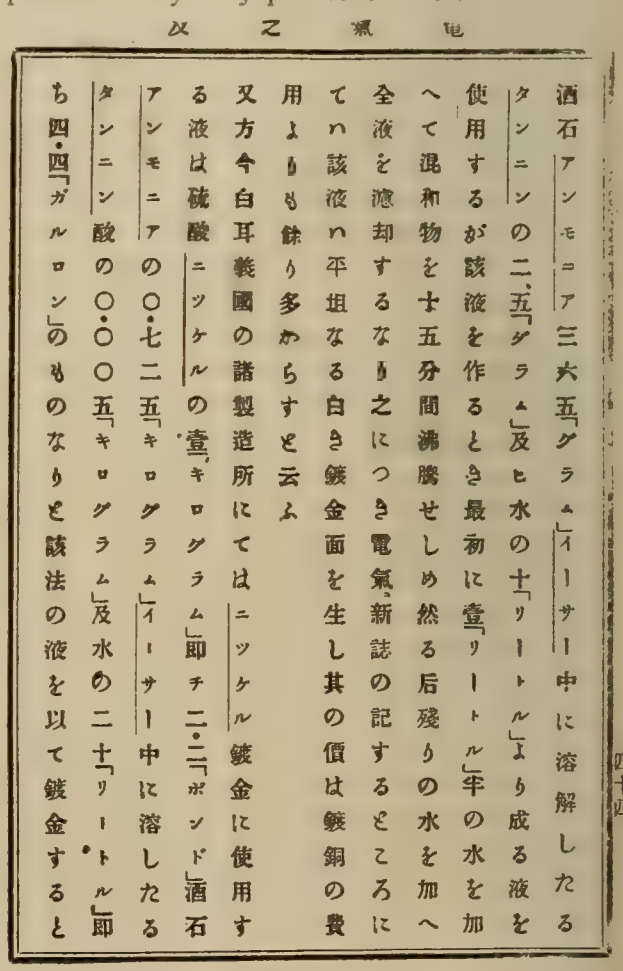
If it is required to cut the telegraph line in half without interrupting through telegraphy, the *modus operandi* shown diagrammatically in Fig. 2 is followed.

The converse problem can also be solved—that is to say, the telegraph circuit can go through, and the telephone circuit can be divided. This is shown diagrammatically in Fig. 3.

In the tests made between Paris, Lyons and Marseilles the interposition of the "transformers" permitted the simultaneous exchange of telegraphic and telephonic communication. But when the Picard apparatus was fixed to the Paris-Troyes line a very different result was obtained. One wire was old, the other recently erected; their electrostatic capacity was by no means the same, and audition was impossible. On equalizing the capacities all went well. The Picard system, it is stated, will allow the Baudot apparatus to be used, which is not the case with that of Van Rysselberghe.

JAPANESE ELECTRICAL JOURNAL.

The first number of the *Electrical Friend*, published in Tokio, Japan, by Mr. S. Katogi, is received. This first number is dated August 30, 1891, and the publication is to be a general review of electrical affairs. The initial number contains some illustrations, one of which shows a lady operating a sewing-machine by electric power. The paper, of course, is printed wholly in Japanese characters. For the



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PAGE FROM THE "ELECTRICAL FRIEND."

benefit of those of our readers who take interest in such matters, we reproduce herewith one of the pages of the first number.

Mr. Katogi spent several years in this country, particularly in the East, studying electrical engineering, and returned to Japan, his native country, nearly two years ago. He takes great interest in electrical matters in Japan, and has been instrumental in the establishment of several electrical industries in that country.

THE ROLLASON GAS-ENGINE.

During the past few years so many isolated electric-light plants have been installed that engineers have been induced to look for more economical motive power than steam, and considerable attention has been given to the improving and perfecting of gas-engines. Natural gas has been discovered in so many different parts of the country that a large field has been created for this type of engine, and even where natural gas is not to be had the manufactured

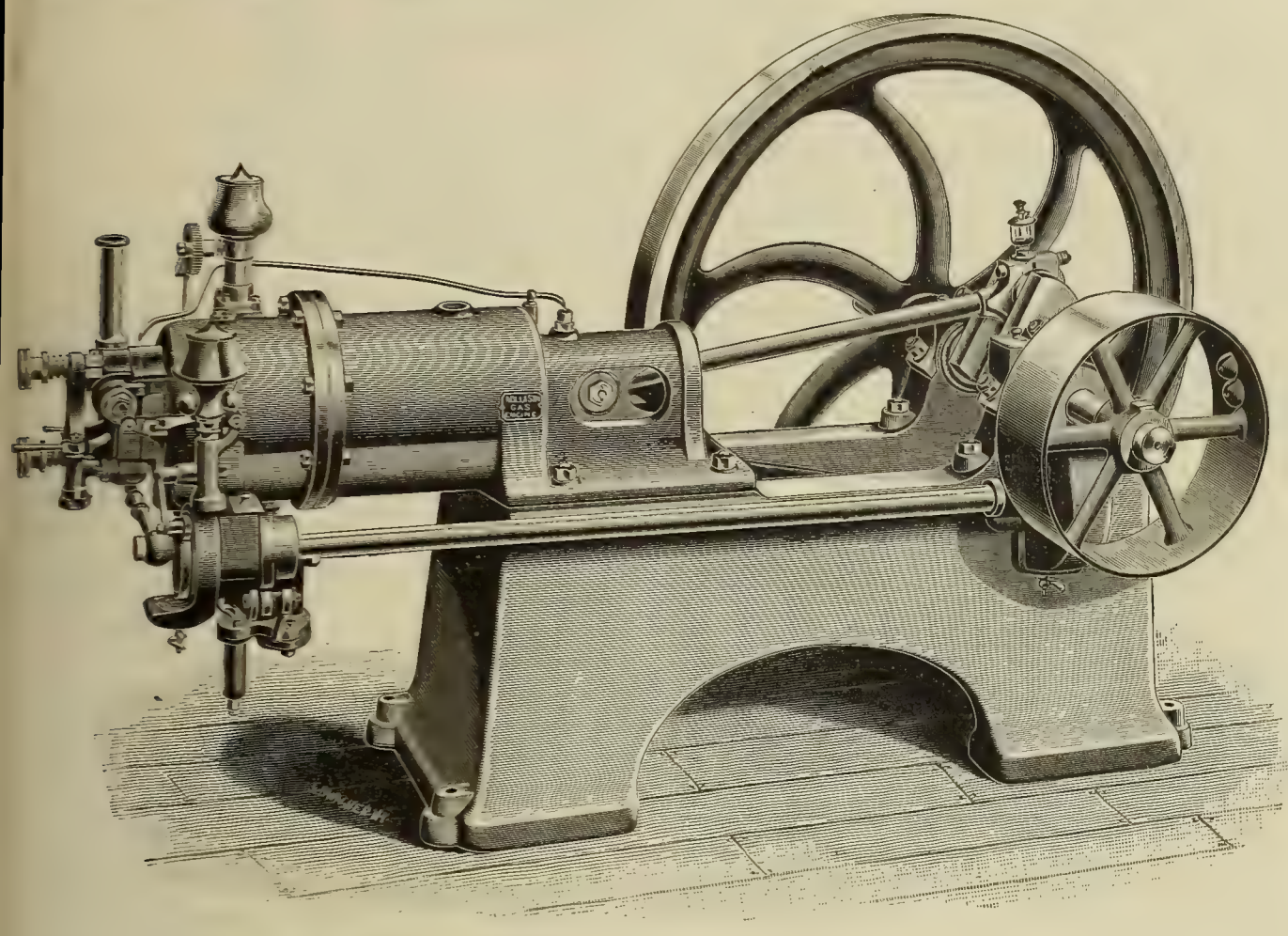


FIG. 1.—TWELVE H. P. ROLLASON GAS-ENGINE.

product is now made so cheap by improved processes that a perfect gas-engine occupies nearly the same position as a water-wheel, and the man who has a flow of natural gas at his disposal is to be envied equally with the one who has a head of water on his property.

The gas-engine which we illustrate and describe herewith is, no doubt, one of the best in the field, and although invented a number of years ago and largely used in foreign countries, it was not used to any extent in the United States until within the past two or three years. The Electric Manufacturing & Gas Engine Company, Greenbush, N. Y., is now manufacturing these engines under the United States letters-patent of Messrs. Rollason and Hamilton, well-known engineers of England. They differ from other gas-engines in the method of mixing the gaseous charge previous to ignition, and the burning of the mixture in a chamber which is heated and maintained at a high temperature.

The engine is constructed with an inner chamber surrounding the combustion-space of the cylinder, and filled with a non-conducting material to prevent loss of heat to the water-jacket at and during the time of the burning of the gaseous charge. A side-shaft revolving at one-third the rate of the crank-shaft works the slide-valve at the back of the cylinder by means of a connecting-rod and a rocking-beam. The gas admission is regulated by two valves—a mitre-valve, which opens periodically, and a throttle-valve, which is always open, but has the area of the opening controlled by a governor. The periodical motion is given the mitre-valve by the longitudinal motion of the throttle-valve spindle, which receives its motion from a lever having a push-piece at its upper end and a roller at the other end, the roller being actuated by a cam on a wheel shaped to proportion the influx of gas to the speed of the piston. The amount of gas admitted is regulated by the governor, which is driven by the side-shaft. The governor is connected to the throttle-valve spindle by a lever and sector, and the throttle-valve is so adjusted that as the governor arises towards its top position the supply of gas is diminished, until the dilution of the charge has been carried as far as economical, when the sector is lifted clear of the push-piece on the top of the lever and no gas is admitted. A second lever connected with the governor carries a counter-weight, and by altering the position of this weight the speed of the engine can be varied at will. For instance, where an engine is not required for constant work it may be run at a very low speed, requiring very little gas, and can be run at full speed when required by changing the position of the counter-weight.

When the combustible mixture is to be admitted to the cylinder the valve-ports coincide with the gas and air inlets, the gas-valve is opened and the charge flows in, following the outward movement of the piston. The first portion of combustible gas taken in flows down the centre of the cylinder until the piston stops, when it divides and flows back along the walls. This portion, which is diluted with air in the combustion-chamber, is collected around the firing-port, while the richer part of the charge is situated next to the piston. The weaker part is ignited first, and the velocity of combustion increases as it approaches the richer part.

After combustion has taken place the piston makes a forward stroke under its impulse, the exhaust-valve is then opened and the piston returns, expelling a large portion of the products of combustion. During the next forward stroke the piston draws in behind it a scavenger charge of air, which it forces out on the back stroke. On the fifth stroke the combustible charge of gas and air is again drawn in, and on the sixth is compressed ready for ignition, completing the cycle, which includes an explosion every three revolutions or at the end of every sixth stroke, except when the engine is working at very low powers.

The engine possesses great strength, rigidity of parts and extra large wearing surfaces, compactness, simplicity and accessibility of all parts, and absence of delicate and easily-broken parts and flying gear, and no joints need be broken to get at the valves. All engines are made of the best quality of material and are thoroughly tested before leaving the works.

No preparation is required in order to effect a start, and the engine is always ready for work. It is claimed to be absolutely free from any danger, and that the consumption of lubricating oil is a negligible factor in its economical working. It is said to be especially adapted for electric-light plants, giving a high speed without variation. The governor on the engine enables the changing of the load by turning on or off the lights as required without causing the slightest flicker. It is said that in its application to running electric dynamos it will give a perfectly steady light with any load.

We are told the following advantages have demonstrated themselves in the use of this engine during the last two years: Premature explosion never occurs and ignitions are perfectly regular; all the products of combustion are expelled; the strength of the explosive mixture is changed automatically in proportion to the work required, and that it is efficient and economical at any speed and for all and varying powers. It is also stated that the ratio of useful work to indicated H.-P. is above the average.

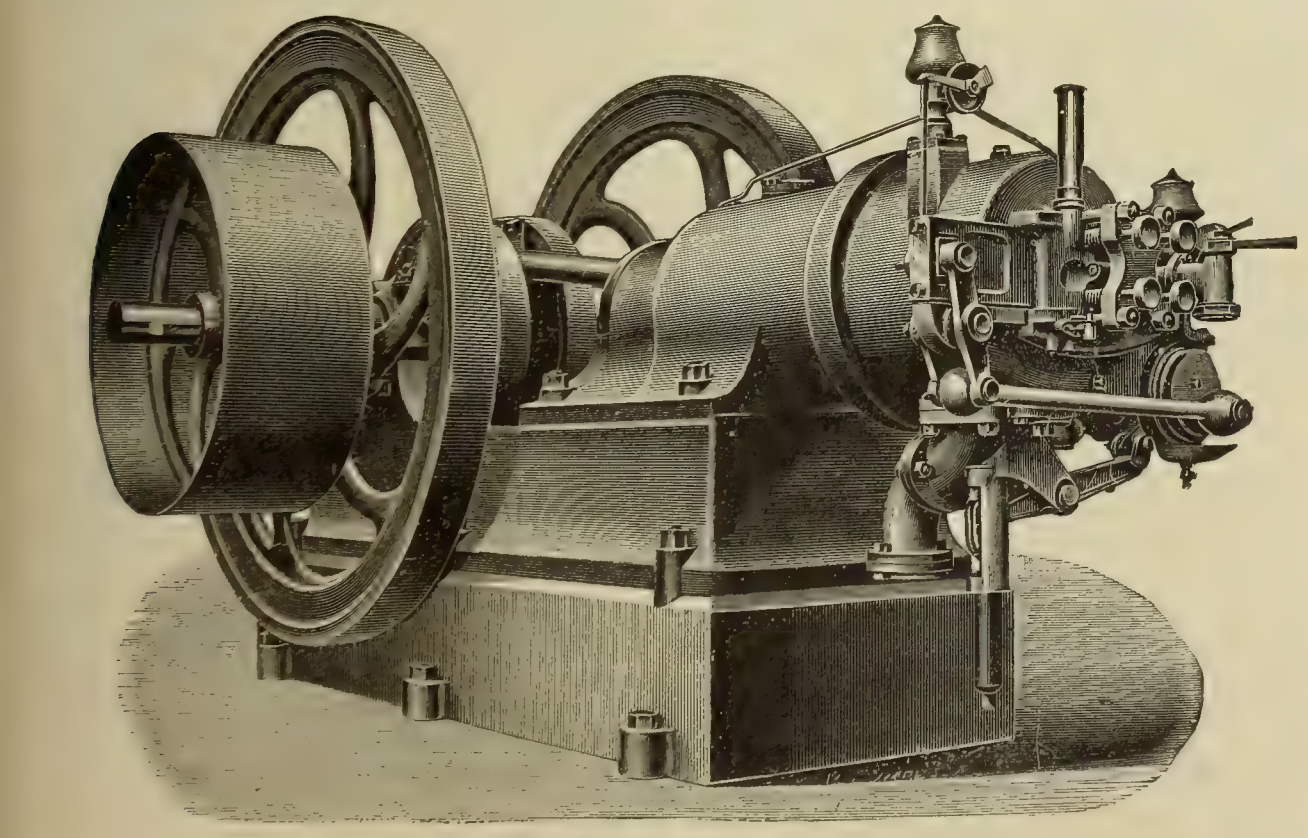


FIG. 2.—ROLLASON GAS-ENGINE OF 25 TO 40 H.P.

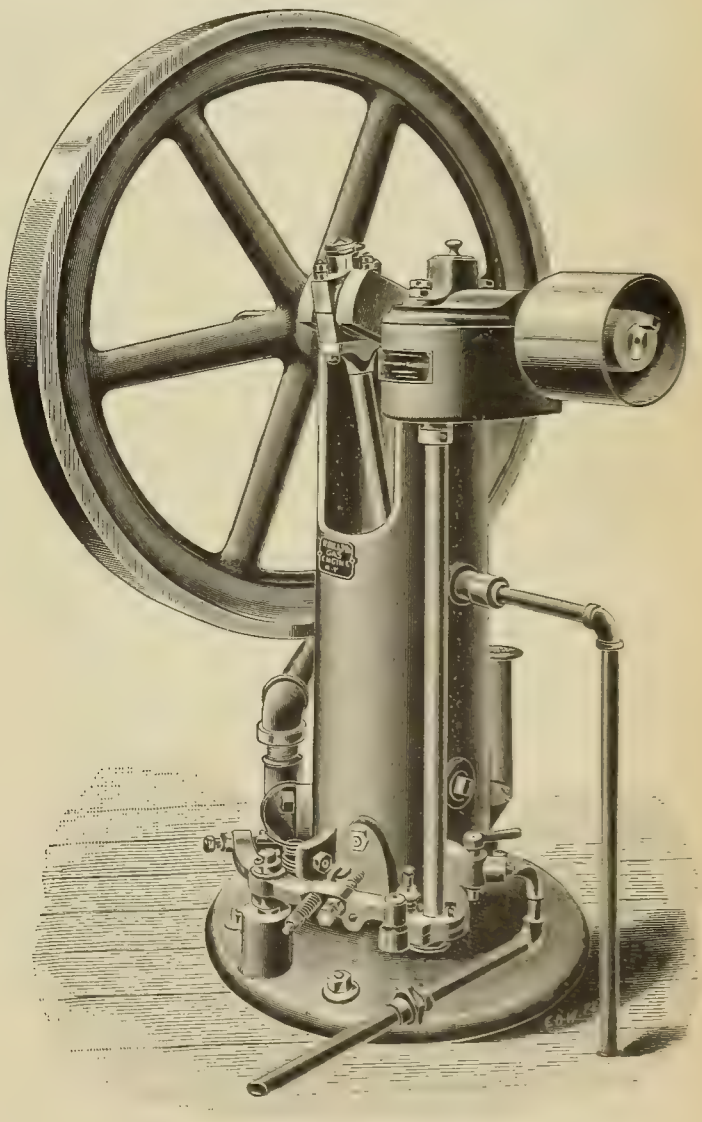


FIG. 3.—TWO H. P. GAS-ENGINE.

Fig. 3 shows a 2 horse-power Rollason gas-engine of the vertical type; Fig. 1 one of 12 horse-power of the horizontal, slide-valve type, and Fig. 2 one of the same type from 25 to 40 horse-power. The works of the Electric Manufacturing and Gas Engine Company are devoted to the exclusive manufacture of these engines.

General office and warerooms, 134 Liberty street, New York, where a handsome exhibition of engines in action can be seen.

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DEVOTED TO ELECTRIC LIGHTING AND POWER — TELEGRAPHY, TELEPHONY, AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

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ACTIVITY IN ELECTRICAL INDUSTRIES.

The condition at large in any one line of business cannot be judged by the business of one concern in that trade, whether it be good or bad. There is one thing certain, however, and that is, business in the electrical trades never promised better than it does at the present time. From the reports we are receiving from all parts of this great land of ours there is every indication of prosperity, present and future.

A glance at our "Electric-Light Notes" every week tells a tale that cannot be compared in any other line. Electric-light plants everywhere are being enlarged. They are enlarged, of course, to meet the constantly-increasing demand for electric light. Electric power is also becoming a large factor in the business of electricity-generating plants, and many of the improvements are made with the view of supplying such power.

Activity in electric-railway work is also unparalleled. New railroads and extensions, and improvements on existing ones are the uniform reports from every quarter. People are not satisfied with the best, but want something better, and all this gives life to the electrical industries.

The supply houses of course feel the influence of this great activity. The influence on their business is far better and satisfactory than it would be if the activity in the industries just mentioned was on the ebb. But this is the flood tide of prosperity, and there is no likelihood that it will ever cease to be a flood tide until some greater power than electricity is discovered. There is nothing in the nature of retrogression about electricity, and everything and everybody that are connected with it must either improve and advance or drop out of the race.

ELECTRICAL SOCIETIES.

With the return of autumn the various electrical societies are resuming their regular meetings, and there is every indication that the present season will be an active and interesting one among these bodies. Their plans promise well, and there is no reason to doubt that there will be greater interest and enthusiasm among students and members alike than ever before.

The development of electrical appliances is constantly revealing something new, the study and application of which present excellent subjects for the consideration of the scientific and semi-scientific associations. These associations are doing an excellent work not only among the communities in which they exist, but in the country at large. May they all prosper and do much good.

Every progressive young man should be a member of at least one electrical society, whether he is directly connected with any electrical business or not. Every one should have a general knowledge, at least, of electricity and its applications, and no better facilities for acquiring this knowledge can be had than by joining a society of this character. Membership carries with it library privileges and the opportunity of meeting many of the shining lights in the electrical firmament.

AN INTERESTING ELECTRIC PLANT.

We give elsewhere in this issue a short description of the generating plant at Lauffen Falls, Germany, and the transforming plant at the exhibition at Frankfort-on-the-Main, and a diagram of each. This combined plant has been the subject of much consideration and discussion lately, mainly from the fact of the long distance which the power is transmitted, and the mechanical and electrical arrangements rendered necessary to meet the extraordinary conditions.

The distance from the generating station to the receiving station at the exposition grounds is about 110 miles. The current was first applied to this circuit on August 25 last, and the immediate result was the lighting of about 900 16 c. p. lamps at the exhibition. The number was increased to 1,100 lamps a few days later. A Brown "three-phase" generator is employed at Lauffen for the production of the current which is transmitted over three wires to Frankfort. At the Lauffen end of the circuit are three transformers and three at the Frankfort end, all having a transforming ratio of 1-160. In order to secure the highest insulation oil is used in the transformers. The value of oil as an insulator is well known, it having been used with complete success where extremely high-tension currents are used.

At Frankfort a novelty consists of an artificial cascade, 30 feet high, the water for which is raised by a centrifugal pump operated by an electric motor, which derives its current from Lauffen, 110 miles away.

This plant is a unique one in many respects, and is interesting to electrical engineers in that it presents an opportunity to study the subject of long-distance transmission in its practical bearings.

ELECTRICITY AS A CURATIVE AGENT.

Last but not least comes that most conservative body of men—medical doctors—to pay homage to electricity and acknowledge its all-powerful influence for good. The American Electro-Therapeutic Association held its first annual convention in Philadelphia during the last days of September and discussed electricity as a curative agent. One of the objects of the meeting was to recommend to the profession at large the recognition of electricity as a remedy for certain ailments of humanity. Electricity, as is well known, holds a very important place in the practice of medicine nowadays. Curative agent is the most apt term to apply to it; it can hardly be called a medicine, yet in one sense it is a medicine. It is but a few years ago that the use of electricity as a remedy or means of relief in certain affections was considered more in the nature of quackery than legitimate practice of medicine, but at the present time very few physicians do not possess an electro-medical outfit. Thus electricity marches on to conquer the world.

IMPROVEMENTS IN SMALL ISOLATED PLANTS.

It is the usual practice to install an accumulator plant in connection with small isolated electric-lighting plants, such as are used for lighting private dwellings, and it is customary to charge the accumulators during the daytime when lights are not needed and take from them part or the entire current necessary to keep the lamps incandescent. The method of operating such plants of course varies according to the requirements of each individual case, and improvements are frequently being made with a view to reducing the cost of maintenance to a minimum.

An ingenious arrangement of this nature has been devised by two English electricians, a brief description of which is printed on another page in this issue.

In such plants it is sometimes necessary to feed the lights and charge the accumulators at the same time, which proceeding necessitates running the dynamo at a higher than normal voltage. It is a practice that cannot be recommended, as it is a wasteful one.

The electricians referred to accomplish the same result without increasing the voltage of the dynamo or increasing its speed. The armature has a supplementary winding and an extra commutator, which gives a voltage of about one-quarter of that of the main armature coils. A shunt is then taken from the main circuit for a charging circuit, and to it is added the current generated in the extra coil, the combined voltage being one-quarter greater than the normal voltage of the machine. In this way a charging current of increased voltage is obtained without altering the speed of the dynamo or in any way affecting its normal condition.

THE WORLD'S FAIR.

Underground-cable manufacturing companies are justly indignant over the action of the Committee on Electricity of the World's Fair in requiring that all companies intending to supply lights must provide the complete equipment, including dynamos, conductors and lamps. If this ruling stands, it will have the effect of preventing the first-mentioned companies from giving their products a practical test as far as electric lighting is concerned.

The rules of this important department of the great fair should not be so rigid as to discriminate against any branch of the electrical industry. All should have an equal chance to make the best of the opportunity, and electric-lighting companies should be accorded the privilege of giving the contract for building their lines to whom they please if they do not care to carry on that part of the work themselves.

Cable-construction companies, as a rule, confine themselves closely to that important industry, and if they would have any display or trial of their goods at the fair, they will have to either go into the electric-lighting business or be excluded from participation, which latter would be decidedly unfair. There should be no restraint upon any individual or concern desiring to display samples of their goods or manufactures.

Some inventive genius in the West has coined a new word, which, while not remarkable for its euphony, is expressive. In describing a thunder-storm the word "kemmlerized" was used to convey the idea of death by lightning in the case of a cow. It will be a good word for the daily press to use, especially those sensational sheets that issue "extras" on the least provocation.

A NOVEL USE OF INCANDESCENT LAMPS.

A small war is in progress between the pool-rooms and the Brooklyn Jockey Club over the right of the former to obtain reports from the race-track in order to carry on the business of the bookmakers. They have been excluded from the track, and the result is that all sorts of schemes are devised and tried with a view of obtaining the desired information in spite of their expulsion. There are always plenty of willing hands to aid in carrying out these "underground" plans, one of which was discovered a few days ago in full and successful operation by the detectives on the track.

The *modus operandi* was as follows: A coach was hired for the purpose and installed with the necessary batteries. Attached to the batteries were wires which ran up under the coachman's wearing apparel to his hat, to which were attached two incandescent lamps, arranged in such a way that the light therefrom was invisible to all but a man who was stationed outside the grounds on a pole with a telescope in his hands. Concealed in the coachman's clothes was a key, by the operation of which the electric circuit could be opened and closed. In this way the coachman, who, by the way, was a telegraph operator, could flash the lamps and signal to the man with the telescope all the necessary information regarding the races; after that it was an easy matter to transmit the news to the bookmakers.

This plan worked well for four or five days, when the detectives discovered it and arrested the "coachman" and the several occupants of the coach, who were there to avert suspicion.

STOPS RUNAWAY HORSES.

A press dispatch from Chicago, September 20, thus describes an electrical invention for bringing into subjection runaway horses:

"The new system of stopping runaway horses by electricity had a practical test on the lake front yesterday. A. B. Holson, the inventor, got into a carriage to which two horses were attached, and with no driver on the box.

"A man lashed the horses with a whip and they dashed away at a break-neck speed. Suddenly the animals raised themselves on their haunches and came to a full stop. The invention consists of a dry battery under the driver's box and connected by wires with metal balls placed in the horse's nostrils.

"There are two buttons, one on the driver's box, the other inside, which will close the circuit when pressed. The result is a mild shock, which the inventor claims will invariably bring runaway horses to a standstill."

MELTING OF IRON BY ELECTRICITY.

Alvin Dings, the electrician at the E. P. Allis Company, Reliance Works, Clinton and Park streets, Milwaukee, Wis., has made application for a patent on a method of melting iron by electricity, which he claims will produce metal 100 per cent. purer than that rendered in the present way.

The metal is placed in a cupola-furnace through which an electrical current is passed, forming arcs at the electrodes, producing sufficient heat to melt the iron rapidly, the molten metal flowing into a receptacle below the furnace, from which it is drawn off for use. The method does away with the use of coke, lime and sand, and saves fully half the time and half the cost of the present method.

Many of the impurities are carried off by a process also the invention of Mr. Dings. As soon as a patent is secured a large cupola-furnace will be placed in the Reliance Works to give the method a thorough test on a large scale. It is said that 200 horse-power will be sufficient to operate one of the large furnaces.

NEW INCORPORATIONS.

The Pulaski Electric Light & Water Co., Pulaski, Va., was incorporated September 26, with a capital stock of $250,000. Incorporators: J. H. Dingee, J. M. Wiegman, W. H. Triol, E. Graves, Philadelphia, Pa., and H. Alexander, Pulaski, Va.

The Pulaski Electric Company, Pulaski, Va., has been incorporated, with a capital stock of $25,000. Incorporators: J. R. Miller, J. W. Lyons, R. E. Watson, R. B. Berkeley and G. I. Colgate.

The Pacific Coast Fuel & Gas Company, Chicago, Ill., was incorporated September 25, with a capital stock of $5,000,000, to furnish electricity and gas for light, heat and power purposes. Incorporators: Levarth Annison, Calvin C. Marsh, Luke T. Drury, Henry N. Miller and James Craig.

The Anglo-American Gas Control Company of San Francisco, Cal., was incorporated September 21, with a capital stock of $200,000. Incorporators: L. A. Kelley, George T. Gaden, S. F. Long, H. L. Tatum, J. J. Bowen, H. A. Williams and J. P. Langhorn, all of San Francisco, Cal.

The Citizens Electric Light & Power Company, Pueblo, Col., was incorporated September 24, with a capital stock of $100,000. Incorporators: John F. Vail, John H. Black and John W. Finlan, all of Pueblo, Col.

The Southern Electric Company of Baltimore, Md., has been incorporated, with a capital stock of $50,000, to manufacture electrical machinery. Incorporators: A. Pierre, John Waters and F. W. Schultz.

The Goshen Light and Power Co., Goshen, N. Y., was incorporated September 21, with a capital stock of $15,000. Incorporators: J. W. Corwin, William H. Wyker and Robert B. Hick, all of Goshen, N. Y.

DYNAMO ELECTRIC GAS-LIGHTER.

This is the newest and best apparatus to ignite gas-jets ever placed upon the market. Mr. A. L. Bogart, of 22 Union square, New York City, with his unlimited capacity for inventing and controlling everything new and valuable in the line of electric gas-lighting apparatus, some time since secured the patented Dynamo Electric Gas-Lighter illustrated herewith, and has made many improvements in the same.

The hard rubber shell, which is held in the hand and which acts as a support for the tube extending therefrom, contains a well-constructed miniature dynamo. The current is generated by pressing the button under the thumb, as shown in the cut, which causes the armature of the dynamo to revolve at a high speed by specially devised mechanism, thus generating a current of electricity and producing a long electric spark at the end of the tube held over the gas-jet. This current is carried through insulated wires, enclosed in the tube, to the extreme end, attached to which is a metal hood. The two ends of the conductors are separated slightly to create the spark as the current jumps across the intervening air-space.



The illustration shows the tube curved at the end; this is done to allow the hood at the end of the tube to collect the gas as it escapes after the key is turned by hand. When the hood is placed in position and the key turned the button is pushed and the gas is lighted instantly. To turn on or off the gas when it is beyond reach a clutch is provided on the top of the curved tube.

This dynamo gas-lighter is made of the very best material. The features of this form of gas-torch consist, first, of improvements in the interior construction, which increase its power and durability; second, instead of the end of the tube being pushed through the globe-holder in the act of lighting (a most troublesome and inconvenient process in the dark) it is simply held above the issuing gas, the hood catching the gas when held in any position.

MEETINGS OF SOCIETIES.

FRANKLIN EXPERIMENTAL CLUB.

The Franklin Experimental Club, of Newark, held its first regular meeting since the summer vacation on Tuesday evening, September 29. There was a good attendance and there is every indication of an increased interest in the society and its work. The Club is preparing to move into larger quarters, and with a view of increasing largely the growing membership it has decided to make the initiation fee for the next three months the small sum of five dollars. Parties desiring further information may secure the same by addressing the Secretary, Mr. F. W. Hillard, at 153 Mt. Pleasant avenue, Newark, N. J. After the regular meeting on Tuesday evening the members were entertained by some remarks by President Hammer upon the Convention and Exhibition of the National Electric Light Association at Montreal. Following this Prof. Geo. C. Sonn gave a most interesting and entertaining talk on his summer tour in Europe, where he visited the Electric Exhibition at Frankfort. He also described many things of scientific interest which he saw in the large cities of England, France, Germany, Switzerland, Holland and elsewhere. His remarks were listened to with much interest.

The Wheeler Condenser and Engineering Company has recently filed articles of incorporation with the Secretary of State at Trenton, N. J. The company has bought out the entire plant and business of The Colwell Iron Works, at Carteret, N. J. The Wheeler Company will continue to manufacture Wheeler's Patent Surface Condensers and other of his specialties. The capital stock of the company is $300,000, and the incorporators are as follows: Fredk. Meriam Wheeler, of Montclair, N. J.; Aaron Vanderbilt, of New York City; Clifton H. Wheeler, of Brooklyn, N. Y.; William H. Hampton, of New York City, and Charles W. Wheeler, of Brooklyn, N. Y. The headquarters of the company will be at 92 and 94 Liberty street, New York City.

ELECTRIC LIGHT NOTES.

The United Electric Light & Power Company, of Dennison, O., wishes to contract for a 35 light 2,000 c. p. arc dynamo. T. H. Wilson is President of the company.

The Thomson-Houston Electric Light & Power Company of Buffalo, N. Y., will soon increase its equipment.

The Binghamton Electric Company, of Binghamton, N. Y., will increase its equipment soon.

The Ballston Electric Light & Power Company, of Ballston Spa, N. Y., contemplates several additions to its plant in the near future.

The Brush Electric Light Company, Buffalo, N. Y., will erect a new building at an early date.

The Edison Electric Illuminating Company, Paterson, N. J., is now working on extensive additions to its plant.

The Bethlehem Electric Light Company, Bethlehem, Pa., contemplates several additions in the near future. The Westinghouse incandescent and the Thomson-Houston arc systems are used.

The Municipal Electric Lighting and Power Company, St. Louis, Mo., is increasing the capacity of its plant by 20,000 incandescent lamps.

The Smith's Fall Electric Light Company, Smith's Falls, Ont., contemplates changing its incandescent system in the near future. It is now using the United States system.

The Lindsay Electric Light Company, Lindsay, Ont., using the Bernstein incandescent and the Ball arc systems, contemplates increasing its incandescent system soon.

A suit has been filed in the Circuit Court of Marion, Ind., asking that the contract for lighting the city of Marion be annulled on the ground of corruption. Several members of the City Council are directly charged with accepting bribes for their votes.

The Central Electric Company of Portage La Prairie, Man., is to make extensive additions to its steam plant in the near future.

The Marble City Electric Light Company, Rutland, Vt., supplying 75 arc and 550 incandescent lights, expects to double its plant soon. James Carruthers is Secretary of the company.

The Kenton Gas & Electric Company, Kenton, Ohio, expects to increase its arc light plant in the near future. W. A. Ross is Superintendent.

The Citizens' Heat, Light & Power Company, Blairsville, Pa., supplying 40 arc and 1,300 incandescent lights, expects to increase both systems in the near future. The Wood arc and the Westinghouse incandescent systems are used.

The Hutton Electric Company of Brampton, Ont., will make several additions to its plant in the near future. The Thomson-Houston arc and the Bernstein incandescent systems are used.

The Edison Electric Illuminating Company, Brooklyn, N. Y., will shortly add 6,000 horse power to its power plant.

The Chambersburg Electric Light Plant (municipal), Chambersburg, Pa., will soon make several additions.

The Little Falls Electric & Water Company, Little Falls, Minn., contemplates several additions shortly.

An incandescent dynamo will be required for the municipal plant of the town of Thorold, Welland Co., Ont., next year. A. Fraser is chairman of the Electric Light Committee. The town at present operates 36 arc and 56 incandescent lamps using the Ball system. The power is furnished by a 65 horse-power Leffel turbine water-wheel.

The La Porte Electric Company, La Porte, Ind., has just increased the equipment of its electric-light plant.

The Citizens' Electric Light and Power Company, Muscatine, Ia., is installing a 200 H. P. Buckeye engine and another 750-light dynamo. The company uses the Hawkeye incandescent system.

The Paperville Electric Company, Paperville, Ill., contemplates enlarging its dynamo capacity in the near future. W. F. Keeny is Superintendent.

The Mt. Sterling Electric Light & Power Company, Mt. Sterling, Ill., supplying 750 incandescent lamps by the Royal Electric Company's (Peoria, Ill.) system, will make extensive additions to its plant soon.

The Port Hope Electric Light & Power Co., Port Hope, Ont., using the Ball arc and the Ft. Wayne Slattery inductive incandescent systems, will add a motor system to its plant next spring. R. A. Corbett is President and Manager of the company.

The Hastings Electric Light & Power Co., Hastings, Minn., contemplates several additions to its plant in the near future. The Thomson-Houston system is used.

The Valleyfield Electric Co., Valleyfield, Que., using the Edison incandescent system, contemplates the addition of an arc-light plant. R. S. Joron is Superintendent.

The Aylmer Electric Light Co., Aylmer, Ont., using the Ball arc and Reliance incandescent systems, will make extensive additions to its plant in the near future. J. D. McDiarmid is President and Superintendent.

The Jacksonville Gas Light & Coke Company, Jacksonville, Ill, using the Thomson-Houston arc and the Westinghouse incandescent systems, contemplates several additions to its plant in the near future. F. M. Doan is Superintendent.

The A. F. Dexter Company, Clay Center, Kan., will make an addition of 1,000 incandescent lights in the near future. This company supplies 85 arc and 300 incandescent lamps on the Western Electric system. The power is furnished by a 325 H. P. water-wheel. A. F. Dexter is President and Superintendent.

The Monroe Electric Light & Power Company, Monroe, Mich., contemplates several additions in the near future. G. R. Hurd is President and General Manager.

The Lakeland Electric Light & Power Co., Lakeland, Fla., will make several additions to its plant in the near future. The company uses the Easton arc and the Mather incandescent systems. H. C. Sloan is Superintendent.

The Adrian Electric Light & Power Works (private company), Adrian, Mich., contemplates the installation of an extensive incandescent system. The company now supplies 235 arc lamps and 12 incandescent lamps on the Thomson-Houston system, and also power for the electric street railway.

A STUDY OF THE PLANTE LEAD-SULPHURIC ACID-LEAD PEROXIDE CELL, FROM A CHEMICAL STANDPOINT.*

PART I.

BY G. H. ROBERTSON.

The author in the introduction, states that though, since Frankland, in 1883, published his first "Contribution to the Chemistry of Storage Batteries," the capabilities of the Planté cell have been well tested and are now thoroughly understood, there is still considerable uncertainty as to the precise nature of the chemical changes which attend their use and that it was principally to study the part played by the electrolyte that the investigation, the results of which are recorded in this paper, was instituted about a year ago at the Central Institution, at Dr. Armstrong's suggestion, as McLeod's observations on the electrolysis of sulphuric acid solutions led to the supposition that the changes occuring in the acid were probably less simple than was commonly supposed. This supposition was verified.

The first section of the paper deals with the nature of the lead salt formed during discharge. It is pointed out that, as is well known, red lead varies considerably in composition, generally containing a smaller proportion of peroxide than is represented by the formula $Pb_3O_4 = PbO_2 2PbO$ and that with nitric acid it behaves as though it were a mixture of the two oxides, the nitric acid always dissolving out the monoxide. There is no reason why sulphuric acid should not behave similarly, and, since lead sulphate is but very slightly soluble, red lead may be expected always to yield a corresponding sulphate, *i.e.*, a mixture of peroxide and sulphate containing an amount of sulphate corresponding to the amount of monoxide originally present in combination with the peroxide. At Dr. Armstrong's request a number of experiments were made at the Central Institution (long prior to the reading of Messrs. Gladstone and Hibbert's papers) by two students, Messrs. Briggs and Ingold, on various samples of red lead, with the result that the sulphate formed always corresponded to the monoxide originally present.

As no proof of the existence of a definite homogeneous sulphate corresponding to red lead can be afforded by analysis alone, evidence must be obtained that the product differs in some of its properties from a mixture. It was to be expected that the E.M.F. of an oxysulphate would differ from that of a corresponding mixture of sulphate and peroxide and have some definite value; therefore pastes were made of peroxide of lead, peroxide of lead and sulphate, in the proportions of one to one and one to two, and also from the product obtained by treating red lead with dilute sulphuric acid (one to five). Experiments made with these pastes showed that there was a difference of degree only between the red lead pastes and the mixtures, and that the lowering of the E.M.F. appeared to depend rather on the intimacy of the mixture and consequent thorough coating of the peroxide granules with sulphate, than on the proportion of sulphate present. Mr. Desmond Fitzgerald had already shown, in 1887, at the Institution of Electrical Engineers, that the mere admixture of lead sulphate with peroxide of lead produces a lowering of the E.M.F.

With regard to Frankland's observations respecting the color of the product formed on the peroxide plate during discharge and the reducibility of the sulphate, the author points out that the color is due to the incomplete reduction of the peroxide, owing, probably, to the almost complete blocking up by lead sulphate of the pathways by which the current travels through the electrolyte in the paste; that careful examination of the plugs from a discharged cell shows that the base consists of practically unaltered peroxide of lead and that the surface, which is rich in $PbSO_4$, is really a mass of partially reduced granules of peroxide of lead which are coated with sulphate. Also, though pure lead sulphate is very difficult to reduce, it is very well known that mixtures of lead sulphate and peroxide of lead, or other conducting substances, are reduced with comparative ease and it is very intimate mixtures of this nature which have to be dealt with as a rule in charging a cell.

In conclusion, the author points out:

That neither chemical nor electrical tests give any ground for supposing that any other sulphate than the ordinary white $PbSO_4$, is concerned in the interactions occurring in the cell.

That were the sudden lowering of the E.M.F. caused by a change in the nature of the chemical compounds formed on the plates, it is very difficult to account for the very rapid recovery of the E.M.F. exhibited by an apparently discharged cell.

In the second section the electrolyte is dealt with, and after referring to the work of Berthelot, Richarz, Schone, Traube and others on the electrolysis of sulphuric acid solutions, the author describes experiments made to test the effect of the addition of sodium sulphate to the electrolyte, as, from information received from Mr. Barber Starkey, it seemed probable that the different behavior of cells containing sodium sulphate was due to the catalytic action of this salt on the hydrogen dioxide always found in electrolyzed acid of the strength used in batteries and which is probably formed by secondary action from persulphuric acid.

Mr. Preece most kindly aided the investigation by allowing experiments to be carried out at the General Post Office, where one-half of the secondary cells contain one per cent. of sodium sulphate, and the other half ordinary dilute acid, sp. gr. 1,180. He also put at the disposal of the author the records of the behavior of the cells and as they showed that there was much less sulphating with sodium sulphate, as shown by the sp. gr. never falling to the same extent as in the plain cells, but that the general character of the changes in temperature and in sp. gr. during charge and discharge were the same in both types of cell and of the nature which the work of Prof. Ayrton and others has rendered familiar to all, it was only the distribution of temperature and of sp. gr., which was investigated and this was found to be very irregular.

It was found that the addition of sodium sulphate, in about the proportion of one per cent. to freshly electrolyzed acid, or during electrolysis, always produced a diminution in the total quantity of "active oxygen," and brought the amount present in the plain cells down almost exactly to that found in the sodium sulphate cells.

Experiments on the growth of the "peroxides" were carried on during five charges and discharges, but only the figures relating to the first discharge are given, as the other charges and discharges are mere repetitions. The peroxides form at once, then undergo a diminution, and then increase again. The alteration in the totals is due mainly to actions occurring at the lead plate in the plain cell, as at the peroxide plate the amounts steadily increase; in the sodium sulphate electrolyte there is a diminution at both plates, followed by an increase.

Determinations were made of the amounts of "active oxygen" present as persulphuric acid and hydrogen dioxide respectively and it was established that acid taken from the cell reduced peroxide of lead. The presence of hydrogen dioxide being thus established, both directly and indirectly, its effect on the E.M.F. of a cell was tested. It was found that, while its addition to the acid in the case of a lead peroxide couple in dilute sulphuric acid produced an annulment or reversal of the E.M.F., the introduction of hydrogen dioxide nto the body of the peroxide paste produced an increase of E.M.F. in the case of a platinum-lead peroxide couple. The latter experiment was made with a view of reproducing, if possible, the conditions of a cell which is started discharging directly it is fully charged and in which the persulphuric acid formed at the positive during charge may be supposed to break up with the formation of hydrogen dioxide on the cessation of the charging current, thereby increasing the normal E.M.F. of the cell.

The cause of the pink color of the acid noticed by Mr. Crompton and others, was investigated and found to be permanganic acid, formed probably from the manganese present in commercial lead.

In conclusion the author points out:

That "peroxides" are found in appreciable quantities in the electrolyte during charge and discharge;

That their influence must not be neglected in considering the behavior of the Planté cell;

And that it is to the electrolyte rather than to the plates that attention must be directed if any considerable improvement is to be effected.

*Abstract of a paper read before the Royal Society, London, June 11, 1891.

A DISCUSSION OF THE CHEMICAL CHANGES OCCURRING IN THE CELL.*

PART II.

BY H. E. ARMSTRONG, F.R.S. AND G. H. ROBERTSON.

The authors arrive in this paper at the following conclusions:

1. That the cooling observed in the Planté cell can only be explained as resulting from the dissociation of the dilute sulphuric acid, and as the values given by Messrs. Ayrton, Lamb, Smith and Woods are in practical agreement with those calculated on the assumption that the acid used is sulphuric acid itself H_2SO_4, that in all probability such acid and not the dilute acid contained in the cell is operative throughout.

2. That the observed loss in efficiency cannot be due to temperature changes, as these arise through actions occurring out of circuit.

3. That it is difficult from a comparison of calculated with observed values of the E.M.F. to arrive at any final conclusion as to the exact nature of the changes which take place in the cell. On the assumption that sulphating occurs at both plates in circuit and under the influence of H_2SO_4, the calculated value is considerably too high, while, if sulphating occur only at the lead plate, the value calculated is far too low.

4. That a counter E.M.F. of about 0.5 volt would account for the observed departure from the highest calculated value. As peroxides are always present in the electrolyte, it is conceivable that such a counter E.M.F. may exist; moreover there is also the possible influence of the lead support to be considered.

5. That the observed loss of efficiency is to be attributed to the formation of peroxides in the electrolyte and to the excessive sulphating occurring chiefly at the peroxide plate in the local circuit existing between the support and the paste.

DETROIT, Mich.—The Detroit Citizens' Street Railway Company has been incorporated, with a capital stock of $4,000,000. Incorporators: Thomas Waller, M. V. Vorse and W. W. Cook.

KANKAKEE, Ill.—The Enterprise Electric Light and Railway Company was incorporated September 1, with a capital stock of $100,000, to construct and operate a street railway and furnish electric light and power. Incorporators: August D. Ehrich, Thomas H. Magruder and William McGillis.

* Abstract of a paper read before the Royal Society, June 11, 1891.

IMPROVEMENTS IN THE TELEPHONE.

On September 8 three patents were granted to Mr. James H. Howard, General Manager of the Tropical American Telephone Company, of Boston, on improvements in telephones and magneto bells. The following are brief descriptions of the same:

No. 459,205.—An improved telephone receiver which shall embody in its own construction a switch device to cut out the coil circuit in the telephone itself when the 'phone is not in use (now done by an elaborate mechanism in the call-bell). Two nails driven in the wall on which to hang the 'phone will suffice with this invention to cut out the 'phone, and

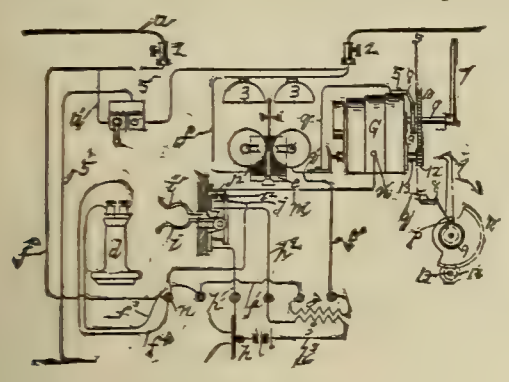


FIG. 1.

a two-point switch would cut in the ringer circuit of any call-bell; or this can be done by a simple circuit closer on the 'phone (see Fig. 1) called into action when the 'phone is hung up.

No. 459,213 is a cheap and simple way of supporting the telephone when not in use, and at the same time operate a switch device for cutting out and in the telephone circuit. It could also be made to cut out and in the ringer or generator circuit (see Fig. 2).

No. 459,214 has for its object an improved call-bell with a self-acting shaft to rotate the armature

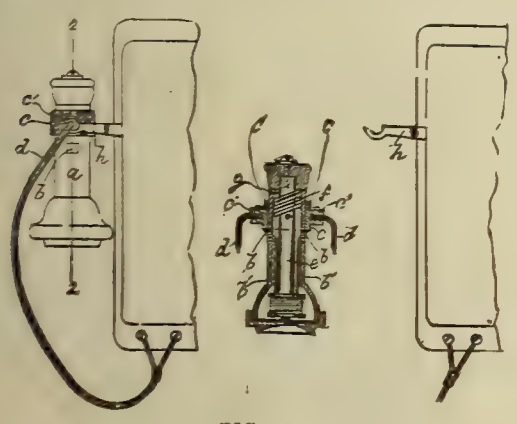


FIG. 2.

so that one or any number of signals can be given with ease and certainty where several stations on a line require a different number of rings or calls for each. It also does away with electrical connection with the ringer through the door hinges—leaves the door free so that no hinges are required. The movable jaws supply support for the telephone when not in use, and also operate a switch device and circuit cut-out (Fig. 3). The lightning arrester is a simple two-point switch on the side of the call-bell, where it can be readily seen and operated. The side crank, telephone support and gongs take up less space and are less liable to injury in packing and shipping, especially for export.

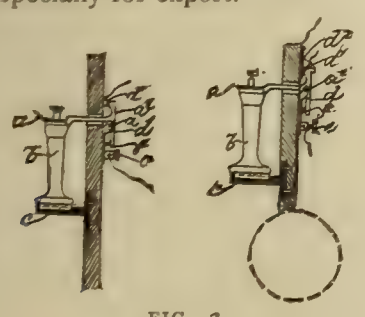


FIG. 3.

The improved devices will be controlled exclusively by the Tropical American Telephone Co., and will be introduced first into foreign territory and later into the United States to supply the private line business. Several other improved devices are pending action in the Patent Office, suggested to Manager Howard by his ten years' experience supplying the export telephone trade.

The Tropical American Telephone Co. has recently secured an old patent which has been overlooked by the managers of sub-companies in the United States, and it is said a royalty for past as well as present and future use of this device in the United States will soon be demanded from all using it. It applies to nearly every magneto call-bell in use in the United States.

ECONOMY IN ELECTRIC POWER DISTRIBUTION.

BY J. STANFORD BROWN.

Mr. H. Ward Leonard in his article, "Minimum First Cost of Plant and Maximum Economy of Operation in the Electrical Transmission of Power" (E. E., XII., No. 174, p. 249, 2 S., '91, or W. E., IX., 135, or Ey., I., No. 8, p. 97), has thrown the gauntlet.

(2) Mr. F. B. Badt replies, W. E., IX., 145.

(3) Mr. Thos. G. Grier, W. E., IX., 146.

(4) Dr. Cary T. Hutchinson, E. E., XII., No. 177, p. 243, on 23 S.

(5) Mr. Chas. J. Reed, E. E., XII., No. 177, p. 344, on 23 S.

(6) Mr. Leonard replies to (5) E. E., XII., No. 177, p. 344, on 23 S.

(7) Mr. Chas. J. Reed answers (6) E. E., XII., No. 178, p. 383.

(8) Mr. Leonard answers (4) E. E., XII., No. 178, p. 383.

In all discussions it is necessary to start from given premises to which both sides will agree.

Mr. Sprague's laws are based on the familiar formula C. M. $= \frac{15{,}666\ nl}{E\ V\ a}$, and using the same abbreviations, Mr. Leonard's C. M. $= \frac{\text{KW. D } 21{,}400}{V\ (E-V)}$ becomes C. M. $= \frac{\text{KW. D } 21{,}000}{E\ V\ a}$. The difference between them is that in Leonard's formula the motor efficiency is omitted, and that Sprague uses 10.5 instead of 10.7 for mil. ft. Cu. resistance. They can be written as follows:

F. J. S., $\frac{(2l)\ (10.5)\ (n \times 746)}{E\ V\ a}$

H. W. L., $\frac{(2l)\ (10.5)\ (1{,}000 \times \text{KW.})}{E\ V}$

Mr. Leonard, desiring to figure in kilo-watts, reduces his H. P. thereto by dividing by 1,000, and then introduces the factor 1,000 in his constant to get them back again. The question is: CAN THE MOTOR EFFICIENCY BE NEGLECTED in figuring the amount of wire?

Perhaps, using a "general formula," Mr. Leonard is dealing with an "ideal machine."

Commercial motors under average conditions of practice will not, as a rule, give over 80 per cent. efficiency. Mr. Thos. J. Fay, "Table showing the conditions under which 50 stationary motor installations were operated in actual practice" (E. P., III., No. 33, S., '91) finds an average motor efficiency of 75.1.

In short, if any given set of conditions

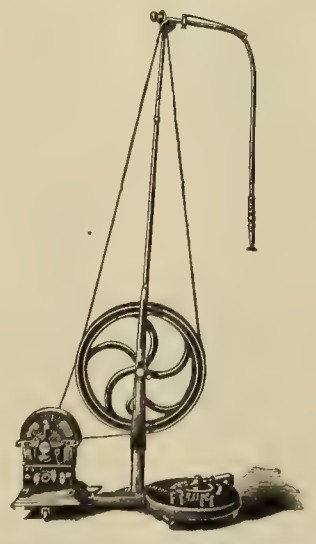
with $a=100$	require C. M. $=x$, then for							
$a=$ 90	they will	"	"	$=1.11$	or	11	%	more Cu.
$a=$ 80	"	"	"	$=1.25$	"	25	"	" "
$a=$ 75	"	"	"	$=1.33\frac{1}{3}$	"	$33\frac{1}{3}$	"	" "
$a=$ 70	"	"	"	$=1.45$	"	45	"	" "

will not formula yielding such results give an excessive "minimum first cost of plant"?

DENTAL DRILL AND MOTOR.

That the practical applications of electricity to useful service are as limitless as electricity itself, is evident from the new developments constantly being made.

Of a striking character is the new combination $\frac{1}{12}$



DENTAL DRILL AND MOTOR.

H. P. Edison Motor and Dental Drill. The cut shown herewith will give a good idea of the arrangement.

An ordinary dental drill is used, the foot-lever and crank being removed. The old pivot is utilized to fix a strip of steel upon which can slide the $\frac{1}{12}$ H. P. Edison motor, arrangement being made to clamp it in any position, so that the belt which is placed around the fly-wheel and pulley of the motor can be kept at any desired tension. The motor, therefore, occupies one of the legs, and the other two legs are used to support the reversing and resistance switch. The handle of the switch is of a special construction, so that the operator can use it as readily as the treadle. It is arranged to project over the edge of the resistance coil, and the operator can, by a slight movement of his foot, switch it over to either side, so that the motor runs in either direction at will.

If the arm is in the central position the current is "off;" if between the central position and one side, the motor runs in one direction, but not at "full" speed.

Catch-clips are arranged so that the operator can tell immediately he has reached either the "off" position or the "full on" position on either side. He can also obtain four different speeds below full

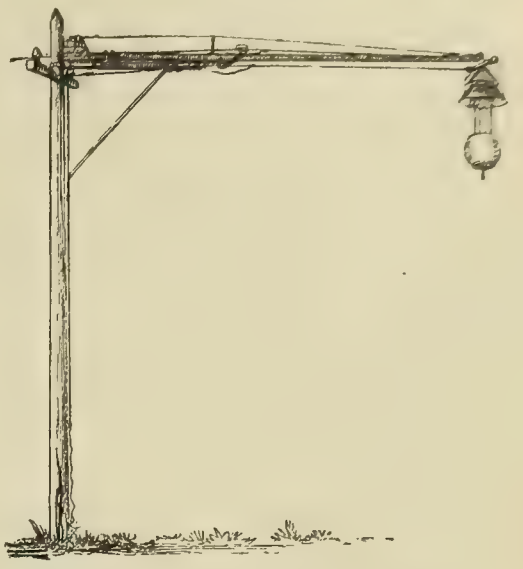


FIG. 1.—MAST-ARM READY FOR USE.

speed. The motor is designed to run on 125-volt circuit, so that it can be used on a local electric-light circuit. A wall-socket is fixed near the dental chair and a flexible cord leads from this to two terminals on the motor.

Motors wound to be operated by a battery have been perfected, so that this ingenious device is placed within the reach of the entire dental profession.

CLIFF MAST-ARM.

The accompanying illustrations show the Cliff Mast-Arm for electric light and electric railway purposes. Fig. 1 represents the mast-arm ready for use, and Fig. 2 shows it as it appears when lowered for the purpose of trimming or repairing the lamp.

It is claimed by the manufacturers that this is the neatest, cheapest and quickest-worked arrangement of any mast-arm in use, and it is said that one man

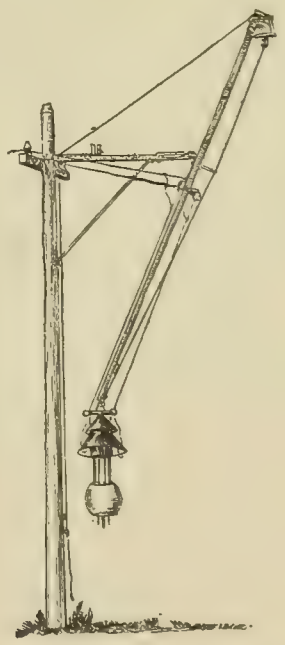


FIG. 2.—MAST-ARM LOWERED.

can with ease make a circuit of ten miles and trim 100 double-carbon lamps in seven hours. The mast-arms are well balanced and it requires little power to operate them. They are constructed of spruce timber and are durable.

These mast-arms are made in all lengths, and they are strengthened by means of a guy from the end of a weight, and can be tightened when desired by screwing a nut connected with the screw-eye running through the weight. They have been in use over two years and the first complaint is yet to be heard.

This mast-arm is made by the Cliff Mast Arm & Construction Company, which does a contracting business for the construction of telephone, telegraph, electric railway, electric light lines, etc. For further information address W. H. Kinlock, West New Brighton, S. I.

NEW YORK NOTES.

Office of the Electrical Age and Street Railway News, First Floor, World Building,
New York, October 3, 1891.

L. H. Rogers, New England Agent for the Thomson-Houston Electric Co., was in town this week. Mr. Rogers was the most successful agent of the Brush Co. before the Thomson-Houston Company secured his services in January last. He has sold more plants since than all previous agents.

Mr. W. S. Rogers has resigned from The Thomas Murray Co. and contemplates starting a construction company. Mr. Rogers, as is well known among electric-light men, organized the Municipal Electric Light Co., of St. Louis, which is now the largest plant in the world using arc lamps. Mr. Rogers afterwards organized C. H. Holmes & Co.'s Supply House at St. Louis, and on February 1 last Mr. Murray induced him to come East. He installed the Grand View Beach Electric R. R., which runs from Charlotte to Manitou Beach, along Lake Ontario beach. The road is seven miles long, and uses seven motor cars and seven trailers. There are 3,800 feet of trestle work, and the road is said to be one of the best in the country for scenery.

I had the pleasure of meeting Mr. A. L. Daniels the past week, formerly of the Eureka Tempered Copper Company, which concern he represented up to within a month ago. He is now travelling in the interests of the Mitchell Brant Copper Co., of Erie, Pa., manufacturer of commutator segments and copper castings of all kinds, guaranteed of pure copper tempered to any degree desired. Mr. Daniels claims that a superior quality of goods is made by his company, and there is no doubt of his ability to judge of their merits on account of his long experience in selling to the leading dynamo and motor manufacturers of the country.

Mr. Albert E. Plowman, representing W. H. Weston & Co., consulting and manufacturing electricians, 830 Filbert street, Philadelphia, Pa., was in town this week with his new line of switches. Weston & Co.'s new high potential and amperage switch exhibited by Plowman is of ingenious construction. The action of this switch is very powerful; it gives a quick break and a throw of over two inches before coming to position. Mr. Plowman had several other smaller switches, single and double pole, very handsomely finished. The company makes a specialty of these goods.

Alexander, Barney & Chapin celebrated their first anniversary October 1, by making their 2000th customer. Messrs. Alexander, Barney & Chapin, as is well known, were among the few most popular electricians at the time of the organization of the company. At their opening one year ago there was a great attendance of buyers from all parts of the country. They launched their ship under most encouraging auspices, and at the start success was guaranteed them by their electric light and power friends from all parts of the United States. This success has been fulfilled to date by the vast number of customers they are supplying with every conceivable line of electrical goods, for the telegraph, telephone, electric light and railways. They have added manufacturing departments to their business, where they make their noted A. B. C. dry batteries, switches, cut-outs and railway specialties. Their improved A. B. C. compound is said to be superior to any other like material in the market. It is soak-proof, water-proof and guaranteed fireproof; hard and not brittle, and can be bored and worked in a lathe. They do not lack facilities except for space to show their full line of wares. You can get everything you need here from a common, ordinary staple for holding a wire in place, to a complete electric light or power plant. Their Electrical Exchange, where you may register your name and let the trade know you are in town, do your correspondence or meet a customer, etc., has been of big advantage to the firm.

The McCreary Electrical Specialty Co., Electrical Exchange Building, 136 Liberty street, city, has set apart one of its rooms for the purpose of exhibiting the goods handled by the company. On the wall is a switchboard, covered with dark cloth. On the board are arranged four horizontal rows of incandescent lamps, and one row of switches for operating the lights on the board and those distributed about the room. The lamps are of 16 and 32 candle-power, and those on two of the rows have half shades of different colors, while the third row has elegant cut-glass half-shades. The lamps on the fourth row (the bottom one) have frosted-glass bulbs in different colors, and when all the lamps on the board are lighted the effect is very pretty. On one of the upper corners is a wall bracket with a melon shade. Besides this board exhibit there are suspended from the ceiling a row of lamps with McCreary shades, varying in diameter from 15 inches to 7 inches. The 15-inch shade is intended for 200 or 250 c. p. lamps. A line of portables with McCreary shades is also shown; also samples of flexible cylindrical chains through which conducting cord may be run; flexible tubes for wall brackets; thermal cut-outs and Bradner hangers. The flexible chain is very ornamental. It may be run along the moulding, or entwined about the chandelier, giving a rather artistic effect. The conducting cord is within the chain and not visible. These chains are made for any size conductors as required. The flexible tubes are so well known that it is not necessary to give any description of them here. They are very handy things, as they permit of placing the electric lamp in any desired position. The thermal cut-outs are made in all sizes, one size being so small that it can be placed very easily within the bracket canopy, and out of sight. It is an excellent idea to display goods in this way, as purchasers are enabled to judge of the effects under different conditions.

The Pelton Water Wheel Company, Central Building, this city, will furnish wheels of 2,500 H. P. capacity for use in connection with the dynamos to be installed by Mr. Ferranti at Niagara Falls. The water-wheels will be connected directly to the shafts of the dynamos. In our issue of September 26 it was stated that wheels of 5,000 H. P. would be used in this installation. That was a mistake. The company makes wheels of that capacity, but 2,500 H. P. wheels will be used at Niagara. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co.	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.	3,000,000	100 00	92 00
Am. Elec Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone. N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	81 00
Asbury Park L. & P., N. J.	50,000	10 00	
Aut. Phon. Exb. Co	25,000		4
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	180 00
Bell Telephone 7s	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light.	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me.	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y.	10,000	100 00	†60 00
Brush Illuminating, N. Y.	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Brush-Swan, Ithaca	50,000	10 00	5 00
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	121 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas & E. Co., Batavia, 6s.	80,000		*95
Cons. Gas Co., Batavia, N. Y.	100,000		
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	20 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	26 50
Detroit Electrical Works	1,000,000	10 00	12 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.	5,000,000		*97
Edison Elec. Ill. 6s, N. Y.	30,000		*99
Edison Elec. Ill., Lebanon, Pa.	80,000	10 00	10 50
Edison Illuminating, N. Y.	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs.	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	100 00
Edwards Manuf. Co., N. Y.	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	18 00
Elizabeth E. L. Co., N. J.	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	45 00
Essick Printing Tel	5,000,000	100 00	30 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak.	100,000		*95
Fidelity Trust Receipts	25,000,000		47 50
Fort Wayne Elec. Co	4,000,000	25 00	14 50
Fremont Elec. L. & P. & Gas Co.	20,000		par
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref 8s.	350,000	10 00	14 50
Guthrie Elec. Lt. Co., O. K., 7s.	15,000		*98
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hudson Electric Light, N. J	100,000	100 00	
Hunt Engineering Co., Brooklyn, 6s	30,000	500 00	*105
Hunt Engineering Co., Brooklyn.	30,000	100 00	140 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill.	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	19 50
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*77
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s.	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*103
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N. Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J.	17,500		*103
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	8 00
Nat'l Aut. Fire Alarm, L. I.	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	16 75
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500		†
N. E. Tel. & Tel. Co	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel. 6s.	1,500,000		*99
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. G. & E. Co. Certs. of Indebt	100,000		†
N. Y. Phonograph Co	20,000		†
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio.	50,000		*95
North New York Lighting	150,000	100 00	10 00
Northern Elec. L. & P., Phila.	200,000	10 00	
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P. Co. 6s	800,000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co. Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I.	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*90
Rockaway Beach Elec. Light	50,000	100 00	60 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	7 50
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	50 00
Thomson-Houston pref	4,000,000	25 00	26 25
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50,000	100 00	100 00
Twin City Rapid Transit, N. J.	20,000,000	100 00	100 00
Union Switch & Signal Co., Pa.	1,370,000	100 00	
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	50 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	4 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Welsbach Inc. Gas	10,000,000	100 00	4 00
Welsbach Inc. Gas of N. Y	4,500,000	100 00	9 00
Western Union	86,188,852	100 00	82 50
Westinghouse Electric Co	7,000,000	50 00	14 50
Westinghouse Elec. Co. pref	3,000,000	50 00	50 00
West End L., Boston			18 00
Yonkers L. & P.	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

CATALOGUES.

The McCreary Electrical Specialty Company, 136 Liberty Street, New York, has just issued a 34-page catalogue illustrating and describing its electrical specialties for incandescent lighting. The well-known McCreary shades, reflectors, dust protectors, sockets, cut-outs and shade-holders are fully illustrated and described. The catalogue is neatly gotten up and fully in keeping with this company's well-known enterprise.

James W. Queen & Co., Philadelphia, Pa., the well-known manufacturers of electrical testing apparatus, have just issued their third edition of Catalogue 1–66. It is the most complete ever issued, and treats of electrical testing apparatus and accessories of all kinds.

PERSONAL.

Mr. G. W. Hunt, president of the Hunt Engineering Company, 238 Washington street, Brooklyn, is at home ill with the typhoid fever. His many friends hope that he will be speedily restored to health.

Mr. W. F. Z. Desant, of the Desant Electric Company, 29 Broadway, this city, is just getting about again after a very serious illness, during which his physicians at one time gave up all hope of saving his life.

Mr. Leo. S. Robinson, who has been Vice-President and General Manager of the Electrical Storage and Supply Co., 723 Market street, San Francisco, since its incorporation, has resigned and disposed of his interest in the concern.

BUSINESS NOTES.

The Typewriter Exchange, 10 Barclay street, this city, of which Mr. George A. Hill is manager, is an excellent place to secure a typewriter. Mr. Hill keeps all makes of typewriters in stock, including the well-known Remington, Caligraph and Hammond, which he sells outright or on installments. All kinds of typewriter supplies may be had here.

The Central Electric Company is out with a new trade-mark. The device represents the continent of North America faintly outlined on a disc, having the principal cities plainly shown, all in connection with Chicago. The words "Central Electric Company" are boldly drawn across the continent, and the well-known trade-mark of The Okonite Company encircles the north and south poles. This "cannon-ball" trade-mark will likely become as well known as the famous Okonite sign.

Messrs. August Belmont & Co., of New York, and Messrs. Lee, Higginson & Co., of Boston, announce in another column of this paper that they will receive subscriptions at par for $3,000,000 7 per cent. cumulative preferred stock of the Westinghouse Electric and Manufacturing Company. The authorized capital stock of the company is $10,000,000, of which $4,000,000 is preferred stock. The balance, $1,000,000, of the preferred stock above the amount offered now for subscription will remain in the treasury to meet the future requirements of the business. The company will continue to have the benefit of the mechanical and engineering ability of its founder, Mr. Westinghouse, while amongst the directors there are many names of high financial standing known for their conservatism and prudence. The subscription for the entire amount of the preferred stock now offered has been guaranteed by underwriters in this country. The public is now invited to participate in the same. The subscription lists will be opened in New York and Boston on Wednesday, the 14th day of October, and will be closed at 3 P.M. on Oct. 16.

The town of Cedartown, Ga., has been bonded in the sum of $50,000 for the purpose of constructing extensive water-works and an electric-light plant. These two plants will be owned entirely by the city, and the work of construction will be under the direction of the city authorities.

The Elektron Mfg. Co., of Springfield, Mass., with New York office at 80 Liberty street, is installing a 185 light dynamo at 89 Liberty street, to supply 125 16 c. p. lamps. The same current will be used to operate a 4 H. P. slow-speed motor in the window for exhibition purposes. The company is pretty busy on sales just now. It has installed a 20 H. P. slow-speed motor in the *Commercial Advertiser's* establishment. This motor runs a large Hoe press and the stereotype and wetting machines. It has also installed a like motor of the same power and one of 10 H. P. in the office of the Williamsport *Grit* Publishing Co., Williamsport, Pa., to run the machinery. This plant is a duplicate of the one installed by this company in the building of the Lancaster, Pa., Daily *Era*. Mr. Robert Watson is the New York manager of the Elektron Company.

McLeod, Ward & Co., the electrical and mechanical engineers, 91 Liberty street, city, make a specialty of installation of motors for all kinds of work and the repairing of any kind of electrical apparatus, and also the manufacture of electric arc lamp hoods and spark arresters of their own design. The McLeod-Ward arrester keeps the sparks in the lamp and protects the lamp from dust, etc. The special features of the arrester are that it is made of galvanized sheet-iron and painted any color desired; that it covers the open top of an arc lamp shade or globe and surrounds the carbon, and that it is made on a hinge so it can be quickly opened to set the carbons. It is principally valuable to protect the feeding rack, keeping it free from the dampness of the atmosphere which causes corrosion of the rack and often makes the feed mechanism inoperative in out door lighting. The arc lamp shades made by this company are all of the best galvanized sheet-iron and made strong and durable.

THE HARRISBURG IDE AND IDEAL ENGINES.

The firm of W. R. Fleming & Co., 174 Fulton St., this city, selling agent for the Ide and Ideal Engines, has been taking orders in such a persistent fashion and in such quantities that the factory it represents—the Harrisburg Foundry and Machine Works—has been, with the present large equipment, unable to keep up with the increasing demand. Substantial additions have therefore been added to its extensive plant. All standard sizes of Ide and Ideal Engines are now being built in quantity, and short deliveries will be answered. One of the most complete and finest engine-testing rooms in the country has just been completed and added to facilitate the large business now on hand. It is said there is not a finer-equipped plant in the United States than at present shown by these Harrisburg people.

MADE HIS WIFE TALK.

GLENS FALLS, NEW YORK, Aug. 24, '91.

J. Kidder Mfg. Co.:

SIRS: I have one of your batteries, No. 5, which requires a new platina plate. * * *

My wife could not talk for eight years, and after treatments with the battery she now talks freely.

Yours truly,

ORIN VANDENBURGH.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued September 29, 1891.

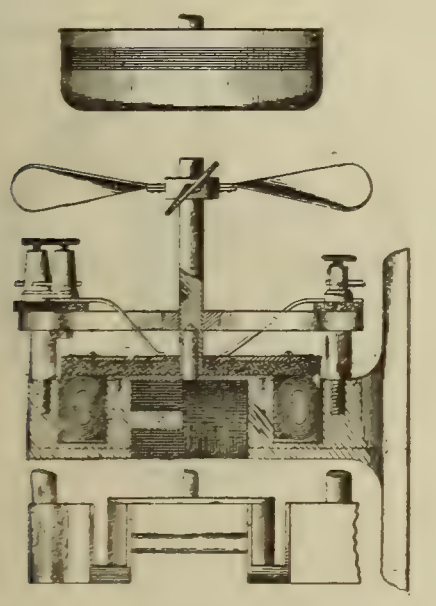
460,109. Telegraphic Transmitting-Instrument. Chas. G. Burke, Richmond Hill, N. Y. Filed June 17, 1890.

460,110. Telegraphic Instrument. Chas. G. Burke, Richmond Hill, N. Y. Filed Dec. 26, 1889. Renewed Feb. 11, 1891.

460,111. Telegraphic Instrument. Chas. G. Burke, Richmond Hill, N. Y. Filed Feb. 11, 1891.

460,122. Process of and Apparatus for Generating Electricity. Thomas A. Edison, Menlo Park, N. J. Filed May 26, 1882.

The process of generating electricity, consisting in subjecting a body of carbon or carbonaceous material to a high temperature in the presence of an active agent composed of a body of oxides capable of combining with carbon at a high temperature, and a positive element composed of a metal not acted upon by such active agent, but located in contact therewith.



460,125.—DYNAMO OR ELECTRIC MOTOR.

460,123. Phonogram-Blank Carrier. Thomas A. Edison, Llewellyn Park, N. J. Filed Nov. 21, 1890.

A tube adapted to fit a phonograph-cylinder and having a flange at each end.

460,125. Dynamo or Electric Motor. William M. Fink, Elizabeth, N. J. Filed Oct. 7, 1890.

A dynamo or electric motor consisting of the combination of arc-shaped pole-pieces having polar extensions on the inner and outer periphery of the armature of the motor or dynamo, a rectilinear core provided with a coil joining the interior polar extension and passing through the centre of the armature, a non-magnetic plate joining the last-named polar extensions and provided with a central spindle fitting loosely in the shaft of the armature, an insulating-disc applied to the armature and carrying the shaft and commutator-plates, screws passing through the commutator-plates and into the disc, the terminals of the coils of the armature passing through the disc and being connected to the screws, posts projecting from the exterior polar projections and connected by a cross-piece which bears the armature-shaft, and brushes forming terminals of the motor or dynamo bearing upon the commutator-plates.

460,140. Electric Safety-Catch. John W. Howell, Newark, N. J. Filed Jan. 6, 1891.

A safety-catch for electric circuits, composed of a conductor of electricity which is destroyed by chemical action (as distinguished from fusion) when an abnormally large current passes through it.

460,178. Hanger for Incandescent Lamps. James A. Matteson, River Point, R. I. Filed Dec. 24, 1890.

In hangers for incandescent lamps or analogous uses, a counter-weight consisting of a box, eyebolt screwing centrally into the bottom of the box, disc weights strung on the eyebolt, ceiling-block having a screw-eye and a wire or cord attached at one end to the block, in combination with two similar cases carrying interior grooved pulleys connected by the wire or cord, and each provided with two holes and cross-screws, the screws being arranged to engage the eye-screws.

460,199. Circuit-Controlling Apparatus. John P. Cushing and William J. Kelly, Boston, Mass. Filed Nov. 6, 1890.

A supporting-frame and a plurality of resistance-heads secured thereto and provided with a plurality of contact members or terminals to which the resistances are connected, combined with a plurality of independently-movable contact-arms co-operating with the contact terminals or members, an actuating device for the contact-arms, handles connected to the contact-arms to move therewith and means to detachably connect them with the actuating device.

460,235. Electrode for Secondary Batteries. John B. McDonald, Chicago, Ill. Filed Feb. 5, 1891.

A grid for the support of the active material, composed of a metal ribbon having indentations or raised portions upon its surface and bent back and forth upon itself to form the supporting-frame.

460,245. Switch for Series Dynamo-Electric Machines. Craig R. Arnold, Sharon Hill, Pa. Filed Nov. 10, 1890.

The combination, with a series-wound dynamo-electric machine, of a circuit making and breaking switch for throwing the machine out of action and disconnecting it from the line, having a contact through which the series circuit of the armature-field and translating devices is completed in series, the contact being connected directly to one terminal of the field-magnet coil of the machine, and a supplemental contact connected directly to the opposite terminal of the field-magnet coil and placed in position to be engaged by the switch in passing from position of circuit closed to circuit broken and before it leaves the first-named contact.

460,277. Method of Obtaining Fluids for Primary Batteries. Joseph B. Gardiner, Nyack, N. Y. Filed Sept. 15, 1890.

460,287. Electric Alarm. Charles H. Shaffer, Rockford, Ill., assignor to the Electric Alarm Company, Muskegon, Mich. Filed June 20, 1890.

460,289. Lightning-Arrester. James J. Wood, Brooklyn, N. Y. Filed Sept. 25, 1890.

A lightning-arrester, having three discharge-plates with two intervening breaks, one of the terminal plates connected to the dynamo and line and the other to earth, a shunt-circuit connecting one of the terminal plates to the intermediate plate, and an arc-rupture device adapted to act upon the passage of the current through the shunt and to extinguish the arc between the other terminal plate and the intermediate plate.

460,328. Printing-Telegraph. John E. Wright, New York, N. Y. Filed Dec. 30, 1890. Patented in England.

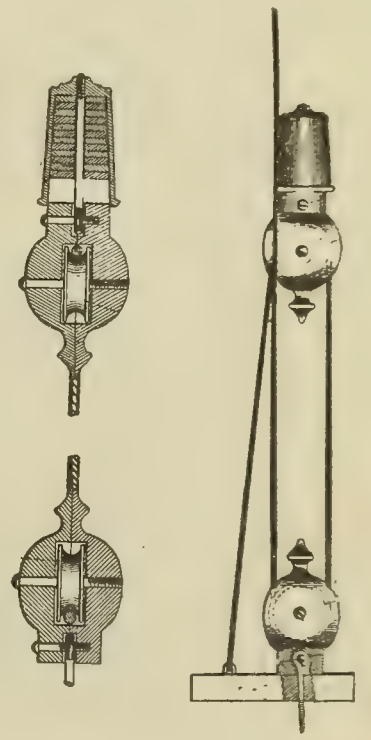
In a printing-telegraph instrument, the combination, with a ratchet or escapement wheel and a magnet for setting the same in any desired position, of a rotating type-wheel, a cam intermediate to the type-wheel and the escapement, and a magnet for moving the cam and adjusting the type-wheel to positions corresponding to those of the ratchet or escapement wheel.

460,349. Printing Telegraphic Apparatus. Gilbert A. Cassagnes, Paris, France. Filed Nov. 28, 1890.

The combination, in a receiving-printing instrument, of a series of printing-wheels on the same shaft or carrier, with a corresponding series of toothed snails, and with a corresponding series of superposed slides supporting stems and electro-magnets, all arranged for conjoint action upon one or more printing-wheels at one time.

460,354. Apparatus for Electrolytically Separating Metals from Ores. Werner von Siemens, Berlin, Germany, assignor to Siemens & Halske, same place. Filed June 13, 1890. Patented in Germany, Spain, Italy and Austria-Hungary.

In an electrolytical cell, the combination of a revolving cathode, a trough-shaped anode situated below the cathode, in the trough of which the cathode revolves, a screen permitting the passage of the electrolyte and of electricity and capable of preventing the passage of vibrations of the electrolyte situated between the cathode and anode, and means for supplying the electrolyte above the screen and for withdrawing the oxidized liquid from the bottom of the trough of the anode.



460,178.—HANGER FOR INCANDESCENT LAMPS.

460,364. System of Electrical Distribution. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 13, 1891.

The combination of a multiple-series distribution system with an equalizing-machine connected in shunt around one of the multiple-arc groups and serving as a motor or generator, according as the major load shifts from one side to the other side of the system, the machine being coupled mechanically with the main generator, so as to return and receive power from the same source of energy.

460,372. Dynamo. William H. Elkins, Cambridge, Mass., assignor, by direct and mesne assignments, to the American Electric Machinery Company, Portland, Me. Filed Nov. 28, 1890.

In a dynamo, a regulating-circuit through a field-coil on one leg of the field-magnet and containing a materially greater number of turns than another coil on the same leg, a work-circuit through a coil on the other leg of the field-magnet and containing a materially smaller number of turns than another coil on the same leg, main brushes and an extra brush, the terminals of the main circuit being the extra brush and the main brush and the terminals of the regulating circuit being the main brush and that part of the work-circuit near the extra brush.

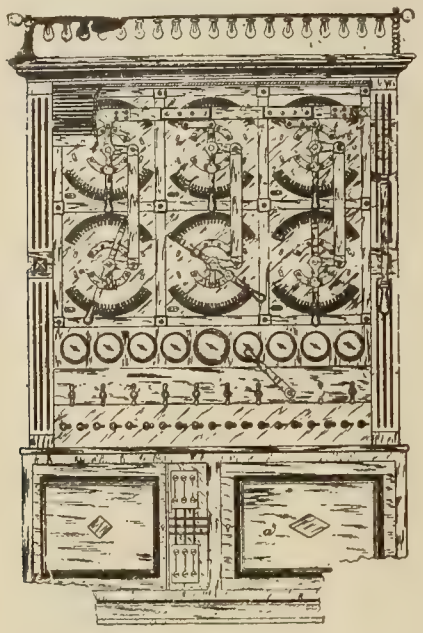
460,391. Electric Lock. William S. Hull, Sheffield, Ala. Filed Dec. 31, 1890.

460,416. Push-Button. John E. White, Syracuse, N. Y. Filed Aug. 21, 1889. Renewed Aug. 21, 1891.

460,428. Method of Soldering or Brazing by Electricity. Charles L. Coffin, Detroit, Mich. Filed April 17, 1890.

The process of soldering or brazing, consisting in connecting one or both of the articles to be soldered or brazed with one pole of a generator, connecting the tool to the other pole of the generator, bringing the tool in contact with the solder and seam to be soldered or brazed, and passing an electric current through the tool and material while the tool is maintained in contact with the solder and seam.

460,448. Insulator. Frank A. Ross, Livingston, Mont. Filed Dec. 16, 1890.



460,199.—CIRCUIT-CONTROLLING APPARATUS.

460,457. Printing-Telegraph Instrument. John E. Wright, New York, N. Y. Filed Dec. 31, 1889. Renewed Sept. 5, 1891. Patented in England.

In a column-printing telegraph-instrument, the combination, with a rotary type-wheel, a clock-motor for turning the same, and an electro-magnetic controlling device, of a swinging paper-carrying or impression roll, an electro-magnet for moving the same, a clock-motor geared with the paper roll, and an electro-magnet for controlling the movement of the motor.

460,464. Automatic Electric Fire-Alarm System. William S. Cook, Moses C. Cook, and Albert H. Morrow, South Omaha, Neb. Filed Oct. 13, 1890.

A fire-alarm system comprising a normally-open alarm-circuit grounded at both ends and including the thermostat and the starting electro-magnetic devices of the call-box and extending to the station, a normally-closed signal-circuit connecting the call-box and station-relay, and a local circuit or circuits controlled by the relay and connected with the alarm-circuit and actuating the register or indicator.

460,503. Electric Bell. Walter Hay, Chicago, Ill., assignor of one-half to George E. Horn, same place. Filed May 11, 1891.

A bell with the armature a continuation of the core of a single magnet, making one pole an armature for the other pole.

460,504. Apparatus for Holding and Sewing Carpets. Rudolph M. Hunter, Philadelphia, Pa., assignor to The Union Special Sewing Machine Company of Illinois. Filed June 4, 1890.

In an apparatus for holding and sewing carpets, etc., the combination of a table, a railway arranged upon the table and slightly below its upper surface, a carriage guided upon the railway, a sewing-machine carried upon the carriage and having its guide-plate in line with the upper surface of the table, an electric motor to operate the sewing-machine, and a source of electrical power to supply electrical energy to the electric motor, consisting of two endless conductors respectively connected with the positive and negative conductors of a source of electrical energy, guides for the endless conductors, and collecting devices carried by the carriage and connecting with the respective conductors and terminals of the motor.

460,505. Apparatus for Holding and Sewing Fabrics. Rudolph M. Hunter, Philadelphia, Pa., assignor to The Union Special Sewing Machine Company of Illinois. Filed Sept. 22, 1890.

460,506. Apparatus for Holding and Sewing Fabrics. Rudolph M. Hunter, Philadelphia, Pa., assignor to The Union Special Sewing Machine Company of Illinois. Filed Oct. 13, 1890.

460,514. Electric Crane. William A. Stadelman, Philadelphia, Pa., assignor to the Equitable Engineering and Construction Company, same place. Filed March 11, 1891.

The combination, in an electrically-operated crane, of a fixed source of electrical supply, a carriage, a motor thereon with a flexible cable connecting the motor with the fixed source of supply, and means for looping the flexible cable as the carriage nears the source of supply.

460,524. Electrical Railway Signalling Apparatus. William F. Z. Desant, New York, N. Y. Filed Sept. 26, 1890.

In a system of electrical block-signals, sets of insulated rails connected together in diagonal pairs, one set being in one block and the other set in an adjacent block, in combination with a visual signal for each block and a two-part magnet adapted to control each signal, one portion of the two-part magnet being connected to the ends of the rails of one block and the other to the ends of the rails of the next succeeding block in advance.

460,525. Electric Railway-Signal. William F. Z. Desant, New York, N. Y. Filed Sept. 26, 1890.

In a railway-signal, the combination of the following elements: a series of electrically-divided blocks having an electrical generator and a relay for each block, a local circuit for each relay, including an electrical motor geared to a semaphore, a second local circuit for each signal, including an inductorium located near the road-bed, and circuit making and breaking devices connected to the semaphore, with an audible signal carried by a moving train and connected in circuit with a second inductorium adapted to be carried in close proximity to the first-named inductorium.

460,538. Thermal Cut-Out. John O. Phillips, New York, N. Y. Filed Jan. 6, 1891.

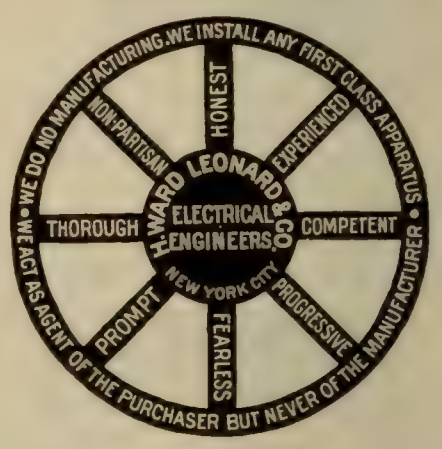
A pendent thermal cut-out, composed of two sections having end caps or pieces consisting of non-conducting material, in combination with a band rigidly secured to one of the pieces, a rotary band embracing the rigid band, double-pole and double thermal connections located within the sections, and pins operating within interlocking slots.

460,541. Electric Elevator. Rudolph C. Smith, Yonkers, N. Y., assignor, by mesne assignments, to The National Company, of Illinois. Filed Dec. 31, 1890.



460,538.—THERMAL CUT-OUT.

The combination, with the cage of an elevator and an electromotor for operating the same, of a switch controlling the circuits through the electric motor, a shunt of high resistance around the switch, another shunt of lower resistance controlled by the high-resistance shunt, and means controlled by the low-resistance shunt controlling the operation of the motor.



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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, OCTOBER 17, 1891. No. 42.

A PITTSBURG ELECTRIC-LIGHT PLANT.

The East End Electric Light Company, a part of whose plant we illustrate herewith, has had a rapid development since starting in 1886. During that year it commenced operations with three small engines of different makes and a few direct-current dynamos. Shortly afterward it adopted the Westinghouse engine as best suited for its purpose, and to-day the plant is exclusively Westinghouse. The present plant consists of 15 engines aggregating 1,800 H. P. and 21 dynamos aggregating 12,000 incandescent and 480 arc lights, as follows: Two 18 and 30 x 16 Westinghouse Compound engines of 250 H. P. each; three 11 and 19 x 11 Compound engines of 80 H. P. each; one 18 x 16 Westinghouse Standard of 200 H. P.; three 15 and 14 x 14 Standard of 150 H. P. each; four 12 x 11 Standard of 80 H. P. each; one 11 x 10 Standard of 65 H. P.; one 7½ x 7 Standard of 25 H. P.; three 2,500-light and three 1,500-light Westinghouse alternating current incandescent dynamos; one 500-light and one 100-light Westinghouse direct-current exciters; twelve 35-light Waterhouse arc and one 60-light Westinghouse alternating current arc dynamos. The station is divided into two sections. The one shown in our illustration is devoted to incandescent lighting alone and the other exclusively for arc lighting.



SECTION OF EAST END ELECTRIC-LIGHT STATION, PITTSBURG, PA.

At present there are three independent steam-mains, but it is thought that a continuous steam-pipe will be installed in the near future. A travelling crane facilitates the shifting of the lighter arc dynamos, and a heavier machine for the engines and large incandescent machines will be fitted up shortly.

ARTIFICIAL RAIN-MAKING.

Prof. Edwin J. Houston, on September 8 last, read a paper before the Electrical Section of the Franklin Institute, Philadelphia, on the subject indicated by the title.

Referring to the similarity between the phenomena of the mid-air explosions employed in the rain-making method and those of lightning and thunder, Prof. Houston said:

"It may be thought by some that the concussions caused by mid-air explosions might result in such a general movement of the surrounding air as to cause rain to fall over an extended area. The flash of the explosion is followed by a sudden movement of the air, causing the noise of the explosion. The phenomena of lightning and thunder are somewhat similar to those of artificial mid-air explosions. First we have the lightning flash and subsequently the thunder, which is a violent concussion of the air. Does this concussion bring down a heavier rainfall? Popularly it is believed to do so, but the general opinion of the scientific world is that the lightning flash is the effect of a rapid condensation of the aqueous vapor—*i.e.*, of a heavier rainfall, and not the cause of such a fall. That is to say, the high potency of the lightning flash is due to the enormous decrease in the surfaces of the already charged rain-drops over that of the surfaces of the thousands of the separate drops that coalesce to form the single drops.

"Nevertheless, the liberation of heat-energy and the rapid admixture of air following the disruptive discharge may slightly increase the rainfall, or may act as a determining cause of rain over an extended area.

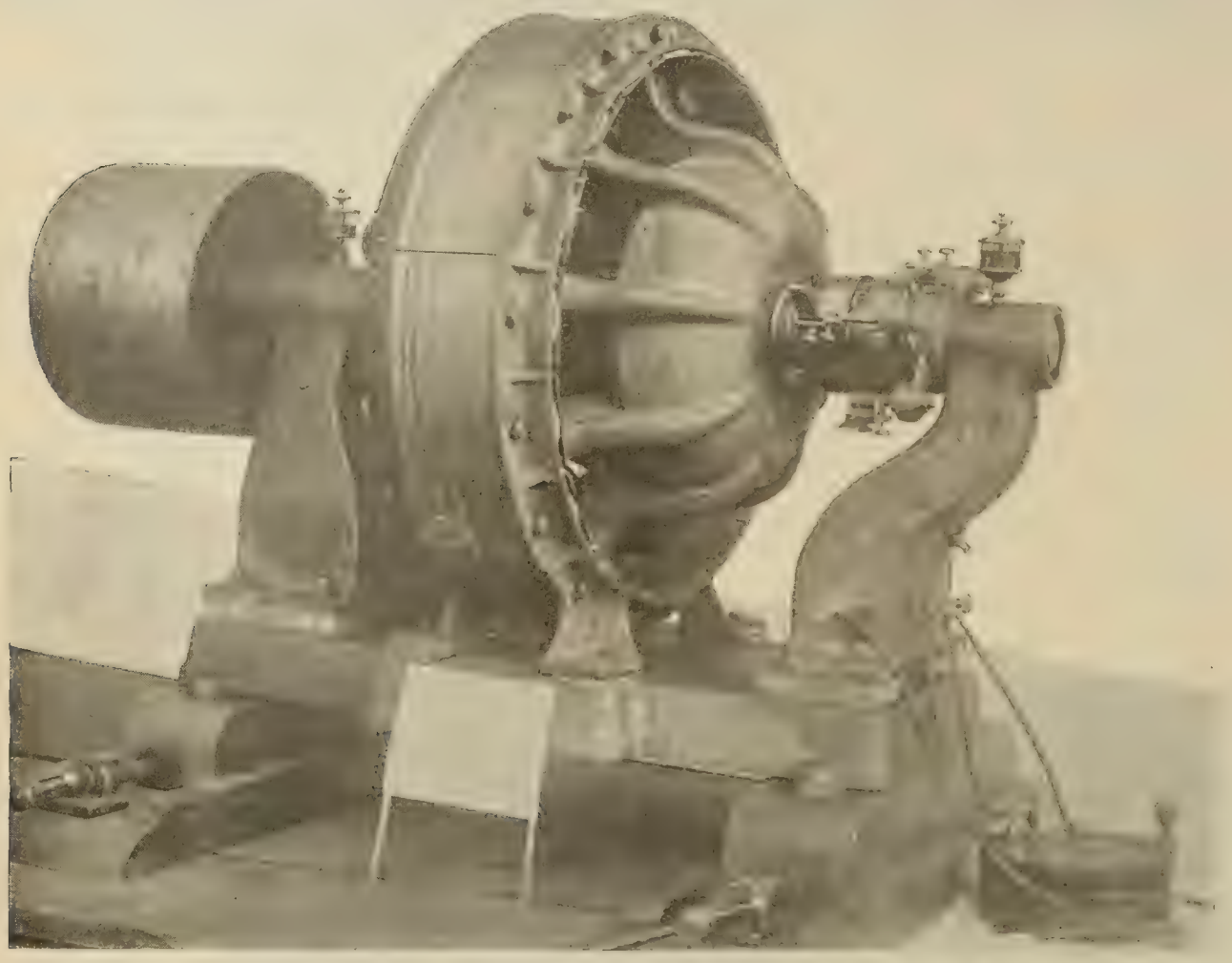
"There is this difference between the lightning flash and the flash of an explosion, viz.: The former occurs over a comparatively great length of path—*i.e.*, a space of small breadth and depth but great length; the latter occurs in a comparatively limited space, the three dimensions of which are nearly equal.

"Though lightning is not a cause of rain, there can be no doubt that if rain can be artificially produced during a period in which there is much free electricity in the air, the storm will be attended by lightning and thunder. If, then, there be any increase of rain due to the presence of lightning, artificial rain-making will be more liable to succeed when the potential of the air, as regards the earth or neighboring clouds, is comparatively high."

The amount of activity in electric lighting in New South Wales may be judged from the fact that no less than seven electric supply bills will be presented at the next session of Parliament.

NEW ALTERNATING AND DIRECT CURRENT APPARATUS.

Electric light and power men will soon see placed upon the market for their inspection and consideration some new and improved electrical apparatus which seem to possess the merit of ingenuity and simplicity, as well as great efficiency. Indeed the apparatus, of which we give a description below, makes up an almost entirely new system of electric lighting and power. It comprises an alternating-current dynamo, a direct-current dynamo, a direct-current motor, a direct-current generator for railway work, a cut-out box and an alternating-current meter.

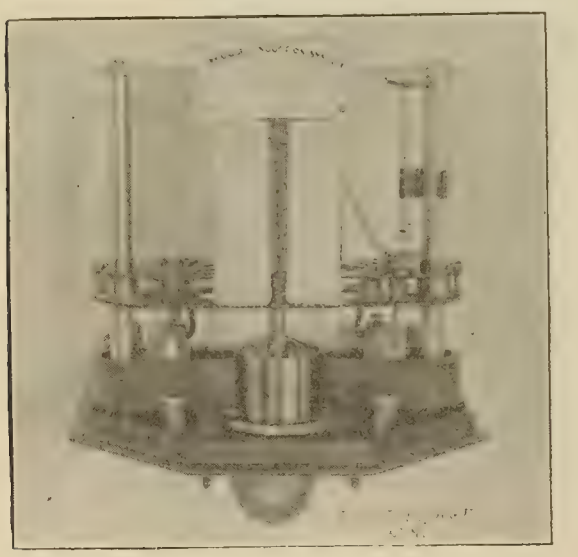


WOOD'S NEW ALTERNATOR.

These machines and apparatus are the productions of Mr. J. J. Wood, electrician of the Fort Wayne Electric Co., Fort Wayne, Ind., who is now in New York overseeing the work of getting out the patterns.

Mr. Wood is producing other specialties for his company, which is now operating many devices of his invention.

The new "Wood" alternator is a compound-wound, separately excited rotating field machine, requiring seven inches of wire per volt, and at a speed of 990 revolutions per minute develops a current of 15 ampères at 1,000 volts, or an equivalent of



WOOD'S ALTERNATING-CURRENT METER

300 16 candle-power lights. The armature is stationary and built in sections, of laminated iron. The poles of the field magnets are constructed of cast-iron, and the form of the combined magnets is star-shaped, with a single wrought-iron connecting piece, containing one coil of wire.

The principal advantages claimed for this generator are that it requires a very slow initial speed in comparison with other makes of dynamos. The armature being stationary, renders the removal of the coils a matter of easy accomplishment, and in case of accident to any one of them the faulty coil can be disconnected and taken out and a new one inserted in its place in about five minutes of time; and this can be done without removing the field magnets. This feature of the machine is a decided advantage over all other makes of dynamos and will be greatly appreciated by the station manager, who realizes more than any one else that time saved is money saved.

It sometimes happens that a new coil is not immediately available. In such cases, however, no serious results need occur when this new machine is used. In most other cases under such circumstances the machine would have to be shut down until the disabled part could be repaired or a new one substituted. In this new machine, however, the defective coil can be disconnected and taken out entirely, and by slightly increasing the exciting current the output of the machine can be maintained at its normal point and the full load carried without any difficulty.

This improvement is one of very great importance and will be appreciated by those using the machines at a great distance from the factory or source of supply, where it may sometimes happen that the supply of extra coils has run out. Under such circumstances work can be carried on as indicated above until the defective part has been repaired or a new one put in its place. Armatures are liable to damage by lightning or other unavoidable causes, but, as will be seen, such break-downs need not necessarily interrupt operations.

Ordinarily the transportation of armatures is by express at an enormous cost, not counting the inconvenience suffered by the customers and the consequent dissatisfaction with the service. In this new machine all of these weak points have been overcome, and the armature coil may be forwarded in the mail, thus avoiding in many cases the large express charges. Any person of ordinary intelligence can replace a coil in five minutes, the construction of the machine is so simple.

The new "Wood" direct-current power generator, of which we give herewith an illustration, is being constructed in sizes from 5 to 160 horse-power and wound for 500, 250 and 110 volts. These generators possess some important advantages over this class of machines of other makes. In the first place they are extremely simple in design and devoid of complicated mechanism. Simplicity necessarily means fewer parts, which is one of the features of this machine; and another important point in its favor is the unique construction of its sliding base on which the machine is mounted. One of these generators was recently tested at the company's works in Fort Wayne, Ind. The machine was constructed to develop 60 horse-power, and during the test was run for a considerable period of time, giving an output equal to 111 horse-power, showing that the limit of supply is very great.

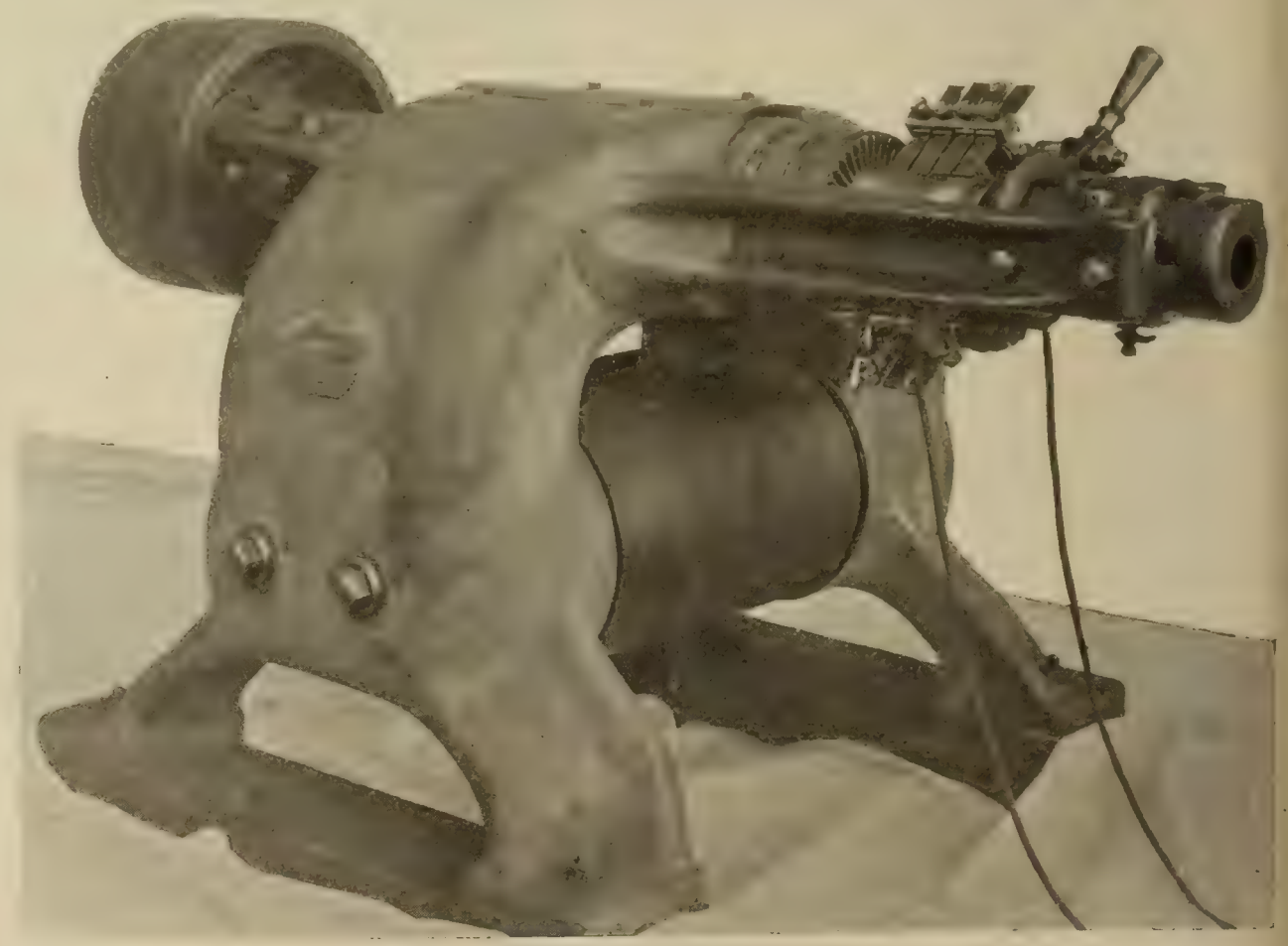
This machine possesses many advantages which will render it especially adaptable to railway work, in which service none but the best can be depended upon to give satisfactory results.

It is claimed that a careful study of this machine and its operation will positively convince any one who is familiar with generators that it will perform every service that is claimed for it, both economically and reliably.

Wood's new cut-out box for arc-light circuits has many novel features. Its dimensions are 6 x 8 and $3\frac{1}{4}$ x 4 inches deep. The case is made of cast-iron, inserted in the bottom of which is a slab of slate, to which all the interior mechanism of the box is firmly attached.

In the construction of cut-out boxes it is highly important that the water-proof and fire-proof qualities be carefully looked after. These points have been fully considered and provided for in the "Wood" cut-out box, and the mechanism of the same is so constructed as to be both fire and water proof, and at the same time making a quick break in either direction.

In this, as in all other parts of an electric-light plant, simplicity is of extreme importance, and the construction of this apparatus is so exceedingly simple that it is practically impossible to get it out of order. Every detail has been carefully looked after and worked out, and the connections of the wires with the box are made with clamps of a new design, which take the place of the old style and unreliable screw contacts.



WOOD'S NEW DIRECT-CURRENT GENERATOR.

To complete the system, Mr. Wood has also devised a new alternating-current electric meter, which is now being put upon the market. There are about 1,200 of these meters in use at the present time, and, like all of the other apparatus above described, it is exceedingly simple in construction. There being

few parts, the liability to derangement and failure to act is reduced to a minimum. In its range of action some idea of its accuracy may be had from the following: On one light it is but 7 per cent. slow; on two lights it is correct, and it remains correct in its record to 100 per cent. overload.

A brief description of the construction of the meter is herewith given, also an illustration of the same. A small electric motor rotates a vertical spindle, which is retarded by a copper cylinder. It has a stationary iron centre into which the jewel is set, this arrangement tending to concentrate the lines of force and also acting as keeper for the permanent magnets, thus maintaining the full magnetic strength and preventing any loss of the same.

Every condition has been provided for in the construction of this apparatus; even the facility for shipping has been considered. An exceedingly unique arrangement is provided to preserve the mechanism from damage during transportation. A milled-head nut is provided, which, on turning to the right, raises the copper cylinder against the upper stop, clamping it at the same time. Simultaneously the vertical spindle is lifted from its jewel or seat and clamped into position. Thus all danger of breakage or damage to the jewel during transportation is completely overcome, and one of these meters can be as safely shipped by express from one place to another as it could be carried by hand—that is, as far as the possibility of damage to the mechanism is concerned.

CORRESPONDENCE.

Bell Telephones "For Export."

[Communicated.]

The advertisements and circulars of the Tropical American Telephone Company, limited, which assert that it has the exclusive right to sell Bell telephones "for export" to South America, Central America, Mexico and the West Indies, throw some light upon the actual cost of these telephones and the price for which they can be sold profitably. The company publishes correspondence to prove that its right is recognized by the American Bell Telephone Company and by the company which manufactures the instruments used in this country and rented to local exchanges by the parent organization.

It has been shown repeatedly that the Bell Company exacts from local exchanges a rental of $14 per annum for instruments the entire cost of which is $3.42, as admitted by officers of the company in testimony given before a committee of the Massachusetts Legislature. The price exacted by the local exchanges for telephone service in the large cities of the United States ranges from $100 to $150 per annum. The profits of the business have been enormous. The parent company has for some years paid dividends of 18 per cent. upon a large capital which has been watered half a dozen times. The investigation made a few years ago by a committee of the New York Assembly gave to the people of New York some knowledge of the profits of the Bell Company and its dependent local organizations, and of the manner in which the parent company had exacted from the local companies stock to the par value of more than $20,000,000, which was then held in its treasury.

One of the circulars of the exporting company to which we have referred set forth the "prices for export" of a complete outfit for a telephone line one mile long, with a station at each end. This outfit consists of "two Bell telephones, two Blake transmitters, two magneto call-bells, two back boards and battery boxes, two Leclanche battery cells to operate transmitters, two flexible cords to connect the telephone and call-bells, one mile of No. 12 galvanized iron wire, thirty-five pony glass insulators with wooden brackets, 100 feet insulated office wire, spikes for brackets, staples for office wire, screws, etc." This circular, printed in English, says the price of the two sets of instruments is $80, subject to a discount which is not expressed, and that the price of the "line outfit" is $13.25. In another circular, however, which is substantially a copy of this one, but printed in Spanish, the discount is expressed, and for the two sets of instruments it is 50 per cent., with an additional allowance of 10 per cent., presumably for cash payment, so that the actual selling price of the outfit of two Bell telephones, two Blake transmitters, two call-bells, with back boards, battery cells and cords, as enumerated above, is only $36.

On the other circular notice is given in red ink, under the date Jan. 1, 1891, that "prices on complete sets, like cut" (which shows a Bell telephone, a Blake transmitter, a battery box, a back board, cords, etc.), have been "reduced to $16.50 net cash." This would make the price of the two sets $33 instead of $36. To this sum may be added $13.25 for the "line outfit," the total being $46.25.

This should be interesting to subscribers in the United States who are paying from $100 to $150 per annum for the use of such instruments and the service connected therewith. It should be borne in mind that this price of $33 for two sets of instruments is a price for absolute sale, and not an annual rent. The buyer owns the property, which costs him only a little more than the rent exacted annually by the Bell Company from the local exchanges simply for the use of such instruments, and is only one-third or one-fourth of the rent paid annually by the subscribers in our large cities.

The same company advertises that it has the exclusive right to sell in South America, Central America, Mexico and the West Indies "Berliner's Long Distance Transmitters and Telephone Sets," which it procures from manufacturers in Europe, "thereby saving the heavy and burdensome United States royalties which have been hitherto paid for instruments manufactured under United States patents." We understand that the patents for these instruments are controlled in this country by the Bell Company.

Those who use telephones in the United States will be surprised to learn that residents of the countries south of us can obtain a complete outfit, except the poles, for a private telephone line one mile long, with all the Bell instruments and appliances, for only $46.25, and by the payment of this sum can become the absolute owners of the property, with no rent or royalty to pay thereafter. But the circulars and advertisements of the company in question seem to show conclusively that such is the good fortune of our Southern neighbors. Undoubtedly there is a good profit in the business even at these prices, which appear very small when compared with the sums exacted here by the greedy Bell monopoly.

Primary Batteries.

Editor Electrical Age: I am somewhat surprised at the sarcastic tone assumed by Prof. Carhart in his reply to my communication to your issue of

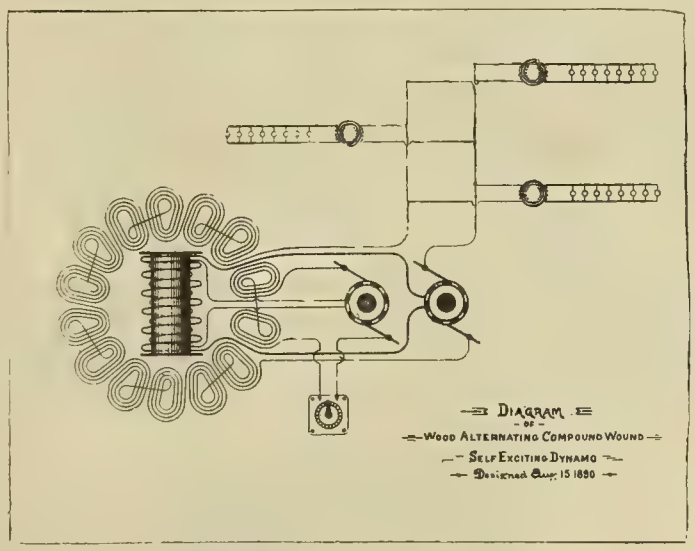


DIAGRAM OF WOOD'S SELF-EXCITING ALTERNATING DYNAMO.

Aug. 15, going so far as to charge me with "obloquy" simply because of my use of the phrase of "Laboratory Professors."

He does not hesitate to insinuate that I am laboring under a "delusion" and that I seem to "despise" certain formulas; and intimates that my "experience" is very limited, etc., etc. Now my use of the phrase "Laboratory Professors" was simply for the sake of brevity, and instead of my having "little respect" for it, I regard the position as one of high honor.

Prof. C., in the preface to his book, tells us for whom he has written, and while he has done excellent service for one of the two classes he names, I think he has done very little for the other, to whom he says a knowledge of the "most simple and useful means of producing electric currents for practical purposes" is indispensable.

It would take too much of your valuable space to fully state the reasons which justify, as it appears to me, the above statement.

But in order to get at something really practical, I will respond to the Professor's kind invitation to "bring forward" a battery that will do most of the work hitherto done by storage cells.

But first let Prof. C. set up the best battery he has described in his book for the production of a strong and constant current with best economy known to him, and which shall be a bichromate cell.

I will set up one of same capacity and will guarantee to depolarize the cell for *half* the cost of charging, and it shall remain depolarized *twice as long* as any cell described in his book, and I will use the potash salt, and may use the soda salt. I will furthermore agree that the test may be made by "short circuit" or "fixed resistance" or by attaching to a small motor with fan. I suppose this to be a fair proposition; if it is not, let it be pointed out and I will consent to a change that will make it perfectly so. P. B.

New York, Oct. 2, 1891.

ELECTRIC LIGHTING IN COAL MINES.

The H. C. Frick Coal and Coke Company, of Pittsburgh, Pa., the largest coal operators in the world, has just completed arrangements for the illumination of its many mines by electricity; in fact, the plans have already so far advanced that the lighting of two mining plants has been successfully accomplished. The contract for the work has been awarded to the Westinghouse Electric and Manufacturing Company, under whose supervision the work of installing the lighting plants was conducted. The first two mines to be lit by electric lights were the Leisenring No. 1 and Leisenring No. 2. The operation of the lights was commenced a few days ago. Everything turned out to the greatest satisfaction of the Westinghouse and the Frick Companies.

The Frick Company has adopted the method of lighting each mine independently, and at every mine is installed Westinghouse direct-current apparatus of sufficient capacity to light up the mine below and above the ground. The lamps are distributed underground throughout the main walks leading to the shaft. In addition, the tipple above ground, the engine-house and other surface buildings are also lighted. The lamps vary in candle-power from 16 to 50 C. P.

Electric-light plants are now being put up at Leisenring No. 3, Trotter and Standard mine—the latter, by the way, is said to be the largest coal mine in the world—but it will probably take a whole year before the plants for all the mines are installed. Many of the mines in Western Pennsylvania have installed Westinghouse apparatus, and not long ago the company completed the installation of a mine in the iron-ore district of Lake Superior.

THREATENED DECADENCE OF THE LECLANCHE BATTERY.

BY CHARLES J. HIRLIMANN.

If the Leclanche battery does not seem to be the same to-day that it was in olden times the public has itself to blame for it. It is simply because people will accept an imitation of it for the reason that it looks like the genuine and is cheap; it is because there are unscrupulous manufacturers who will make the spurious article because it is profitable.

If the users of the Leclanche battery were competent to do so and applied to the battery the same tests and intelligence to distinguish the good from the bad that they do in handling money, the fraudulent makers would soon be forced out of the market: if the public exercised as little care in discriminating between legal tenders and counterfeits and made "cheapness" the only test of merit as they do in purchasing batteries, the country would be soon flooded with green goods and false coin.

The public is not alone at fault; the intelligent dealer is often accessory to the deception, forced into that position, perhaps, by competition.

One of the many difficulties in the way of determining the merit of a battery lies in the fact that the external appearance of the good and the bad is substantially the same. The same glass jar, the same zinc, the same sal-ammoniac, apparently, and the porous cup with its carbon head showing no special difference. All these external appearances can be cheaply bought, and serve to hide the absence of worth in the cup itself.

Now the porous cup may be filled with a given weight of sand or gold without outward sign of contents. Fortunately it is filled with neither, but, as a matter of fact, the ability to decrease the manufacturing cost of the cell lies in robbing the porous cup.

Every time that five cents' worth of material is skimped from the porous cup and replaced with a worthless article, five dollars per hundred is saved; fifty dollars per thousand. This sum represents to the manufacturer the distance between an actual loss and a handsome profit. This is the exact explanation why the reputable manufacturer cannot reduce the price of his cell two cents, or even one cent.

Because the inside difference is not outwardly visible is exactly why the unscrupulous manufacturer tampers with it; and what makes it all the worse is that the inside is the vital, life-giving part of the cell.

If the change would not be immediately visible the same fraudulent manufacturer would attack the glass or the sal-ammoniac or the zinc. I beg your pardon:

(*Continued on page* 611.)

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THE STREET RAILWAY CONVENTION.

On the 21st instant Pittsburgh, Pa., will become the Mecca of street-railway managers and electric-supply men. On that date will meet in annual session the American Street Railway Association, and there is every promise that it will be a most important meeting. Compared with former meetings, the radical change in the character of this coming one is a most prominent feature. Horses and mules and bob-tail cars will not be considered at all; everything will be electricity. It is a notable fact that almost every paper to be read before the meeting pertains to the application of electricity to the operation of street railways. Contrast this with the vain efforts of a few newspapers with warped vision and judgment to belittle and discourage sentiment in favor of electric roads. Happily the American people are quite capable of judging for themselves whether or not there is any merit in any new enterprise which concerns themselves to such a degree as electric roads do.

The Electrical Age and Street Railway News will be well represented at the convention.

LIGHTING MINES BY ELECTRICITY.

In our issue of October 3 we described and illustrated a safety mine electric cable invented by an English electrician. The possible dangers attending the use of electricity in mines were there pointed out, and it was to avoid these that the cable was devised. In this connection it is interesting to note what is being done in this country in the way of lighting mines by electricity and on another page in this issue will be found an interesting article on the subject. There it is recorded that the largest coal operators in the world have completed arrangements with a prominent Pittsburgh electrical concern to illuminate many of the former company's mines by electricity. The current was turned on for the first time in two of the mines, and everything seems to have given satisfaction from the start.

There can be no question as to the result of such an undertaking if the work of installing the plant is properly performed. Cheap work on mine plants would sooner or later end in dissatisfaction and disgust, if not disaster, and it is gratifying to the trade at large to note that the contract was awarded to a reliable concern.

The mine-operating company has adopted the wise plan of lighting each of its mines by an independent plant. If more than one mine depended upon a common source of electric supply for its light, any stoppage of the machinery would necessarily affect operations in each of the mines depending upon that source, and consequently greater loss upon the operating company would be entailed.

NEW ELECTRICAL APPARATUS.

We print in another portion of this issue the first description of the new electrical apparatus invented by Mr. J. J. Wood, a well-known electrician. Mr. Wood is now at work getting out the patterns for the construction of the various machines, and he promises that it will be a system that will be simpler than any other, as far as the apparatus is concerned. The new machines Mr. Wood is bringing out are an alternating-current dynamo, a direct-current dynamo, a direct-current motor, a direct-current power generator, a cut-out box and an alternating-current meter. All of these machines are constructed on new lines, and simplicity and efficiency seem to be their main characteristics.

We refer our readers to the article, which embraces fine illustrations of the various machines. In design the alternator is unlike anything heretofore constructed in this country, and as far as appearances go it will be unique.

A REMARKABLE MACHINE.

A correspondent at the Electrical Exhibition at Frankfort describes a new electric generator invented by Messrs. Schuckert & Co., of Nurnberg. The use of this generator opens up a new method of current distribution which is remarkable in its results. It is at once an alternator and a direct-current machine, and it is practicable to take both classes of current from the one machine.

According to the correspondent the apparatus may be used (1) as an ordinary continuous-current machine, current being taken off from the commutator in the usual way; (2) as a self-exciting alternator, giving a single alternating current only, by using two commutator-rings, or by using four rings, two alternating currents with displacement of phase of 90 degrees (rotation current, as proposed by Dobrowolsky; (3) as a continuous-current motor; (4) as an alternating-current motor; (5) as a transformer of either class of current into the other; (6) in combination with three phase transformers for transmitting currents at high pressure from one point to another, to be used for either lighting or motive power at low pressure.

This machine was regarded as the greatest novelty at the exhibition.

ARTIFICIAL RAIN.

Can rain be produced at will by artificial means? is a question that is attracting considerable attention in this country at the present time. A method has been tried in the West and Southwest which is claimed by the inventor to be unfailing in its results. The reports of the trials printed in the newspapers, however, are so conflicting that it seems a matter of considerable difficulty to form an opinion of the merits of the system. There is evidently considerable difference of opinion among scientists themselves as to its efficacy. Rain does sometimes follow the mid-air explosions, and in some cases the effect may be brought about by the artificial cause; but a consensus of scientific opinion seems to be that it has not yet been clearly proved that the explosion of an explosive compound in mid-air will invariably produce rain. Naturally the inventor of the system claims unfailing results in every case, but repeated tests have, as far as we know, failed to positively prove that such is the case.

Prof. E. J. Houston, of Philadelphia, has given the subject some consideration, and in a paper read recently before the electrical section of the Franklin Institute he discusses the similarity between the artificial method of producing rain and the effect of lightning in the same direction.

The paper contains a good many interesting things which are developed incidentally to the discussion of the subject proper. On another page in this issue we give an abstract of this paper, giving that portion referring to the comparison between lightning and the mid-air explosion method of producing conditions favorable to the formation and precipitation of rain. It makes interesting reading and contains many suggestions.

CHEAP BATTERIES.

A communication from Mr. C. J. Hirlimann, printed elsewhere in this issue, will be read with considerable interest, inasmuch as it seeks to arrest a species of fraud carried on in the manufacture of certain batteries. The brisk competition in electrical goods in late years has had a tendency to lead manufacturers to sacrifice quality to cheapness, and this has had as much as anything else to do with the dissatisfaction among users of electrical apparatus with the service obtained therefrom. In the electrical trades, as in every other, a good article is worth a certain price, and anything offered at a cheaper figure than the standard should be regarded with suspicion. In the case of batteries the life-giving substances are lessened in quantity and quality, with the result of shorter life.

There is a wholesome lesson in Mr. Hirlimann's appeal for fair dealing in the matter of batteries that might be profitably applied in other directions.

COMPLIMENTARY RESOLUTION.

At the last meeting of the Executive Committee of the National Electric Light Association a very complimentary and deserved resolution was unanimously passed, thanking Mr. John Carroll, of the Eugene F. Phillips Electrical Works of Montreal, Canada, for his untiring and eminently successful labors in connection with the reception of the association during its convention at Montreal. These resolutions were ordered engrossed and presented to that gentleman.

NOTES.

In Constantinople the only use of electric light is in the palace of Yildiz. The use of it elsewhere is forbidden by law.

Herr Zipernowsky read a paper at the Electrical Congress held in connection with the Frankfort Exhibition, in which he proposed a rapid-transit electric road between Vienna and Buda-Pesth, a distance of 200 miles, to be run in less than two hours.

The first cable road in the world was the Clay Street Hill line of the San Francisco system. It was built in 1873, and the conduit walls were made of redwood.

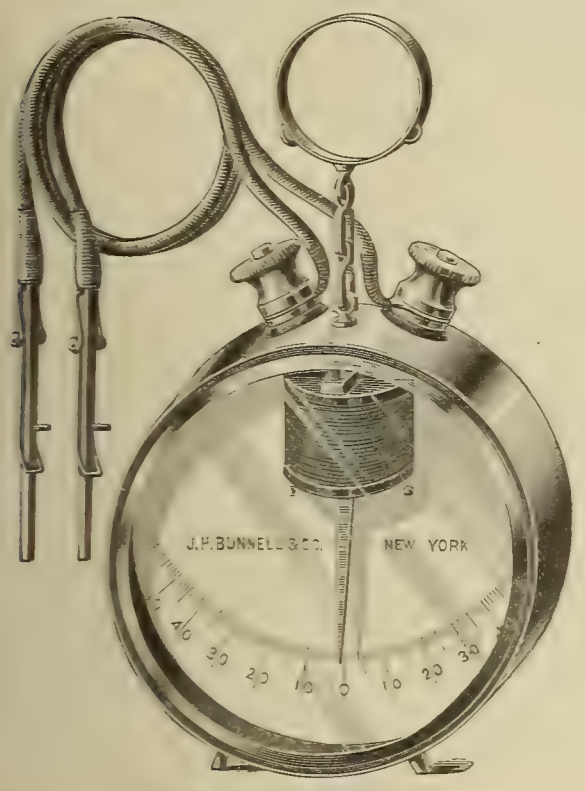
After several successful experiments with the electric lighting of the trains on the Paris, Lyons, and Mediterranean line, the company has definitely decided to light all its trains in that way.

POCKET GALVANOMETER BATTERY GAUGE.

This pocket galvanometer is of such construction and calibration as to furnish a reliable standard for practical measurement of current strengths in testing from one to five cells of ordinary batteries, such as the various forms of sal-ammoniac, sulphate of copper and acid batteries.

As these gauges are all calibrated to a single standard and are made exactly alike, their introduction furnishes for comparisons, or condition tests, of from one to five cells, an accurate instrument such as has not heretofore been available.

The Galvanometer Gauge is arranged for use either standing upright on instrument table or desk, or, as when used for general testing in battery-room, etc., it is held suspended by the chain and ring, in which position, without current, the needle hangs at



POCKET BATTERY GAUGE.

zero the same as it would if the Galvanometer were standing on a table.

These Galvanometer Gauges are especially advantageous for use as permanent circuit-indicators for fire-alarms, burglar-alarms, district telegraphs, etc., on account of their presenting the face of the instrument in upright position. They are also perfectly "dead beat."

Two silk-covered conducting cords are attached to each gauge, and these cords are provided with a very convenient form of improved tip, which is so made that it can enter any ordinary binding-post and be held by the binding-screw in the usual way, or, having a square end, is suitable for English binding-posts; and also having a spring clamp it can be hooked firmly on to bare wire at any exposed point. This form of tip is extremely handy in all experimental temporary wire-connecting, and by its use with the gauge the condition of any one to five cells in the middle of series can be instantly ascertained without making breaks and reconnecting.

A LARGE ORDER FOR ALUMINUM.

A press dispatch from Lockport, N. Y., on October 7, contains the following interesting information:

"The German Government has recently placed an order in the hands of its agents in the United States for a large quantity of pure aluminum for army purposes. This order calls for eighty-five tons of the metal. The amount placed in the hands of the agents is $110,000. As yet the order has not been accepted, and probably will not be for some time. There are only two companies in this country—the Cowles Electric Smelting and Aluminum Company, of this city, and the Pittsburg Reduction Company, of Pittsburg. Neither can accept the order, or part of it, because of a gigantic patent litigation which is now being waged between them, and the probability is that the German Government will have to wait some time before it can secure the metal. This metal will be turned into buttons, buckles and for field purposes, such as wire for telegraphic and telephone service and cartridge shells, it having been proved that aluminum will withstand the corrosive action of the new smokeless powder which has come into universal use in Europe lately. It is also to go into a certain newly-invented pontoon bridge, its great lightness especially commending it for this purpose."

ELECTRIC MINING MACHINES.

The Jeffrey Electric Coal Mining Machine consists of a bed-frame occupying a space 2 feet wide by 8 feet 6 inches long, composed of two steel channel-bars firmly braced, the top plates on each forming racks with their teeth downward, into which the feed-wheels of the sliding frame engage. Mounted upon and engaging with this bed-frame is a sliding frame similarly braced, consisting mainly of two steel bars upon which are mounted at the rear ends the electric motor. From this motor power is transmitted through straight gear and worm-wheel to the rack, by means of which the sliding frame is fed forward. Upon the front end of this sliding frame is mounted the cutter-bar, held firmly by two solid steel shoes with suitable brass boxes. The cutter-bar contains bits made of tool steel, held in place by set-screws. When it is revolved these cutters or bits cover its entire face.

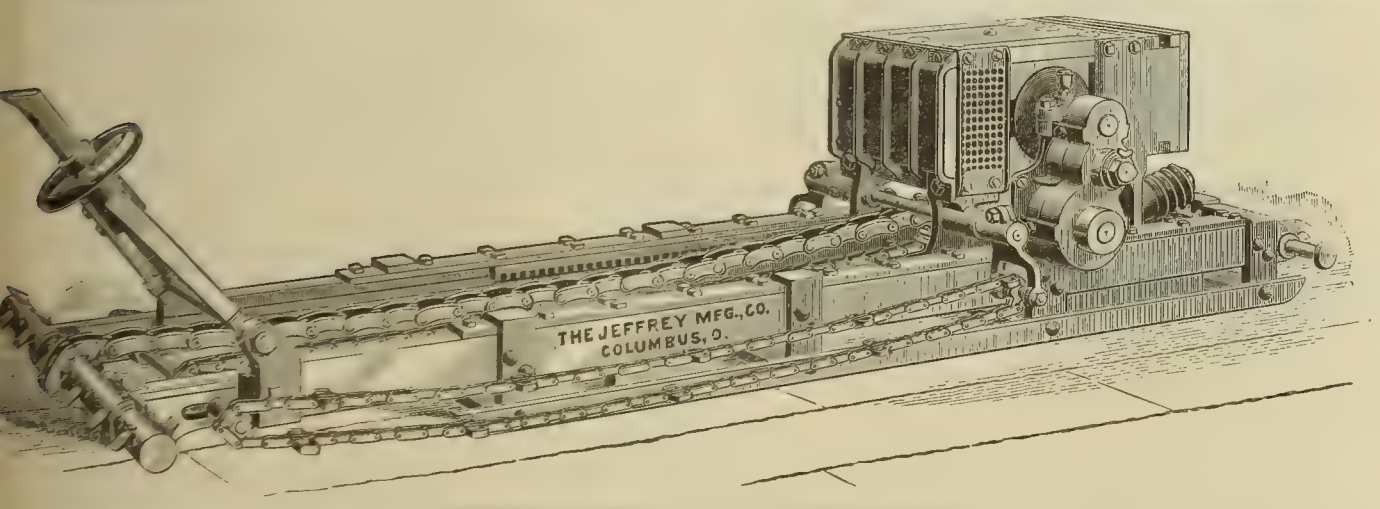
The cutter-bar is revolved by an endless curved link steel chain from the driving shaft and is advanced to the desired depth by the above mechanism into the coal or other material to be undercut.

The electric motor occupies a space of about 20 inches square and is built in the most workmanlike manner, both mechanically and electrically. The current required is from 30 to 50 ampères, at a pressure of 220 volts. The motor is wound to develop fully 15 horse-power, though frequently in some veins of coal the machine only uses 30 ampères, or 7½ horse-power, in making cuts.

The machine is started by means of a switch located on a suitable resistance-box on the rear end of the motor, the same being arranged with buttons. The current is gradually turned on by simply passing the lever over these buttons.

The armature of the motor is calculated to run at a speed of 1,000 revolutions per minute, from which the speed is reduced so as to run the cutter-bar 200 revolutions per minute.

The momentum of the armature is such that ordinary obstructions met by the cutter-bar in the coal are not perceptible, causing the machine to run steadily and comparatively quiet.



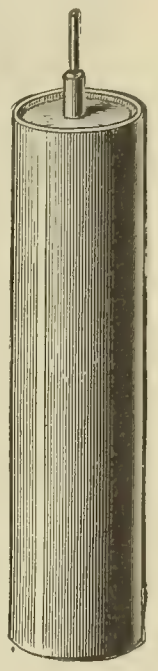
JEFFREY ELECTRIC COAL MINING MACHINE.

The laying of the Spanish cable to Morocco called forth a strong resistance from the Moors of the Anghera tribe, 150 of whom attacked the telegraphists at Tangiers, during the final operations of laying the wire, and put them to flight.

Since the development of the electro-technical industry in Germany, greater stimulus has been imparted to the production of zinc in the country. Out of a total annual output throughout the world of, in round figures, 350,000 tons, Germany alone produces about 140,000 tons, or forty per cent. of the whole. The out-turn increased from 105,500 tons in 1881 to 139,270 tons in 1890.

CAPSULE BATTERY AND DOOR-BELL OUTFIT.

The Nassau Electrical Co., 112 White St., New York City, manufacturer of electrical specialties, capsule batteries, electrical bells, portable bell outfits and medical battery combinations, has been making many improvements in its various specialties in the past year or two, and none have been so successful as the last improvement in the capsule battery. Mr. Philip Hathaway, Secretary and General Manager of the company, a gentleman who is a thorough electrician and mechanician, is the designer of these numerous specialties. He has added many improvements to the company's goods, and has succeeded in devising a machine for stamping out the zinc shell of the capsule battery, shown in the illustration, which is the actual size. By his method he takes a piece of sheet zinc and through five processes of stamping he produces a perfect battery shell



CAPSULE BATTERY.
Actual size.



DOOR-BELL OUTFIT.

which composes the negative electrode of the battery and is also a support to the elements and chemicals composing the active materials. Upon testing the new style of battery it gave 19 points against 20 points from two cells of the old, proving that the new cell has almost double the strength of the old one. One of the new cells was set up in combination with a 2½-inch bell, and at the end of a week was still ringing the bell with great force.

These cells are very valuable for testing, experimental work, laboratory work, general house work, stores, offices, etc. They can be connected up in series or in multiple, as may be desired.

There are so many applications for a battery of this convenient size that it is impossible to mention them all. It has many advantages. It is the smallest effective battery ever constructed, its actual dimensions being 2½ inches long by ⅝ inch in diameter. Its electromotive force is over one volt, and it gives a current of 2.20 ampères. It is perfectly dry, requires no wiring, and the power remains constant until the battery is exhausted. It has long life, there being no local action whatever when the circuit is open, and it is claimed to be the most efficient battery for testing purposes, as it always yields a uniform current. Another feature is that it can be mailed to any destination or carried in the vest-pocket.

The other cut which accompanies the one just referred to illustrates the Nassau door-bell outfit, made by the same company. This outfit consists of a hardwood frame, to which is affixed an electric bell of the best construction, a Nassau capsule battery and a binding post, all connected and ready to be placed in position. No electrical or mechanical skill is needed for putting up this apparatus or for any subsequent attention.

A push-button, staples and 70 feet of insulated wire come with the apparatus, all packed in a box, and forming a complete and most convenient door-bell outfit.

The New York and New Jersey Tel. and Tel. Co. held its regular meeting on the 30th of September and elected Mr. Henry J. Cullen, Jr., a director in the place of the late William H. Murthy. The gross business of the company this year amounted to $950,000, but the electric storms have made a big hole in what should have been dividends. The usual quarterly dividend of 1½ per cent., however, has been earned and was declared.

ELECTRIC LIGHT NOTES.

The Missouri Electric Light and Power Co., St. Louis, Mo., is increasing its plant by 10,000 lights.

The Dallas Electric Light Co., Dallas, Tex., will increase within the next four months. The company supplies 390 Wood arc and 3,753 Slattery incandescent lamps, power for two electric railroads and 187 commercial electric motors.

The Rutland Electric Light Company, Rutland, Vt., expects to double its capacity in the near future.

The Kittanning Electric Light, Heat and Power Company, Kittanning, Pa., will increase its plant at once. The Thomson-Houston alternating system is used. J. M. Painter is superintendent.

The Abingdon Water Works Company, Abingdon, Va., will increase its electric-light plant in the near future. The Edison incandescent and the Ball arc systems are used. T. L. Pickle is superintendent.

The Edison Electric Illuminating Company, Spokane, Wash., is to increase its plant by one Thomson-Houston arc machine.

The Harrison Water, Light and Power Company, Harrison, Ohio, is to increase its plant in the near future. The Thomson-Houston system is used. F. C. Horn is president.

The Walla Walla Gas and Electric Company, Walla Walla, Wash., is to add a Corliss engine to its power plant.

The Little Rock Electric Light Plant (municipal), Little Rock, Ark., is to be increased in the near future. The Fort Wayne arc system is used. G. E. Fish is superintendent.

The Delta Electric Light Company, Delta, Pa., using the Edison incandescent system, will extend its line about a half mile shortly. The company may require some construction material. Address J. T. Crawford, secretary and manager.

The Tiffin Electric Light Company, Tiffin, Ohio, will increase both its arc and incandescent systems shortly. H. McCall is secretary and superintendent.

The Wyoming Light, Water, Heat and Power Company, Wyoming, Ohio, using the Westinghouse incandescent system, will soon increase its plant. L. G. Lilley is superintendent.

The Windsor Electric Light and Power Company, Windsor, N. S., will increase its incandescent plant in the near future. A. Forsyth is president.

The Fort Wayne Electric Company, Ironton, Ohio, will increase shortly. The company uses the Slattery system.

The Canton Electric Light and Power Company, Canton, Ohio, is to add two 50-light arc dynamos to its plant shortly.

The Telluride Electric Light and Power Company, Telluride, Col., has just completed enlarging its plant. The company uses the Edison system.

The Jersey City Electric Light Company, Jersey City, N. J., will shortly make some additions to its plant. This company uses the Fort Wayne, Thomson-Houston, Ball and Wood systems.

The Salem Electric Light and Power Company, Salem, Ohio, will build a new plant and increase its capacity in the near future. Milton Davis is president.

The Rich Hill Water, Light and Fuel Company, Rich Hill, Mo., is to add a 20-light arc dynamo to its plant shortly.

The Edison Electric Illuminating Company, Sea Isle City, N. J., will increase its plant shortly.

The Americus Illuminating and Power Company, Americus, Ga., is to add a 50-light arc machine to its plant.

The Electric Improvement Company, of San Francisco, Cal., contemplates extensive additions to its plant in the near future.

The Yarmouth Gas Light Company, Yarmouth, N. S., is to furnish power for an electric street railway, which will be in operation next year.

The Santa Ana Gas and Electric Light Company, Santa Ana, Cal., is to install a complete incandescent-light system. The company now supplies 30 arc lights on the Thomson-Houston system.

The Olympia Light and Power Company, Olympia, Wash., contemplates extensive additions in the near future. R. Fleming is superintendent.

The Manchester Electric Light Company, Manchester, N. H., contemplates the addition of one 50-horse-power generator and one 1,300-light incandescent dynamo in the near future.

The Watsonville Electric Light and Power Company, Watsonville, Cal., contemplates the addition of a 650-light dynamo and a 60 H. P. engine. The Thomson-Houston system is used.

The Denison Light and Power Company, Denison, Tex., will increase its plant shortly.

The Port Arthur Water, Light and Power Company, Port Arthur, Ont., using the Heisler incandescent system, will increase its plant in the near future.

The Ionia Electric Company, Ionia, Mich., contemplates the addition of a power plant.

The Butler Light, Heat and Power Company, Butler, Pa., using the Edison three-wire system, will increase shortly.

The Electric Company, Connellsville, Pa., will increase its incandescent system in the near future.

The Northern Electric Light and Power Company, Philadelphia, Pa., contemplates several additions in the near future.

The Rutherford, Boiling Spring and Carlstadt Electric Company, Rutherford, N. J., will make extensive additions within the next thirty days.

The Brandon Electric Light Company, Brandon, Vt., expects to increase its plant soon.

The Aberdeen Light and Power Company, Aberdeen, So. Dak., is just starting a power circuit.

The Circleville Electric Light and Power Company, Circleville, Ohio, intends to install a complete system of accumulators.

The Bryan Water, Ice and Electric Light Company, Bryan, Tex., will make additions to its plant shortly.

The San José Light and Power Company, San José, Cal., contemplates several additions to its plant.

The Maryville Electric Light and Power Company, Maryville, Mo., using the Thomson-Houston system, will increase its facilities shortly.

The Commercial Electric Light and Power Company, Tacoma, Wash., has just ordered a new engine and one 80 H. P. Thomson-Houston generator.

The Champion Electric Light Company, Springfield, Ohio, will add a new boiler to its power plant in the near future.

The Visalia Gas, Light and Heat Company, Visalia, Cal., intends to increase its electric-light plant.

In the municipal plant at Harriman, Tenn., an incandescent system will be installed in the near future. Its present capacity is 55 arc lights.

The Los Angeles Electric Company, Los Angeles, Cal., will increase its facilities in the near future.

The Lebanon Light, Fuel and Power Company, Lebanon, Ohio, will shortly make some additions to its plant.

The electric-light plant at Hastings, Minn., was destroyed by fire September 16.

NEW SNAP-SWITCH.

The snap-switch which is so generally used in electric lighting to-day is covered by a broad patent claim, so broad that it has up to the present time baffled inventors in their efforts to produce a switch which would not infringe on the original patent. Mr. Charles J. Kintner, the well-known electrical expert of this city, has, however, recently invented a snap-switch which in no way conflicts with previous patents, and which possesses some ingenious features.



KINTNER'S SNAP-SWITCH.

We give herewith an illustration of the switch, which is reproduced from a photograph of the same, with the cover removed.

The switch-lever consists of a bar of soft iron pivoted at its centre. It is limited in its play by the ends of a permanent magnet of somewhat peculiar shape. The poles of the magnet will be easily recognized by reference to the illustration, the near end of the lever being in contact with the pole at the right hand, which may be either N. or S.

It will be evident at a glance that in the operation of the switch the lever will be strongly attracted as it approaches the N. or S. pole of the permanent magnet, and brought into contact with the same with quite a good deal of force.

The lower ends of the two springs encircling the spindle rising from the centre of the switch-lever are set in small holes drilled in the lever, while their upper ends are set in similar holes in the ebonized handle which sets loosely on the spindle, being kept in position by the milled-head screw. The direction of the winding of each spring is opposite to that of the other, so that when the handle is turned by the fingers one or the other of the springs is put to a tension. When the tension is sufficiently great to overcome the attractive force of the magnet pole, the lever is drawn away from the pole by the energy accumulated in the twisting of the spring and carried to the other pole with a snap.

The electrical connections are made and broken in a very simple manner. The method will be readily understood by reference to the cut. On the under surface of the lever is a piece of copper, shaped something like the letter Z, the lateral projections making frictional contact with the wire terminals when the switch is turned to close the circuit. The connecting parts on one side are shown in the cut.

This same principle can be applied to ceiling-switches with flexible cord and pendent lamps. It is proposed to hang the armature or switch-lever in such a way, with reference to the poles of the permanent magnet, that with a slight pull downward the circuit will be broken and the lamp consequently extinguished. To re-establish the current, all that is necessary is to raise the lamp slightly so that its weight will be taken off the cord. By doing this the counter-balance provided at one end of the switch-lever will lift the other end towards the poles of the permanent magnet, and when it has got into the magnetic field sufficiently far it will be strongly attracted to the magnet and the electrical contact will thus be made. It will be readily understood from this description that this switch in either form is an extremely simple one, and at the same time efficient.

BELTS FOR DYNAMOS.

It is best when purchasing a belt for driving dynamos to have it well stretched before placing upon the machine. New belting stretches very much and gives a great deal of trouble until it settles down to its work. Before measuring for a belt screw the dynamo upon its slides as near to the engine or driving pulley as possible. For moderate powers the belt should have one inch in width for each horse power transmitted, running at a speed of 1,000 feet per minute. It is impossible to avoid a slight slipping of the belting when new, but moving the dynamo from the driving pulley by means of the slides will tighten it. Care must be used to keep the belt from being too tight, as a belt that is too tight is as bad as one too loose. Thin, flexible belting is generally used for dynamo work, but rope driving is coming rapidly into favor for large dynamos, a single or multiple rope being used upon a groove pulley. There is less liability to loss by slipping in this method, and there is no stoppage to the plant by a belt coming off of the pulley.

NEW INCORPORATIONS.

The Chicago Electric Wire Co., Chicago, Ill., was incorporated October 1, with a capital stock of $1,000,000. Incorporators: J. W. Dryenforth, C. N. White and J. N. Hanson.

The Lewis-Mercer Construction Company, Jersey City, N. J., was incorporated September 29, with a capital stock of $200,000. Incorporators: Jared E. Lewis and John F. Zebley, New York, N. Y., and Harry B. Zebley, Atlantic Highlands, N. J.

The Crown Electric Company, Chicago, Ill., was incorporated September 30, with a capital stock of $100,000, to manufacture and sell electric curative appliances. Incorporators: Robert Greer, John Greer and Annie Greer.

The American Engineering Company, Jersey City, N. J., was incorporated September 28, with a capital stock of $1,000,000, to design and construct steam and electric power plants. Incorporators: Granville T. Woods, Jersey City, N. J.; J. S. Zerbe, C. C. Bowen and A. J. Zerbe, all of Brooklyn, N. Y., and Henry Rein, New York, N. Y.

The Attic Electric Light and Power Company, Attic, N. Y., was incorporated October 1, with a capital stock of $20,000. Incorporators: Joseph Birt, Buffalo, N. Y.; Erastus B. Wallis and Andrew Krauss, Attic, N. Y.

The Leslie Electric Light and Power Company, Leslie, Mich., was incorporated October 2, with a capital stock of $10,000. Incorporators: J. A. Hanelly, V. H. Grout and A. A. Lumbard, all of Leslie, Mich.

The People's Electric Light and Power Company, Creston, Ia., was incorporated October 2, with a capital stock of $12,000. Incorporators: Markemer Bros., W. A. Tipton, F. A. Sparr, A. H. Sparr, Beecher & Miller, Lewis & Cole and S. A. Brewster, Creston, Iowa.

The St. Paul Electric Manufacturing and Construction Company, St. Paul, Minn., was incorporated October 2, with a capital stock of $100,000. Incorporators: Paul Martin, James F. Hughes and Charles H. Lienan, St. Paul, Minn.

The Cornwall Electric Lighting and Power Company, Cornwall, N. Y., was incorporated October 3, with a capital stock of $15,000. Incorporators: Thomas Taft, S. B. Young, Henry W. Chadeayne, all of Cornwall, N. Y.

The Edison Electric Light and Power Company, Jersey City, N. J., has been incorporated, with a capital stock of $500,000. Incorporators: R. M. Jarvis, C. B. Van Dyke, D. E. Cleary, P. G. Van Zandt, B. A. Watson, James Warner, J. D. Carscallen, F. J. Matthews, H. Lembeck, A. Q. Garretson and William F. Abbett, all of Jersey City, N. J.

The American Manufacturing and Engineering Company, Elizabeth, N. J., has been incorporated, with a capital stock of $100,000, to manufacture and sell electrical and mechanical apparatus. Incorporators: Samuel T. Hillman, New York, N. Y.; Asa D. Phillips, Plainfield, N. J., and Charles W. Leveridge, Brooklyn, N. Y.

The Egyptian Pottery Company, Trenton, N. J., has been incorporated, with a capital stock of $14,000, to manufacture and sell electrical supplies of all kinds. Incorporators: Charles H. Baker, C. Turford, John Brindley and M. J. Carroll, all of Trenton, N. J.

(*Continued from page 607.*)

he does attack all these points in so far as it can be done without attracting attention. But he does not make the zinc the diameter of a knitting-needle or hollow, as he assuredly would do if detection were not certain and immediate.

If in the use of the Disque Leclanche battery today we do not find more instances of the cells still in operation that have done good work anywhere from two to six years, it is solely because "there is poison in the cup." The cup has been robbed of its life-principle and deleterious matter substituted.

Unless this pandering on the part of dealers to makers of a cheaper Leclanche battery is resisted it will yet result in a homœopathically impregnated mud-cup. The wooden-ham manufacturer will make it for them. When that time comes, gentlemen, the public goose which lays the golden eggs will have been killed by the indigestible trash forced into its body.

Therefore I exhort, keep up the standard ; maintain the integrity of the Leclanche battery—the heart and lungs of the gigantic household electrical systems springing into existence—and protect the Leclanche battery from disrepute.

Buy a good battery as cheaply as you can, but at any price let the battery be a good one.

HOW TO PURCHASE AN ELECTRICAL PLANT.

In advance proofs of a pamphlet about to be issued by H. Ward Leonard & Co., the well-known electrical engineers, Electrical Exchange Building, New York, we find some very sound advice to those contemplating investing in electrical plants. The title of the pamphlet is "The Value of the Services of a Consulting Electrical Engineer to Persons Investing in Electrical Plants."

Referring to the purchase of plants, the pamphlet says:

Perhaps the purchaser who lives in a foreign country or at a great distance from the headquarters of the principal electrical companies is the one who is most dependent upon competent advice and the representation of his interest by a consulting electrical engineer.

The day has passed when a purchaser can afford to use any one system for his entire equipment for any comprehensive plant. How, then, is a distant purchaser going to judiciously determine the best methods of operation, the kind and amount of the various apparatus and materials he will require, and to whom is he going to look to see that everything necessary will be secured that nothing unnecessary will be sent, that everything purchased will operate properly and without interfering with the best operation of other parts of the plant, that everything will be shipped simultaneously and economically, and that full instructions as to the installation and operation of the entire plant will be sent with it?

The services of a competent and independent electrical engineer are in such cases essential for the best and most economical result.

For such the firm acts for the purchaser to tell him first just what data is required in order that it can advise him as to what general plan he should pursue, what power he shall use, where he shall locate his plant, what type of apparatus he had better use, what size plant he should provide for, and how much to install in the beginning.

Having secured such data it sends him a plan and estimate for the work contemplated, and also statistics based on practice as to the probable earnings and expenses of operation.

If he then decides to go ahead, the firm draws a specification and secure bids, which it submits with its advice. Having received instructions from him, it then proceeds to purchase the required apparatus and materials of all kinds under a clear specification and contract. It inspects the goods, sees that all goods are properly assembled, marked and shipped, and that complete information is sent to the purchaser, enabling him to install and operate the plant according to the best practice.

Under such methods good and profitable plants are installed, and not only the purchaser but the manufacturing companies are benefited, and a great many hesitating purchasers, seeing the good results obtained, proceed with undertakings which might otherwise never be consummated.

The value and importance of expert electrical advice to architects is thus set forth :

What architect is there who has ever had a comprehensive steam or electric plant installed for him, who does not appreciate that thoroughly competent engineering would have improved the lay-out in certain respects, and that careful and intelligent supervision would have prevented troublesome delays and expensive errors?

It is self-evident that no one of the contractors scrutinizes the plans and specifications with a view of reducing the amount of apparatus they will sell, in order to effect a possible saving to the purchaser, so long as all bidders must bid under a fair and identical specification, and but few architects have sufficient knowledge and experience in electrical engineering to devise the best and most economical arrangement of machinery, conductors, etc.

Hence it is that we now find the most experienced architects retaining to assist them the competent and entirely neutral electrical engineers who are now available, and the lack of which has occasioned their past clients so much trouble and expense.

The subjects discussed throughout the pamphlet are well thought out and written, and the advice to intending purchasers and others requiring the benefit of expert knowledge will be most valuable. Certainly by following the same there can be no reasonable cause for unsatisfactory results in any instance. The reputation of the house is a sufficient guarantee that its part of a contract will be faithfully and honestly carried out.

MEETINGS OF SOCIETIES.

BROOKLYN INSTITUTE.

On Friday evening, October 30, before the Department of Electricity, of the Brooklyn Institute, a discussion will take place on "The Measuring of High and Low Voltages." Apparatus will be used in measuring voltages from one-one-thousandth of a volt to several thousand volts. Several leading electricians will take part in the discussion, which will take place in the lecture-room of the Y. M. C. A. building.

BUFFALO ELECTRICAL SOCIETY.

The annual meeting of this society, held on Monday, October 5, was largely attended. Reports of the officers for the past year were read, and the following officers elected for the ensuing year: President, F. P. Jones; Vice-President, Madison Buell; Secretary, A. C. Terry; Treasurer, Samuel Stewart; Librarian, Wm. C. Lewin. Members of the Executive Committee, Frank Kitton, Wm. H. Dopp and M. B. Marvin.

The reports of the several officers showed the year just closed to have been a very prosperous one for the society. Its roll of membership had increased, its finances were in better condition than ever before, and the interest in the proceedings of the society was increasing. Among the papers presented during the year were several of exceptional merit, and the year's work altogether very creditable.

The programme for the coming winter was discussed at considerable length and with great interest. While not wholly completed, it promises to embrace some very interesting papers. At the next meeting, October 19, the president-elect will present a paper.

ELECTRICAL SECTION, FRANKLIN INSTITUTE.

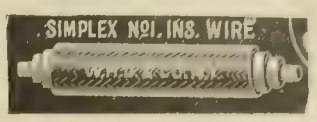
In the programme of lectures to be delivered before the Electrical section of the Franklin Institute, Philadelphia, during the season 1891–92, the following on electrical and kindred subjects are announced, with the dates of each: November 27, "The Electrical Transmission of Power," by Capt. Eugene Griffin, of Boston ; December 4 (subject to be announced), Carl Hering ; January 15, "Aluminum from an Engineering Standpoint," Mr. Alfred E. Hunt, President of the Pittsburg Reduction Company; February 12, "Technical Notes on the Gramophone," Mr. E. Berliner, Washington, D. C.; February 15, "An Experimental Study of Light Effects Produced by Alternating High Potentials," Nikola Tesla, New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

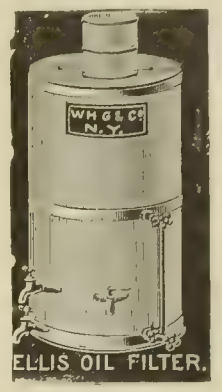
The monthly meeting of the American Institute of Electrical Engineers has been postponed until October 27, to avoid conflicting dates with the Street Railway Convention at Pittsburg.

A FEW ELECTRICAL SPECIALTIES.

W. H. Gordon & Co., 115 Broadway, New York, electric-light, electric-railway and general electrical supplies, are doing a very excellent business for this season of the year. They are having unusually large orders for their incandescent circuit-switches, lamp-sockets, Sunbeam lamps, arc-light hangers, arc-lamp switch, Simplex feeder wires, Simplex stranded cables and Simplex No. 1 insulated wire. They are carrying in stock and are doing a good business with the Ellis oil-filters. These filters should have special mention at this time on account of their great saving of oil, which means cash to electric light, power and railway stations. Waste oil full of grit and sand taken from the drip-pans, or receivers, after the oil has been used on an engine or dynamo, can be placed in this filter, and after being thoroughly cleansed will be equal if not superior to the original oil. The cost of the filter can be saved in a few months' time. The firm's success in business is due to the fact that in nearly every instance they have endeavored to furnish the very best goods in the market. Their Sunbeam lamps are suited to all conditions, and reports in every instance have been highly satisfactory. This has given the firm great encouragement, so much so that they have made extra endeavors to push these lamps into electric-light stations and isolated plants. They have lately added very largely to their stock, particularly in the line of switches and incandescent fixtures, and are prepared to fill orders at satisfactory prices.













WHAT ELECTRICAL PEOPLE ARE DOING IN BROOKLYN.

The Easton Electric Co., Kent Ave., Brooklyn, N. Y., was found actively engaged testing dynamos and lamps for several large contracts it has made lately, one or two of which is for concerns in the immediate vicinity, for which dynamos and nearly 1,000 incandescent lamps are to be furnished. The dynamos to be used in this plant are of the latest construction. The frame is made solid in one piece, and is of the most unique design. The field-magnet cores are wound by a machine and set directly upon the field magnets, a most simple and labor-saving process. The armature is of the Siemens type. The machine throughout is constructed in the very best manner and is of a very handsome design. One of these dynamos of 100 H. P. has just been completed, and the company can build them in any desired size and of any voltage, for electric railway and power use. This company offers special inducements to isolated and central-station plants in this vicinity to do special repair work promptly and guarantees satisfaction. This is a great convenience to a number of companies and individuals using dynamos, as they will not find it necessary to send parts of machines to distant points for repairs.

NEW YORK NOTES.

Office of the Electrical Age and Street Railway News, First Floor, World Building,
New York, Oct. 10, 1891.

The North American Automatic Co., Electrical Exchange Building, city, is the manufacturer of the nickel-in-the-slot device of which Mr. W. K. Bassford, an expert electrician, is the inventor. This apparatus is of ingenious construction, and it has been a question whether a Canadian silver sixpence, which is a small coin, would operate the nickel-in-the-slot mechanism. Mr. Bassford has, however, settled the question by inventing a device which successfully operates a phonograph when one of the aforesaid sixpences is dropped into the slot. By dropping this coin through a slot it falls into a balance which makes contact through a mercury pot; the circuit is closed on phonograph motor which runs the cylinder of the phonograph. After the cylinder has passed to the end of a tune a very ingenious electrical device raises the cylinder and returns it to its original position. He has adopted one of the smallest Porter motors for operating this latest device, in connection with very ingeniously arranged mechanism. The power is supplied by one storage cell, and both of these devices were gotten up especially for use in Canada. Mr. Bassford has lately invented and has placed on the market, through the Automatic Vending Co., New York, a nickel-in-the-slot postage-stamp apparatus. By dropping a nickel in the slot on the top of a handsomely constructed cabinet, two 2-cent postage-stamps are produced.

General C. H. Barney, manager of the late International Electrical Exhibition in Montreal, has just returned to New York. He gave the Electrical Age and Street Railway News a call last week.

The International Portelectric Co. has taken offices at Room 211, Electrical Exchange Building, 130 Liberty street, this city, where it expects shortly to have an exhibit of its system of transportation. J. F. Williams is President and Frank Lawton Secretary.

Mr. W. S. Chesley, electrical supply and purchasing agent, 136 Liberty street, this city, reports business booming. On one day alone he sold a 45-light Thomson-Houston arc and two Edison incandescent dynamos, besides 2,500 Edison key sockets.

T. J. Murphy, manufacturer of slate specialties, 136 Liberty street, city, is said to be making the largest switchboard ever made of electric slate for the Western Electric Company, to be used in the Presbyterian Hospital, New York City. It will be in two pieces, each 8 feet long by 4 feet 1 inch wide, and will be finished in imitation of Italian marble.

Mr. W. L. Boyd, who was well and favorably known among electricians throughout the States, some few years ago left the electrical business and became a member of the Petroleum Stock Exchange. While a member of this exchange he lost his voice, which he has lately largely recovered. Mr. Boyd through his energy, practical experience and geniality has been able to make himself felt in most every line of business he has been interested in. He is now associated with the Vacuum Oil Co., of Rochester, N. Y., making his headquarters at 29 Broadway, this city, and is meeting with his usual success in introducing that company's special dynamo and machinery oils. He sells "the oil that lubricates most."

Alexander, Barney & Chapin, 20 Cortlandt street, this city, have just issued a neat little pamphlet containing many testimonials on the subject of the A B C incandescent lamps. It is needless to say that the letters speak of these lamps in terms of highest praise. A price-list of the lamps is also given. The front cover of the pamphlet has a full-sized cut of a 16 c. p. A B C lamp, on the bulb of which are printed the words, "For Light, See Inside."

Mr. Albert E. Plowman, representing Wm. H. Weston & Co., Philadelphia, Pa., gave us a call last week. He reports business brisk.

It is the universal custom to annually celebrate important events in domestic and business life. In accordance with this custom, that young but vigorous and enterprising firm, Alexander, Barney and Chapin, 20 Cortlandt street, this city, on October 6, celebrated the completion of the first year of its existence as a firm, in a social manner. The store was profusely illuminated with incandescent lamps with shades and bulbs in various colors, and the members of the firm received their many friends in their characteristically hospitable manner. Mr. P. H. Alexander, the head of the house, who was absent during the morning of the day marking the first anniversary, on returning to the store in the afternoon found it in holiday attire and beautifully illuminated for his reception and the anniversary celebration in full blast. The firm received endless congratulations and hearty wishes for continued prosperity.

Mr. Harry Alexander, well known to the electrical fraternity through his connections with the T.-H. Electric Co., as well as with other companies, and who went into business a short time ago, has found his business increasing to such an extent that he has taken a partner in Mr. Rufus N. Chamberlain and will do business under the name of Alexander-Chamberlain Electric Co. Mr. Chamberlain has also had vast experience through his connection with the Sawyer-Mann Electric Co. and the Julien Electric Traction Co. This new company intends to make a specialty of automatic isolated plants for private houses, as well as inspection of all kinds of electric plants, and all kinds of electric work will receive prompt attention. Mr. Alexander has done a good deal of this work, and as to isolated plants for private houses, he will in a later issue give our readers a very interesting article on the same. Mr. Alexander and Mr. Chamberlain have both had considerable experience with storage batteries, and propose to make the installation of accumulator plants for light and power for launches as well as buildings a special feature. Electro-deposition will also be made a specialty, as well as electrical engineering and experimental work of all kinds.

Bryan Enholm & Co. is the name of a new firm which has just opened headquarters in the Electrical Exchange Building, 136 Liberty street, city. Mr. Iver H. Enholm, the electrician of the company, is the inventor of a new primary battery which the firm is introducing to the trade under the name of the "Enholm Primary Battery." This battery has been tested thoroughly by the New York Phonograph Co. in operating a number of nickel-in-the-slot phonographs, and is spoken of very highly by several other large electrical companies in the city.

Mr. M. S. Rosenweig, travelling agent for the Nassau Electrical Co., 112 White street, this city, will make an extended trip throughout the Western States. He starts on his pilgrimage about October 14. The trade throughout the West should be prepared for Mr. Rosenweig's call upon them, as he will have a line of goods they cannot refuse to purchase upon examination. Probably some very excellent orders will be placed with him, as he will carry with him some valuable additions to his samples which he has never had the pleasure of presenting in his previous travels.

Mr. J. J. Wood, Chief Electrician of the Fort Wayne Electric Co., Fort Wayne, Ind., is in the city supervising the pattern making for his new alternating machine, new direct current dynamo, new direct current motor and new direct current generator; also other specialties that he is producing for the Fort Wayne Electric Co. Mr. Wood has been in Fort Wayne only ten months. It will be remembered last fall we called attention to the fact of Mr. Wood's purchasing a $50,000 homestead in Fort Wayne, Ind. He was at this time the chief electrician of the Fort Wayne Electric Company's works in Brooklyn, of which city Mr. Wood is a native. Since his removal to Fort Wayne ten months ago, he has constructed large and elegant new factories containing what is said to be the finest arc light testing-room in the world. He has also installed new boiler plants, new engines, and an entirely new machinery equipment for the manufacture of his many inventions, owned and controlled by the Fort Wayne Electric Co, There are in use to-day of his build, 168 arc light dynamos, 75 of which are of 80 lights each; one 7,000 volt machine and 13,000 arc lamps of 1,200 and 2,000 candle-power, the majority of which are in use at the present time. He has also built a new arc circuit indicator designed to notify station superintendents of the reversal of the current. This instrument prevents the burning of the negative carbon holders due to the polarity of the current being reversed. In addition to the above, the company has put on the market, a new card mining machine built under the supervision of Mr. Wood, and in operation in the Hocking Valley mine. Mr. Wood has over 23,000 of his arc lamps in use including the 13,000 mentioned above; also 1,200 new alternating current meters invented by himself and constructed on entirely novel principles. It differs entirely from the old meters now in use in the many plants installed by this company. A full description of this meter appears in another column of this paper. Mr. Wood's new direct current power generators will be built in sizes from 5 to 160 horse-power for electric light, electric railway and general power use. His new incandescent alternating current machine will be built in sizes of from 50 to 1,600 lights capacity; also direct current motors of from one-half to 150 horse-power. His new cut-out boxes for arc circuits, a sample of which he has in the city with him, contains numerous improvements over the old style of boxes in use by the company. It is composed entirely of cast-iron on the exterior and at the base, inside, is a slab of slate, making the box fireproof. All the mechanism is contained within the box. The wires enter from the sides at an angle of 45 degrees and are connected to contact or binding-posts of very unique and novel design, the wire setting in a V shaped seat and clamped down with a cap supported by two screws. This binding-post is held in position with two screws, which is a great improvement over the old style of single screw binding-posts, as it prevents swerving or moving out of position. The draw bar for cutting in and out the circuit, pulls down with a ring depending from the bottom of the box, and acts with a positive quick break. It is of the most ingenious construction. The make and break contact pieces in the interior are held in position by a rivet at the bottom binding-post and are moved to and from the upper contacts by the action of the powerful springs on the draw bar. Five thousand of these boxes are now being made for the Thompson-Houston Electric Co. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co.	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.	3,000,000	100 00	92 00
Am. Elec Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	81 00
Asbury Park L. & P., N. J.	50,000	10 00	
Aut. Phon. Exb. Co.	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	181 50
Bell Telephone 7s	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo.	100,000	100 00	100 00
Brunswick Elec. L. & P., Me.	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y.	10,000	100 00	460 00
Brush Illuminating, N. Y.	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co.	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co.	7,716,000	100 00	122 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C.	15,000	50 00	par
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co.	300,000	25 00	25 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	30 00
Detroit Electrical Works.	1,000,000	10 00	11 00
Direct U. S. Cable Co., Ltd.	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co.	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.	5,000,000		*98
Edison Elec. Ill. 6s, N. Y.	30 000		*99
Edison Elec. Ill., Lebanon, Pa.	80,000	10 00	10 50
Edison Illuminating, N. Y.	4,500,000	100 00	76 00
Edison Elec. Ill. Co.	44,678	100 00	476 00
Edison Elec. Ill. Convt. Certs.	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	101 75
Edwards Manuf. Co., N. Y.	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y.	120.000	15 00	16 00
Elizabeth E. L. Co., N. J.	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	45 50
Essick Printing Tel.	5,000,000	100 00	30 00
Excelsior E. L. Co.	500,000	100 00	
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak.	100,000		*95
Fidelity Trust Receipts	25,000,000		47 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	par
Fort Wayne Elec. Co.	4,000,000	25 00	14 00
Fremont Elec. L. & P. & Gas Co.	75,000	100 00	125 00
G. T. Woods Mfg. Co., Ky.	2,000 000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co.	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	14 50
Guthrie Elec. Lt. Co., Ok., 7s.	15,000		*98
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co.	250,000	100 00	20 00
Hudson Electric Light, N. J.	100,000	100 00	
Hunt Engineering Co., Brooklyn, 6s	30,000	500 00	*105
Hunt Engineering Co., Brooklyn.	30,000	100 00	140 00
Interior Conduit & Ins. Co., N. Y.	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas & Elec. Light, N. Y.	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill.	50,000		*99
Kansas Elec. Co. 6s, Mo.	20,000		*98
Laclede Gas Co.	7,500,000	100 00	19 50
Laclede Gas pref.	2,500,000	100 00	60 00
Laclede Gas 5s.	10,000,000		*77
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s.	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*103
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s.			*105
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N. Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J.	17,500		*103
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	8 00
Nat'l Aut. Fire Alarm, L. L.	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	16 75
New England Butt Co.	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500		†
N. E. Tel. & Tel. Co.	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel. 6s.	1,500,000		*99
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. G. & E. Co. Certs. of Indebt	100,000		†
N. Y. Phonograph Co.	20,000		†
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio.	50,000		*95
North New York Lighting	150,000	100 00	10 00
Northern Elec. L. & P., Phila.	200,000	10 00	
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton.	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P. Co. 6s	800,000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn.	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I.	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*90
Rockaway Beach Elec. Light.	50,000	100 00	60 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston.	300,000	5 00	6 00
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s. Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co.	16,000	100 00	480 00
Swan Incandescent	800,000	100 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co.	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co.	6,000,000	25 00	49 00
Thomson-Houston pref.	4,000,000	25 00	26 25
T.-H Electric Co. 5s, Boston.	500,000		*98
T.-H. E. L. Co., Yonkers, 6s.	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50 000	100 00	100 00
Twin City Rapid Transit, N. J.	20,000,000	100 00	100 00
United Elec. Light and Power.	3,000,000	100 00	40 00
United Elec. Traction 6s.			*20
United Elec. Traction Co.	1,370,000	100 00	
United States Elec. Co.	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	50 00
Universal Arc Lamp Co.	100 000	100 00	75 00
U. S. Volta Elec. Bat. Co.	2 000,000	10 00	1 00
Utica Elec. & Gas Co. 6s.	150,000		par
Utica Elec. Light Co. 6s.	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Welsbach Inc. Gas.	10,000,000	100 00	4 00
Welsbach Inc. Gas of N. Y.	4,500 000	100 00	9 00
Western Union.	86,188,852	100 00	82 50
Westinghouse Electric Co.	7,000 000	50 00	15 00
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston.			18 50
Yonkers L. & P.	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Who that follows the stock market can fail to see the opportunity offered by the present activity in all directions, and especially in electric securities? The farmer has produced this result, and he must have light and power in the future to not only repay him for his present fortunate position, but to urge him on to greater and continued efforts. There can be but little inside manipulation with the expense and income of the electric industry, with the possible exception of a few—a very few—advanced corporations, and their tether is short. All others depend on local demand and supply, for while a company may monopolize everything electrical used for public purposes in a city, they will soon find that that city is the limit. Even admitting that the general government may purchase the whole telegraph and telephone interest, there is every other application left for local people to invest in. It is time to lay in electric bonds and secure stocks before they are watered and join in the grand army of those who live on an income which will, in the United States, double itself every fourteen years. I say now is the time to invest. There is no trouble about choosing; not half as much as for a hat or for a pair of boots. Read the Electrical Age, and then if you do not see what suits your purse or pleasure, ask for it. You can be fitted on all but price, and that the present owner must settle on; but bonds paying from five per cent. to seven per cent. and shares at from fifty per cent. to par give a wide margin. Dividends can all be collected for a two-cent stamp in any business centre and the transfer made at any New York bank, if you so elect. Do not delay and then blame me, for I will turn back to this and kindred articles in the Electrical Age and turn a current on which will convince you even against yourselves. Invest in electrics, and now.

In the general advance along the whole line of Stock Exchange securities, electrics keep pace with the best. It is a financial shame that there are not over twenty of the electric corporations with the

largest capital listed on the New York Stock Exchange. That they would be actively dealt in goes without saying. Of course the reason is that they pay big dividends, but that is no excuse for a few to get all the benefits. Set up your price as high as the Chemical Bank, if you like, but let the public in.

A great deal of money is being lost by somebody in torpedo experiments, and at the end of each, somebody's purse finds but little advance in the line of destruction. To be sure, a torpedo loaded up with dynamite may be sent out and exploded under an enemy's ship in some cases, but before putting any great amount of money into the scheme, is it not just as well to exhaust the opponent's remedies? I think there is one point which has been overlooked entirely, and that is to oppose the advance of the destroyer with a bomb exploded in front of it. If the concussion at fifty feet distance will sink a large vessel, will not a very few pounds of dynamite, exploded a few feet under water, produce sufficient concussion to explode the torpedo long before it can do any harm? Small bombs cost less money than big torpedoes, and it would be a poor gunner in the main-top or crow's-nest who could not drop a shell within a short distance of an object coming toward him at a speed of twenty or thirty miles an hour only. Decent shots all over the land confidently wait for and rely upon a single shot at short range; why should the incident differ on or under the water? I should like to hear from some of the torpedo inventors and promoters on the above. Besides this, from a strictly financial point of view there is but one customer—the government, and international courtesy has not yet reached a standard whose admirals or other officers, afloat or ashore, will respect a patent. No one man can construct and transport an effective torpedo, consequently no secrecy can be maintained. I don't see my way clearly to recommend investment in coast-defending torpedo companies, unless Congress authorizes a loan for that purpose.

WESTERN NOTES.

The Central Electric Company, Chicago, reports that eight of the large buildings now being constructed in Chicago, to contain in the aggregate 14,200 incandescent lamps and 650 arc lamps, are being wired with Okonite wire.

Mr. E. L. Debell, manager of the Sheboygan Electric Lighting Co., of Sheboygan, Wis., gives notice that the plant and property of that company are now owned and operated by the German Bank of Sheboygan, Wis., dating from September 1, 1891, under a sale made pursuant to decree of the Circuit Court for Sheboygan County August 24, 1891, and confirmed September 3, 1891. Until disposed of, the same will be so operated by German Bank under Edwin L. Debell as manager.

The Great Western Electric Supply Co., 203-209 S. Canal st., Chicago, has just completed the delivery of the steel poles for the Citizens Street Railway Co., Indianapolis, Ind., the contract for which the company was awarded a few months ago. The Citizens Street Railway Co. expresses great satisfaction with its poles, and considers them an ornament to the streets through which the lines pass.

The Great Western Electric Supply Co., Chicago, reports large sales of K. K. wire in the central and western districts. Among them are sales to the Citizens Street Railway Co., of Indianapolis, Ind.; Des Moines Street Railway Co., Des Moines, Ia.; the Eau Claire Street Railway Co., Eau Claire, Wis., and the Des Moines Water Power Co., Des Moines, Ia. It is admitted by street-railway men in general that a thorough insulation is absolutely necessary to mains and feeders, and the best results are always secured by the use of K. K. in such places. The Great Western Electric Supply Co. is sole Western agent for this wire, and is filling orders very promptly.

BUSINESS NOTES.

Any one in search of a well-equipped shop or factory, especially adapted to the manufacturing of electrical instruments, will do well to apply at Room 70, third floor, 45 Broadway. The yearly rent, considering location, is exceedingly reasonable, or the factory can be bought outright.

J. W. Parker & Co., Philadelphia, Pa., representatives of the Ball Engine Co., Erie, Pa., are installing a 100 H. P. engine, built by that company, in the station of the Citizens' Electric Illuminating Co., Pittston, Pa.

The California Electric Light Co., San Francisco, Cal., is adding to its already immense power plant a 300 H. P. Cross Compound engine, built by the Ball Engine Co., Erie, Pa.

W. F. & F. C. Sayles, Saylesville, R. I., are installing an isolated electric-light plant. A 35 H. P. engine, furnished by the Ball Engine Co., Erie, Pa., supplies the necessary power.

The Falconer Mfg. Co., Falconer, N. Y., has purchased a 150 H. P. engine for running an electric-light plant and for operating its works. The engine was manufactured by the Ball Engine Co., Erie, Pa.

In the office of The Ries Electric Specialty Co., at Baltimore, hangs a magnificent set of resolutions, framed elaborately, which was presented to its President, Mr. Elias E. Ries, and Vice-President, Lew. S. Greensfelder, by the Board of Directors, recently. These resolutions were presented to the above-named gentlemen for their untiring efforts in behalf of the introduction of the new Regulating Socket for incandescent lamps, which was shown for the first time at the exhibition of the National Electric Light Association, held in Montreal, Canada, September 7–16 last. On each side of these resolutions hang the photographs of the members of this convention, which were taken in front of the Windsor Hotel. The display looks neat, and the company looks upon it as a valuable souvenir of this convention, where the Regulating Socket received its introduction and was pronounced the feature of the exhibition.

The Ball Engine Company, of Erie, Pa., reports the following orders for its engines and accessories.

The Palace Hotel, San Francisco, Cal., a 200 H. P. Cross Compound engine, for its electric-light plant. (The Palace Hotel is now using a 100 H. P. Tandem Compound Ball engine with satisfaction.) The Patent Brick Co., San Francisco, Cal., a 150 H. P. Tandem Compound Condensing engine, one 200 H. P. Stewart Purifier and Heater, and one 200 H. P. Wheeler Independent Pump and Admiralty Surface Condenser. Mr. H. Bloomfield, San Francisco, Cal., a 150 H. P. Compound Condensing engine. The same company has shipped to the World's Fair one 60 H. P. engine for operating the incandescent electric-light plant on the grounds, and a 25 H. P. engine of the same company's make is being installed in the Wesleyan University, Middletown, Conn.

The Johnson Co., Johnstown, Pa., has recently ordered from the Ball Engine Co., Erie, Pa., a 60 H. P. engine, being the 22d engine built by it for the Johnson Company, aggregating over 3,000 H. P.

Mr. E. G. Gilbert, Atchison, Kan., representative of the Ball Engine Co., Erie, Pa., is erecting a 40 H. P. steam plant, consisting of engine, boiler, heater, pump, etc., for the Norfolk Street Railway Construction Co., Norfolk, Neb. He also set up a 35 H. P. engine for the Norfolk Beet Sugar Co., Norfolk, Neb.

The Hine Eliminator Company, 106 Liberty street, New York, reports an increased number of orders for its well-known eliminator. The Hine eliminator, for expelling oil, grease and grit from exhaust and entrained water from live steam, is well known among engineers to do the work claimed for it. It has been some time since they were first placed on the market, but they have never failed to give satisfaction wherever installed.

James F. Hotchkiss, 112 Liberty street, New York, has just issued an illustrated catalogue describing his well-known mechanical boiler-cleaner. The principle upon which the cleaner works is fully shown, and a large number of different kinds of boilers, with the cleaning apparatus in position, are illustrated. The little book, which consists of nearly 100 pages, contains valuable information regarding boilers and boiler-metal, and many valuable recipes, tables, etc.

Benj. Blum, export agent of the Wenstrom Consolidated Dynamo and Motor Co., Kemble Building, New York, has taken an order for and shipped one 450-light direct-current dynamo for an isolated plant in Montreal.

The Toronto Construction and Electrical Supply Company, Toronto, Ont., is now handling Vulca ducts and appliances, and also Grimshaw White Core and "D B" wires, tapes and compounds, manufactured by the New York Insulated Wire Company, 649 and 651 Broadway, this city.

IN USE TWENTY YEARS.

Ogden, Utah, Aug. 14, '91.

Jerome Kidder Mfg. Co.:

Sirs: I have now in use one of your batteries that I have now used for over twenty years. The machine is in as good working condition as when I first got it from you, with the exception that the platina plates are corroded and will have to be replaced with new ones. I will have to ask you to send same by mail.

Hoping to hear from you at your earliest convenience,

Very respectfully, Jas. C. Whitehill, M.D.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued October 10, 1891.

460,548. Safety-Plug. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed Dec. 1, 1890.

460,572. Printing-Telegraph. Moses G. Farmer, Eliot, Me. Filed May 15, 1891.

The combination, in a printing-telegraph mechanism, with a primary battery, step-by-step mechanism adapted to reverse the current, and keys for reversing the order of the connections of any part or branch of the battery-circuit controlled by the step-by-step mechanism, of a secondary line-circuit in inductive relation to the primary circuit and a polarized magnet or relay therein for actuating the step-by-step mechanism.

460,587. Electric-Arc Lamp. Hosea W. Libbey, Boston, Mass. Filed Jan. 12, 1891.

The combination of a saddle for carrying the carbon-holder, the saddle-rod having a screw-thread thereon, the



460,650.—MILLIAMPERE-METER.

upper end of the rod being square, a spiral disc carbon journalled in the saddle, a pencil carbon, and mechanism for operating the same to keep the carbons a suitable distance apart.

460,595. Arc-Lamp Pencil. Isaiah L. Roberts, Brooklyn, assignor to the Roberts-Brevoort Electric Company, Limited, New York, N. Y. Filed March 10, 1890.

460,596. Electrode for Arc Lamps. Isaiah L. Roberts, Brooklyn, N. Y. Filed March 6, 1891.

460,597. Electrode for Arc Lamps. Isaiah L. Roberts, Brooklyn, N. Y. Filed March 18, 1891.

460,599. Electrode for Secondary Batteries. William A. Rosenbaum, Jersey City, N. J. Filed Dec. 31, 1890.

460,606. Electric Conductor. William Vogler, Somerville, Mass. Filed Nov. 9, 1889.

An electric conductor consisting of two branches or wires, an independent semi-cylindrical insulation for each branch, and a re-enforcing strip interposed between the branches, upon the opposite sides of which the flat surface of the insulation rests, and an outer covering of insulation enveloping the branches, and a re-enforcing strip to secure the parts in place.

460,607. Conduit for Electric Wires. William Vogler, Somerville, Mass. Filed Feb. 25, 1891.

A conduit for electric wires or cables, consisting of a series of sections abutted together end to end and a series of surrounding shields held in place thereon by clamps.

460,614. Regulating the Speed of Electric Motors. Merle J. Wightman, Scranton, Pa. Filed Feb. 28, 1891.

460,618. Electric Switch. Charles Wirt, Chicago, Ill., assignor to the Electrical Supply Company, of Illinois. Filed Jan. 10, 1891.

In a circuit-breaker, the combination of a central rotating portion with extended spring-arms, contacts having faces concentric with it, and similar contacts having faces eccentric with reference to the centre of the rotating part and having faces exposed to the arms, one pair of contacts being connected with the electrical circuit to be controlled.

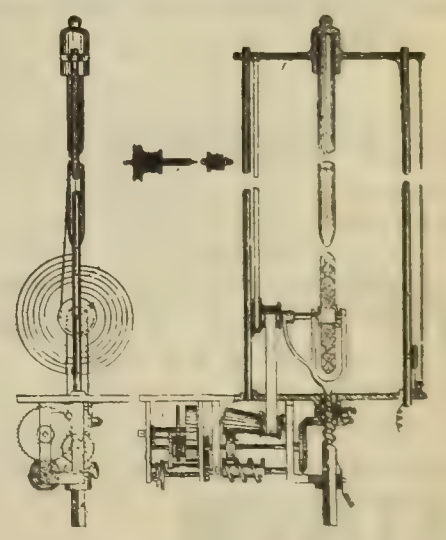
460,619. Steno-Telegraphic Apparatus. Alexander Wood, Philadelphia, Pa. Filed Dec. 7, 1886.

460,650. Millampère-Meter. Lyman D. McIntosh, Chicago, Ill. Filed Sept. 5, 1890.

460,652. Globe-Protector for Electric-Arc Lamps. Edward J. Openlander, St. Louis, Mo., assignor of one-third to John C. King, same place. Filed March 14, 1891.

In an electric lamp, the combination of a shade and a guard, the shade having the usual opening at its bottom to connect with a cup which supports the shade and carbons, and the guard being dished in shape and having a central opening and resting upon the bottom of the shade, with its central opening connecting directly with the shade-opening.

460,674. Illuminating-Balloon for Advertising Purposes at Night. Augustus Gross, Sydney, New South Wales. Filed April 25, 1891.



490,587.—ELECTRIC ARC LAMP.

460,676. Message-Recording Instrument. Albert Storer, Boston, Mass. Filed Jan. 27, 1891.

The combination of an actuating-train, a starting-magnet and its armature, a main and an auxiliary stopping device for the train, one of which is controlled by the armature and the other by the train in running, and a controlling device which causes or permits the main and auxiliary stopping devices to co-operate and stop the actuating-train after the

circuit has remained in its normal condition a longer time than the longest time that the circuit remains in its normal condition during the transmission of any signal.

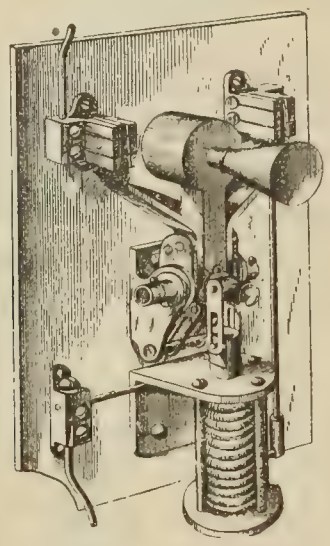
460,680. Arc-Lamp Electrode. Hosea W. Libbey, Boston, Mass. Filed Oct. 17, 1890.

A carbon electrode for arc lamps, consisting of a hollow cylindrical carbon, the upper end of which is at right angles to its side and its lower end of spiral form.

460,695. Electrically-Controlled Cutting Device. Le Roy S. White, Waterbury, Conn., assignor to himself and Samuel A. Chapman, same place. Filed Jan. 16, 1891.

460,701. Automatic Safety Cut-Out. William B. Cleveland, Cleveland, Ohio. Filed June 8, 1891.

The combination of a contact, a pivoted arm, and a switch-tongue engaging the contact and pivotally connected to the pivoted arm at a point a distance from the axial line of the fulcrum of the same.



460,701.—AUTOMATIC SAFETY CUT-OUT.

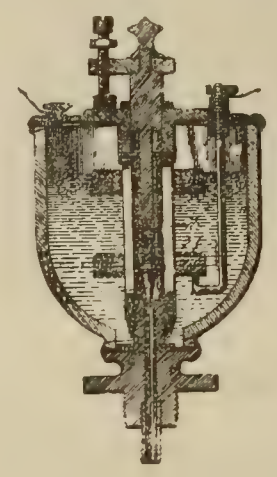
460,725. Insulation for Electric Wires. John R. Markle, Detroit, Mich. Filed Nov. 24, 1890.

In combination with an insulating base having scarfed end projections, a pair of wires extending longitudinally of the base and at some distance from each other, female contact-plates located in the projected scarfed end of the base and communicating with the parallel wires, and the male contact-plates projecting from the shoulder of the opposite scarfed end of the base, the male contact-plates having communication with the ends of the wires opposite the female contacts.

460,765. Composition for Insulating Material. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 5, 1889.

An electrical insulating composition consisting of a fibrous mineral insulator, as a base, a cementing insulating substance, such as rubber, and a lubricator consisting of an insulating material.

460,767. Central-Station Apparatus for Call-Boxes. Edmund R. Wilder, Kansas City, Mo. Filed Jan. 2, 1891.



460,895.—ELECTRICAL ALARM.

The combination of a registering mechanism, a metallic circuit from the box to the station, a register-controlling device in such station, a starting-battery at the central station, and a ground-circuit from the station to the box, the metallic portion of which is the metallic connection from the box to the station, and which circuit includes the starting-battery and a battery-changer, whereby the starting-battery is switched out after a momentary connection and a signalling-battery switched in.

460,771. Telegraph Block System of Railway-Traffic Control. David C. Coombes, Lewisham, near Sydney, and William Rowe, Marrickville, near Sydney, New South Wales. Filed June 19, 1891.

In telegraph systems of railway control, the combination, with the operating device of the telegraph-transmitter or block-instrument, with insulated rails at either end of a block-section, and with an additional or error signal, of make-and-break connections, electric alarms, electric batteries or generators in the signal-boxes, and line-wire connections between the parts, all arranged and adapted to complete an electric circuit and give alarms on the entry of a train into a blocked section.

46 ,779. System of Electrical Signalling for Railroads. Simon de Jager and Albertus Zoutman, Denver, Colo. Filed April 25, 1891.

460,831. Iron or Steel Telegraph or other Post. William E. Pedley, Prescott, Ariz. Filed July 24, 1891. Patented in England, France and Belgium.

460,864. Automatic Electric Switch-Indicator. Everest W. Hadley, Corvallis, Oreg. Filed Jan. 7, 1891.

An automatic circuit opener and closer, consisting of an insulating-body divided longitudinally in two halves, each of which is provided with a groove and a pocket, insulator-cup likewise divided longitudinally in two equal parts, each half provided with registering grooves to provide a bed for the wires a button-rod mounted in the grooves in the case and extending into the hollow of the cup and carrying on its inner end the circuit opener and closer and a washer, circuit wires imbedded in the insulating-cup and coiled at their outer ends, while their inner ends are placed to form a contact with the circuit-closer when the button-rod is not compressed, and casings adapted to snugly house the insulating case and cap.

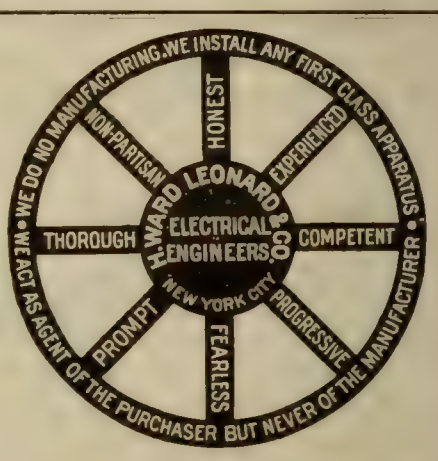
460,895. Electrical Alarm. Homer P. Smith, Neenah, Wis. Filed March 24, 1891.

460,926. Core for Electric Solenoids. John T. Williams, Mount Vernon, assignor to the International Portelectric Company, New York, N. Y. Filed Dec. 18, 1890.

The combination, with a coil, of magnetic core movable axially through the coil and composed of a series of members of different lengths and varying diameters, which are fitted one within the other in metallic contact.

460,933. Machine for Casting Grids. Albert F. Madden, Newark, N. J. Filed May 25, 1891.

The process of making grids for secondary batteries, which consists in placing a suitably-recessed mould in communication with a superincumbent body of molten metal and simultaneously therewith subjecting successive portions of the metal to the pressure of a roller within the body of metal, whereby metal from the mass is driven into the mould cavities.



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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, OCTOBER 24, 1891. No. 43.

FRICTION CLUTCHES.

The installation of electric light and power plants and the generation of electricity are scientific problems that have been largely simplified by proper attention to mechanical details, and to-day the shafting and pulleys receive as much care and thought as the dynamos and engines.

Among those who have paid particular attention to this part of a station is D. Frisbie, M.E., of the D. Frisbie Co., 112 Liberty street, New York. Some years ago this gentleman invented a friction-clutch pulley that would transmit many horse-power and could be started and stopped by a few pounds pressure. This was operated by an arm. Many improvements have been made in these clutches, making them more powerful in action and simpler to operate. The pulley or clutch runs loose on the shaft, allowing the engine shaft to run at its full speed at all times if so desired. Strong massive arms on one side of the clutch-pulley and powerful bolts on the other side of the pulley-ring are brought into positive contact with the ring (see Figs. 4 and 5) by a few pounds pressure on the clutch-lever, making the pulley as effective as if keyed to the shaft. No lubrication is used on the clutch-pulley's friction surfaces.

The cuts 1, 2 and 3 represent the graphite and bronze bushing which the Frisbie Company has used in its pulleys for several years with perfect success. The castings are made with a spiral core, and, after being bored to size, are filled with the graphite by a patented process.

The bushings will run at high speed without oil, but oil will not injure them. In cases where the pulleys stand on a running shaft, and where there is any danger of its not being properly oiled, this makes a safety bushing.

Fig. 6 shows a system of clutch-pulleys and shafting now being installed by the Frisbie Company in the dry-goods establishment of Bloomingdale Bros., this city. The isolated electric plant in this building is undergoing extensive alterations, and these clutches will be one of the features of the new installation. The electric-light plant, when completed, will consist of five Edison dynamos, and the steam-plant of two Fishkill-Corliss engines of 275 and 150 horse-power. The clutch on the first engine is 46 x 38 inches and of 275 horse-power, and that on the second 42 x 28 inches, and of 150 horse-power. Each of the five dynamos will have a 75 horse-power clutch 16 x 14 inches. The shaft is 5½ inches in diameter. The plant was started a few days ago.

This company's clutches are used in the arc light central station, Utica, N. Y., the New Haven Electric Light Company's station, New Haven, Conn., and numerous other central stations, and the clutch is said to be one of the best made for electric-railway work.

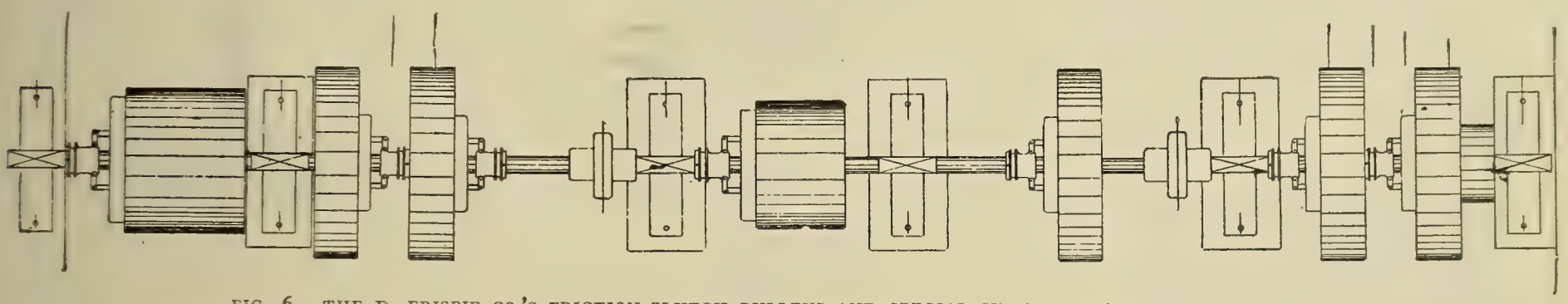


FIG. 6.—THE D. FRISBIE CO.'S FRICTION-CLUTCH PULLEYS AND SPECIAL SHAFTING FOR ISOLATED PLANTS.

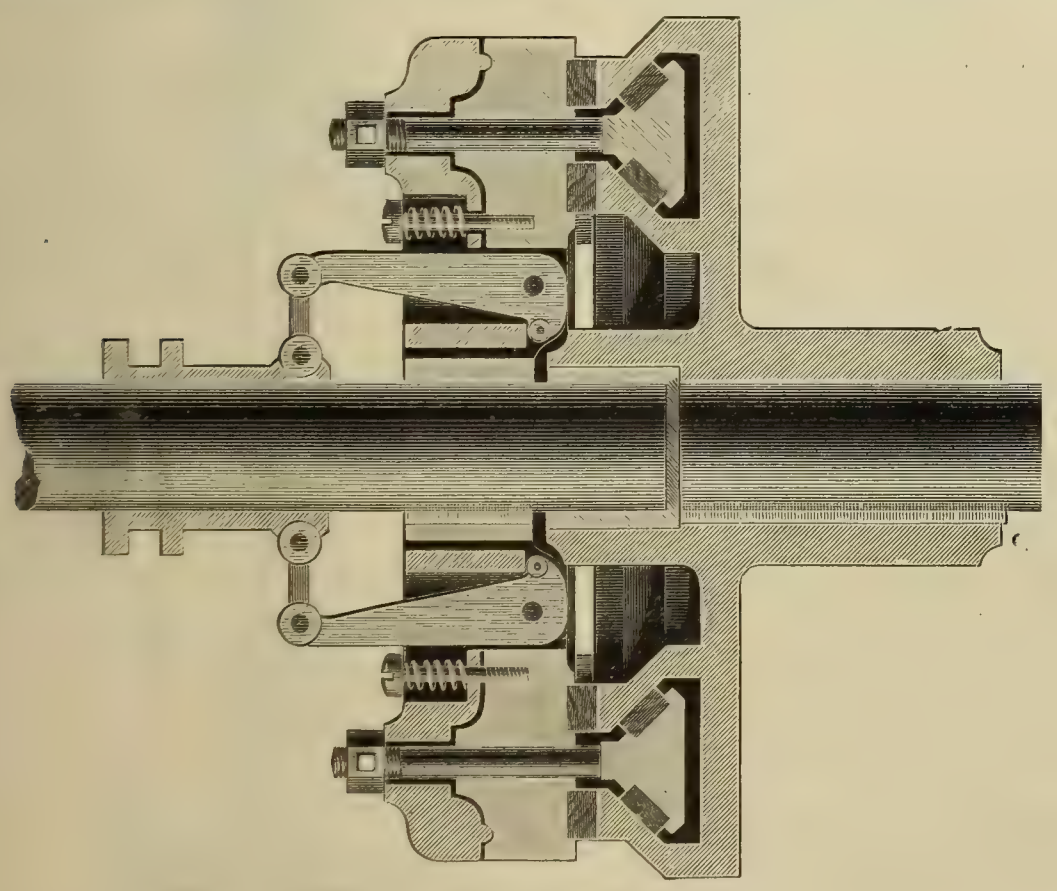


FIG. 4.—CUT-OFF COUPLING WITH IMPROVED LINK-MOTOR.

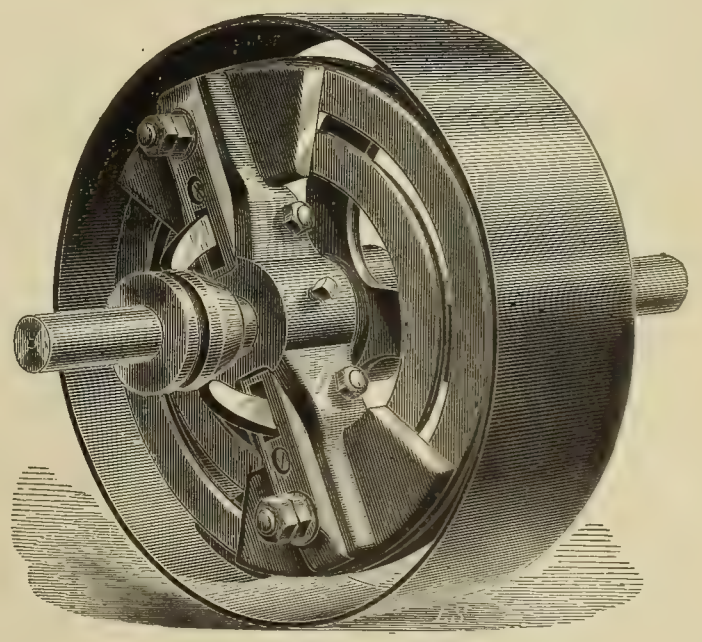


FIG. 5.—FRICTION-CLUTCH PULLEY.

FOREIGN NOTES OF INTEREST.

The plant recently installed in Odessa, Russia, by the Thomson-Houston International Electric Company for lighting the harbor, is now in full operation. The installation includes 64 arc and 8 incandescent lamps.

An express train between Berlin and Frankfort has been fitted with electric lights supplied by storage batteries underneath the car floor. The lamps in each coach are placed on two distinct circuits, connected with two separate storage batteries, so that in case of accident to one circuit, or on changing batteries, the coach shall not be entirely without light. The cells have a capacity of 200 ampère hours.

A LARGE BOILER.

A boiler has just been installed in the new Edison electric light and power station, Cincinnati, Ohio, which is claimed to be the largest in the world. It is an upright boiler, thirty-five feet high and fourteen feet in diameter, including the tubes. With the tubes and jacket it measures sixteen feet in diameter.

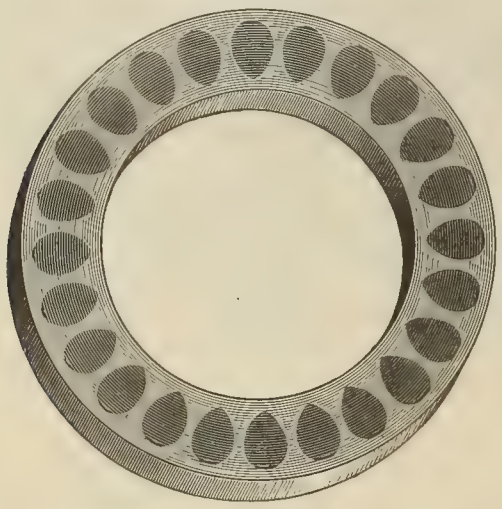


FIG. 1.—GRAPHITE BRONZE BUSHING.

The shell is made in sections, each one of which is of rolled steel an inch thick and lap-welded. There is also an inside shell, less heavy in construction. Into the main shell extend 725 tubes, which are fastened by expansion, or by creating a burr. Each one of these tubes is three inches in diameter, and the aggregate length of the 725 is nearly two miles. The tubes are bent and re-enter the cylinder on a level about eighteen inches higher than that from which they start. Inside the outside cylinder is another, extending to a little below the normal water-line, and open at its upper end, from which short tubes are led, fitting loosely into the lower ends of the curved tubes. The feed water is introduced into this inner cylinder, and passing outward into the

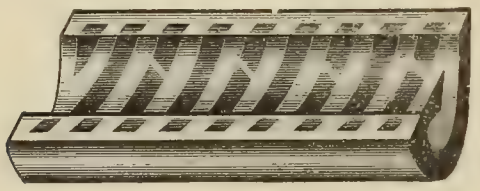


FIG. 2.

curved tubes, in which a rapid circulation is maintained by reason of their upward course and the intense heat by which they are surrounded, is discharged into the annular space between the inner and outer cylinders as a mixture of water and steam.

A continuous and rapid circulation is thus kept up, the movement being downward in the centre cylinder and upward in the intermediate space. In that portion of the central drum before the fire-level is afforded a settling-space for sediment, access to which is afforded by a full-sized man-hole, and which, presenting no complexity in construction and surfaces without braces, can readily be cleaned. In the main cylinder, a short distance above the water-level, is inserted a deflector plate, which tends to throw back any water which may be carried by the steam, and a series of diaphragms divide the cylinder above, so that the steam in leaving the boiler is

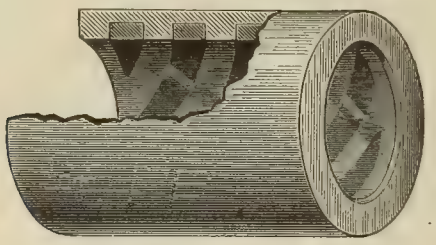


FIG. 3.

compelled to pass successively through a number of the heating tubes in the upper portion of the boiler and to become thoroughly dried or even superheated.

The fire-box surrounds the large cylinder, and is annular in form. It is lined with fire-brick. The fire-box contains a revolving grate and four fire-doors, and the feeding is done by hoppers. The capacity is rated at 800-horse-power, and the shell will stand a pressure of 190 pounds to the square inch. The heating surface is some 8,000 square feet. Under ordinary conditions about 9,000 pounds of coal per hour will be used.

ELECTRO-CALCIUM LIGHT.

Theatrical managers have been looking for a long time for an electric focussing-lamp adapted for stage lighting, to take the place of the old-time calcium light. Lamps used heretofore have not been satisfactory on account of complicated mechanism, unsteadiness and unsuitable mounting for stage work.

The Scott Electrical Manufacturing Co., of New York, has developed a focussing-lamp which fills all the requirements. Mr. Martin Kreuger, of Chicago, the Western agent for the company, has adapted to the lamp apparatus for stage and front lighting which produces the most brilliant effects. This gentleman's ingenuity in the matter of scenic effects is deserving of the highest praise; his large experience with the Chicago Calcium Light Co. and thorough familiarity with stage requirements have well fitted him to develop this new application of electric light. A large number of lamps have been placed in Western and Eastern theatres — the Chicago Opera House; Duquesne Opera House, Pittsburg, Pa.; Amphitheatre Auditorium, Louisville, Ky.; Grand Opera House, St. Louis; Baldwin's Theatre, San Francisco; New York Casino, Union Square Theatre, and now the Broadway Theatre, New York. Francis Wilson was so well pleased with the effect at the Chicago Opera House during a recent visit that he directed his business manager, Mr. Richardson, to commission Mr. Kreuger to come to New York and install 8 lamps in the Broadway Theatre. This

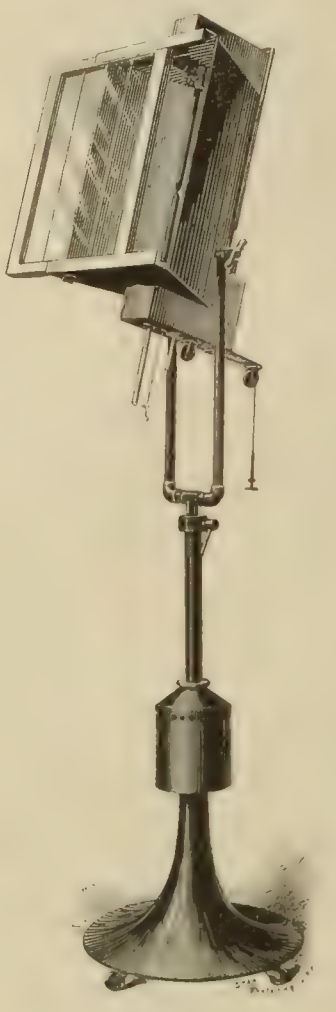


FIG 1.—COLOR-BOX.

Mr. Kreuger has done during the past week, and the aggregate of 50,000 candle-power illuminates the "Merry Monarch" and company more brilliantly than has ever before been seen in the history of stage lighting.

Much of this success is due to valuable suggestions offered by Mr. James Stewart, the able electrician of the Metropolitan Opera House and Broadway Theatre. Many orders are in hand for these lamps for various theatres throughout the country. The Scott Co. also manufactures a lamp for photo-engravers which is used by the principal artists in that line.

The Huntington search-light, made by the same company, is in use on a number of steamers, yachts, etc. A number of theatres have recently purchased these lights to place on towers for the purpose of attracting attention. The Madison Square Garden, Star Theatre, of New York, and some Western theatres make use of it in this way.

The new series lamps made by this company are an innovation in arc lamps, and orders are in hand to warrant the company increasing facilities for manufacture.

WATER-MOTOR INSTALLATION.

One of the finest examples in Europe of water-power utilization in connection with alternating currents is the new electric station which is being established at Tivoli, near Rome. As is well known, there is at the town of Tivoli a large and valuable supply of water-power, and recently a portion of this has been utilized in the establishment of a large alternating-current station for 2,000 H. P., intended to supply a portion of the city of Rome with electric light. A part of the Falls of Tivoli is conducted along an aqueduct, at the extremity of which the water falls into a large iron fall-tube 1.6 of a metre in diameter. This fall-tube is 48 metres in vertical height, and has a capacity for delivering three cubic

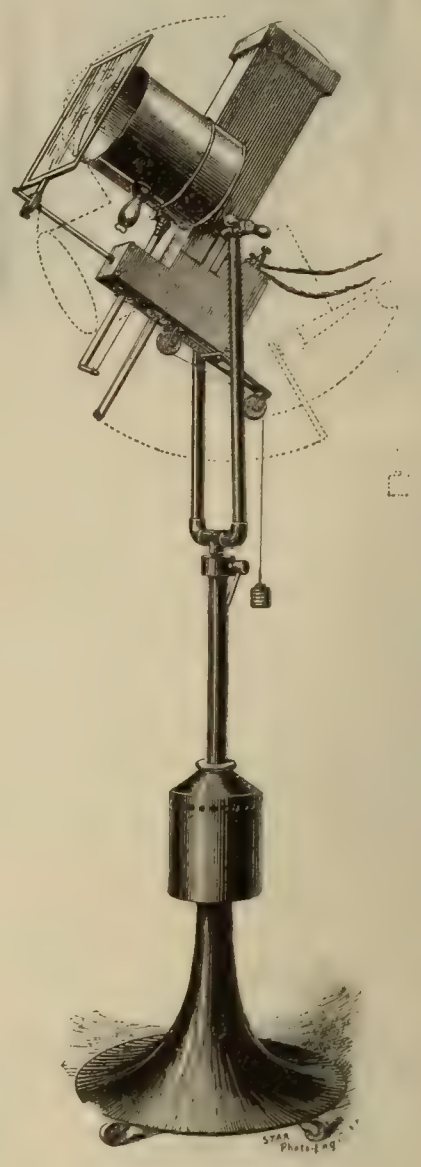


FIG. 2.—LENS-BOX.

metres of water per second. At the lower level of the fall-tube the electric station has been erected on the side of the hill, and the fall-tube, terminating near it, branches into three secondary supply tubes, which convey the water into the building. Each of these branches feeds three Pelton water-wheels, two of which are about 300 or 400 H. P. and one smaller.

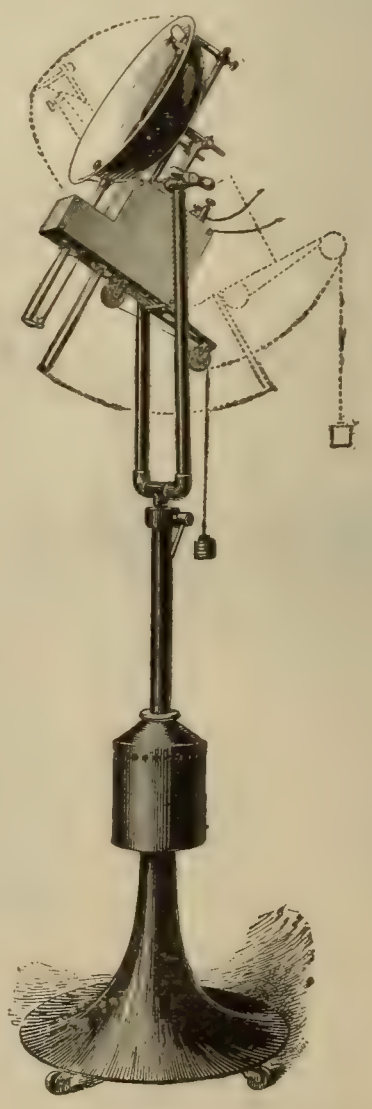
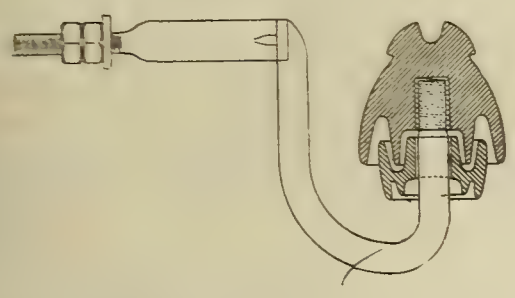


FIG. 3.—GALLERY REFLECTOR FOR FRONT LIGHTING.

The six larger Pelton wheels are coupled direct to 350 H. P. Ganz alternators. The supply of water to each wheel is governed by hydraulic inlet valves

which are worked by a sensitive hydraulic relay, the relay being set in operation by a centrifugal governor. By this means the speed is automatically kept constant, independent of the working of the machine. In addition to the six 350 H. P. alternators there are three other direct-current machines used as exciters, which are also driven direct from the smaller Pelton wheels. Each alternator is designed to furnish current at 5,000 volts pressure and 45 ampères. The machines will be driven at a speed of 170 revolutions per minute. The alternating current so generated is to be transmitted to Rome, a distance of 25 kilometres, by means of four stranded copper cables, each being 100 square millimetres in cross-section, and capable of carrying 120 ampères, carried overhead on iron poles placed 35 metres apart, and about 30 feet high, insulated by means of double-shed oil insulators, specially designed for this work by Prof.



DOUBLE-SHED INSULATOR.

Mengarini. The lower part of the insulator can be lowered to remove or renew the oil, and when raised into place it keeps the flanges of the upper part wet with oil, and yet renders it impossible or difficult for insects to get round into the interior. A drop of 1,000 volts, or 20 per cent., is to be allowed in these lines. At the far end of the trunk mains the pressure will be reduced by step-down transformers to 2,000 volts, and distributed underground by Siemens cables to secondary centres, at which it will be again reduced to 100 volts. The six machines are all capable of being worked together in parallel, the maximum number of five being used together, and one machine being always in reserve. Two of the exciters are sufficient to supply exciting current to the whole of the dynamos, the third being a reserve.

ELECTRICAL CENSUS.

The following is a copy of a letter from Mr. R. P. Porter, Superintendent of Census, to Hon. J. W. Noble, Secretary of the Interior, in regard to the prosecution of the electrical census work, which is self-explanatory, and it pays an excellent compliment to the influence of the National Electric Light Association:

DEPARTMENT OF THE INTERIOR,
CENSUS OFFICE,
WASHINGTON, D. C., October 5, 1891.

SIR: I have the honor to acknowledge receipt of your communication of date September 30, requesting me to "reconsider and report upon the inclosed memorial of the National Electric Light Association, sent down by the President," together with your reference to a letter from the Honorable the Postmaster-General, of date October 1, touching the same subject, and respectfully submit the following information in relation thereto:

The wonderful advancement of the electrical science, both in invention and successful application, occurring during the last decade, induced this office upon the solicitation of the National Electric Light Association and other interested parties to institute preliminary inquiry thereinto, being the first investigation of that subject ever made under federal authority or by any other government. For this purpose Mr. Allen R. Foote, an electrical expert and author of national reputation and a most worthy gentleman, was strongly indorsed by the National Electric Light Association and a large number of representative firms and public men. He was appointed December 4, 1889, and has been indefatigable in his efforts to push the work to completion.

It is proper to observe, however, that when it was decided to investigate this subject it was not contemplated that the scope of the inquiry would extend beyond certain defined limits common to the special branches of productive industry. Subsequently, however, upon consultation with gentlemen interested in this subject, the schedules were so broadened as to cover details that were regarded as necessary properly to present the condition of these important industries, and the questions contained in the schedules were approved by the National Association as well as by electrical experts and others.

Electrical science being a newly-applied industry, the cost of the investigation could not possibly be estimated with accuracy nor even approximated, but as it progressed the expense, present and prospective, was found to be so great that I felt unwilling to divert funds from other branches of census work and employ them in behalf of an industry, however important, which would inevitably entail larger outlay than could possibly have been anticipated.

To meet this emergency a bill was introduced at the last Congress providing an appropriation of $50,000, to be expended specifically in making inquiry into the electrical art and industries, but it failed to pass. It then became imperative to secure, if possible, the necessary returns by correspondence; and although every effort had been made in this behalf, the project did not yield satisfactory results. The reason for this failure is peculiar and anomalous. While the parties engaged in the various branches of electrical industries were entirely willing to supply information called for, they frankly admitted that they did not possess the technical knowledge incident thereto, and hence none but experts could secure the same in any other way save by personal visit to each plant.

Hence it was determined to postpone further investigation until the Fifty-second Congress should assemble, thus relieving the Census Office temporarily of further expense in the premises, and accordingly an order issued to that effect.

Upon the representations, however, of Special Agent Foote, concerning the non-advisability of completely suspending the work, this order has been countermanded. The inquiry will henceforth be conducted by correspondence, so far as the same may be found practicable, with the aid of one special agent in the field.

It should be borne in mind, however, that similar action of temporary suspension was taken with reference to all other special branches of productive industry. It was also found that the outlay required to complete the collection, examination and tabulation of the manufacturing returns was so large as to render it impracticable to assign to this branch a sufficient amount from the funds remaining on hand to complete any part of the statistics of manufactures. Hence I have been impelled to apply the remainder of the appropriation to the completion of the population statistics and such other branches of census investigation as could, without great expense, be immediately concluded, and meantime defer publishing the statistics of manufactures, simply maintaining the current work of that division until after the meeting of Congress and additional appropriation shall have been secured.

No one more than myself appreciates the high importance and value of the investigation into the electrical art and industries in connection with the presentation of census statistics comprising all other productive industries of the country.

Prior to entering upon the electrical inquiry the Division of Transportation had been charged with the collection of statistics relating to telegraphs, telephones and electrical railroads, and the Division of Vital Statistics trenched somewhat upon the electrical lighting and surgical domain. These inquiries have been eliminated from other divisions and committed as an entirety to the Division of Manufactures, and assigned to the branch of special investigation into the electrical industries, thus materially adding to the cost as contemplated for the original inquiry.

In order that some idea may be formed of the great extent and value of the work now involved in the census inquiry concerning electrical industries, it may be important to state that there have been prepared for the collection of statistics for the electrical industries for the Eleventh Census, 19 schedules and as many supplements, covering the following subjects:

1. Schedules for Preliminary Information.
2. Schedule for Educational Institutions giving a course in Electrical Engineering.
3. Electric Light and Power Stations.
4. Manufactures of Electrical Apparatus and Supplies.
5. Isolated Electric Light and Power Plants.
6. Commercial Telegraph Companies.
7. Commercial Telephone Companies.
8. Steamboat Electric Light and Power Plants.
9. Municipal Electric Light and Power Stations.
10. Uses of Electricity in Medicine and Surgery—Manufactures of Apparatus.
11. Uses of Electricity in Medicine and Surgery—Medical Colleges.
12. Uses of Electricity in Medicine and Surgery—Hospitals.
13. Uses of Electricity in Medicine and Surgery—Physicians.
14. Municipal Fire Alarm Telegraphs.
15. Municipal Police Patrol Telegraphs.
16. District Messenger Companies.
17. Uses of Electricity in Mining.
18. Telegraph Lines used by Steam Railroad Companies.
19. Electric Street Railroads.

There have also been issued about 50 different forms of printed letters of inquiry and transmittal, besides numerous typewritten and form letters.

In addition to the statistics provided for by these schedules, statistics are to be collected by letter or by personal application on the following subjects:

1. Scientific Electrical Instruments.
2. Ocean Telegraphs.
3. Electrical Distribution of Time.
4. Uses of Electricity by the United States Government.
5. Electrical Tabulating Machines and Registers.
6. Electroplating.
7. Electro-Metallurgy.
8. Electric Welding.
9. Special Uses of Electricity by Steam Railroads, such as:
   (*a*) Telegraphing from Moving Trains.
   (*b*) Special Uses of the Telephone.
   (*c*) Block and Road-crossing Signals.
   (*d*) Electric Head-lights.
   (*e*) Electric Train Brakes.
   (*f*) Electric Train-lighting.
   (*g*) Uses of Electric Motors for Operating Drawbridges, Turn-tables, Travelling Cranes, Hoists and Telpherage.
10. Electrical Patents issued by the United States.

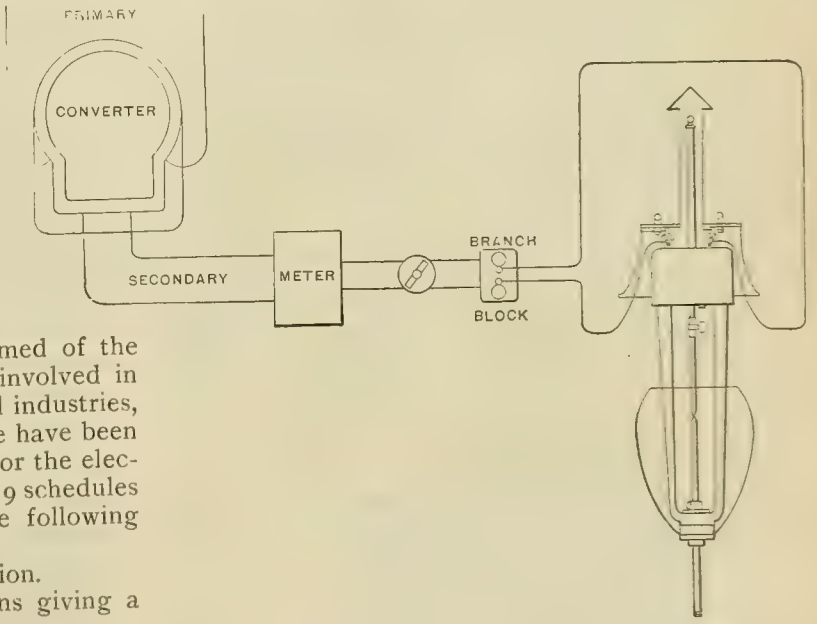
All advices received by me concerning the inquiries comprised in the schedules prepared under the direction of Special Agent Foote express the conviction that they are skilfully drawn and thoroughly adapted to that purpose. It is also indicated that the parties employed in the development of electrical invention and industries will interest themselves therein and cheerfully make response thereto, a consummation of supreme importance to the Census Office. The memorial and other papers are herewith returned.

Very respectfuly,
(Signed) ROBERT P. PORTER,
Superintendent of Census.
The Hon. JOHN W. NOBLE, Secretary of the Interior.

ARC LAMPS FOR LOW POTENTIAL ALTERNATING-CURRENT CIRCUITS.

The "Ward" arc lamp for incandescent circuits is now well known as a very efficient lamp. It has made its mark, and it is a mark that can be seen by all—it is a successful mark, and a large one.

The "Ward" arc lamp, as commonly known, is designed for use on incandescent circuits, and will operate on any multiple-arc circuit. Little has been said, however, about the arc lamp made by the



"WARD" LOW POTENTIAL ALTERNATING-CURRENT ARC LAMP.

Electric Construction and Supply Company of New York, for use on alternating currents of low potential. This company, as is well known, is also the manufacturer of the "Ward" arc lamp for incandescent circuits.

The alternating-current lamp is of the same general appearance as that for continuous currents. It is intended to run on alternating circuits of 50 volts from the secondary of the converter. The accompanying cut shows the connections of the lamp with such circuit. Two or more arc lamps can be connected on one converter with the incandescent lamps without affecting their brilliancy. As far as appearances go and the quality of light, it would be difficult for any one to determine positively whether one of these arc lamps was burning on a continuous or al-

(*Continued on page* 617.)

THE ELECTRICAL AGE
DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT

Established 1883.

Entered at New York P. O. as second-class matter.

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THE PITTSBURG CONVENTION.

We call the attention of our friends, especially our street-railway friends, to the current issue of Street Railway News.

It is an easy matter on an extraordinary occasion, as this is, to get together a great deal of matter with little in it of news on practical value, but we feel justified in calling attention to the fact that there is nothing in this issue of Street Railway News that is not of some practical value to some one.

The first and only weekly street-railway journal ever published is thoroughly alive to the requirements and interests of street-railway men, and it studies to please and instruct these.

At Pittsburg this week there will be a representative gathering of street-railway men, and there is every indication that the meeting of the American Street Railway Association will be the most successful ever held. There can be no question that much substantial good will result. One of the effects will be a more intimate and extensive knowledge of the application of electricity as motive-power on street railways. Electricity will be the motive-power of the convention, so to speak, and we look for a great boom in electric-railroad work as a result of this meeting.

We refer our readers to the Street Railway News, which comprises a portion of this paper, for all facts and details concerning the convention. There are a great many interesting and valuable things in the News this week, and we trust that every one in attendance at the convention will derive both pleasure and profit.

THE ELECTRICAL CENSUS.

We print on another page an interesting letter from the Census Superintendent, Mr. R. P. Porter, to the Secretary of the Interior, regarding the collection of the electrical census.

The efforts to secure a census of electrical industries has extended over a comparatively long period of time; so that a good many of the facts in connection therewith may have been quite forgotten. This letter, however, gives the history of the work from its inception down to the present moment, and it is gratifying to learn that the work of collecting electrical statistics will not be entirely suspended until Congress should make provision for its resumption and continuance. It was announced at Montreal during the recent convention of the National Electric Light Association that it had been decided to suspend all work in this particular direction until Congress should appropriate more funds to resume it. This announcement was official, but since that time on the representation of Special Agent Foote, Mr. Porter has decided to continue the work of collecting statistics by correspondence, and he so notifies Secretary Noble in his letter.

This method of collecting technical statistics is not the best, for reasons given in the letter, but as knowledge concerning electrical apparatus, etc., is rapidly becoming diffused, it is to be hoped that the correspondence plan will work better than was expected. Congress will meet in a little more than a month, and every effort should be made to make the special appropriation an assured fact.

DO PATENTS PAY?

When an inventor has secured letters-patent from the United States, he at once enters into a partnership with the whole forces of the government, which in effect gives him the aid of the courts of the land and the protection of the machinery of justice to prevent any person from competing with him. Even those who make colossal fortunes out of patented inventions hardly realize this fact. They may be unmolested by infringers and their gains are easily gotten. But the patentee who meets with infringements at once recognizes the vast aid he has obtained by reason of his patent. When Thomas A. Edison invented and secured his patent for an incandescent lamp, little did he dream that the courts of his country would secure to him over twelve millions of dollars without his lifting a finger for it, except to sue infringers. And yet this will be the result of his suit recently decided. The United States government agreed with him that in case of any person attempting to infringe his patent, it would not only crush out such an infringement, but make the infringers pay all the profits Edison would himself have realized had he sold the lamps. This the courts have magnificently accomplished. In what other line of human effort can such a partnership be formed? And all the government received or ever will receive as its share of this tremendous bargain was the fee of thirty-five dollars paid for the issuance of the letters-patent. It is well to ponder over this celebrated case when the question is asked, "Does it pay to get a patent?"

There are now over 460,000 patents issued by the United States. These cover articles in every trade and every branch of business, and each one of these inventions cannot be made except by the lucky holder of the patent. Let another hit upon the same device but one day later than the first inventor, and the last man's ingenuity goes for nothing. Many a procrastinating inventor has lost all the benefit of his wonderful brain by delaying to file his application until another had anticipated him. And there are many instances where it was only too apparent that the successful applicant had boldly stolen the patient labor of the real inventor. Nevertheless, the United States government, with its courts to uphold the right, gives to these half-million patentees the monopoly of their inventions. In ages gone a monopoly of the right to sell salt and other necessary articles was the cause of such discontent that thrones have been shaken by the angry people. But is the monopoly of the right to sell a sewing-machine, without the use of which thousands of women must starve, any less a hardship than these old monopolies? Yet we all acquiesce in the modern theory of patents, because the right to acquire a monopoly is open to all.

It has been argued that a government in taking its fee for a patent ought to guarantee that the inventor will be secured from infringements, and that a department should be instituted to prosecute infringers and reap damages for the patentee. But it will appear upon reflection that this is not one of the duties of the executive branch of government. This business is delegated to the courts, and justice is rarely accused of failure in this respect. So while the government does protect the invention, it does so according to the forms and procedures incidental to all methods of relief from wrong dealing. Litigation implies knowledge of law, and another bureau established for inventors' suits would be simply another court.

So in regard to the view advanced that there should be insured to the patentee the fact that his invention has not been anticipated or invented before. This question, involving disputed facts and law, is perfectly safe in the custody of the courts. It is, perhaps, a mistake for our bureau of patents to intrust to examiners the delicate task of deciding whether an invention has been before patented. One obvious objection to this method is that the examiner's view has no weight whatever with the courts. The granting of a patent by an individual examiner carries with it no authority in a legal sense. In Great Britain and in most other countries an examination for prior inventions is practically ignored, and no harm results, for in any contest as to priority of right, the courts must necessarily have the final decision.

The American brain has been so stimulated by the reward offered of a monopoly for a new idea in the practical work of the world that we have all become inventors. Many useful improvements are, however, not brought to light from lack of money. But there was never yet a good advance made in any branch of inventive art which could not command means enough not only to patent it, but to introduce it to the world. Capitalists are never so eager to invest money as when they are assured of a patentee's rights. And it is the aim of this journal to encourage all inventors to apply for patents. In another column we specify one of the avenues through which this can be done in a cheaper manner than ever before, so that inventive genius may be assisted.

OBITUARY.

Mr. Charles F. Heinrichs, a well-known electrician, took his own life in a hotel in Chicago on Oct. 14

Mr. Heinrichs was born in Berlin, and was about 45 years of age. He took a course of scientific study in Germany and France, and then went to England, where he began business life as an electrician. In 1869 he came to New York, where he obtained employment with the Gold Stock Telegraph Company. While here he invented an arc light which interested the Westinghouse people, and Mr. Heinrichs went abroad to perfect and introduce it. On his return he became interested in the works of the Westinghouse Company, but a misunderstanding arose a few years ago between him and the company, and he severed his relations with them.

Three months ago he went to Chicago to interest capitalists there in his inventions. Mr. Heinrichs was one of the experts appointed by the State to witness the killing of Kemmler at Auburn.

(*Continued from page* 615.)

ternating-current circuit, the light is so steady. The unavoidable noise which is always present in the alternating-current arc lamp is so small in this particular make of lamp that it is necessary to get close to it while it is in operation to detect the noise.

This lamp is very simple in construction and is controlled by fewer movable parts than a continuous-current lamp, and its simplicity in construction render it less liable to get out of order.

The difficulties heretofore encountered in mauufacturing arc lamps for a current for which these lamps are designed have been entirely overcome, and it is claimed by the manufacturers to be the only satisfactory lamp for alternating currents. It is wound for eight or ten ampères of current as desired, and the light is evenly distributed. This lamp is intended for outside use.

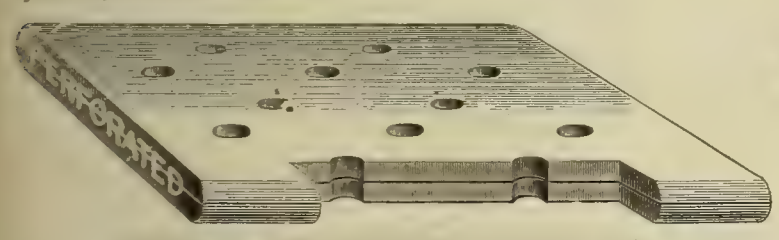
EXHIBITS AT THE AMERICAN INSTITUTE FAIR.

The United Electric Light and Power Co., *Times* Building, New York, represented by Mr. Thomas F. Merritt, electrician, supplies the light for the American Institute Fair. There are 102 arc lights in all,



SCHIEREN'S PERFORATED BELTS.

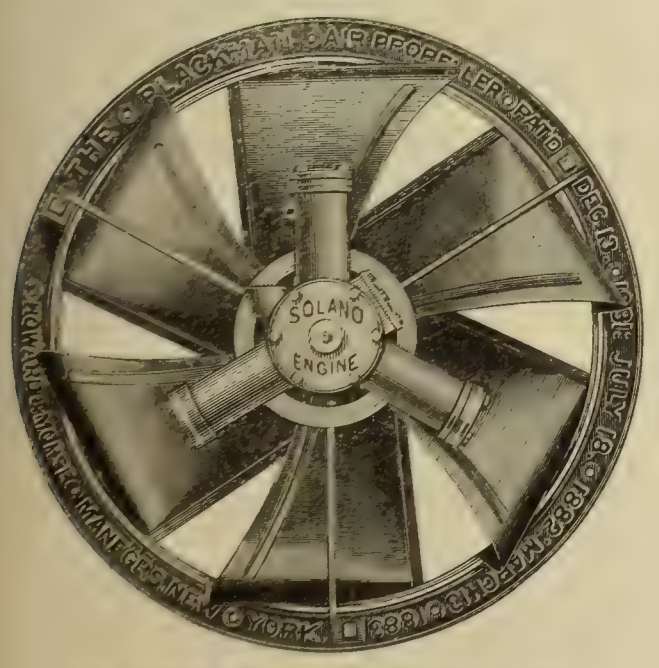
supplied by six 20-light United States dynamos. Each dynamo is run by an American leather-link belt, and there is one held in reserve. One of Mr. Jos. Meier's patent friction-pulleys is used in running temporarily two old style 10-arc light United States dynamos. The pulley will generate 50 H. P., 25 H. P. on each side. The object in running it in this connection is to show its application to practical uses. It will be used later for the transmission of power. Mr. Meier has a model of a pulley running a small dynamo, which feeds three colored incandescent



SECTION OF BELT SHOWING PERFORATIONS.

lamps placed on a table. Mr. Meier is the patentee of this friction-clutch, which is made by the Newark Leather Belting Co., 32 and 34 Ferry St., New York, and 29 Market St., Newark, N. J.

Messrs. Chas. A. Schieren & Co., of New York, manufacturers of the well-known electric perforated belts for dynamos, have a large display of belts. One immense belt attracts great attention. It was made for the New York Biscuit Co., is 60 inches wide (5 feet) and 3 ply. The exhibit includes large



BLACKMAN WHEEL AND SOLANO ENGINE.

sizes of perforated belts, round belts, etc. Messrs. C. A. Cropwell and E. P. Atkinson are looking after the company's interests.

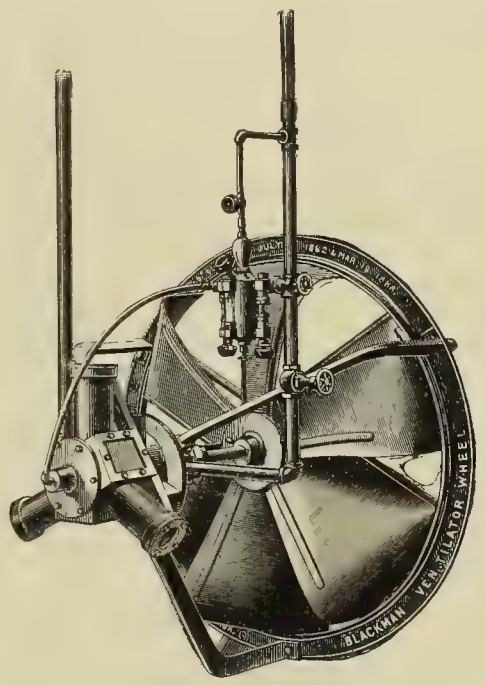
Messrs. Howard & Morse have a large C. & C. generator of 150 lights capacity supplying current for three motors, each running a Blackman Ventilator Wheel. The speed of the fans can be varied at will. The same generator is furnishing current for incandescent lamps used by several of the exhibitors. Two Blackman Ventilator Wheels, each operated by Solano 3-cylinder engines, are also shown. These engines run the wheels at 900 revolutions a minute, and it is said they require very little steam for their operation. They are now being tested with a view to adapting them to running dynamos. This firm makes a specialty of steamship ventilation; cattle-carrying vessels and many passenger steamship saloons are ventilated by this system. The wheels run by the three C. & C. direct acting motors are 30, 36 and 48 inches in diameter, and the Solano engines are running 42 and 48 inch wheels. Mr. F. R. Morse is the engineer and manager of the exhibit.

E. T. Copeland & Co., 54 John St., New York, exhibit a full line of Case engines. These are placed in all sorts of positions and one of them is running a 3-feet Blackman Ventilator Wheel. Another engine is coupled to a Thomson-Houston direct-current generator which supplies the current used in lighting the exhibit.

The Litofuge Mfg. Co., 62 John street, New York, has an exhibit consisting of a pyramid of boxes of Litofuge Compound. This substance is well known as a solvent of scales in steam-boilers.

Mr. T. Kielley, 11 West 13th street, New York, manufacturer of Steam Traps, Damper Regulators, etc., has a full line of his goods on exhibition, which is attractive to steam-power men.

The Tucker Electric Company has two large Mather dynamos in operation, supplying the current for all the incandescent lamps in the exhibition hall,



BLACKMAN WHEEL SET UPRIGHT.

which number several hundred. The dynamos are run by two electric belts made by Chas. A. Schieren & Co.

A. J. Weed & Co., Model Makers, 106 and 108 Liberty street, New York, have a small dynamo electric machine in operation. This firm manufactures model dynamos for the use of students, amateurs and ingenious boys. These dynamos are sold in the rough castings or finished. The complete machine generates sufficient current to light two or more half-candle incandescent lamps.

Volney W. Mason & Co., Lafayette street, Providence, R. I., have a display of friction and clutch pulleys. This concern manufactures patent friction pulleys and friction clutches for all classes of high-speed machinery, which they claim to be very serviceable and reliable.

The Garvin Machine Co., manufacturers of and dealers in machinery, Laight and Canal streets, New York, has an exhibit of extraordinary size. It is said to be the largest of its class ever displayed at the Institute, and any one interested in the goods manufactured by the Garvin Co. would do well to make a special trip to see this exhibit and study it.

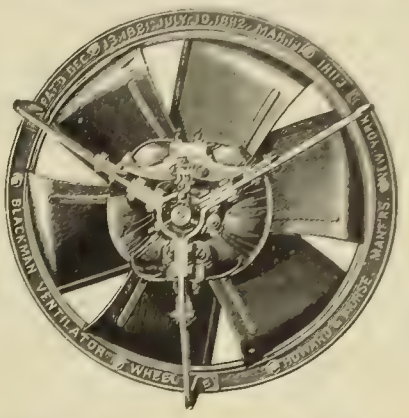
Mr. A. B. Calkins, 54 Warren street, New York, agent for the Engineers' Instrument Co., and himself the inventor of a steam-indicator, is exhibiting the Woodbury engine, manufactured by the Stearns Manufacturing Co. Mr. Calkins will give exhibitions nightly at the Fair and lessons on the Indicator with cards taken from a Woodbury automatic engine.

The Daimler Motor Co., 937–941 Steinway avenue, Steinway, Long Island City, N. Y., has two of its well known gas-engines running.

Mr. John S. Hall, manufacturer of and dealer in Engineers' and Machinists' Specialties, 40 Cortlandt street, New York, has an attractive display of his various goods. Mr. Hall is the inventor of an oil-cup and lubricator for high-speed engines, and he makes a specialty of them.

Jeffers & Kumberger, West Broadway near Walker street, New York, agents for the White and Middleton Gas Engine, have one of these engines on exhibition running a 25 horse-power C. & C. dynamo. The dynamo supplies current for over 100 Edison 110-volt lamps.

The D. Frisbie Company, 120 Liberty street, New York, has a notable exhibit in the main hall. It consists of a passenger electric elevator complete. The elevator is operated by electric power and it works with remarkable smoothness and is under easy control.



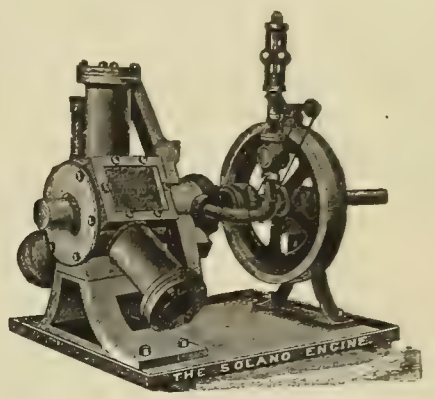
BLACKMAN WHEEL RUN BY C. & C. MOTOR.

The Bristol Manufacturing Company, Waterbury, Conn., has on exhibition one of its steam-pressure recording gauges running in connection with the engine plant of Robert Whitehill, Newburg, N. Y.

The power used at the Fair in driving the machinery is furnished by a large engine made by Robert Whitehill, Newburg, N. Y.

The Clark Electric Co., of 192 Broadway, New York, as usual, is to the front with an exhibit of its apparatus. It has dynamos and ornamental arc lamps displayed to good advantage.

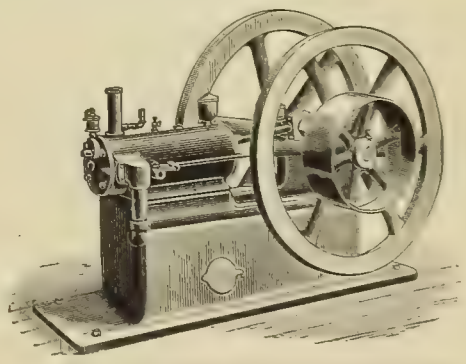
Mr. Owen Walsh, 105 Walker street, New York, makes an attractive display of his patented automatic electric speaking-tube annunciators. They are claimed to be superior to any annunciator on the market.



SOLANO ENGINE ON STANDARD.

B. W. Payne & Sons, 45 Dey street, New York, manufacturers of Modern High-Speed Engines, have on exhibition a compound engine, a description of which will be found on another page in this issue. The factory of this company is in Elmira, N. Y.

Priestman & Co., 420 Walnut street, Philadelphia, are represented by Mr. Percy Taylor with an exhibit of their Standard Oil (Internal Combustion) Engine. A 7 H. P. oil-engine is in operation, running an Edison dynamo which supplies currents for 30 lights. This exhibit plant includes resistance-box, ammeter and voltmeter. These engines—of the horizontal type—are especially adapted for electric-lighting installations. The points in their favor are reliability, steadiness of speed, safety, simplicity, durability, economical, self-contained and convenient, and they are also automatic in their action.



JEFFERS & KUMBERGER GAS-ENGINE.

ELECTRICAL INTELLIGENCE.

H. Ward Leonard & Co. report that their subscriptions for electrical intelligence are coming in in an extremely satisfactory manner. Owners of central stations and isolated plants seem to quickly appreciate the great advantages to be derived by securing information from a concern such as this at such moderate rates. Quite a large number of supply houses and even electrical manufacturing companies are among the subscribers. For special information such as is called for by concerns of the latter description special rates are quoted by H. Ward Leonard & Co.

THE HUBBELL PORTABLE BATTERY.

The Hubbell Portable Primary Battery Co., 61 Broadway, New York, a short time ago gave an exhibition of its battery to its friends and members of the press. This battery is for portable lighting, power—such as running sewing-machines, lathes, etc.—experimental work, firing guns, and general telegraphic work—in short, for all uses wherever a small portable battery is applicable.

On the occasion mentioned representatives of some of the New York daily papers, including the *Herald* and *Sun*, were present and witnessed the performance of the Hubbell battery, and thoroughly tested its merits. These papers in describing the tests spoke of the battery in very flattering terms, and predicted for it very useful and general application, particularly to the purposes mentioned above.

During the past two weeks Lieut. G. A. Whistler, of the 5th U. S. Artillery, made a thorough test of the Hubbell primary battery and made a report thereon. In this report we find the following, which will be of interest to our readers :

"A 4-cell battery was charged at 11 P.M., and gave on short circuit slightly less than 8 volts and about 7.5 ampères. The pressure soon ran up to something over 8 volts, and at 1 P.M. the ammeter gave 9.5 ampères. During this time the battery was at work maintaining incandescent a 3 c. p. lamp, except a few times when it was taken off to run a fan and a dental hammer.

"During this test I attached the ammeter, and taking the battery in my hand swung it round, turned it over, and shook it severely, without producing the slightest variation in the reading of the instrument. This I did time and time again with the same result.

"The most astonishing feature of this battery is its remarkable constancy and freedom from polarization.

"The battery is a simple carbon zinc cell, using a strong solution of sulphuric acid in the porous cup and acidulated water in the cell proper. There is no special preparation of the negative element; that there should be no polarization is simply incomprehensible.

"Mr. Hubbell repeatedly stated that there was absolutely nothing else in the liquid, although in the printed circular I find mention of depolarizing powder.

"It is, however, a matter of no moment whether this constancy is produced by the chemicals used or is due to mechanical construction ; the fact remains that it exists, and that there is nothing in the construction of the cell to show any reason why it should ever cease to exist.

"So far as I could judge the claims of the inventor are sustained; the battery is all he claims it to be.

"So far, however, as economy is concerned, the tests which have been made are in my opinion of no value; they show practically nothing. It of course must be recognized that no primary battery can be economical for ordinary lighting at the present price of zinc, but it must be remembered that the battery is not intended for ordinary lighting, but for a class of work where portability, convenience and, above all, safety are far more important than expense.

"For use in lighting railroad cars, mine lamps, magazine lanterns, running light lathes, sewing-machines and dental engines, I do not think it has an equal.

"One remarkable and valuable feature is the absorbing pad, which makes it possible to use this battery in a closed room or car, without inconvenience from fumes."

In closing his report Lieut. Whistler says: "I shall officially recommend it for trial by the government. I consider it for the purposes for which it is introduced to be the most remarkable combination of efficiency, compactness and portability in an electric battery that I have ever seen."

Mr. Chas. J. Hubbell, the inventor of this battery, was for many years chief inspector of the Gold and Stock Telegraph Company, and during this time Mr. Thomas A. Edison occupied a subordinate position with the same company under Mr. Hubbell.

Mr. Hubbell has such boundless faith in the efficiency of his battery that he will permit any expert who may desire to investigate its merits in the interest of some live enterprise or investor to make a thorough test of its capabilities in his own way. He may use his own ammeter and voltmeter for testing the current, and every opportunity will be afforded to study the battery in every aspect. It may be put on any work, such as running motors, lamps, fans, etc., and it may be placed on short circuit to satisfy the test.

The Hubbell Primary Battery Company is now preparing the dies and moulds for manufacturing its batteries in different styles and sizes, and it hopes to have the batteries upon the market very shortly to supply the many local companies. It has secured rights for the United States and foreign countries.

NEW YORK NOTES.

Office of the Electrical Age and Street Railway News, First Floor, World Building,
New York, October 21, 1891.

Mr. L. N. Cox, of Washington, D. C., Southeastern agent of the National Electric Manufacturing Co., of Eau Claire, Wis., gave us a call last week. Mr. Cox has just completed electric transformer plants at Florence and Darlington, S. C.

W. H. Gordon & Co., 115 Broadway, are carrying a full line of Bryant incandescent lamp sockets, cut-outs, switches, etc. The firm was filling a large order when your correspondent dropped into its large salesrooms and offices.

Mr. W. H. Wissing, the Chicago agent of the L. J. Wing Co., 126 Liberty street, this city, is in town.

C. P. Rutty, travelling agent for the McCreary Electrical Specialty Co., Electrical Exchange, 136 Liberty street, city, has just returned from the West and Northwest after a successful trip. He will now turn his attention to Mexico and Texas, and will carry a fuller line than ever of his company's noted shades, cut-outs, half shades, flexible fixtures, etc.

The Crocker-Wheeler Motor Company, of New York, has placed Mr. D. Herbert Jeffery, formerly general manager of Jeffery & Co., manufacturers of springs, Jersey City, N. J., in charge of its offices, handling its large correspondence, management of records, etc. This step has been found necessary to relieve the other officers of the company of these duties, in order to enable them to meet the exacting requirements of their several branches of the business, electrical, technical, installation, etc., each of which receives the personal attention of an officer, and thus the high standard of "perfection" attained by the Crocker-Wheeler Company is assured for all time.

Mr. Bryant, of Bryant electric specialty fame, Bridgeport, Conn., was in town this week and completed arrangements with W. H. Gordon & Co., 115 Broadway, to carry a full line of his incandescent lamp sockets, cut-outs and fittings.

H. Ward Leonard & Co. now have on exhibition at their offices in the Electrical Exchange Building, No. 136 Liberty street, a Crocker-Wheeler motor operating under Mr. Leonard's new principle for controlling the speed, torque and direction of motors. The motor is made to perform various work in such a manner as to clearly show the principle used and the facility with which either the speed or torque is controlled. The exhibition is extremely interesting.

The Alexander, Barney & Chapin Co., 20 Cortlandt street, city, has in its Electrical Exchange an Ajax switch which breaks a current of 1,500 ampères at 500 volts. This is done without any undue arcing, and the switch does its work perfectly. The Electric Merchandise Company, of Chicago, sold one of these switches recently.

The Hunt Engineering Co., on October 15 moved its offices from 238 Washington street, Brooklyn, to 126 Liberty street, New York, where it will be glad to see its friends. The removal was necessary on account of the Brooklyn Bridge acquiring the property formerly occupied by the Hunt Engineering Co., in Brooklyn, for the extension of the bridge terminal facilities.

W. T. H.

PERSONAL.

—Mr. C. E. Chinnock, once vice-president of the Edison Co. and the pioneer of the old Pearl street station, New York, has resigned his present position with the Edison General Electric Company. Mr. Chinnock has been for the last six months in charge of all the Southern business of the Edison General Company. Mr. Chinnock's future is awaited with considerable expectation among the electrical fraternity. Probably no one in central-station work is not familiar with Mr. Chinnock's great efforts in 1883, when he took hold of the Pearl street station. He brought it from a failure to the present standard of success. We are glad to learn that he does not leave the electrical business a poor man.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age :

Names of Companies.	Capital.	Par.	Price.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	92 00
Am. Elec Exercise Mach. Co., N.Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone. N.Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Aut. Phon. Exb. Co	25,000		†
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	181 00
Bell Telephone 7s	2,000,000		*112
Boston Electric Light	1,500,000	100 00	85 00
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y	10,000	100 00	†60 00
Brush Illuminating, N. Y	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	125 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y			98 50
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s. S. C	15,000	50 00	*102 00
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	25 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	28 00
Detroit Electrical Works	1,000,000	10 00	11 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*99
Edison Elec. Ill. 6s, N. Y	30,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	10 50
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	476 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	97 25
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	46 00
Essick Printing Tel	5,000,000	100 00	30 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		47 50
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*101 00
Fort Wayne Elec. Co	4,000,000	25 00	10 00
Fremont Elec. L. & P. & Gas Co.	75,000	100 00	125 00
G. T. Woods Mfg. Co., Ky	2,000 000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	14 50
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*98
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hudson Electric Light, N. J	100,000	100 00	
Hunt Engineering Co., Brooklyn. 6s	30,000	500 00	*102
Hunt Engineering Co., Brooklyn.	30,000	100 00	140 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	20 50
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*78
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill. 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30 000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*103
McLeod Car Heat. & Vent. Co	1,00 000	25 00	35 00
Metropolitan Phonograph	22,500		†
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2.300,000		*95
Mount Morris Electric Light, N.Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J	17.500		*103
Morristown L. H. & P.	50.000	100 00	110 00
Nassau M'f'g Co., New York	100.000	10 00	8 00
Nat'l Aut. Fire Alarm, L. I.	150 000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	16 50
New England Butt Co	100.000	1,000 00	1,000 00
New England Phonograph Co	12,500		†
N. E. Tel. & Tel. Co	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel. 6s.	1,500.000		*99
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. G. & E. Co. Certs. of Indebt	100.000		†
N. Y. Phonograph Co	20,000		†
N. Y. Storage Baty. Co	100.000	100 00	58 00
Newark L. & P	150.000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50.000		*95
North New York Lighting	150.000	100 00	10 00
Northern Elec. L. & P., Phila	200.000	10 00	
Northwest Elec. Co. 6s, Manitoba.	50 000		*90
Postal Telegraph	10,000.000	100 00	30 00
Paterson Electric Light	100.000	100 00	
Pennock Baty. E.L.& Impt.Co., Ill	500.000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P.Co. 6s	800.000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston	200.000	25 00	30 00
Pittsburg Reduct. Co, Aluminum	1,000,000	100 00	105 00
Plainfield ElectricLight	100 000	100 00	75 00
Public Wks. Imp. Co., Tenn	500 000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500.000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200.000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*90
Rockaway Beach Elec. Light	50.000	100 00	60 00
Rockaway Elec Lt. Co. 6s	75.000		*94
Russell Electric Co., Boston	300.000	5 00	6 00
Saginaw E. L. & P. Co. 6s, Mich.	50.000		*98
San Diego Gas & Elec. Co. 6s. Cal.	750.000		*90
Sawyer-Man Elec. Light Co., N.Y.	125.000	100 00	100 00
Seibold Electrode Manf. Co., N.Y.	100.000	100 00	
Shaver Corporation. N. Y	100.000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	8 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900.000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	48 50
Thomson-Houston pref	4,000,000	25 00	26 50
T.-H Electric Co. 5s. Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H.L.H. &P.Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50.000	100 00	100 00
Twin City Rapid Transit, N. J.	20.000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1.370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	50 00
Universal Arc Lamp Co	100.000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	1 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188.852	100 00	82 50
Westinghouse Electric Co	7,000.000	50 00	13 50
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston			17 50
Yonkers L. & P	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

PATENTS.

These wishing to take out patents on inventions cannot do better than by procuring the same through the Patent Department of the ELECTRICAL AGE. The department is in the hands of a lawyer of well-known ability and integrity, and under his care it has rapidly developed into an important feature of the business. Applications are being received daily and are constantly increasing in number, and the utmost satisfaction is given our clients. Our patent business is now on a successful basis and the interests of our friends are carefully looked after in every case. Our charges are as reasonable as those of any other first-class establishment, and if there is any merit at all in an invention it will be fully developed by placing the work in our hands.

—It is a notable fact that every concern which advertises in the ELECTRICAL AGE AND STREET RAILWAY NEWS is prosperous. This is worth remembering.

EASTERN NOTES.

The Elektron Manufacturing Co., of Springfield, Mass., is out with a neat pamphlet descriptive of the well-known Perret electric motor, of which that company is the manufacturer. The pamphlet is well illustrated, showing the various machines manufactured by the company, and at the back there are several interesting testimonials from users of Perret machines. The New York office of the company is at 89 Liberty street.

The Germania Electric Company, of Boston, has closed a contract to install a central-station plant in Pascoag, R. I. The installation will include dynamos, engines, etc., and 750 incandescent and 30 arc lamps. This contract was secured by Mr. Ricker, agent for the company.

Mr. O. K. Stuart, of the Germania Electric Company, Boston, has recently closed a contract with the Portland (Conn.) Electric Light Company for electric generators aggregating about 800 H. P. for mining purposes and 750 incandescent and 30 arc lamps.

BUSINESS NOTES.

The Mahoney Engine and Safety Boiler Co., 245 Broadway, this city, is fitting up a plant at the Plaza Hotel, New York, and is also putting in a 650-light dynamo and a 60 horse-power Wright automatic cut-off engine, which it expects to have completed in about a week. This firm makes a specialty of installing all kinds of light and power plants; it also manufactures an improved grate for public buildings, schools, etc. A model 2 horse-power boiler is on exhibition in its offices, on which the company received a patent last July. The boiler is guaranteed to be absolutely safe, and it is said to have no braces, screw-joints or any other flat surface to impede its working, and to combine the best features of all other boilers made.

The many properties of the mineral wool manufactured by the U. S. Mineral Wool Company, 2 Cortlandt street, New York, make it a valuable material to the engineer. From its non-conductivity of heat and non-combustibility, it can be used in the engine-room or workshop for many purposes for which no other material is adapted. In workshops located close to dwelling apartments a filling in the walls and floors deadens the sound, isolating the shop from the rest of the building and doing away with considerable annoyance to other tenants. Mineral wool is claimed to be non-decaying, vermin-repelling, a good non-conductor of heat, non-combustible and a perfect deadener of sound. Mechanics and engineers generally will readily see the many uses to which such a material can be put.

The following letter explains itself:

WORLD'S COLUMBIAN EXPOSITION.
D. H. BURNHAM, Chief of Construction.
F. L. OLMSTEAD & Co., Landscape Architects.

Ball Engine Company, Erie, Pa.:

GENTLEMEN: We started last night the 10 x 12 engine kindly loaned by you to us for our temporary power and lighting plant. I have to congratulate you herewith upon the start made, which I have no hesitancy in saying was the prettiest I have known in my experience.

We started the engine under full load at 6 o'clock, and it ran until 6 o'clock this morning without the slightest trouble from heating or any other cause. I consider it a very valuable record.

Please accept my thanks for the promptness with which you filled our order, and for your liberality in furnishing us this engine. Very respectfully yours,

(Signed) J. C. SLOCUM,
Mechanical Engineer.

The Typewriter Exchange, 10 Barclay street, New York, reports a rushing business, an average of sixty machines a week being sold. At the Exchange you can have your choice of any of the well-known makes of machines, either on the instalment plan or by rental. Mr. George A. Hill, manager, informs us that he has always on hand a complete line of typewriters' supplies.

It is noticed in the catalogue recently issued by J. W. Queen & Co., Philadelphia, that the well-known Queen Magnetic Vane ammeters and voltmeters have been improved by having their dials made larger and clearer, a point that will enable the engineer in the central station to read the indications some distance away. The portable testing set and galvanometers have undergone considerable change also, making them handier and more rapid in their manipulation. The Queen "Hot Wire" voltmeter, the standard for both direct and alternating circuits, has also been improved. The old form of electro-dynamometers—Siemens and Kohlrausch's patterns—have undergone some radical changes, improving their efficiency, while a new dynamometer appears in the catalogue for the first time. This is the Brackett's Cradle Dynamometer.

PROPOSALS FOR ELECTRIC-LIGHT PLANT.

Arthur W. Brady, Esq., Mayor of the city of Muncie, Ind., sends us under the date of October 13 the following.

The city of Muncie, Ind., invites sealed proposals for an electric arc-light plant of 100 lights or 150 lights capacity. Bids must be filed before 7 P.M. Monday, October 26, 1891, with the undersigned. Plans and specifications may be had on application to the City Civil Engineer. By order of the Common Council.

A. S. SHIDELER,
City Clerk.

THE "IDEAL" ENGINE.

The Hotel "Marlborough," corner of Broadway and Thirth-sixth street, New York City, is about to install a 100 H. P. Ideal engine. This makes the third of these celebrated self-oiling automatic engines ordered for this hotel. These engines are built by the Harrisburg Foundry and Machine Works, Harrisburg, Pa., whose factory is busy with the many orders they have received. They have recently made large improvements in their equipment in the way of new machinery which enables them to fill their orders promptly. A great many of the orders they now have are from their New York representatives, W. R. Fleming & Co., 174 Fulton street.

WELL PLEASED WITH IT.

EMPORIA, KAN., August 11, 1891.

J. Kidder Mfg. Co., 820 Broadway, New York City:

DEAR SIRS: Many thanks for your reply. . . . Herewith find draft for one No. 1 Physicians' Office Apparatus complete, which you will send by return express. . . . Should you need our indorsement on cabinet or other instruments you can command us.

Sincerely,
DRS. DOOM and EIDSON.

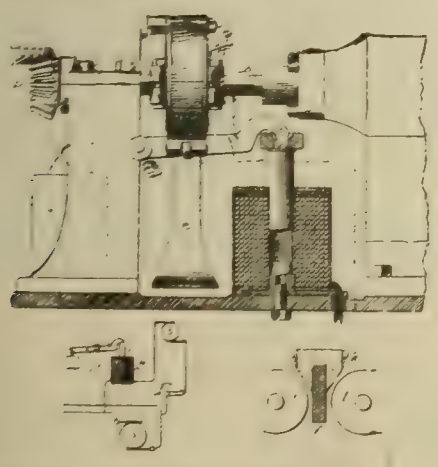
THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued October 13, 1891.

460,958. Electric Signal for Railway-Trains. Lawrence Dunn, Fort Smith, Ark. Filed Feb. 18, 1891.

460,962. Electro-Magnetic Separator. Gustave M. Gouyard, Leadville, Colo. Filed Jan. 6, 1891.

In a magnetic separator, the combination, with a plurality of magnets connected in series and each set of magnets connected to a separate plate or division of the commutator, of a commutator having a separate plate or division for each set of magnets and a pair of brushes therefor, whereby the working magnets are all of one polarity, which polarity is changed when the magnets pass the brushes.



461,052.—ELECTRO-MAGNETIC BRAKE.

460,963. Combined Electric Clock and Thermoscope System. Henry J. Haight, New York, N. Y. Filed March 7, 1887. Patented in England.

460,968. Fuse-Box for Electric Lamps. Arnold B. Holmes, Boston, and George F. Gale, Winthrop, Mass. Filed April 15, 1890.

A fuse-box of the character described, comprising a fixed section provided with conducting-plates separated by a dovetail groove extending across its inner face, in combination with a movable section provided with a block fitted to enter the groove, and spring-electrodes having fusible connection with the lamp-wires and adapted to engage the conducting-plates.

460,972. Rheostat. Otto A. Kessner, Newark, N. J., assignor to the Hanson & Van Winkle Company, of New Jersey. Filed March 18, 1891.

An instrument for controlling electrical currents, consisting of a base or support of non-conducting material, a conductor spirally disposed upon its upper surface and projecting up from and above it, extending from or near the outer edge of the base towards and near the centre thereof, a conducting-traveller connecting with the spiral conductor, and means for moving the traveller along the length of and in contact with it.

460,978. Electric Soldering-Iron. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed Jan. 9, 1891.

460,979. Electric Soda-Fountain. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed Feb. 9, 1891.

460,980. Electric Heating-Core for Smoothing-Irons. Willis Mitchell, Malden, assignor to the Butterfield-Mitchell Electric Heating Company, Boston, Mass. Filed March 24, 1891.

In combination with a wire forming part of an electric circuit and wound in a heating coil or spiral, a solid core of insulating material which is grooved to receive the wire and provided with a passage permitting the return of the wire to the end of the core where the winding began.

460,991. Incandescent Electric Lamp. Albert L. Reinmann, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company. Filed Feb. 11, 1891.

The method of making incandescent electric lamps having leading-in wires composed of two sections of platinum wire with an intermediate section of copper wire, which consists in forming a glass seal around the lower section of the platinum wire, surrounding the copper sections with glass tubes having vent-openings in the sides, then sealing the upper ends of the tubes around the upper platinum sections, then closing the vent-openings, securing the carbon conductor to the leading-in wires, and sealing the mount so formed into the lamp-bulb in the usual way.

461,023. Electric Battery. Daniel M. Lamb, Boston, Mass. Filed Dec. 7, 1889.

461,024. Composition for Electric Batteries. Daniel M. Lamb, Boston, Mass. Filed April 10, 1890.

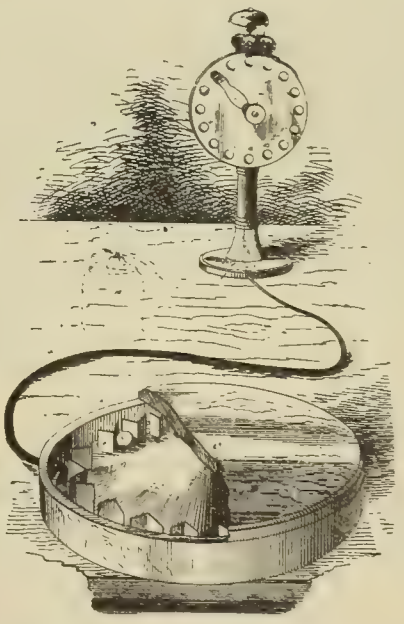
461,025. Electric Battery. Daniel M. Lamb, Boston, Mass. Filed July 23, 1890. Renewed May 26, 1891.

461,026. Compound for Electric Batteries and Method of Preparing the Same. Daniel M. Lamb, Boston, Mass. Filed May 26, 1891.

461,027. Electric Battery. Daniel M. Lamb, Boston, Mass. Filed May 26, 1891.

461,052. Electro-Magnetic Brake. Alton J. Shaw, Milwaukee, Wis. Filed July 2, 1891.

In combination with an electric motor and with a brake drum or disc, a brake shoe or band adapted to bear upon the drum or disc and to prevent its rotation, a pressure device



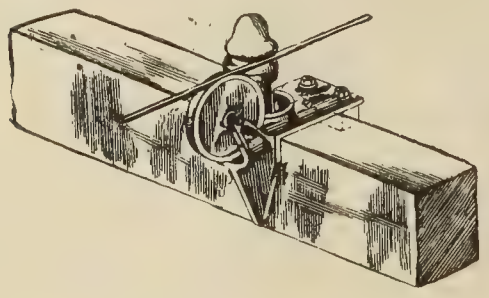
461,075.— CIRCUIT-CONNECTOR.

serving to force and hold the brake shoe or band against the drum or disc, a lever provided with an inclined face of varying angle to work against and force back the shoe or release the band, an electro-magnet connected with the source of supply of the motor, and an armature carried by the lever and arranged within the field of attraction of the electro-magnet.

461,075. Circuit-Connector for Electric Signalling Apparatus. Waldo L. Gates, Springfield, assignor, by direct and mesne assignments, to Frederick A. Warren, Wilbraham, and Frederick W. Buffington, Springfield, Mass., and the Electric Novelty Ad-

vertising Company, of New Jersey. Filed July 19, 1889. Renewed March 10, 1891.

461,076. Electric Parlor-Game. Waldo L. Gates, Springfield, assignor, by direct and mesne assignments, to Frederick A. Warren, Wilbraham, and Frederick W. Buffington, Springfield, Mass., and the Electric Novelty Advertising Company, of New Jersey. Filed July 19, 1889. Renewed March 10, 1891.



461,109.—DEVICE FOR STRETCHING WIRES

461,087. Electrical Automatic Fire-Extinguisher for Buildings. William H. Soley, Philadelphia, Pa. Filed Jan. 17, 1889.

In an electrical valve-opening device, in combination, a source of current-supply, a thermostat in electrical connection with it, a rod, attached to the valve, an electro-magnet, a catch upon the armature of the magnet, a weighted lever adapted to be held normally in a perpendicular position by the catch, an insulated pin upon the valve-rod, electrical connection between the pin and the thermostat, and electrical connection from the magnet to the source of the current-supply, the rod being in the line of travel of the lever when the catch is released.

461,089. Electrical Fire-Extinguisher. James Wolstencroft and William H. Soley, Philadelphia, Pa. Filed Feb. 1, 1889.

461,104. Electric Signalling Apparatus. Eugene G. Mettler, Indianapolis, Ind., assignor, by direct and mesne assignments, of one-half to Frederick L. McGahan, same place, and Henry C. Bailey, Edinburg, Ind. Filed Oct. 15, 1890.

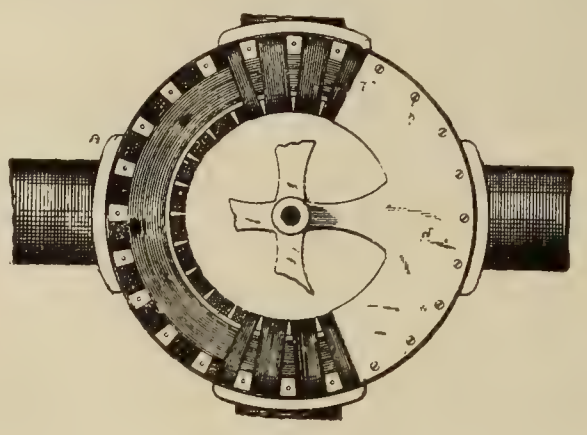
An electric signalling apparatus comprising an electro-magnet set in the main circuit between the dynamo and the mechanism to be operated upon, the core of such magnet weighted and provided with a numbering-tag at its lower end, its upper end connected to a steam-whistle, the latter suitably connected to the steam-supply.

461,105. Commutator-Oiler. Fred L. McGahan, Indianapolis, assignor, by direct and mesne assignments, of three-fourths to Henry C. Bailey, Edinburg, Ind. Filed Nov. 7, 1890.

An oiler for commutators, comprising a cylinder covered with saturable material and having an oil-chamber within, such cylinder mounted in bearings connected to a pivoted base-plate, and a weighted lever connected to such plate whose gravity normally holds the cylinder in contact with the commutator.

461,109. Device for Stretching Heavy Wires on Poles. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed March 21, 1891.

A device for the purpose described, consisting of a base-plate having a recess adapted to fit around the insulator, and a roller carried by the base plate.



461,296.—ARMATURE FOR ELECTRIC MOTORS.

461,122. Electric Door-Operating Device. Robertus F. Troy, Madison, Wis. Filed Sept. 18, 1890.

The combination, with a door and its frame, of an electric motor operatively connected with the door, with its wire connections, an electric switch adapted to switch a current of electricity through or around the motor, and a platform in front of the door adapted to be operated to work the switch to set the motor in motion to operate the door.

461,135. Electric Inductional Transformer. William Stanley, Jr., Pittsfield, Mass. Filed Jan. 16, 1891.

A sectional transformer-core composed of detached plates or groups of plates held loosely in their supports, so as to be capable of mutually-independent self-adjustment in planes substantially parallel with their respective surfaces.

461,139. System of Distributing Electric Energy. Rankin Kennedy, Glasgow, Scotland. Filed Sept. 24, 1890.

Two armature-windings which alternately traverse the same or similar magnetic fields, whereby alternating electrical pulsations of unlike phases are induced in the respective windings, in combination with independent pairs of main conductors, independent commutators whereby the alternating pulsations induced in the respective windings are rectified before traversing the respective pairs of main conductors, a conductor directly uniting one positive brush of one with one negative brush of the other of the commutators, and translating devices connected between the conductor connected with the other positive brush of one pair and the conductor connected with the other negative brush of the other pair of the mains.

461,140. Dynamo-Electric Machine. Rankin Kennedy, Kilmarnock, Scotland. Filed Oct. 30, 1890.

In a dynamo-electric machine or motor, the combination of a field-magnet having multiple poles disposed in two groups of opposite polarities, each of the groups being composed of a plurality of radial polar extensions, two annular laminated armatures having a radial thickness not less than half the breadth of the faces of the radial poles, and a cylindrical iron shell inclosing and supporting the armatures and serving to concentrate the magnetic lines.

461,144. Electric-Arc Lamp. Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed June 14, 1890.

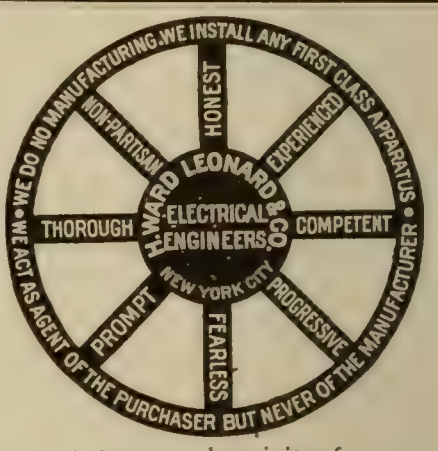
A positive feed-gear, such as a worm and screw, a pivoted frame sustaining one member of the gear and the carbon-carrier connected with the member, an electro-magnet for actuating the frame to bring the two members of the gear into engagement and form the arc, and a derived-circuit actuating-magnet for operating the other member of the gear to cause a feed of the carbon.

461,152. Telautograph. Max Soblik, Berlin, Germany, assignor to Paul Adolph, same place. Filed March 23, 1891. Serial No. 386,070. (No model.)

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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, OCTOBER 31, 1891. No. 44.

DOUBLE TANDEM COMPOUND AUTOMATIC ENGINE.

The McIntosh & Seymour Double Tandem Compound Automatic Engine, as illustrated in accompanying cut, has been in the market for some time and given exceptional satisfaction. The illustration represents a 500 horse-power condensing engine, having two high-pressure cylinders 13″ diameter, two low-pressure cylinders 23″ diameter, all four cylinders 22″ stroke. The engine is regulated to run at a speed of 150 revolutions per minute and will develop 500 indicated horse-power with 110 pounds initial steam pressure, $\frac{3}{10}$ cut-off in high-pressure cylinders and 22″ vacuum.

The engine is composed of two tandem compound side-crank engines, one being right, the other left hand. The engines have one common shaft with cranks at right angles to each other. The double-arm fly-wheel, which weighs 13,000 pounds, is accurately balanced and has a diameter of 12 feet by 43 inches face for 42-inch driving-belt. Instead of one fly-wheel the engine can be fitted with two or more fly-wheels for direct belting to dynamos or railway generators; or, if desired, a dynamo armature can take the place of fly-wheels, thereby saving space and dispensing with the use of driving-belt and all its accompanying disadvantages.

Each engine is fitted with a receiver placed between high and low pressure cylinders. The object of this receiver, which is steam-jacketed, is to reheat the steam before it enters the low-pressure cylinder, and thus prevent condensation, which is very liable to occur on account of expansion. The high-pressure cylinders are fitted the same as receivers with a live-steam jacket. The steam fed to the high-pressure cylinder jackets is re-used in receiver jackets and returned to the boilers at a high pressure and temperature, or can be used to run the condenser if an independent steam-actuated condenser is used in connection with the engine. Both high and low pressure cylinders are properly lagged, the space between lagging and body of cylinders being filled with asbestos.

The valves in high and low pressure cylinders are of the piston-valve type, and are working into crescent-shaped split-contracting seats, which can be adjusted from the outside of steam-chest. By means of these adjusting seats the lost motion in valves can be easily taken up and the valves *always maintained* steam-tight without removing the steam-chest cover. Each high and low pressure cylinder has two valves, of which one has a fixed travel and controls the exhaust and steam admission. The other being worked automatically by the governor, regulates the point of cut-off.

The governor is a so-called shaft governor, and is very simple in construction but sensitive in action. The governor-spring is a compound flat spring shaped into an elliptical form. The motion from fixed eccentrics and governor is transmitted to the different valves by means of rocker arms, as clearly shown in cut.

Both high and low pressure cylinders are fitted at each end with one automatic safety relief valve, which can be set to work at any desired pressure. These valves are of great importance in case any water should enter the cylinders, the presence of water in steam-pipes being a very common occurrence in plants where engines are located far from the boilers.

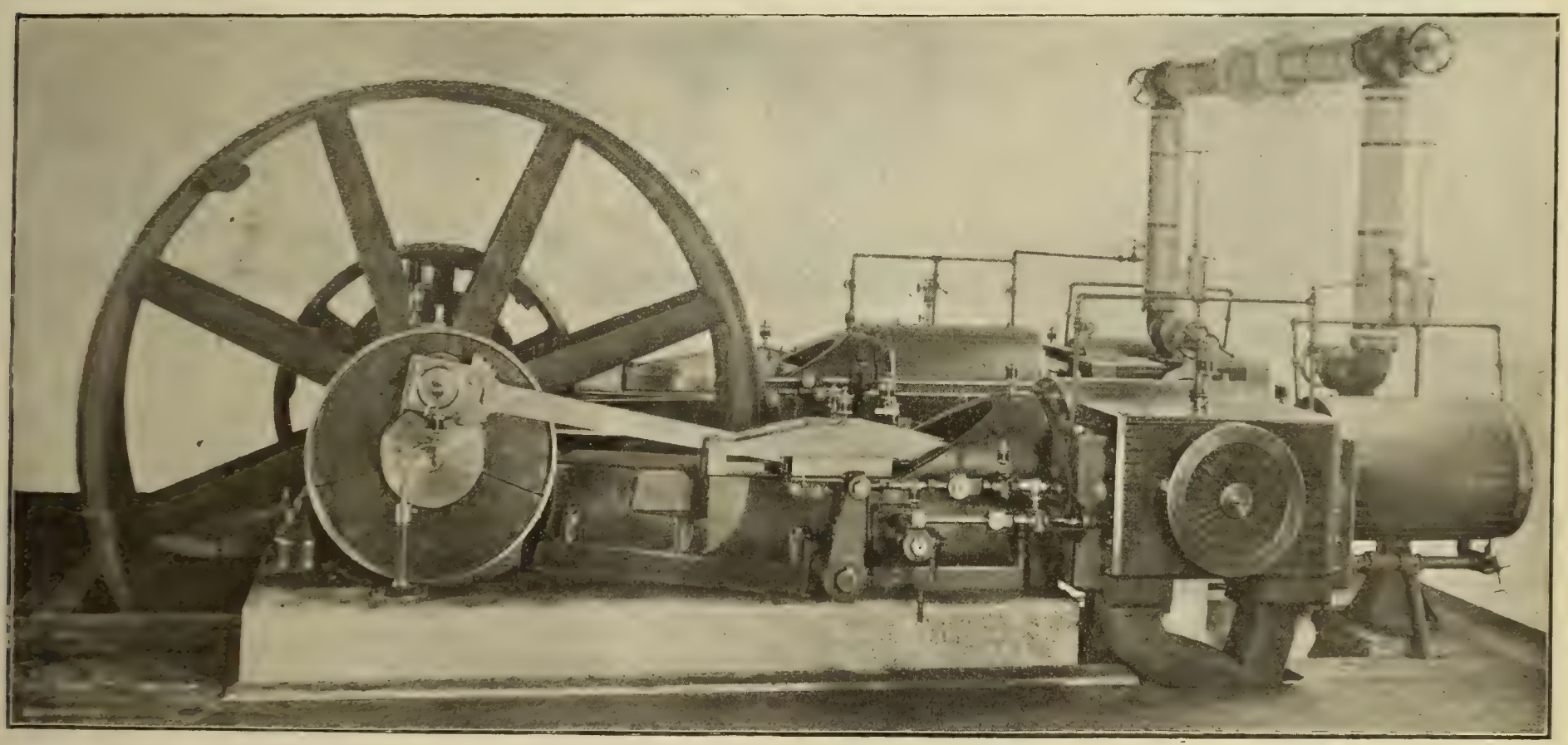
The high-pressure cylinders are supported by means of adjustable standards, in order to prevent vibrations and to keep the cylinders perfectly in line. The shaft with cranks is all one piece, made of best cast-steel, the disc-cranks being attached only to counterbalance the cranks. The main bearings have very large diameters and length; they are adjustable by means of quarter boxes and are lined with best anti-friction metal.

The frames are built very heavily and rigidly, the two main frames being tied together by cross-ties to prevent any possibility for engines to get out of line. Frames are fitted with oil-grooves and oil-pockets to collect all the waste oil. All reciprocating parts are made extra heavy, in order to stand sudden and violent changes of load, as are common in electric-light and electric-railway work.

The engines run with exceptional smoothness, on account of the cranks being set quartering and also by reason of a certain amount of compression in high-pressure cylinders, which very nearly reaches the initial pressure when the crank is nearing its centre.

These engines are especially adapted for electric light and railway work when dynamos or generators are to be direct-belted; and, as they are only running at about 150 revolutions per minute, they are a fair intermediate between high-speed and slow-speed engines. They require less attention than high-speed engines and have a closer regulation than the latter, and in comparison to the slow speed engines they are less expensive in first cost and are more economical in floor-space.

The McIntosh & Seymour Co., of Auburn, N. Y., of which Pierce & Thomas, 42 Cortlandt street, New York, are the agents, are prepared to furnish these engines of any power ranging from 250 to 1,200 horse-power.



McINTOSH & SEYMOUR DOUBLE TANDEM COMPOUND AUTOMATIC ENGINE.

THE QUADRUPLEX.*

The quadruplex is a combination of the Stearns (neutral) duplex and the polar duplex, so arranged by Mr. Edison. In the original duplex systems it was necessary only to so arrange the relays that they would respond to but one of the two currents sent to the line. In the quadruplex it was necessary, of course, to arrange each instrument so as to respond to one of the four different currents independently of the remaining three currents.

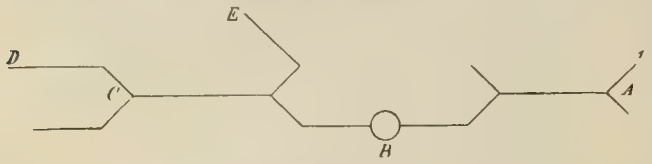


DIAGRAM OF CIRCUITS AND STATIONS.

The differential duplex relay was wound as you would wind a straight bar of iron from one end to the other, then bending the bar bringing the ends near each other, forming a horseshoe. One end of the helix was attached to the line, the other through a rheostat to ground. By connecting this helix at the centre with a circuit-preserving transmitter which places a ground and battery alternately to this particular conductor, signals could be transmitted without affecting the relay. The polar duplex relay was wound in the same manner, attached to the main line and the ground in the same way, tapped at the centre as in the differential and connected to a pole-changer which alternately sent positive and negative currents to the line. A detailed explanation as to how different results are obtained by different positions of the transmitters or pole-changers, and why one current will not interfere with the other is not necessary, as you are familiar with the fact that when you have a perfect balance the current is divided at the connection at the centre of the helix, half going to the main line and half to the ground through the rheostat, resulting in producing two magnets of different polarity in the core, the one neutralizing or nullifying the other. In consequence you do not hear your own signals, but, as the current reaching the distant station passes through only one side of the helix at that point, going to ground *via* the shorter route through the transmitter, only one magnet is formed which records the signal. If you will notice the diagrams of Prescott, Terry & Finn, Maver & Davis and others, in which the winding of quadruplex relays is shown, you will notice that there are four different coils on the two sides of the horseshoe, connected in pairs with one helix on each arm of the shoe. One pair acted upon independently of the others would produce a magnet, but if acted upon in conjunction with the other pair the result would be a neutralization of the effects and no signal would be recorded on the home instruments. But follow the arrival of the current to the distant end, and you will see the same result as was noticed in the one side of the helix of the duplex.

Deeming it unnecessary to go into further detail, as you are undoubtedly familiar with what I might say, I shall endeavor to say something of the uses of the quadruplex system other than that of using it as such between two stations; also some improvements which have been adopted and others that might be used by the company with which I am connected. We quadruplex one wire between Chicago and Marion, Ia. (225 miles), and work a single wire Marion to Omaha (300 miles) into one side, and another, Marion to Kansas City (306 miles), into the other side. This enables our office in Chicago to work with any or all of the offices between Marion and Omaha, and between Marion and Kansas City.

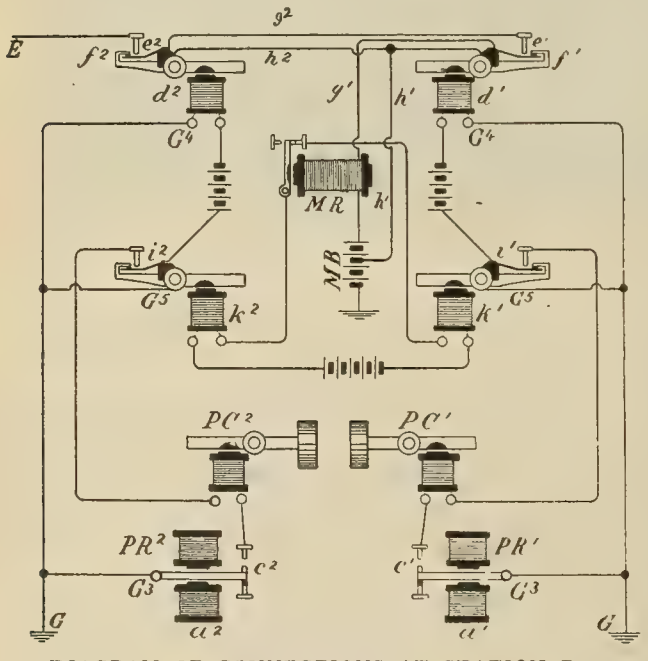
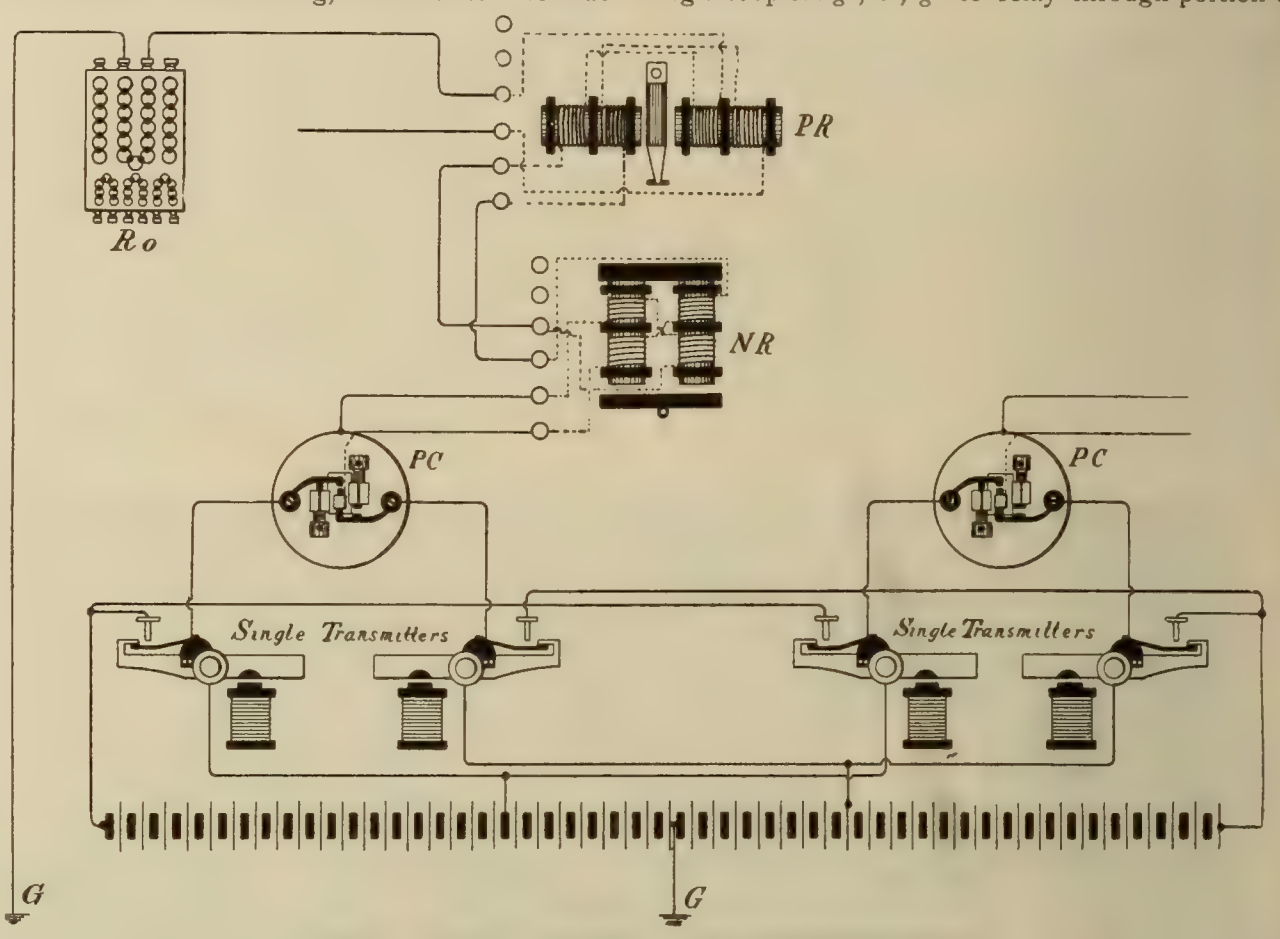


DIAGRAM OF CONNECTIONS AT STATION B.

On another quadruplex between Chicago and Milwaukee, we work a single wire from Milwaukee to Minneapolis (345 miles) on one side; at night a single wire from Milwaukee to Prairie du Chien (200 miles) is worked on the other side, and from thence through an automatic repeater to Canton, So. Dak. (300 miles), but during the day this circuit is disconnected and that side of the quadruplex is worked double.

With this arrangement at Milwaukee we are enabled to close the night office there, allowing the wires to work through, giving the general office at Chicago access to the entire system through other night offices.

I might add here that with the aid of these combinations and automatic repeaters at junction points we can, during the day, place our general manager's office in direct communication with any division superintendent's office on the system on very short notice. We run two wires from the telegraph office to the general manager's office, one to a key and sounder for transmitting, the other to a sounder for receiving, and from thence to ground. With the aid of four switches we can extend the local circuits of any quadruplex set to his office on these two wires.



TWO OR MORE QUADRUPLEXES FROM ONE BATTERY.

Those who have had experience with quadruplex troubles, no doubt have examined the repeating sounder in the No. 2 side time and again when unable to locate the trouble elsewhere. We have dispensed with this repeating sounder entirely and have improved the working of the No. 2 side 75 or 100 per cent. We do it in this way: Place the reading local circuit on the neutral relay and allow that relay to close local on the back stop as before, then exchange the tap wire and long end which will place the short end of the battery to the line with key closed, give the signal on the back contact at the distant end, and the whole battery to line with key open, breaking the local at the distant end.

We find this very beneficial in working single circuits into quadruplex circuits where it is necessary to keep the keys closed, because when the circuits are idle the short end is to line, preventing the heating of the rheostat that otherwise would occur. This I believe to be the proper and more economical way of operating a circuit of this class; besides, it overcomes the danger of the operators leaving the single-wire keys open. This change necessitates closing the keys of the quadruplex set, as well as those on the single wires, rendering the use of keys uniform.

I wish here to submit an arrangement which Mr. Miller of the Alton road intends to try. This is the working of a quadruplex wire from A to B; another from B to C, and a single wire C to D, a single C to E and a single B to F, placing A, B, C, D and F in communication with each other the same as if they were on one wire, also A, B, C and E on the other side.

The polar relay at station C responding opens the single line C to D by the usual method of repeating at such points.

The second diagram is intended to show the instruments and connections at station B necessary to accomplish this.

Referring to the first diagram, suppose the wires A to B and B to C are quadruplexed and the wires C to D, C to F and B to E single: if No. 1 side at station A opens his key the polar relay a^1 at B will respond, breaking the local circuit at c^1, which allows the pole-changer PC^1 to reverse the current on the line from B to C and also allows the transmitter d^1 to respond, opening the single wire from B to E and closing the armature at e^1 and the tongue-points at f^1, forming a loop *via* g^1 to the Morse relay MR, through portions of main battery MB, back *via* h^1 through the armature to f^1, causing the armature of MR to remain closed, which prevents the transmitters K^1 and K^2 breaking the local circuits at i^1 and i^2.

Now suppose after all the keys are closed D should open his key. The usual result would be observed at C, the polar relay a^2 at B would respond, breaking the local circuit at c^2, allowing PC^2 to reverse the current in the line from B to A and also allow transmitter d^2 to respond, opening the single line from B to E at e^2, at the same time closing the points of the transmitter, tongue and armature at f^2, forming a loop *via* g^2, e^1, g^1 to relay through portion of MB, back *via* h^1 and h^2 to the armature at f^2, causing the Morse relay MR to remain closed, preventing the breaking of the local for the transmitters K^1 and K^2.

If E opens his key when all the other keys are closed the Morse relay MR will respond, opening the local circuit of K^1 and K^2, which in turn break both locals from G^3 and G^3 to G^4 and G^4 at i^1 and i^2, allowing both pole-changers to respond but closing both armature and tongue points, leaving local circuits G^5 and G^5 to G^4 and G^4 closed, preventing transmitters d^1 and d^2 breaking back into the single wire.

The polar relays PR^1 and PR^2 operate locals on their respective sides which extend from G^3 to G^4, and the Morse relay operates both these locals at the same time.

PC^1 reverses current from B to C and PC^2 from B to A.

An ordinary quadruplex repeater placed at R operates No. 2 side from A to C, thence *via* the single wire to F.

I also submit to you for consideration another plan which appears practicable.

Usually one battery divided into one-third for short end and two-thirds for long end is considered the proper arrangement, and this one battery thus divided can be worked only on one quadruplex set or wire. I wish to call your attention to the ground which is necessarily placed on the pole-changer, forming the terminal for the circuit. If you will think for a moment you must find that every time the pole-changer reverses the battery this ground comes in contact with all the points of the pole-changer by reason of the necessity of all conditions changing at the same instant, and while these points all form contact for an instant, the ground necessarily being one of them, you will see that at that instant there can be no battery to line practically, because of the low resistance between the pole-changer and the ground.

* Paper read by U. J. Fry at the Convention of Railway Telegraph Superintendents, Cincinnati, O., June 18, 1891.

In the plan submitted to you I hope to be able to show it is not necessary for the ground to come in between the battery and the line at the moment of change of polarity; also that the battery used for operating one quadruplex set may be made with a slight increase to operate several quadruplex sets. This is accomplished by grounding the battery in the centre, then dividing each side into one and two-thirds, and by the aid of two transmitters or a double transmitter conduct the short end or the long end of the battery to the pole-changer, where reversals are made merely by sending one polarity to line and the other to rheostat. By referring to the diagram (Fig. 3) you will see that the battery current is divided in the battery itself instead of dividing the current of the whole battery at a point between the pole-changer and the neutral relay.

This arrangement would, of course, necessitate a change of the ordinary method of running wires from the pole-changer to the relays, because both polarities are going to the relays instead of one. This change, it will be seen, is necessary when you consider that the same polarity should approach the two middle posts of the relay.

One thing more I wish to mention. When taking a balance we invariably place the armature in the centre so it will remain on either side. This is, of course, not always necessary, but should this be omitted by the class of operators we are obliged to place in charge of some of our offices, the taking of two or three balances by adjusting the armature to the front contact point would in a short time bring it so far to the front as to allow it to strike the core of the magnet, causing the signals to come imperfectly or not at all.

When we wish to adjust the discharge from the condenser, we hold the armature of the polar relay between the front and back contacts with a light touch of thumb and finger, change the number of plates in the condenser, or shorten or lengthen the resistance between the condenser and relay, while dotting on the polar side until all the jar or kick has disappeared. This we consider the proper way to remove the kick, as one can tell with absolute certainty that it has been removed, while if it is done by observation only, one may be considerably out of the way.

BUFFALO W. U. OPERATING-ROOM.

It is with pleasure that we present to our readers of this issue a photo-engraving of the Western Union telegraph office at Buffalo, N. Y.

The photograph from which the engraving is made was taken by Mr. Astley C. Terry, assistant chief operator of the Buffalo office, who adds to his other well-known abilities those of an amateur photographer.

It will readily be seen from an examination of the engraving that the Buffalo office will compare favorably with some of the more pretentious offices of the Western Union Company, covering as it does over five thousand square feet of floor.

The Buffalo office has the credit of being the largest repeating-station in the United States, if not in the world.

It is well known that Mr. J. W. Tillinghast is the manager of the Buffalo office, and he is ably assisted in his managerial duties by Mr. Jno. A. Pferd.

The handling of the entire operating force is entrusted to the care of Mr. Frank Kitton as chief operator.

Mr. Kitton is ably seconded in his efforts by the following staff of gentlemen whose abilities are such that it is doubtful if the company can show at any one point men better qualified for their respective duties:

Mr. Astley C. Terry, assistant chief operator and mechanical engineer.

Messrs. Chas. H. Carter, Wm. C. Lewin and Madison Buell, repeater chiefs.

Mr. Wm. Finn, Wheatstone chief, and Mr. Samuel Stewart, traffic chief, assisted by Mr. Chas. F. Towers.

Messrs. Thos. A. Laird and Cuyler C. Smith, wire chiefs.

Mr. John Lapey, chief of the Gold and Stock department.

The night chiefs are Mr. James Corcoran, chief in charge, with Messrs. Wm. N. Stevens and Ed. L. Frost as traffic chiefs, and Mr. Cloys M. Frost, wire chief; Mr. Peter J. Haley, repeater chief.

The Great Northwestern department, which is in the Western Union operating-room, but which is not seen in the engraving, is under the management of Mr. George A. Burnett, assisted by Messrs. W. M. Fyfe, chief operator, and James H. McNally, night chief.

To give an idea of the great increase in all branches of the service that has taken place during the last ten years in this office, it may be stated that in 1881 the entire operating force consisted of 61 persons; wires, 73; loops, 23; duplex sets, 14; quadruplex sets, 15; single repeaters, 6; and the number of cells of battery, 7,500.

In 1891 the entire force consists of 61 females and 95 males, a total of 156; the number of wires, 205; loops, 110; duplex sets, 49; quadruplex sets, 28; single repeaters, 20; and the number of cells of battery, 15,700.

The record and the engraving speak for themselves, and the Western Union Telegraph Company ought to be very proud of its Buffalo office.



WESTERN UNION OPERATING-ROOM, BUFFALO, N. Y.

Mr. Kitton is so well known throughout electrical circles that it would be superfluous to add anything in the way of commendation as to the skill with which the force is effectively handled, it being a matter of creditable record at all times.

"IMPERIAL" OPEN-CIRCUIT BATTERY.

Those of our readers who have purchased the valuable little motors and dynamos manufactured by the Nowotny Electric Co., of Cincinnati, Ohio, will be pleased at its success in designing an open-circuit battery different from the many cells now on the market, and exposing, it is said, nearly one-third more carbon surface to chemical action.

In developing the Imperial Battery, it has been the aim of the manufacturer to produce a battery that is superior to anything heretofore put upon the market, regardless of cost.

The battery is an improved form of the "Multiple" manufactured by this company, and is somewhat more expensive than the average low-grade battery in the market, but in quality it is said to have no equal. It is claimed to have none of the disadvantages to which other open-circuit batteries are subject, and that it stands as an "Imperial King" of open-circuit cells.

Its combined strength, durability, recuperative qualities and long life, with an enormous working power, are beyond any one's expectations.

It is intended principally where an exceptionally high grade of battery is wanted for general hard work, such as telephone service.

In this battery there is by actual measurement 1964 square inches of available carbon surface below the fluid-line exposed to chemical action. This surface is placed in such a manner that the internal resistance of the cell is cut down to the lowest possible minimum.

The entire outer cell of this battery is made of carbon, dispensing with the glass jar, serving the double purpose of a negative exciting element and a retaining vessel.

There are eight inwardly-projecting ribs of carbon extending over the inner surface of the cell pointing toward the centre and surrounding the zincs on all sides. The inner surface of the cell is also corrugated for the purpose of increasing the surface. Few batteries expose more than 110 square inches of actual surface to chemical action.



IMPERIAL BATTERY.

It is a well-known fact that when the circuit is closed in carbon and zinc batteries using sal-ammonic as an excitant, the zinc is dissolved, forming chloride of zinc, and hydrogen gas appears at the carbon surface. Hydrogen is a non-conductor, and when it attaches itself to the carbon that portion becomes insulated. Therefore in such a cell, from the instant of the closing of the circuit the current grows weaker and weaker, for the reason that the carbon surface exposed to chemical action becomes smaller and smaller through the generating and lodging of the hydrogen gas. If the circuit now be left open, this gas gradually escapes, again exposing the carbon free for action, and thus the strength of the battery gradually returns during the resting-spell.

Admitting these facts to be true, the advantage of the large carbon surface exposed to chemical action in this battery can be readily seen.

The company is having a good sale for them, and now has its factory in such shape that large orders can be filled promptly.

EDUCATIONAL.

Ignorance of even the simplest electrical devices and the methods of their operation is continually occasioning laughable incidents. The Electric Merchandise Company, of Chicago, had on exhibition at the Montreal Convention a set of Burton Electric Heaters. These were arranged upon a stand in the company's parlors. Each evening a large electric headlight was placed just outside the door to serve the double purpose of illuminating the dark hallway and indicating the situation of the company's quarters. About the light were scattered numerous advertising cards of the Burton Electric Heater. A party of Montreal citizens passing through the hallway were attracted by the light, and upon reading the announcement on the cards one of the number stopped and held his hand near the headlight, remarking in a disgusted tone as he did so: "That does not give much heat!" Before leaving they made the acquaintance of the heater, and previous disgust expressed at the inability of the headlight to radiate great heat changed to interest and surprise.

THE ELECTRICAL AGE
DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

Established 1883.

Entered at New York P. O. as second-class matter.

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THE PITTSBURG CONVENTION.

The American Street Railway Association held its tenth annual convention in Pittsburg last week, with most signal success. This Association, originally started among horse-car companies, has undergone a marvellous change in the past three years, and is now one of the most important organizations of operating companies in existence.

During the proceedings of last week's Convention the words "horse" and "mule" were hardly mentioned, except in referring to them as things of the past—as far as street railways are concerned. Electricity pervaded everything, and was the power of the Convention. The discussions all related to the use of electricity as a motive-power for street cars, and the thought that this condition of things existed in an organization that was once essentially all horse and mule power was strangely significant. Very few delegates are not now familiar with the new power, and those who are have unconsciously become advocates of the same. If any one, perchance, still operates a horse line, he is inclined to keep quiet and in the background, as if ashamed to be recognized as being in any way concerned with so ancient an institution as a horse-car line. On the other hand, look at the delegate who is connected with an electric line. He is proud of his connections and is full of life and energy. He is eager to learn the latest and his road, you may depend on it, is a thriving one.

The Convention was a remarkable one in point of attendance of delegates and number and variety of exhibits. The latter were exceptionally interesting and important, showing that the manufacturers and supply men are constantly exercising their ingenuity to produce the best of everything for the railroad men. The only thing of an unfavorable character that can be said of the exhibition is that it was a mistake to allow the exhibits to be scattered as they were. There may have been good and sufficient reason for it this time, but we have every reason to believe that next year the exhibition will be held under one roof and managed in a different manner. To have all the exhibits together means that the goods of no one will escape the attention of the visitors; whereas when they are scattered as they were at Pittsburg it is reasonable to suppose that many of the visitors went home without seeing some of the most important and interesting exhibits, simply because they were scattered and few knew which way to turn to find them.

The papers read during the meetings were of exceptionally high character, and we refer our readers to Street Railway News of even date for a full account of the proceedings and the papers read. Both were highly instructive and much profit will be derived from a careful consideration of the same.

A review of the work done at the Convention would not be complete without a brief reference to the daily edition of Street Railway News. The work of getting out the daily edition was one attended with extraordinary and unlooked-for difficulties. But these were all met and overcome, with the result that Street Railway News scored a great victory and was the subject of much praise and admiration. The name of the new President and the place of the next meeting were announced in the Street Railway News within a very short time after the votes on these questions were recorded. Altogether Street Railway News won the hearts of the delegates and others in attendance.

Montreal, having established a reputation for hospitality during the Convention of the National Electric Light Association last September, is again to the front bidding for the American Street Railway Association Convention next year. Mr. A. J. Corriveau, of Montreal, to whose efforts much of the success of the Electric Light Convention was due, made a pilgrimage to Pittsburg with Montreal's invitation in his vest-pocket, but unfortunately he arrived too late to accomplish his object. The Association had decided to go to Cleveland next year, but as the selection was made subject to change, Mr. Corriveau takes advantage of this provision and extends an invitation to the Association to meet in Canada's metropolis next year. To hold the next Convention in Montreal would no doubt give the electric railroad a wonderful impetus in Canada.

The action of the Executive Committee of the Street Railway Association on this suggestion will be watched with a great deal of interest.

ELECTRIC POWER FROM NIAGARA TO CHICAGO.

In a dispatch from Chicago, Oct. 21, it was stated that Prof. John P. Barrett, Chief of the Electrical Department of the World's Fair, had received a letter from Mr. J. A. Hornsby, who is now in Frankfort, Germany, in which the latter gentleman said that he would bring home with him a proposition of great scientific interest and importance. The proposition comes from Dolivo von Dobrowolsky, and, according to the dispatch, it is to transmit a 1,000 or 5,000 horse-power alternating three-phase current from Niagara Falls to the World's Fair at a pressure of 50,000 volts over an uninsulated copper wire.

Mr. Hornsby's return to America will be looked for with a great deal of interest by electrical engineers and scientists in general, who will naturally be anxious to learn more details concerning this unparalleled scheme of long-distance transmission of electrical power.

The transmission of power from the waterfall at Lauffen to the exposition grounds in Frankfort-on-the-Main attracted considerable attention throughout the electrical and scientific world on account of the distance between the two points and the evidently successful accomplishment of the undertaking. In the latest project, however, the distance from Niagara Falls to Chicago far exceeds that between Lauffen and Frankfort; it is at least four times the distance. Owing to this fact and many others of a scientific nature such an undertaking as that proposed would be an event of the greatest moment in the world of science. As to the practicability of the scheme no one can with certainty predetermine. All we can do is to wait and see.

NEW TELEGRAPH OFFICE.

The telegraph is an old-established institution—old compared with practical electric lighting and electric street cars—but for all that it has not yet reached that stage of perfection where nothing more can be expected in that direction. Improvements are constantly being made, and with the improvements comes largely-increased business. To facilitate the handling of the large business larger offices and the latest improved apparatus are necessary.

A model telegraph office is that of the Western Union Telegraph Company in Buffalo, an interior view of the operating-room of which we give elsewhere in this issue.

This office is one of the most important repeating points in the country, and a large amount of talent and skill is necessary to maintain the standard requisite to insure the best service. Our illustration is made from a photograph taken by Mr. A. C. Terry, a prominent electrician of Buffalo.

THE LIFE OF THE TRADE.

We doubt if any profession or trade has ever done so much to develop the business capacity of so many young men as has the electrical profession. Scores of young men have risen to positions of prominence in late years in the different departments of the electrical industry, and there is no gainsaying the fact that the marvellously rapid strides made in the application of electricity is due to the fact that the business is largely in the hands of young men. Youth and vigor are synonymous expressions, and the proof of this is demonstrated in the electrical trades, which without question are the most vigorous and healthy of all in the present generation.

We present elsewhere in this issue the features of a gentleman well known in the electrical profession. He is young and possessed of that healthy vigor that is necessary these days to keep large enterprises to the front. He has an honorable career behind him and a limitless future before him, and he is of the kind that keep the world in a state of activity.

RECORDING ALTERNATE-CURRENT CURVES.

An interesting article appears on another page in this issue describing a method, designed by Mr. Blondel, of making a record of alternate-current curves. Joubert devised some apparatus for this purpose and used a contact-maker, revolving with an alternator, to make a connection with a brush once during a revolution, and thus charge an electrometer to the voltage generated in the dynamo at the corresponding part of the period. By adjusting the brush the voltage at all parts of the period could be measured and a complete curve thus obtained. The Blondel method consists of an extension of the Joubert apparatus. In the former uses a d'Arsonval galvanometer in series with a condenser is used. Two brushes are necessary in this method, one for charging the condenser and the other for discharging through the galvanometer. The galvanometer spot is focussed on sensitized paper which is moved vertically by clockwork, and the photographic record thus made is an accurate trace of the alternate-current curve. Blondel uses two galvanometers, one for potential and the other for current, but both focussed on the same spot. A double curve is in this way obtained, the corresponding ordinates of which represent the simultaneous values of the current and electromotive force. This is an excellent way of studying the action of an alternator.

THE M'INTIRE CONNECTORS.

The connectors we illustrate herewith have been before the public for some time, meeting with the favorable reception they deserve wherever introduced. No doubt some prefer to carry a heavy soldering-pot and soldering-irons about with them, but give us the tools that do equally as good or better work with least labor. We all like soft snaps,

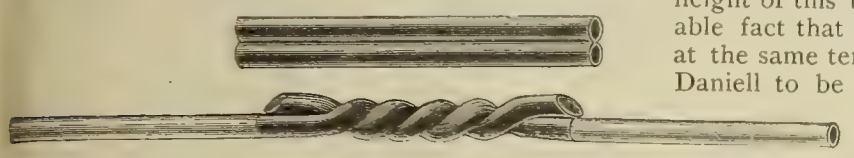


FIG. 1.—M'INTIRE CONNECTOR.

and the first time we have occasion to splice a wire, connect a cord to a lamp-socket, or put in a fuse wire we will take the precaution to have the "Connector" shown in Fig. 1, lamp and cut-out terminals like those seen in Fig. 2, or fuse-wire terminals as seen in Fig. 3, within convenient reach.



FIG. 2.—LAMP AND CUT-OUT TERMINAL.

A connector giving the best results, forming a perfect metallic contact, with a life that equals that of the wire itself, without the use of solder, acid or heat, is what we want when we have work to do.

It is claimed that a joint made with these connectors is a point of least resistance to current, and is weather and moisture proof.

The variety of purposes for which these connectors are made make them valuable to any one doing electrical wiring of any kind; a branch wire can be attached to an incandescent-light circuit without cutting the main wires, two wires of different sizes may be spliced as firmly as if they were of the same size, or an iron and a copper wire may be connected as if of one material; in all cases making a firm and secure joint.

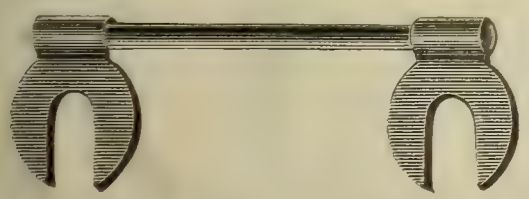


FIG. 3.—FUSE-WIRE TERMINAL.

For iron and steel wires the connectors are made of iron, brazed together, then tinned, and for copper wires they are of the best lake copper.

These connectors are made by the C. McIntire Co., 13 and 15 Franklin street, Newark, N. J., who will make special sizes and combinations to order.

The firm recently shipped a large order to Antwerp, Belgium, for the International Bell Telephone Company for use on hard-drawn copper wire.

ELECTRICAL FACTS AND FORMULÆ.

The resistance of copper wire increases .21 of one per cent. for every degree Fah.

The hot resistance of an incandescent lamp $= \frac{E}{c}$.

The electrical energy in watts spent in a lamp $= E \times c$.

The energy in H. P. spent in a lamp $= \frac{E \times c}{746}$.

The number of lamps per H. P. $= \frac{746}{E \times c}$.

The resistance per mile of pure copper wire d mils in diameter $= \frac{54892}{d^2}$.

The light emitted by glowing solid bodies increases more rapidly than the temperature; therefore the proportionate amount of horse power consumed per candle-power in lamps decreases as the candle-power increases, but at the expense of their life. An example of this is seen in heating platinum wire. When it is heated to 2,600° F. it emits 40 times more light than when heated to 1,600° F.

Heat and light are identical in character, though different in degree, and whenever solid matter is raised to a very high temperature it becomes luminous. The amount of light is dependent upon the height of this temperature, and it is a very remarkable fact that all solid bodies become self-luminous at the same temperature. This was determined by Daniell to be 980°, by Wedgewood 947°, and by Draper 977°; so that we may approximately assume the temperature at which bodies begin to show a dull light to be 1,000°. Bodies, when raised to incandescence, pass through all stages of the spectrum; as the temperature increases, so does the refrangibility of the rays of light. Thus, when a body is at a temperature of

250°,	it may be called	warm.
500°,	"	hot.
1,000°	we have the	red rays.
1,200°	"	orange rays.
1,300°	"	yellow "
1,500°	"	blue "
1,700°	"	indigo "
2,000°	"	violet "

So that any body raised to a temperature above 2,000° will give us all the rays of the sun.

INSTALLATION OF DYNAMOS.

In erecting large dynamos the magnetic joints must be as nearly perfect as possible. All surfaces must be clean, and no two portions of the iron-work forced into contact by means of bolts or nuts. Joints should be fitted previous to setting up, so that the bolting together of parts will not warp the castings. The armature bearings must be so set that the periphery of the armature occupies an exactly central position in the armature chamber. On no account must the armature be allowed to touch either of the pole-pieces. When the boxes are bolted down the armature shaft should be easily turned by hand, and have an end play of at least ¼ of an inch to assist in distributing the oil.

As the shaft becomes heated in working the expansion will cause binding if fitted quite full into the boxes, so it is best to allow for this expansion. Do not roll an armature along the floor, but lift it by means of the shaft. The brushes should be trimmed square so as to bear equally upon the commutator. They must be free from any twist, which might cause them to bear upon the bars with one corner only. The contact must be flexible and not too heavy. When the dynamo is first started a current is passed through the field coils to give the core a certain polarity and leave therein residual magnetism as a basis for the excitation of the machine. This magnetism is very feeble, and is easily destroyed by knocks and reversed by accidental contact with other magnets. Complete failure of residual magnetism is rare, but in such a case a current must be passed through the field coils from some other source. In constant-current dynamos care should be taken to pass the current in a direction to give polarity for which the machine was designed. In alternating dynamos it is immaterial which way the current is passed. Care should be taken to have the belt tightened and the foundation rails carefully levelled and free from warping throughout their length, and to have the dynamo carefully insulated to lessen the danger of grounds at the machine. A great many of the common failures of dynamos and dynamo-circuits are due simply to ground contact of the machine. The electrical system should be carefully insulated from the iron-work of the dynamo, yet an accidental contact often occurs. If the dynamo be completely insulated from the earth this fault need not extend beyond the dynamo itself. The effect of "grounds" extends to every part of the electrical system, in some cases practically halving the leads.

Dynamos are sometimes only insulated from earth by being placed upon dry wood battens, but it is becoming more customary to mount the machine on a vulcanized fibre or a brick foundation. It should be remembered that the more care bestowed upon the different parts of the system the more efficient will be the plant, and a little carelessness in erecting a dynamo may cause sufficient trouble after the plant is running to double the first cost of the installation before the fault is located. Every day we see accounts of trial tests of new plants both for light and power, and very often they refer to the failure of some part of the system. Electrical science is sufficiently developed to render these failures inexcusable, and it looks as if these systems were not carefully constructed. There are some firms who do their work thoroughly and well, who know that the moment they start their plant it will work, and work as it was intended to.

BIOGRAPHICAL SKETCHES.

CHARLES D. SHAIN.

Mr. Charles D. Shain, the son of Charles J. Shain, of the once celebrated firm of Knox & Shain, of Philadelphia, was born in that city November 2, 1855, making him now just 36 years of age. Many will recollect the above-named firm as being the oldest manufacturer of telegraphic instruments in the United States.

Mr. Shain graduated from the Central High School of Philadelphia, and for a time followed the profession of civil engineering, afterwards connecting himself with the United States Electric Lighting Company of Chicago as assistant to the Western manager.



CHARLES D. SHAIN.

Later he was General District Agent of the Westinghouse Electric Company at Cincinnati, with the United Edison Manufacturing Company in New York, and for over a year past he has been Eastern District Manager of the Edison General Electrtc Company, with headquarters in New York City, handling the railway, lighting, power, mining and other business for the company in the States of Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia and West Virginia.

Mr. Shain was one of the pioneers in electric circles in the West, and is one of the charter members of the Chicago Electric Club and one of the managers of the New York Electric Club.

REPORTS OF STREET LIGHTING BY ARC LAMPS.

We have received from Special Census Agent Allen R. Foote a copy of the blank form of the "Report of Street Lighting by Electric Arc Lamps," printed as recommended to the Census Office by the National Electric Light Association. The report is for the census year ending June 30, 1890, and at the head of the blank is the following note: "First, enter the data for street lighting as the facts were at the close of the census year. Second, enter the data as the facts are at the date on which the information is obtained."

The blank is divided into six columns under general headings, and each is subdivided. The general headings and those of the subdivisions are as follows:

NUMBER OF LAMPS—Single; double.

CURRENT USED—Volts; ampères; watts.

CONTRACT—Term of years; rate per annum; hours per year; nights per year.

CIRCUIT—Aerial or underground; mileage of wire; mileage of streets; lamps per mile of streets.

POWER—Water, or if steam, kind of fuel; cost per unit D.

RATE PER UNIT—A, per lamp mile; B, per lamp hour; C, per lamp-mile hour; D, per kilowatt-mile hour; E, per lamp per night.

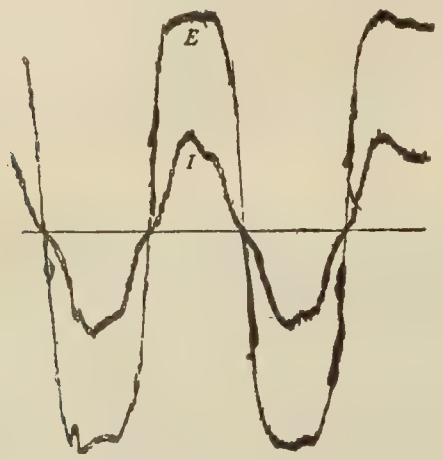
The margin provides for date of reports.

A similar form will be provided for reports for electric incandescent lamps used for street lighting.

The amount of activity in electric lighting in New South Wales may be judged from the fact that no less than seven electric supply bills will be presented at the next session of Parliament.

RECORDING ALTERNATE-CURRENT CURVES.

In a recent number of *La Lumière Electrique* M. Blondel describes some apparatus designed for the determination of the periodic curves representing alternate currents. It consists of an extension of the apparatus originally devised by Joubert, who, it



DOUBLE CURVE.

will be remembered, used a contact-maker, revolving with alternate-current dynamo, to make connection with a brush once during a revolution, and thus to charge an electrometer to the voltage generated in the dynamo at the corresponding part of the period. By adjusting the position of the brush the voltage could be measured at all parts of the period and the complete curve obtained. After an exhaustive comparison of the effects obtained with galvanometers and electrometers, M. Blondel finds the former preferable, and uses a d'Arsonval galvanometer in series with a condenser instead of the static instrument. It is necessary in this case to use two brushes, one for charging the condenser and the second for discharge through the galvanometer. The two brushes are fixed to an arm movable about the same axis as the revolving contact-maker, and this arm is turned at a regular rate by clockwork. The scale on which the galvanometer spot is focussed consists of sensitized paper, and is moved vertically by clockwork. The photographic record obtained is, therefore, an accurate trace of the alternate-current curve. The curves obtained are potential curves, or current curves, according as the condenser is connected with two points of the circuit whose voltage is required, or to the terminals of a standard resistance in series with the main current. In all the cases described by M. Blondel the apparatus was duplicated. Two galvanometers were used, one for current and the other for potential. The spots of light were, however, focussed on the same scale with a common zero, the light being obtained from a powerful arc lamp, and reflected on to the instruments by mirrors suitably placed. The double curve thus obtained is such that corresponding ordinates represent the simultaneous values of the current and electromotive force. The figure given shows the curves obtained with an arc lamp worked with the alternate currents produced by a Méritens magneto machine. The curve I is the current curve, while curve E represents the electromotive force.

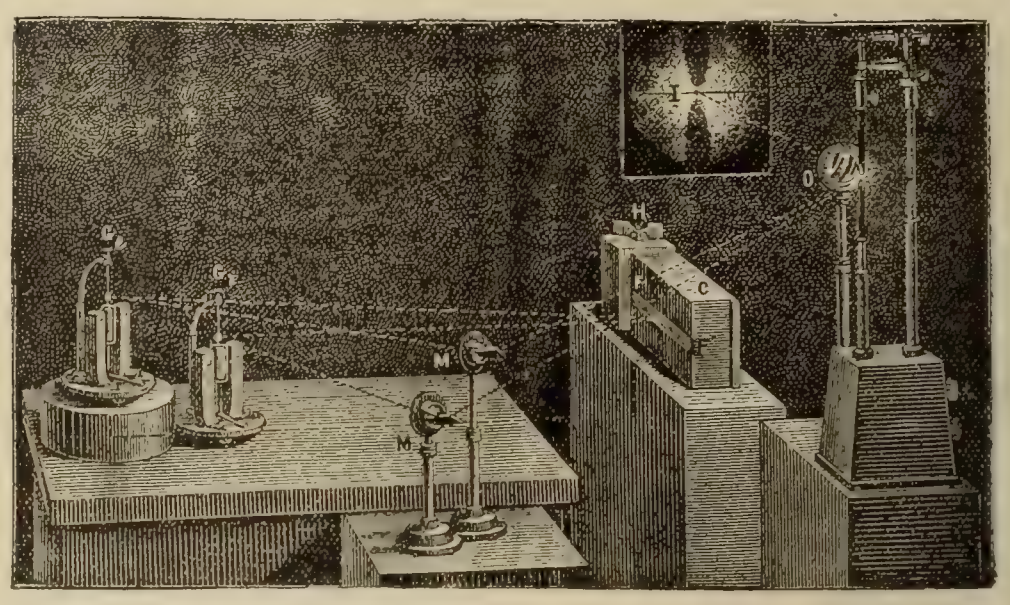
When the apparatus is once set up it is possible in a comparatively short time to make a complete study of an alternator under all circumstances of use. A complete alernate-current curve can be obtained in two or three minutes.

ELECTRO-PLATED ORNAMENTS.

Ornaments for the house can be made by electro-plating insects, flowers, leaves, etc., producing effects both unique and pretty. It is not an uncommon sight to see imitation spiders, spider-webs and skeletons sold on the streets for ornaments, but the genuine articles cannot be improved upon, because when plated every mark seen during life is retained, the plating taking the same formation as the original. The plating on insects and leaves cannot be polished, as the articles are too delicate to stand the pressure of the brush, but the rough plating increases rather than detracts from the effect. A pretty spider-web that needs no plating can be made with No. 36 B. & S. bare German-silver wire, costing about $6.50 per pound. As there is nearly 10,000 feet to the pound, enough for a web would cost very little. Soak a spider in an alcoholic solution of nitrate of silver, made by shaking 1 part crystals of nitrate of silver to 50 of purest alcohol in a bottle; then when dry expose it to a stream of sulphuretted hydrogen. This preparation gives the insect a conducting film of silver upon which other metals may be deposited by the electro-plating process, but always plate with copper first. Preparing twigs and flowers in the same manner, plating different parts with different metals and hanging the spider and web among the leaves, makes a rich ornament. With copper alone all shades, from a bright copper color to a dull brown, can be produced by regulating the quantity of current passing through the bath.

COMPOUND ENGINES.

Among the exhibits of machinery at the American Institute Fair in this city is a compound engine made by B. W. Payne & Sons.



APPARATUS FOR RECORDING ALTERNATING CURRENT CURVES.

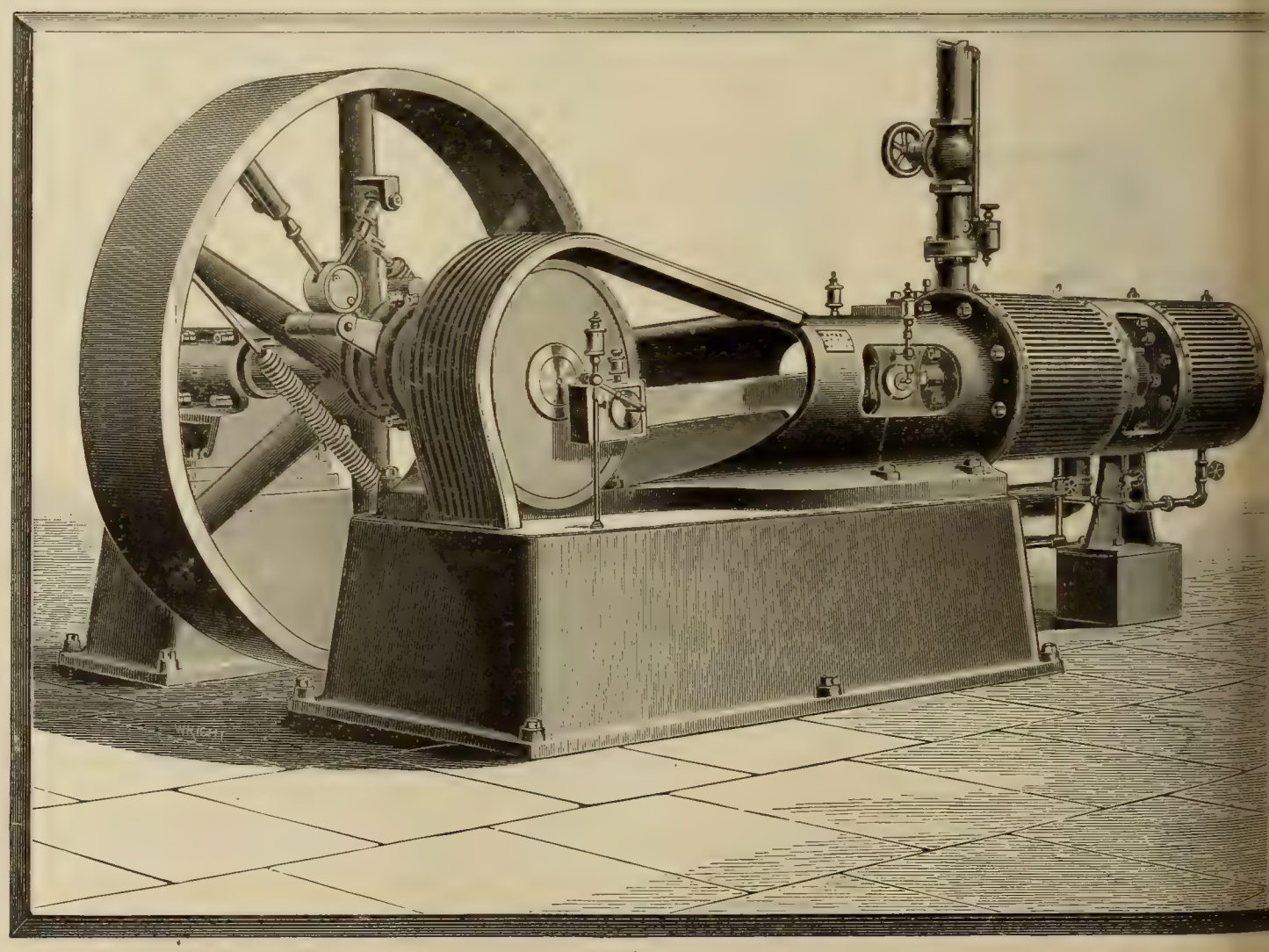
It is only within recent years that compounding steam-engines has been practiced in this country, except in cases of large steam plants. This was owing largely to the excessive cost of such plants and the limited knowledge of compound practice, as applied to small engines.

Messrs. B. W. Payne & Sons are among the first builders of compound engines, having put out a large number both at home and abroad. The marked success attending the operation of these engines recommends them to all in search of steam-power at a minimum cost.

The advantages derived from their use are obvious. The piston-rod and heads can be easily removed through the low-pressure cylinder without disconnecting cylinders.

The arrangement of valves is such as to give the best attainable results. The low-pressure valve is driven by a fixed eccentric, the valve-rod passing through the steam check of the high-pressure cylinder. The high-pressure valve is perfectly balanced, and actuated by an eccentric controlled by the automatic governor. In regulation, these compound engines are said to be unsurpassed, and they are especially adapted to electric light and power purposes.

The factory of B. W. Payne & Sons is at Elmira, N. Y., and the general sales office is at 45 Dey street, New York City.



PAYNE & SONS' COMPOUND ENGINE.

ELECTRIC MOTORS.

Those who have noticed, by comment in our paper, the results which Mr. H. Ward Leonard is able to accomplish by his new method of operating electric motors, will be interested to learn that Mr. Leonard announces that he has now perfected his method to such an extent that, by a slight modification in a central-station plant, which will not in any way affect the operation of existing devices, he will be able to control any motor upon the circuit so that it will operate in either direction and automatically at any desired speed and torque and with perfect efficiency under all conditions.

Mr. Leonard's first development of this method made it necessary, when using his motor from a central-station circuit, to use the equivalent of a transformer of the energy. In his latest development no transforming of the energy is required; consequently the first cost will be no higher than that for shunt motors in use to-day, and yet all the advantages will be secured of the perfect control obtained by his

method. No change in the generators, conductors or translating devices of the present stations will be required in order to accomplish this result.

GAS vs. ELECTRICITY.

In a circular recently issued by E. T. Pardee, Agent Mather Electric Company, Syracuse, N. Y., some interesting figures are given showing the relative economy of illuminating by gas and electricity. He says: "Let us assume the problem of a mill, factory or hotel using in one instance 300 5-foot gas-burners, and in the other operating 300 incandescent lamps of 16 c. p. each.

"Assuming that the price of gas is $1.50 per 1,000 feet, and that each burner averages 400 hours per year, we find the gas used per year for 300 burners to be 600,000 ft., which at $1.50 per 1,000 would cost $900.000.

"The conditions in the second case are that 4½ lbs. of coal will produce one horse-power one hour; the price of coal, $4.00 per ton; the cost of a 300-light plant installed is $2,200; that the lamps have a guaranteed life of 1,000 hours, with renewals at $0.75 each. If 300 lamps are guaranteed for 1,000 hours and burn but 400 hours per year, this means that they would last 2½ years, or that 4-10 of them would require to be renewed each year at a cost of $90.00. Thirty horse-power would be required for the 300 lamps, as each 16 c. p. lamp requires 1-10 of a horse-power (this is a low average, as with the Mather system eleven 16 c. p. lamps to the horse-power is guaranteed); therefore the cost of lighting by electricity would be $438.00—a saving of $462.00.

"Incandescent lamps can be operated in places where it would be impossible to use gas or oil lamps; they can be handled with great ease and facility, and can be extended to cover a larger area at a less cost than could be accomplished by any other form of artificial illumination."

BRISTOL'S RECORDING PRESSURE-GAUGE.

Bristol's Recording Pressure-Gauge, which is illustrated in the accompanying engravings, is being successfully introduced and is fast filling a long-felt want for a recording-gauge of fundamentally simple construction, which would be reliable in its operation and of moderate cost. Fig. 1 shows the instrument complete and ready for operation. Fig. 2 shows the pressure-tube with inking pointer attached; the front of case, dial, and clock cover being removed. As

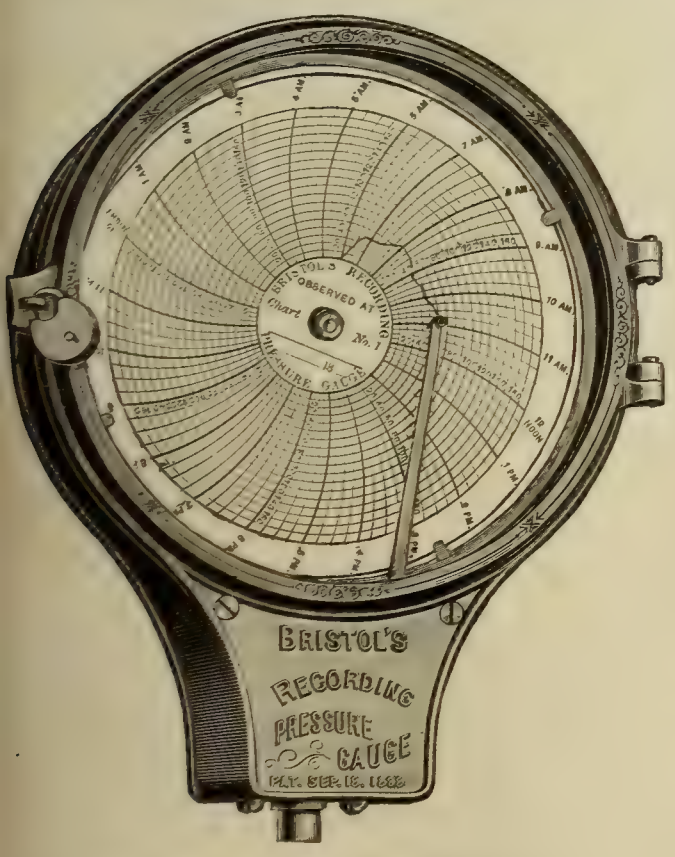


FIG. 1.—RECORDING PRESSURE-GAUGE.

will be seen, the tube A is of flattened cross-section and bent into approximately sinusoidal form. A flexible strip, B, of the same metal as the tube is secured at the ends and along the bends. Pressure applied to the tube produces a tendency to straighten each bend, or, collectively, to elongate the whole. This tendency to lengthen the tube is resisted by the flexible strip B, and thereby converted into a multiplied lateral motion.

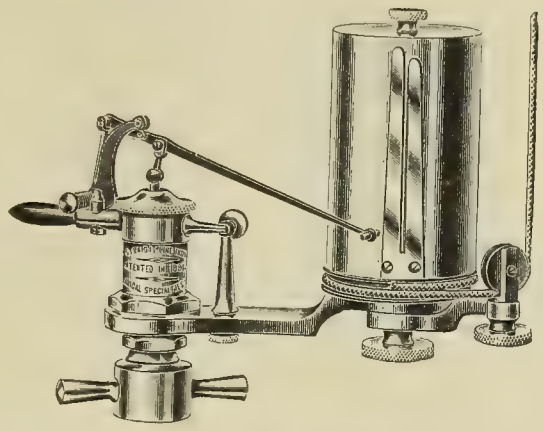
The inking pointer is attached directly to the end of the pressure-tube, from which it will be seen that the usual mechanism and multiplying devices are dispensed with, since the motion of the tube itself is positive and of sufficient range. The special advantage of this is evident, considering that in many other pressure-gauges the movement of the tube or diaphragm is small, and requires a system of mechanism to multiply it many times before it is available for indicating purposes. These multiplying devices must be delicately constructed and properly cared for, and even under the most favorable conditions they are liable at any moment to be a source of error.

The recording-gauges are made to suit all varieties of work, from very low pressures, such as those employed in steam-heating and electric light and power stations, to such pressures as are carried in hydraulic-press work.

The instrument herein described is manufactured by The Bristols' Mfg. Co., of Waterbury, Conn.

A STRAIGHT-LINE INDICATOR.

We describe and illustrate herewith the latest development of indicators manufactured by Hine & Robertson, 45 Cortlandt street, this city. The Arc Indicator, manufactured by this firm, is familiar to all engineers, and we think that this Straight-Line Indicator will acquire equally as good a reputation.



STRAIGHT-LINE INDICATOR.

The peculiarity of this instrument lies in the simplicity of its parallel motion and in the auxiliary spring, by which it is held up to one working surface and thus prevents the appearance of any backlash. The guiding mechanism for the parallel motion is placed as near the fulcrum as possible, to obviate the great amount of movement as found in other indicators and to be where the momemtum will be the least. For a card of average height a sideways movement of not more than one-eighth of an inch is necessary to oblige the pencil to move in a straight line, and for so slight a movement very little mechanism should be sufficient.

In this indicator this is accomplished by two rocking surfaces, one attached to an upright and the other permanently fixed on the pencil-arm. The one on the upright is made circular, and the other of such form that when the lever rises and falls these two guiding surfaces roll together for a very slight distance and cause the pencil to move in a perfectly straight line throughout its full range. All that is required of the auxiliary spring is to give it sufficient tension to keep these guiding surfaces in contact while the instrument is running. This may be determined by turning on steam while the drum is stationary and noting if the pencil traverses the same vertical line. This spring is intended also to take up all play that may ever appear in the joints and oblige the pencil to always follow in the same path. The first indicator made was subjected to the test of being run continuously nine hours per day, on a high-speed engine, for over a month, and showed no appreciable wear; what wear there may have been was taken out by the auxiliary spring, and the instrument improved, if anything, by this hard usage.

The effect of the auxiliary spring on the main spring is to weaken it. This allowance is made in numbering the spring, and the scale of spring, therefore, is the net resistance of the two springs.

The moving parts of the instrument are the lightest weight of any straight-line indicator, and that weight is disposed so near the fulcrum that its little movement makes the momentum very little and specially adapts it for the highest speeds.

PERSONAL.

Mr. Herbert Laws Webb, who since the illness of Mr. J. W. Dickerson, editor of *Electricity*, has been acting editor of that paper, has now taken full charge of the editorial department.

Mr. Webb, who left his position as assistant electrician to the Metropolitan Telephone and Telegraph Company to enter into newspaper work exclusively, has become well known as a contributor to the various electrical journals, and his writings have invariably been characterized by the rare combination of literary skill and sound technical knowledge. In Mr. Webb's new capacity his former experience on the staff of the London *Electrician* and his intimate connection with his uncle, Mr. W. H. Preece, F.R.S., the head of the Postal Telegraph service in England, are likely to serve him in good stead, and *Electricity* is to be congratulated on having placed its editorial direction in such capable hands.

Mr. Dickerson, the retiring editor, is just recovering from severe and tedious illness. He has had an active newspaper career, and was well known as the editor of the *Western Electrician*, which he left in order to organize *Electricity*. The favorable impression created by the appearance of that paper was the result of Mr. Dickerson's indefatigable efforts in developing the new venture. Mr. Dickerson has, by his sterling qualities, secured the esteem and respect of friends and acquaintances alike, and it is safe to say that he has the good wishes of the whole electrical community for his speedy restoration to health and active work.

NEW INCORPORATIONS.

The Alexander-Chamberlain Electric Company, of New York City, was incorporated October 14, with a capital stock of $1,000, to carry on an electrical engineering business. Incorporators: Hugo Alexander, Harry Alexander and Rudolph N. Chamberlain, all of New York, N. Y.

The Cumberland Electric Light Company, Pittsburg, Pa. (incorporated in W. Va.), was incorporated October 13, with a capital stock of $100,000. Incorporators: James S. Humbird, Harvey L. Childs and Frank S. Marr, all of Pittsburg, Pa.

The Logansport Electric Light and Power Company, Logansport, Ind., was incorporated October 15, with a capital stock of $60,000. Incorporators: R. T. McDonald, E. J. Hathorne and Joseph Seiter.

The Butler Electric Light and Gas Company, Butler, Mo., was incorporated October 13, with a capital stock of $15,000. Incorporators: Arthur L. McBride, Thomas W. Legg, Thomas W. Silvers and George W. Canterbury, Butler, Mo., and John A. Keller, St. Charles, Mo.

The Granite City Electric Company, Barre, Vt., was incorporated October 12, with a capital stock of $50,000. Incorporators: E. L. Smith, R. S. Currier, Barre, Vt., and E. D. Blackwell, Montpelier, Vt.

The Crouch-Houston Electric and Manufacturing Company, Eugene, Ore., was incorporated October 12, with a capital stock of $1,000,000. Incorporators: Frank J. Crouch, Eugene, Ore.; C. P. Houston and W. L. Houston, Junction, Ore.

W. D. Hyslop Electric Company, LaFayette, Ind., was incorporated October 16, with a capital stock of

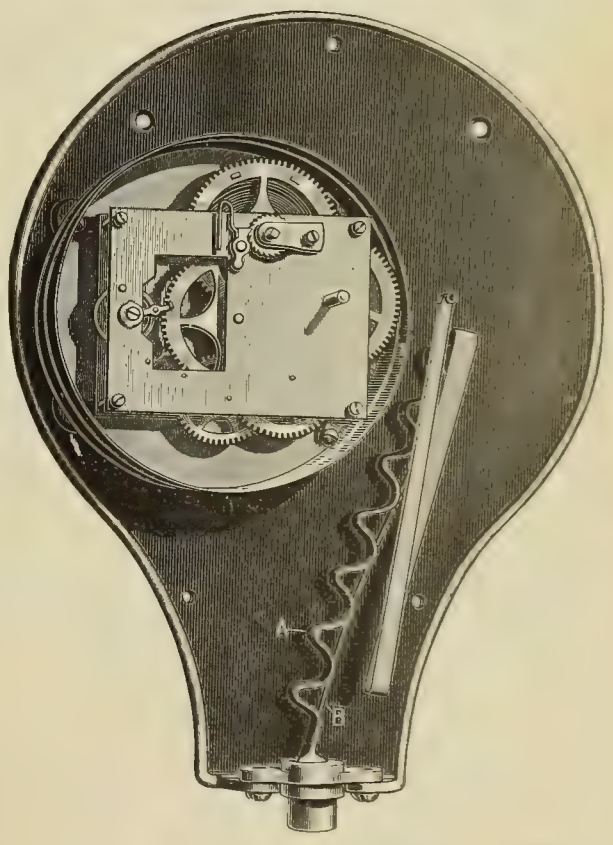


FIG. 2.—INTERNAL MECHANISM OF GAUGE.

$10,000. Incorporators: William D. Hyslop, R. H. McMullan and John B. Sherwood.

The Glenwood Heights Company, Charleston, W. Va., was incorporated October 15, with a capital stock of $52,000, to generate electricity for light, heat and power. Incorporators: John Alleman and P. F. Duffey, Charleston, W. Va., and L. A. Christie, Winfield, W. Va.

The Mott Visual Telegraph Company, Jersey City, N. J., was incorporated October 16, with a capital stock of $500,000, to manufacture and sell electrical bulletin instruments. Incorporators: W. A. Vail, G. N. Smith, Brooklyn, N. Y.; C. R. Truex, B. Whitehorne, Montclair, N. J.; and R. G. Brown, New York, N. Y.

The Pascagoula Ice Company, Scranton, Miss., was incorporated October 16, with a capital stock of $15,000, to generate electricity for light and cold storage purposes. Incorporators: L. T. Bell, Sr., F. McArdle, F. P. Rives, John Foster and Ed. Bloomfield.

The A. C. Seibold Company, New York, N. Y., was incorporated October 12, with a capital stock of $5,000, to manufacture and sell electrodes for arc lamps and similar devices. Incorporators: Albert C. Seibold, Mt. Vernon, N. Y., and Edgar O. Clark, New York, N. Y.

The Franklin Electric Company, New York, N. Y. (incorporated in W. Va.), has been incorporated, with a capital stock of $5,000,000. Incorporators: George B. Waterhouse, Passaic, N. J.; Frank K. Irwing, Brooklyn, N. Y.; and Henry M. Munsell, New York, N. Y.

The Oyster Bay Electric Light and Power Company, Oyster Bay, N. Y., was incorporated October 14, with a capital stock of $5,000. Incorporators: Frederick M. Brigham, Edgar T. Sammis and Stephen A. Bayles.

NEW YORK NOTES.

Office of the Electrical Age and Street Railway News, First Floor, World Building,
New York, Oct. 24, 1891.

Mr. F. H. Sparling, formerly with W. H. Gordon & Co., 115 Broadway, is now with John A. Roebling's Sons.

Mr. W. H. Gordon, of 115 Broadway, agent of the Simplex Electric Co., of Boston, manufacturer of Simplex Wires, is constantly receiving old wires to be reinsulated.

Mr. Gordon guarantees that his insulation will never deteriorate. He says it is cheaper to buy Simplex feeder wires at the start, as they never require reinsulation, as is the case with wires of some other makes. It frequently happens that Mr. Gordon is called upon to reinsulate wires of the latter class after only two years' use.

W. H. Gordon & Co., 115 Broadway, wish it fully understood that they are the agents and headquarters for Bryant lamp-sockets and switches and incandescent specialties. These Bryant sockets are said to be superior to those of any other make. Dealers will do well by writing to the above firm before laying in their fall stock.

G. C. Baillard, formerly with Alexander, Barney & Chapin Company, has become connected with the firm of Parmly, Mitchell & Co. Mr. Baillard is well thought of in the trade, and his connection with this firm is looked upon as a good move. The quartette—Parmly, Mitchell, Doubleday and Baillard—will make things lively. The firm is meeting with good success and has a bright future in store for it.

The Crocker-Wheeler Motor Company has recently added Mr. Thomas J. Fay to its already large electrical staff. This gentleman brings with him an extensive experience gained by a previous connection with the Edison, Thomson-Houston and other prominent electrical companies, which will be of considerable value in his present work. Mr. Fay will have charge of the testing department, the force of which the company has lately increased. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor Electrical Age:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	92 00
Am. Elec Exercise Mach Co., N.Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone, N.Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Aut. Phon. Exb. Co	25,000	100 00	†20 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	180 00
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y	10,000	100 00	†60 00
Brush Illuminating, N. Y	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	130 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	99 25
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000	50 00	*102 00
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	24 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	27 50
Detroit Electrical Works	1,000,000	10 00	8 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*99
Edison Elec. Ill. 6s, N. Y	30,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,600	100 00	98 50
Edwards Manuf. Co., N. Y.	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120.000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	43 75
Essick Printing Tel	5,000,000	100 00	30 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*101 00
Fort Wayne Elec. Co	4,000,000	25 00	13 50
Fremont E. L. & P. & Gas Co., O	95,000	100 00	125 00
G. T. Woods Mfg. Co., Ky	2,000 000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*98
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hudson Electric Light, N. J	100,000	100 00	
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*104
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	19 00
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*79
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N.Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J	17.500		*101
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	16 60
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel. 6s	1,500.000		*99
N. Y. and N. J. Telephone Stock	2,535 000	100 00	94 00
N. Y. G. & E. Co. Certs. of Indebt	100,000		†
N. Y. Phonograph Co	20,000	100 00	†20 00
N. Y. Storage Baty. Co	100.000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50.000		*95
North New York Lighting	150,000	100 00	10 00
Northern Elec. L. & P., Phila	200.000	10 00	
Northwest Elec. Co. 6s, Manitoba	50 000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light	100,000	100 00	
Pennock Baty. E.L.& Impt.Co., Ill	500.000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P. Co. 6s	800,000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200.000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec Lt Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	5 50
Saginaw E L. & P. Co. 6s, Mich	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750 000		*90
Sawyer-Man Elec. Light Co., N.Y.	125.000	100 00	100 00
Seibold Electrode Manf. Co., N.Y.	100.000	100 00	
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co., N. Y.	1 000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750.000	100 00	100 00
The Hall Signal Co. N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	49 00
Thomson-Houston pref	4,000,000	25 00	26 00
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H.L.H. &P.Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
Twin City Rapid Transit, N. J	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	40 00
Universal Arc Lamp Co	100.000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	1 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	82 00
Westinghouse Electric Co	7,000.000	50 00	13 00
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	
West End L., Boston			17 75
Yonkers L. & P	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

It is pleasant when financial business assumes a mysterious position and liquidation on account of excessive speculation reaches above a general average to note the advent of such solid institutions as the Plaza Bank, just opened, with $100,000 capital and an equal amount as a surplus. The combined wealth of the stockholders is fully $500,000,000, and number among them such well-known men as Wm. C. Brewster, A. Newbold Morris, Wm. H. Tillinghast, Eugene G. Blackford, Benj. H. Bristow, Dr. Thomas Gaillard, Wm. C. Whitney, Dr. Wm. M. Polk, Bishop H. C. Potter, Woodbury G. Langdon, T. C. Eastman, Col. W. L. Strong, D. S. Hammond, M. K. Jesup, H. O. Havemeyer, Wm. Ottman, Obid Wheeler, John L. Riker, Wm. D. Sloan, Wm. Rockafeller, David Donner, Hy. G. Marquand, J. M. Fiske, James Morris, W. E. Damon, John J. Astor, R. N. Hunt, Horace L. Hotchkiss, C. P. Huntingdon and Wm. B. Wheeler. This will be one of the soundest banks in New York.

The annual meeting of the Western Union Telegraph Co. stockholders was held at the Broadway offices on the 14th inst., and the old board of directors was unanimously re-elected. The financial report shows gross income $23,034,326, being an increase of $647,298. The net earnings are $6,605,584, which is a decrease of $707,141; interest and sinking fund $931,219, increase of $16,084; balance $5,674,365, decrease $723,225. Dividends $4,309,607, decrease $646,401; surplus $1,364,758, decrease $76,824; total surplus $11,417,741. The cost of repairs on the head office since the fire to the present amounts to $358,062. The real estate is valued at $2,903,918, supplies $320,231, securities of leased telegraph companies $8,182,300, stocks of other companies $7,599,312. The plant is valued at $96,745,391. The uncapitalized surplus put into the property is $13,015,925. The report is for the year ending June 30, 1891.

There were 1089 companies incorporated in the United States during the month of September, with a capitalization of $374,973,325; 74 of these were Light, Heat, Power and Transportation companies, with $27,298,000, and miscellaneous corporations, some of which are electric, numbered 356, with capital amounting to $35,127,775—not at all a bad showing for the first month of the fall business season.

Michigan is one of the states in which financial corporations are very active this fall. Port Huron has not been as active since Col. Sibley floated the Silver Islet mining property early in the '70's. The people are well abreast of the times in electrical undertakings. The Port Huron electric railroad bonds guaranteed by the Gratiot Electric Railway Co., are on this market at par and interest. Gov. Thos. M. Waller has completed the Detroit street-railway consolidation and everything is running smoothly and profitably. The Detroit Electric Light and Power Co. is one of the most successful in the state, with long contracts, and at present supplying no less than 1,100 arc and 5,000 incandescent lamps, their preference 6 % shares a bargain at 100 % because they not only participate in all dividends equally with the common stock (which can be had at 90) after receiving the guaranteed 6 %, but having a vote on all questions renders them superior to a bond, of which the company has none, to date. One of the largest private electric plants in the state is at Manistee. The Chicopee Valley Railroad Company, with forty odd miles in successful operation earning dividends, is in this market for $500,000 to complete thirty odd miles more which gives them a connection with all the great trunk roads and for which they give a mortgage on all their assets. The county through which it runs is the best in the state, and many cities will spring up on and near its course. The whole northern part of the state is filled with copper and iron, both of which are prime factors in the electric industries; offering a vast field for investors who are seeking an income on their capital above the ordinary, yet equally safe.

The Great Western Electric Supply Co., Chicago, is among the first to feel the influx of wealth and its resultant business activity throughout the grain belt. Its 8 % preference shares, on which the regular quarterly dividend checks for 2 % were posted on the 15th inst., are among the most lively electric stocks dealt in. A few of them make a nice birthday, wedding or Christmas present. I think it will be some time before a safe 8 % preference stock, participating in any excess in common with the ordinary shares and having also a vote in the management of affairs, can be had for less money. I recommend such to my friends.

Another good purchase is the Detroit Electric Light and Power Co.'s 6 % preference shares, with its thousands of arc and incandescent lights and rapid, constantly-increasing business. Still others are the Fremont, O., Electric Light and Power Co. and the Gas Co., which are owned by the same parties and paying 10 % net. The entire business is for sale. No bonds or other than current debts. These are only a few of the creameries. I could name others, but refer you to the list. You who are not regularly or correctly quoted in it can be by sending me your correct corporate name and the three lines of figures.

A NOVEL WIRED PLANT.

The wiring of the new depot of the Pennsylvania Railroad at Jersey City, N. J., for 450 32 c. p. lamps is being done in a thorough and workmanlike manner by Mr. William F. Jackson, dealer in electrical supplies and contracting agent, 739 Broad street, Newark, N. J.

Instead of running a multiplicity of heavy wires for mains from the dynamos to the distributing point, there are two heavy copper tubes, 2½ inches in diameter, filled with bare copper wire. The tubes are supported on insulating saddles bolted to the iron-work of the arches. They are placed high, so as to be out of the reach and to avoid the danger of any metallic substance falling on them. The tubes are screwed together and soldered, and are filled with solder at the points where the branches are taken off.

The novel construction of the mains is due to the division operator, Mr. William Ettenger.

The distributing point is situated as near the centre as possible, and from there the wires are led to the centre of the hall on each floor, where they are again divided into four separate circuits. The circuits in each room are divided, so that in case of the blowing of any of the small safety fuses provided, no more than five lights would be extinguished at one time.

In all cases the wire is inclosed in special ash moulding of the standard P. R. R. design, securely screwed to the walls and ceilings.

It is said the loss will not exceed 3 per cent. when fully loaded.

Mr. Jackson has also just finished wiring the new building of the Jos. Dixon Crucible Co., Jersey City, using Vulca conduits and Grimshaw wire throughout.

The Hanson Battery Light and Power Company, Washington, D. C. (incorporated in W. Va.), was incorporated October 9, with a capital stock of $1,500,000. Incorporators: Walter Hanson, Luke Strider, Washington, D. C., and Frank Aldrich, Mount Pleasant, D. C.

The Early Electric Light Company, of Richmond, Ind., was incorporated October 8, with a capital stock of $25,000. Incorporators: George P. Early, Charles Morris and W. W. George.

ELECTRIC LIGHT NOTES.

The electric light has been introduced into the city of Ouro Preto, Brazil, for illuminating the streets. The inhabitants greatly admire its brilliancy.

The Owosso Electric Company, Owosso, Mich., is installing one 150-horse-power engine and boiler.

The Anderson Electric Light and Power Company, Anderson, S. C., is to install a power generator for an electric street railway in the near future.

The Compania Anenima y Alumbrado Electrie, Puebla, Mex., supplying 110 arc and 900 incandescent lamps by the Thomson-Houston system, will make extensive additions in the near future.

The Salt Lake Power, Light and Heating Company, Salt Lake City, Utah, supplying 425 Thomson-Houston and Western Electric arc and 4,000 Edison incandescent lights, is installing three more engines and a 1,300 light Thomson-Houston alternator.

The East Portland Electric Light and Power Company, Portland, Ore., is to install a small Easton arc plant in the near future. The company now supply 200 20 and 30 C. P. incandescent lamps by the Heisler system.

The Santa Fé Electric Company, Santa Fé, New Mexico, is to make extensive additions at once. The company supplies 540 incandescent lamps by the Edison system. F. T. Webber is president.

The Beatrice Light and Power Company, Beatrice, Neb., expects to double its plant in the near future. The Thomson-Houston arc and the Westinghouse alternating incandescent systems are used.

The West Point Electric Light and Power Company, West Point, Neb., contemplates extensive additions to its plant in the near future. J. C. Crawford is president.

The York road from Baltimore to Chestnut Hill, north of Waverly, is to be lighted by electricity in the near future.

The Board of Trustees of South Denver, Col., has passed an ordinance regulating and licensing the business of electric-light wiring. It provides for a license of $50,000, and that applicants for licenses must qualify as to their ability.

CHICAGO NOTES.

The Central Electric Company feel happy over the fact that its sales of Packard high-grade incandescent lamps are constantly increasing, and report that there is a great tendency toward using better material in electric-light construction. These lamps satisfy the most exacting demands.

Okonite Tubing seems to be fast replacing the soft rubber tubing for special insulating purposes. This is composed of a tough and almost indestructible compound, and has all the high insulating qualities that the Okonite wires possess. It has a decided advantage over the ordinary soft rubber tubing in that it is not in any way affected by exposure or by the action of the elements.

Prof. Elisha Gray, of Highland Park, laid some Okonite wire underground without any protection whatever, over three years ago, on which his telautographic experiments have since been conducted. The wire is still in perfect condition, showing an infinite insulation resistance. The Central Electric Company of Chicago reports that it never has any comments on this superior grade of insulation except such as are favorable, and of which the above is a sample.

The Central Electric Company, 116-118 Franklin street, Chicago, is pushing the sale of Paiste batteries, of which it has a large stock. This company can fill almost any kind of an order from its warerooms.

BUSINESS NOTES.

The following copy of a letter from Mr. Barstow, General Superintendent of the Brooklyn Edison station concerning the installation on that company's elevator of Mr. Leonard's recently-invented method of controlling the speed of electric motors, speaks for itself:

EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN,
BROOKLYN, October 22, 1891.

Messrs. H. Ward Leonard & Co.,
Electrical Exchange Bldg., N. Y.:

GENTLEMEN: We have just permanently equipped our passenger elevator with your new system of motor power, and are greatly pleased with the result. The arrangement is perfect in its absolute control of the elevator car, and requires very little attention in its operation. As the current on the motor is constant, whatever the speed may be, the neutral point is fixed and the brushes require no adjustment to prevent them from sparking.

In this system the motor operates continuously at its highest efficiency, and there is no likelihood of the armature burning out, due to sudden changes of load. We are able to instantly reverse the car and motor, at any speed, without any strain whatever; while the motion under all conditions is similar to that of a hydraulic elevator.

Should any one desire to investigate this system they can see it in successful practical operation at this station.

Yours truly,
(Signed) W. S. BARSTOW, Gen'l Supt.

The Magnolia Anti-Friction Metal Company, 74 Cortlandt street, this city, with offices in Chicago, London, Berlin, Marseilles, St. Petersburg and Vienna, made greater sales and did more business in the month of September, this year, than it did in the first eighteen months of its existence, commencing several years ago.

THE JEROME KIDDER BATTERY.

W. B. Brooks, M.D., editor of the Texas *Courier-Record of Medicine*, writes September 4, 1891, to Jerome Kidder Manufacturing Co., 820 Broadway, New York: "The No. 1 Electro Medical Apparatus arrived all O. K., and it is certainly one of the best faradic batteries we have ever seen and we are highly pleased with it.

"Very respectfully,
"TEX. MED. PUB. CO.,
"Per W. B. Brooks, Manager."

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

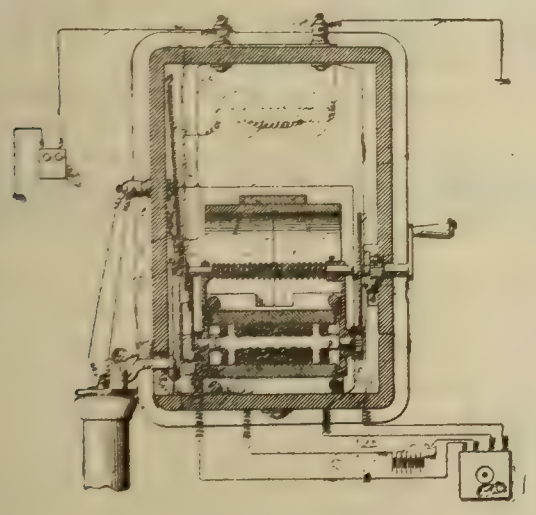
Issued October 20, 1891.

461,420. Spring Cushioned or Suspended Arc Lamp. Charles F. Brush, Cleveland, Ohio, assignor to the Brush Electric Company, same place. Filed May 26, 1880.

The combination, with an electric circuit, and a series of arc lamps included therein, of springs or cushions for supporting one or more of the lamps.

461,423. Electric Clock-Winder. James W. Du Laney and Charles F. Du Laney, Canton, Ohio. Filed Feb. 12, 1891.

461,424. Circuit-Closer for Clock-Winding Mechanism. James W. Du Laney, Canton, Ohio. Filed May 13, 1891.



461,573.—TELEPHONE SYSTEM.

461,437. Thermo-Electric Element. Charles W. Iden, New York, N. Y., assignor to the Thermo Electric Company, of West Virginia. Filed May 13, 1891.

A thermo-electric element provided with an extension projecting from the body of the element and composed of a different material from the element itself, and a source of heat supplied beneath the extension.

461,452. Electric-Wire Connector. George R. Scrugham, Lexington, Ky. Filed June 15, 1891.

A trolley-wire connector consisting of the combination of conical conductors fastened to the ends of the trolley-wires, a doubly-conical truncated conductor between the other-named conductors, extensions upon the last-named conductor fitting in holes in the first-named conical conductors, through which pass retaining-screws, and washers or spacers separating the doubly-conical conductor from one of the conical conductors.

461,456. Electric Switch. Alfred Swan, Orange, N. J., assignor to the Insulite Manufacturing Company, New York, N. Y. Filed Aug. 6, 1890.

461,464. Non-Interfering Successive Signalling System and Apparatus. Frank B. Wood, New York, N. Y., assignor to Theodore W. Bayaud, same place. Filed Oct. 24, 1890.

461,470. Telautograph. Elisha Gray, Highland Park, Ill. Filed June 13, 1889.

461,471. Art of Telegraphy. Elisha Gray, Highland Park, Ill. Filed July 19, 1889.

461,472. Art of and Apparatus for Telautographic Communication. Elisha Gray, Highland Park, Ill. Filed Sept. 17, 1889.

461,473. Telautograph. Elisha Gray, Highland Park, Ill. Original application filed Sept. 17, 1889. Divided and this application filed Aug. 13, 1890.

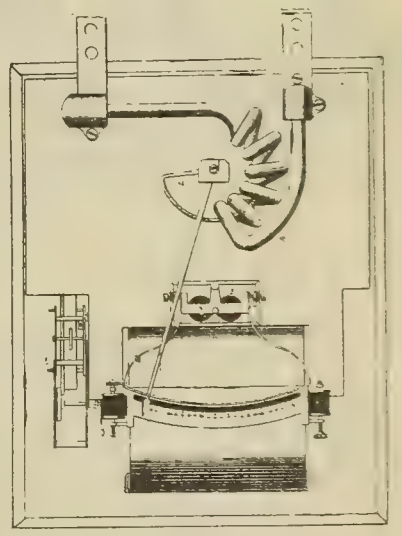
461,474. Telautograph. Elisha Gray, Highland Park, Ill. Filed Sept. 22, 1890.

461,493. Electric Elevator. James F. Byrne, Boston, Mass. Filed Dec. 2, 1890.

An auxiliary electric motor and a main switch connected through a train of mechanism, an auxiliary operating-switch carrying a pin which engages with the main-switch arms, a battery and suitable electric connections between he motor and auxiliary switch and battery.

461,526. Adjustable Transformer. Elihu Thomson, Lynn, Mass. Filed April 17, 1889. Serial No. 307,616. (No model.)

461,552. Field-Magnet for Dynamo-Electric Machines. Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric Railway and Motor Company. Filed Jan. 19, 1885.



461,575.—ELECTRIC METER.

The combination, with a series of longitudinal plates forming a field-magnet core, of outer clamping-plates having extended portions and a cross-brace extending from one portion to the other.

461,554. Electrical Valve-Controller. John V. Stout, Easton, Pa. Filed March 26, 1891.

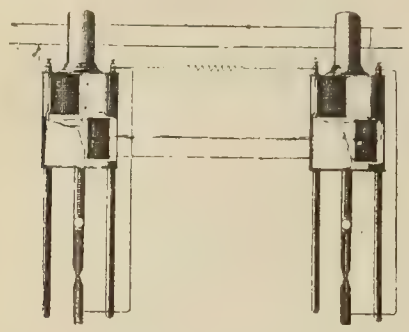
461,555. Shunt-Magnet for Valve-Controllers. John V. Stout, Easton, Pa. Filed July 1, 1891.

461,560. Snap-Switch. Henry P. Ball, New York, N. Y., assignor to the Edison General Electric Company, same place. Filed March 2, 1891.

The combination, in a switch, of a circuit-terminal, a lever or arm pivoted thereto, a second terminal in the path of the lever, a plate-spring parallel with the lever and connected to the lever near its pivot, and a handle on the spring for operating the switch.

461,561. Snap-Switch. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed April 18, 1891.

461,562. Electric-Wire Connection. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed May 12, 1891.



461,569.—ARC-LIGHTING SYSTEM.

461,563. Electrical Connecting Device. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed June 13, 1891.

A connector consisting of a single metal rod or wire, an end of which is bent at right angles and coiled, the coiled portion surrounding the right-angled portion.

461,568. Coupler for Electric Wires. James H. Delany, South Orange, N. J., assignor to the Edison General Electric Company, New York, N. Y. Filed Dec. 29, 1890.

461,570. Thermal Cut-Out. Lorenzo B. Favor, Gloucester, Mass., assignor to the Thermal Electric Company, same place. Filed March 12, 1891.

461,573. Telephone System. Claude C. Gould, Buffalo, assignor to the Eastern Electrical Manufacturing Company, Wheatfield, N. Y. Filed May 28, 1891.

461,575. Electric Meter. Albert B. Herrick, New York, N. Y. Filed Oct. 16, 1890. Serial No. 368,332. (No model.)

The combination of a recording-surface, a hand carrying a recording-point, means for moving it over but not in contact with the recording-surface by the current to be measured, and a magnet, armature, circuit-controller, and a time mechanism therefor for making a record periodically.

461,582. Hanger for Overhead Wires. Charles A. Lieb, New York, N. Y., assignor to the Sprague Electric Railway and Motor Company, same place. Filed Aug. 30, 1890.

In a hanger for overhead wires, the combination, with suspending devices, of a pair of hinged gripping-jaws and a wedging device for closing and holding the jaws upon the wire.

461,657. Control Apparatus for the Position of Signal-Discs. Theodor Weisser, Vöhrenbach, Germany. Filed Nov. 29, 1889.

461,659. Electric-Arc Lamp. Aloys Wirsching and Rupert Schefbaeur, New York, N. Y. Filed Nov. 15, 1890.

A solenoid having a hollow core, a carbon-carrier passing through the core, a clock-work mounted in a pivoted frame and engaging with the carrier, and a compound lever or link devices joining the pivoted frame to the hollow core.

461,677. Electrical Conduit. Edwin T. Greenfield, New York, N. Y., assignor to the Interior Conduit and Insulation Company, same place. Filed May 11, 1891.

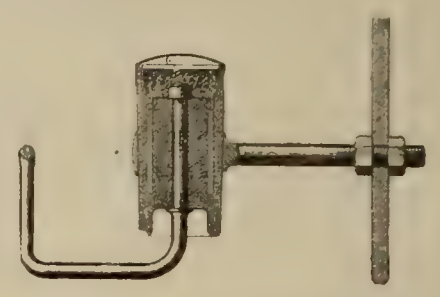
A conduit having interlocking sections and covers, in combination with individual spaced ducts surrounded with an insulating mass which unites the ducts and the conduit and holds the covers in place.

461,706. Incandescent Double-Key Lamp-Socket. William J. McCutcheon, Jr., Pittsburg, Pa. Filed March 21, 1891.

In a double incandescent-lamp socket, a frame to receive the lamp, contact-points and conductors for two filaments, and two keys arranged concentrically, each key moving independently of the other and provided with suitable contacts.

461,748. Annunciator. Lambert F. Fouts, Trinity Mills, Tex. Filed June 5, 1891.

461,760. Electric Block Signal System. John La Burt, New York, assignor of one-half to William H. Agricola, Brooklyn, N. Y. Filed July 14, 1891.



461,631.—INSULATING SUPPORT FOR ELECTRIC CONDUCTORS.

461,761. Electric Switch. George R. Lean, Boston, Mass., assignor to the Bernstein Electric Company, Portland, Me. Filed Jan. 17, 1891.

461,791. Automatic Electric Switch. Sigmund Bergmann, New York, N. Y., assignor to the Bergmann Manufacturing Company, same place. Filed Feb. 25, 1891.

461,795. Armature for Electric Motors or Dynamos. Robert Lundell, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed April 4, 1891.

461,797. Incandescent-Lamp Filament. John T. Marshall, Metuchen, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Nov. 9, 1885.

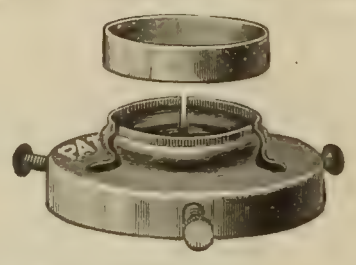
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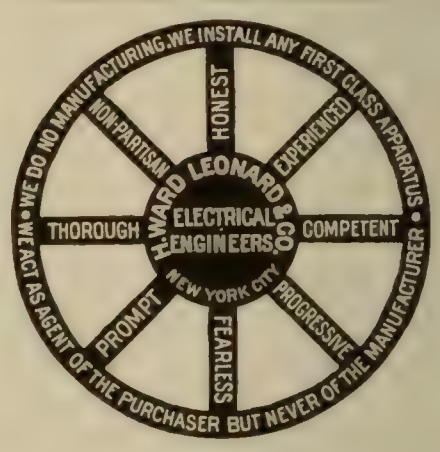
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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, NOVEMBER 7, 1891. No. 45.

WESTON COMPOUND ENGINE.

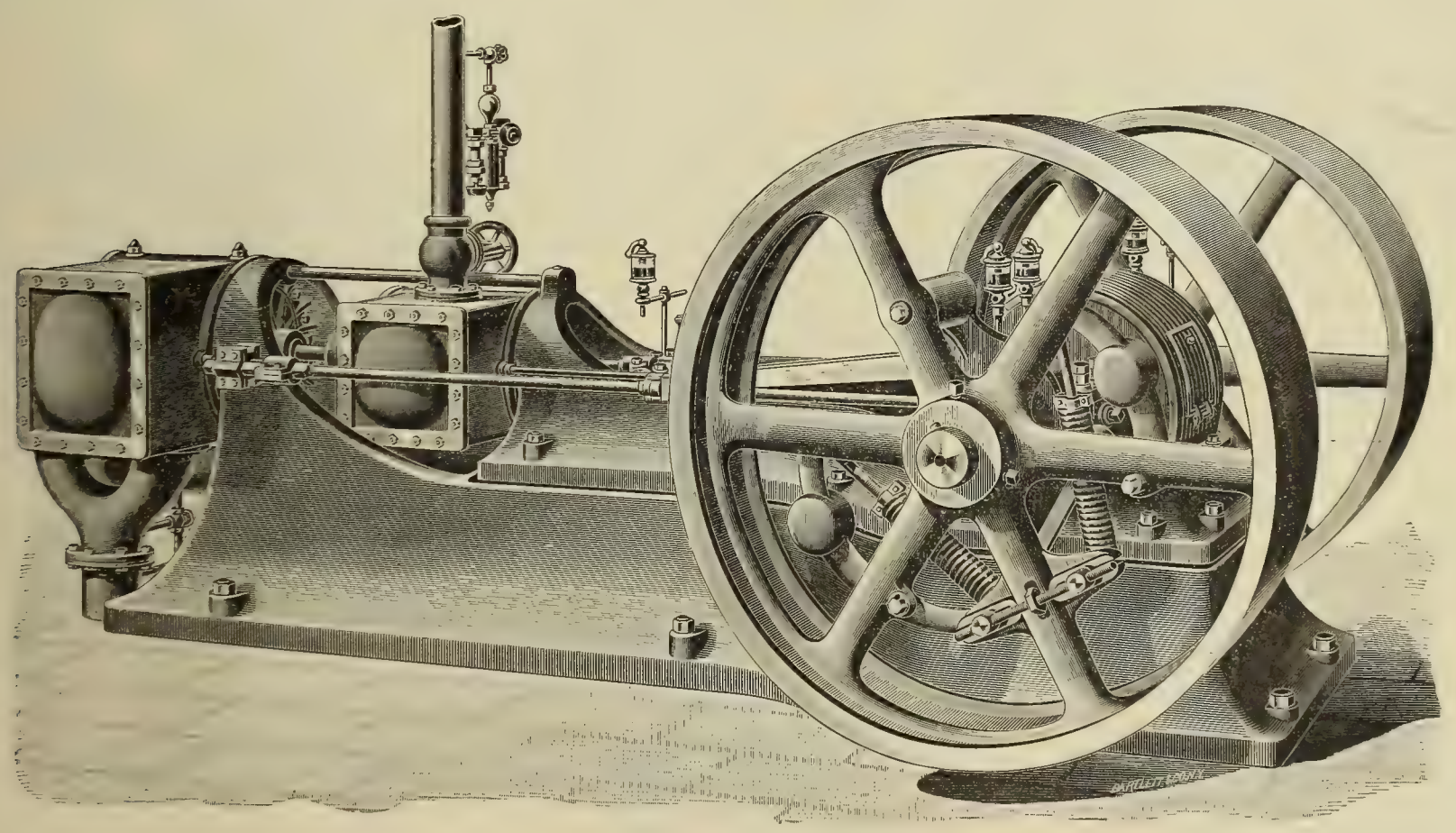
The accompanying illustration is of the Weston Compound Engine, built by the Weston Engine Co., Painted Post, N. Y., and handled in New York City by Julian Scholl & Co., 40 Cortlandt street.

As will be seen, the sub-base is made a part of the engine proper by extending it and projecting a neck in front of the high-pressure cylinder for the attachment of the large or low-pressure cylinder. This arrangement has several advantages, principal among which is the accessibility of the low-pressure cylinder for inspection. As leakage from this cylinder represents the most serious loss, it is obvious that the usual practice in tandem compounding of making the low-pressure cylinder practically inaccessible is a mistake, as no opportunity is given for examination of the piston. As the Weston engine is arranged there is every opportunity for inspection.

Another advantage of this form is in the total elimination of cylinder vibration, indicating great rigidity and securing permanent alignment.

These engines have a balanced four-admission valve on each cylinder, and both valves are attached in a direct manner without rocker-arms to an automatic governor, thus keeping the load about evenly divided between the two cylinders. This has decided advantages over the usual arrangement of having the low-pressure eccentric fixed to the shaft, or at best adjustable by hand, for owing to the variation of load constantly occurring in some lines of service, such as electric lighting, electric railways, rolling mills, etc., the hand adjustment is of little value, as the engine must be set for the entire run, before starting, to the maximum load that may be thrown on, and as the actual load is considerable less during most of the time, the vital feature of compounding is destroyed; whereas with the automatic attachment to each valve the engine is always in condition to take care of any load within range of its capacity, and without disturbing any of the essential elements of compounding.

This feature of two automatic valves must be well received under any circumstances, and where strict economy of fuel is necessary its use is imperative.



WESTON COMPOUND ENGINE.

PRECAUTIONS AGAINST FIRE.

The Electric Mutual Insurance Company, 85 Water street, Boston, Mass., of which Mr. Stephen E. Barton is president, has issued a neat pamphlet giving specifications for inside hose system and water supply to protect electric stations against fire. From this pamphlet we make the following abstracts, which will be of interest to all concerned:

"If we concede that the electric equipment of a light and power station properly installed and under competent supervision imposes *per se* no special hazard, so far as originating fire is concerned, beyond that attaching to a like quantity of other machinery of equal weight and speed and with the same motive power, there still remain the hazards inherent to any building used for mechanical purposes and as a rule containing steam boilers and engines and shafting.

"In the best class of modern electric stations the amount of inflammable material is limited to the floors and the roof, the latter in a modern high and roomy boiler-house, being so far removed from the boilers and fires (eight feet or more) and so well ventilated as to cause little apprehension of direct communication of fire, and to the small quantity of oils needed for daily use. In this class of stations—*i.e.*. with brick walls without furring or ceiling of any sort, either at the sides or under the roof, a good brick division wall between dynamo and boiler rooms, extending above the roof and not over one story high—the minimum amount of protective apparatus is necessary.

"But floors accumulate more or less grease, and roofs become dry and burn rapidly, and electric apparatus is susceptible of much damage from heat and water, and ready means of extinguishing fire are needed in such cases as well as others.

"The practice of the mutual companies in such cases where the buildings are not exposed by others will be to rely upon a small hose system under constant pressure and ready for instant use at all times.

"The following apparatus is recommended, disposed in the following manner:

"In steam power stations with dynamo rooms covering 5,000 feet or less in area, two connections in dynamo-room as remote from each other as possible, but in all cases near a door or window. An additional connection in boiler-room for the first 2,500 feet of area, and additional connections each in boiler or dynamo room for each additional 2,500 feet of area or fraction thereof in that room. Basements and second stories to be protected in like manner. In water-power stations a connection for each 2,500 feet of area, but not less than two in any event.

"Unlined linen hose is strongly recommended for inside use: it is light, strong and durable, and when dry can be kept in small compass and is easily handled. Particular care should be used in selection, as the existence of the property may depend upon a single test of its efficiency.

"No definition can be given of a sufficient water supply that will apply to all cases; as a rule, how-

ever, a connecting pipe leading from a street main of sufficient size will suffice for isolated stations in towns or cities having reliable water-works and good constant pressure. In stations above one story high or exposed by other buildings it may not be sufficient; this must be determined, usually by the judgment of the underwriter.

"Where city water cannot be depended upon, recourse must be had to other means: in water-power stations, rotary pumps; and in steam stations, operated continuously, duplex steam pumps and reservoirs or cisterns.

"In cases of stations not operated continuously, and not connected with town water having good pressure, some means of maintaining a constant and sufficient pressure, covering the interval needed to start the pump, is necessary. This is best applied by an apparatus suggested some years since by A. F. Nagle, C.E., of Chicago, known as a pressure tank, and which is largely used in connection with the automatic sprinkler systems.

"Wherever there is sheathing or ceiling or concealed spaces of any sort a fire-axe should be kept at each hose-rack. They should never be removed except for fire use. A short crowbar is also advised to be kept with each. These are very often needed before the hose can be used, and their absence has frequently resulted in much unnecessary damage. The instant removal of a little sheathing will often permit of the suppression of a fire that would by a little delay become destructive.

"As it is necessary to shut off the electric current at once in most cases of fire, two or more good fire-lanterns should be kept at hand ready for use; they can be kept in a small case near hose-rack. A good supply of heavy tarpaulins to throw over machines in case of fire will also commend itself as a practical precaution.

"Carelessness is the father and dirt the mother of fire, and concealed spaces the shelter that nourish it to life. None of these should be permitted in an electric station.

"Attention is called to the value of soda ash in cleaning the floors of dynamo-rooms. It should be sprinkled dry and rather thickly upon the floor (a common hand-sieve being useful for the purpose) and allowed to remain as long as convenient, then swept or scraped up. No water is necessary, though at first a damp cloth may be used after sweeping. A few applications will produce excellent results, but in old oil or grease several applications may be required to produce visible effect.

"As an extinguisher of fire on oily floors or in grease, dry soda ash is unequalled. This material is cheap, and two barrels with a dry metal pail in each and a sieve for sprinkling are advised in every station in accessible situations."

NEW INCANDESCENT CIRCUIT-SWITCH.

A new departure in incandescent switches is soon to be offered to the trade by the Cutter Electrical and Manufacturing Company, of 27 South 11th St., Philadelphia.

In the subjoined illustrations Fig. 1 shows the switch "open," while Fig. 2 shows it "closed." This switch is of the "single-pole," "double-break" class, with the brushes and switching mechanism

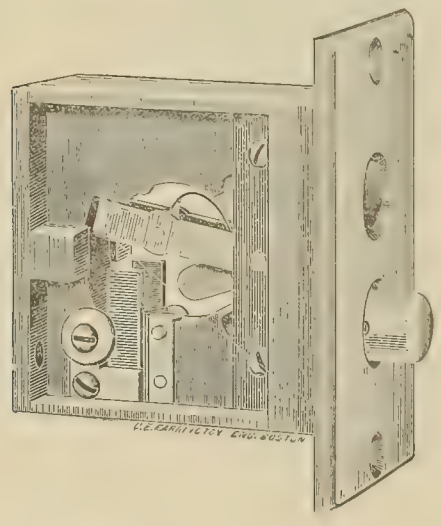


FIG. 1—SWITCH "OPEN."

mounted upon a porcelain base, which is in turn enclosed in a casing of the same material.

The copper terminal brushes are set one over the other, the distance between them being $\frac{1}{16}$ of an inch, the end of the switch-bar acting as a bridge between them when the switch is closed, and giving a break of $\frac{1}{4}$ inch on each side when open, or an actual break of $\frac{1}{2}$ inch. The switch-bar is operated entirely by a flat semi-elliptical spring, which acts eccentrically in such manner that until the switching-lever brings the spring to centre there is no movement whatever of the switch-bar; consequently when it is moved past the centre, the full tension of the spring is brought to bear for the break, which is absolutely instantaneous, so that with ten ampères of current this size of switch exhibits but the faintest indication of a spark.

The working parts are of hard brass plate put together in a substantial and workmanlike manner. In fact, the mechanical and electrical construction of this switch is exceptionally good, but perhaps the most taking feature of the device is the fact that it is operated by two push-buttons set into a face-plate

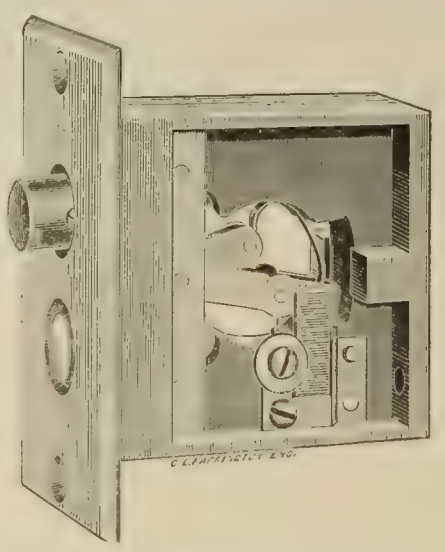


FIG. 2—SWITCH "CLOSED."

which is set in place flush with the wall or surface of the switch-board, the porcelain case containing the switch mechanism being recessed into the wall, so that nothing is presented to view but the face-plate, which may be so ornamented as to correspond with its surroundings.

One of the push-buttons is white, the other black. By pushing the white one the circuit is closed, while by pushing the black one it is opened; and in case the light governed by a particular switch is in a distant room, the condition of that light as to whether it is "on" or "off" is indicated by the relative positions of the push-buttons. If the white button is flush with the surface of the face-plate the light is "on;" if the black one is thus flush with the plate the light is "off."

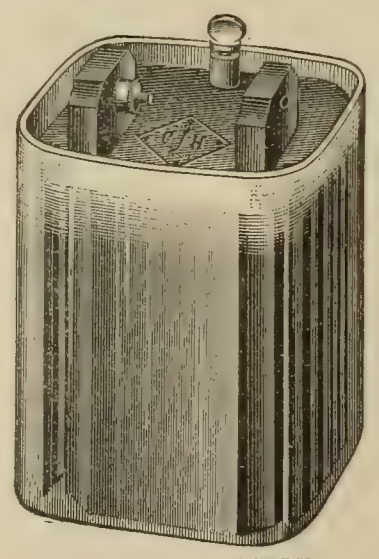
The peculiar construction of this switch permits of an exceedingly convenient method of placing a number of switches in "gang" on the same face-plate, in a manner similar to that adopted in electric gas-lighting. For instance, a gang of ten switches would exhibit only a face-plate fifteen inches long by three and one-quarter inches wide.

The switch is also modified so as to be able to control one or more lights from two or more places.

THE "CHAMPION" BATTERY.

In our issue of January 17 last we gave an illustrated description of a new primary battery invented by Mr. C. J. Hirlimann, of New York City. This battery is known in the trade as the "Champion," and it has already established for itself a high reputation for efficiency.

The "Champion" is made in two patterns, the



CHAMPION BATTERY.

main difference between them being in the form of the zinc elements. One is a rod, such as is used in the Leclanche battery, and in the other style the zinc is made of corrugated sheet metal.

The type of cell with the zinc rod is most suitable for telephone work, and that with the corrugated zinc element is adapted to conditions requiring a large output of current for a short space of time, such as gas lighting, electric bells, etc. The battery is of the open-circuit class, with sal-ammoniac base.

The carbon reservoir is quadrangular in shape, and charged with ingredients under a secret formula.

Prof. Henry Morton, of Stevens Institute, has recently made a test of the "Champion" battery and makes an excellent report on the results.

The tests continued two months, and he says: "As a result I find your battery to be an excellent one, equal to the best, and possessing some distinctions which in certain cases will give it an advantage.

"Thus, on open circuit or with a high resistance it shows a higher electro-motive force than others in about the proportion of 15 to 14.

"On closed circuit, through a low resistance, however, this advantage does not appear on account of the internal resistance of your battery, which is relatively high.

"Your battery also shows a remarkable promptness in recovering its electro-motive force on the opening of the circuit. Thus, it will recover 50 % of its loss in one minute, while other like batteries will only recover 10 % in the same time."

The cells were tested under different conditions with similar results, all proving that the "Champion" is an excellent battery.

COMBINATION ADJUSTING SCREWS.

Looking at the ordinary electric bell, now so universally used, one would hardly think that there is room for improvement in its construction. Perhaps not, so far as the user is concerned, but the manufacturer is ever on the alert for methods that will tend to better the bell without adding to its cost.

An exceedingly clever and valuable improvement in bell manufacture has recently been patented by Richard Varley, Jr., of Passaic, N. J., whose late inventions have attracted considerable notice. This device is called "A New Method of Assembling Bells." It consists of but three parts, which take the place of the somewhat complex method now in vogue for the adjusting attachment. These parts are the rubber stopple, Fig. 2, which affords an insulator for the adjusting screw, and serves as a lock-

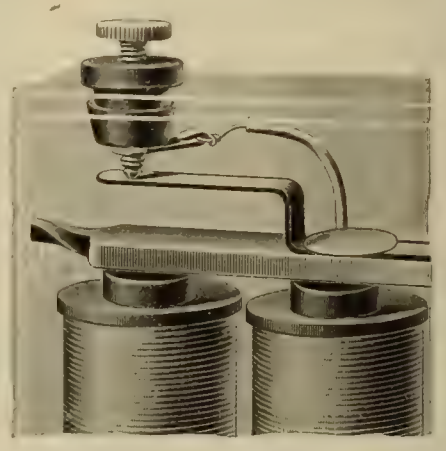


FIG. 1. FIGS. 2 and 3.

COMBINATION ADJUSTING SCREWS.

nut by compression of the rubber; the adjusting screw itself, and a connecting clamp, Fig. 3. The office of this clamp is to connect the wire from the coils to the adjusting screw, it being held in position by the two prongs that fit into the small holes shown in rubber stopple.

The simplicity of this device may be briefly explained by stating the method of adjusting it to the bell. The stopple is first placed in position by forcing it through the hole in the side of the box and through upright in skeleton bell. Next the connecting clamp (which has previously been connected to the wires leading from the magnets) is placed in position by forcing the prongs into the stopple. This brings the hole through which the adjusting screw passes diametrically opposite the hole running through the stopple. Lastly the adjusting screw is pushed through the rubber stopple, which forms at once a perfect insulator, and a lock-nut for keeping it in position.

Fig. 1 shows the device complete attached to an iron box bell. In skeleton bells a lug is cast on the frame in place of the regular binding-post now in use. Through this lug is drilled a hole which admits of the rubber stopple, as in box bell described.

Aside from cheapening the materials necessary to make a bell, it greatly economizes the labor necessary for assembling the parts. It also adds to the bell's efficiency to the extent of preventing it getting out of adjustment by loosening of the screw, as the latter cannot turn in the soft rubber bed. In places where there is considerable jarring, such as in cars, factories, etc., the question of loose screws is an important one to be considered.

This valuable device has been placed on the market by J. Jones & Son, 602 West Twenty-second st., New York.

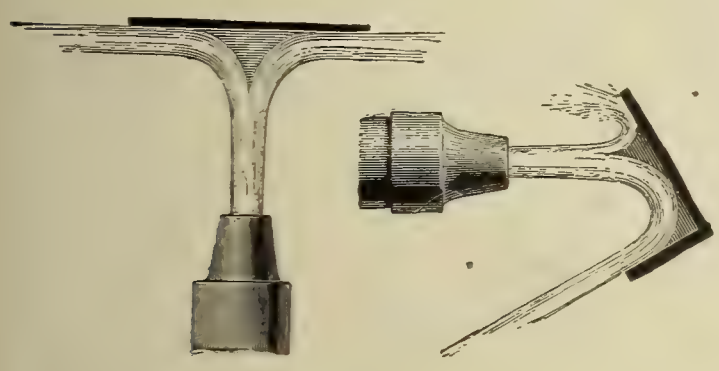
THE PELTON WATER-WHEEL.

The Pelton Water-Wheel, now largely used in electrical plants, has been proved to be constructed on scientific principles, and is no doubt the best on the market. The principle of its construction is plainly shown in Fig. 1, in which it is seen that the bucket surface at the entrance is approximately parallel to the relative course of the jet, and the bucket curved in such a manner as to avoid sharp angular deflection of the stream.

Buckets in which the jet is sharply deflected by striking the surface at an angle, similar to that in Fig. 3, a portion of the water is backed, the smoothness of the stream is disturbed and there results considerable loss of power. The action of water on a bucket with a flat surface is plainly shown in Fig. 2. A bucket shaped like that in Fig. 4 will cause the heaping of more or less turbulent water at the point indicated by the dark shading. This dead water is subsequently thrown from the wheel with considerable velocity, and represents a large loss of energy. In the Pelton bucket, as seen in Fig. 1, it can be readily seen how the wedge obviates this loss.

A small number of buckets is made possible by applying the jet tangentially to the periphery, making the total wetted surface of the wheel very small, thus reducing the loss by friction to a minimum.

The discharge end of the bucket is as nearly tangential to the wheel periphery as compatible with the clearance of the bucket which follows, and great differences of velocity in the parts of the escaping water is avoided. The entrance and deflection of the jet is remarkably smooth and induces very little shock. The discharge from the wheel when running at proper speed is almost entirely at the bottom, and the loss due to the energy of the discharged water is unusually small. Both feed and discharge are practically tangential.



FIGS. 2 AND 3.

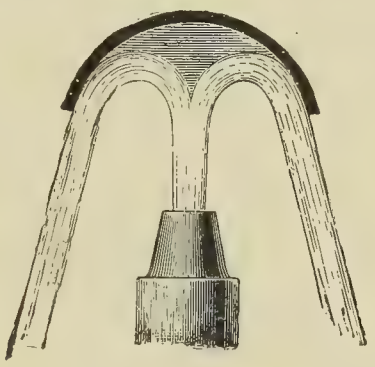


FIG. 4.

A large number of these wheels are now being used for driving dynamos and generators, for which purpose they are well adapted, as they are uniform in speed and reliable in power. Close regulation being very important in this class of service, separate wheels for each dynamo afford certain and reliable control. Where the head admits they can be attached to the dynamo shaft direct, or connected by belt, as will best suit the conditions of each particular case. Where the head is too low for direct coupling of the shafts, a direct belt connection can be made from the wheel to dynamo without intermediate gearing. Fig. 5 represents a 125 horse-power Brush dynamo and a Pelton water-wheel used on the Comstock lode under a head of 1,680 feet. The wheel is attached to the shaft of the dynamo with an insulated coupling, and is made of a size to give the proper number of revolutions under the head named. In operation it is protected by an iron housing, which prevents all splash.

The Pelton water-wheel is said to give a high efficiency under a wide range of heads, and is equally efficient whether operated by very small or very large nozzles, provided the proper ratio is maintained between the diameter of nozzle and size of bucket, etc. It is very simple in construction and made of the best material. Its use frequently enables the avoidance of counter-shafting and the application of power direct, a saving both of space and cost.

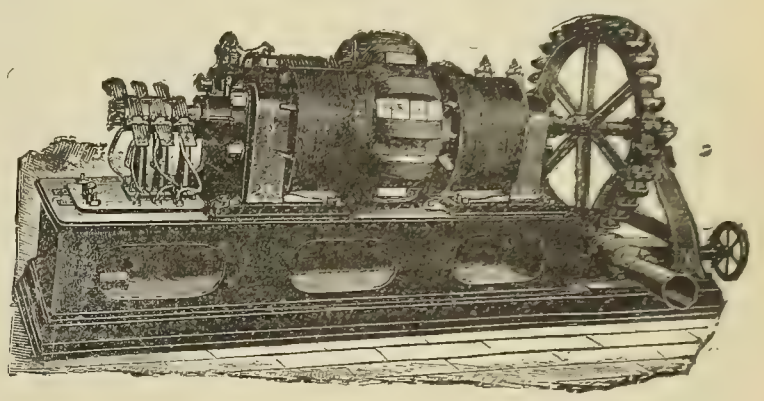


FIG. 5.—BRUSH DYNAMO AND PELTON WHEEL.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

A meeting of the Institute Committee on the International Electrical Congress of 1893 was held in the office of the Secretary, 12 West 31st street, New York City, October 27. The committee is composed of the following members:

Edward Weston; Dr. S. S. Wheeler; Geo. A. Hamilton; Prof. Henry Morton; Prof. Chas. R. Cross; C. H. Haskins; R. W. Pope; Prof. W. A. Anthony; F. L. Pope; Prof. E. J. Houston; T. C. Martin; T. D. Lockwood; G. M. Phelps; C. O. Mailloux and Carl Hering.

The Committee organized permanently, and elected T. C. Martin, Chairman, and R. W. Pope, Secretary. It was voted that the members of the existing committee on Units and Standards be added to the Congress Committee; also the following members: Prof. Elihu Thomson, Prof. Alexander Graham Bell,

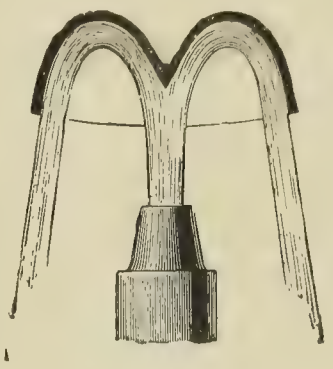


FIG. 1.

Dr. E. L. Nichols, Mr. Nikola Tesla and Mr. Ludwig Gutman. A sub-committee of three was appointed by the Chair, composed of Messrs. Carl Hering, W. A. Anthony and A. E. Kennelly to formulate a provisional programme for the work of the Congress. The Chairman is a member *ex-officio* of this committee.

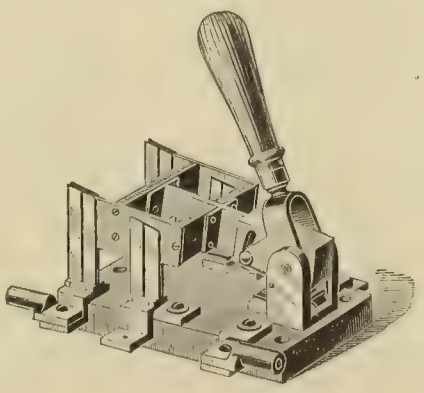
It was recommended that the Council appoint a committee to be sent to Chicago as soon as possible, to represent the claims of the Institute to a leading part in the Congress and to arrange for its co-operation with the authorities there upon a proper basis. The Council subsequently appointed Prof. Elihu Thomson, Mr. C. H. Haskins and Mr. F. L. Pope, as such committee.

At the meeting of the Council the following associate members were elected:

Capt. Achilles De Khotinsky, Electrician, Germania Electric Co., 505 Exchange Bldg., Boston, Mass.; Robert Edward Dunston, President, The Connecticut Motor Co., Plantsville, Ct.; Edward T. Middleton, Instructor in Electricity and Physics, Rutgers College, New Brunswick, N. J.; Joseph T. Monell, with F. B. Crocker, 236 W. 22d street, New York City; T. Carpenter Smith, partner in firm of M. R. Muckle, Jr., & Co., 212 Drexel Building, Philadelphia, Pa.; Frederick G. Strong, Electrician, Midland Electric Co., 1616 Seventeenth st., Denver, Col.

At the meeting of the Institute in the evening Vice-President Lockwood presided. After the reading of a paper on "Magnetic Reluctance," by Mr. A. E. Kennelly, which was very freely discussed, the report of the Committee on Units and Standards was taken up, and after considerable discussion it was decided to take no definite action upon it at present.

Professor Ryan communicated some corrections in his paper read at the September meeting, but on account of the lateness of the hour its further discussion was postponed.



DOUBLE POLE SWITCH.

DOUBLE POLE QUICK-BREAK SWITCH.

A double pole quick-break switch, as illustrated herewith, has been recently put on the market by the Hunt Engineering Co., New York.

The mechanical devices used for releasing the knives from the brushes and making a quick break are entirely original. This switch has been constructed to meet the demand which is constantly increasing for superior goods with perfect mechanical action, and it has been found very effective and satisfactory, and to-day has no equal for workmanship and perfect action, making an instantaneous break, which will safely work on a 500 volt current. By an ingenious device a fuse terminal is attached to each side of the slate base of the switch and each terminal. These terminals are so arranged that they can be used at the discretion of the purchaser; the switches being sold with or without fuse attachments, as purchaser may desire. These switches are made in four sizes, one, two, three and four hundred ampère capacity, which are constantly kept in stock. Other sizes up to 1,000 ampère capacity will be made to order. The prices of these switches are very low considering the workmanship.

The brushes are made from engravers' copper, and no pains or expense have been spared in making the switch perfect in every detail.

Any one desiring a first-class switch can do no better than to examine this one.

NEW JOURNAL.

The Circular System is the title of an 8-page monthly just brought out in Oakland, Cal., by W. W. Felts. This paper is the organ of the circular system of science. A considerable space in the first number is devoted to the consideration of natural magnetic currents and electricity.

NEW BOOKS.

"How to Make Inventions." By Edward P. Thompson. D. Van Nostrand Company, 23 Murray street, New York.

This book has 161 pages and is intended as a practical guide for inventors. The style of language is that of a lecture, and the object in view is to make a mere beginning in the establishment of inventing as a science and art, but especially to present conclusions arrived at in the study of inventing, in order that the capacity of inventors may be enlarged.

This book will be found valuable to others than inventors, since it is full of facts concerning the different branches of science. A great deal of valuable information is given, and it is hardly possible that the inventive faculties of any one who peruses its pages will fail to be stimulated. Mr. Thompson's book will do as much good, therefore, toward general education as it will benefit inventors. To the latter class it will unquestionably be of great value as a work of reference.

This and all other books on electrical and kindred subjects can be obtained of the Electric Age Publishing Co., first floor, World Building, New York City.

Correction.—In our issue of September 26 last, on page 581, we gave a description and an illustration of the Ferranti Sub-station Transformer, taken from a London contemporary, and inadvertently gave the wrong paper the credit for the same. Believing in the principle of giving credit to whom credit is due, we desire to state that the London *Electrician* should have received the credit for the article.

—Circulars 37, 38, 39 and 40 of the Thomson-Houston International Electric Co., 180 Summer street, Boston, are full of interest. No. 37 is on the subject of electric hoists; No. 38 about carbons; 39, the Thomson Recording Watt-meter, and 40, about water-power for electric lighting.

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DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY, AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

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THE INTERNATIONAL ELECTRICAL CONGRESS.

It is gratifying to note the active interest taken by American electrical engineers in the International Electrical Congress to be held in Chicago in 1893 during the World's Fair. This Congress will bring together in Chicago the foremost electricians of the world, and it will indeed be a notable one.

There is much work to do in this direction and the beginning cannot be made too early, although the time of holding the fair is yet two years ahead of us.

With commendable promptitude and interest the American Institute of Electrical Engineers has already commenced active operations, and the committee appointed at the meeting of this body on October 27 is composed of some of the best-known electrical engineers in the country. A perusal of the names (a list of which is given in another column) is abundant evidence that the work that will necessarily devolve upon the committee will be promptly and thoroughly prosecuted.

It is also gratifying to learn that steps were taken at the same meeting to keep the question of units and standards at the front. This will be one of the most important subjects the International Congress will be called upon to consider, and as there will necessarily be much preliminary work in this connection, it was a wise move of the Institute to add to the Congress Committee the existing one on units and standards. The combination of these committees will insure thorough consideration of the work they have in hand, and the addition thereto of such names as Prof. Alexander Graham Bell, Dr. E. L. Nichols, Mr. Nikola Tesla and Mr. Ludwig Gutman will inspire every electrician with the feeling that the work will be well done.

It was recommended that a committee be appointed to visit Chicago as soon as possible to represent the claims of the Institute to a leading part in the Congress and to arrange for its co-operation with the authorities there upon a proper basis.

When these arrangements are completed the committee will know exactly what they may do towards making the Congress a complete success.

HIGH SPEED ON RAILROADS.

The so-called limited express trains on the trunk steam roads are models of luxury and convenience. The passenger need not leave the train once from the time he sets his foot aboard until he arrives at his destination, if it be one of the large cities or any intermediate stopping-place. Dining-cars are provided; a barber shop is aboard; baths, libraries and smoking-rooms are also provided—all for the comfort of the company's patrons. The different lines have been trying to outdo each other in the matter of convenience, and having attained everything that science and art can provide in that direction, they have lately turned their attention to the attainment of extraordinary speed.

On New York's main trunk line, the other day, part of the distance between New York City and Buffalo was covered at a speed of 70 miles an hour, and the entire distance (440 miles) was covered in 8 hours and 40 minutes. This is said to probably be the fastest train service in the world.

Sixty miles an hour is regarded as the safe limit on steam railroads, but many engineers look to electricity as the power of the future and anticipate speeds of 100 miles an hour or more. There is reasonable grounds for believing that electricity will be the power of the future, and that the attainable speed on large roads will be far in excess of the best results of steam-railroad practice of the present day. Electricity is the engineers' hope, and there is no doubt that the day will soon come when we will see the electric locomotive pulling our trains across the country at speeds greatly in excess of those obtained by the present steam locomotive.

INTERNATIONAL ELECTRIC LIGHT ASSOCIATION.

The fact that there has been created in Montreal and throughout Canada in general a sentiment in favor of the formation of an association on lines similar to those of the National Electric Light Association of America, is evidence of the good results of holding the last convention of the latter Association in Montreal last September. There can be no doubt that electrical interests in the Dominion have been greatly stimulated as a result of that meeting, and those engaged in the trade have seen for themselves the great advantages of association for mutual benefit.

It is a question in the minds of some, however, whether it would be advisable to form an independent Canadian Association or join the American body. It has been proposed, we believe, to change the name of the American Association so that it will be known as the International Electric Light Association, and there seems no reason to doubt that the interests of Canadians would be better served by becoming members of the International Society than by maintaining an independent and separate organization. No one can question the assertion that all of the experience is on this side of the border, and our Canadian friends could profit by it by becoming members of the parent body.

Mr. A. J. Corriveau, of Montreal, who is a member of the National Electric Light Association and who is competent to speak on the subject, thinks that it would be better for Canadians to join the International body rather than form an independent Canadian Association. Much good would result on both sides if unity should be established. The interests of the electrical fraternity in both countries are practically identical, and there seems to be no reason why they would not be furthered by all being members of one body.

PROTECTION AGAINST FIRE.

We print elsewhere in this issue some extracts from a pamphlet recently issued by the Electric Mutual Insurance Company. This pamphlet gives some sound advice in the matter of protecting electric-light stations against fire.

This question of protection against fire is one that is frequently overlooked, and very often not until fire has wrought destruction does the subject receive any consideration whatever. In such cases provision is made to cope with fire after the damage is all done. No one can tell when a fire may take possession of his premises, and it is to his own interest to be prepared to battle with the enemy with the appliances that ingenuity and science have prescribed as being adequate for such emergencies.

Few electric-light stations are built in a thoroughly fire-proof manner. The walls may be of brick and the roof of iron, but if the floor be of wood the accumulation of grease thereon, which cannot well be avoided, introduces an element of danger, and ready means of extinguishing fire are needed in such cases as well as others.

So many people are dependent upon the light supplied by an electric-light station that it is of the greatest importance to provide every protection possible against fire.

The pamphlet in question gives many practical and valuable suggestions in this direction, and no doubt it will have a good effect in bringing station managers to realize the importance of having means at hand to grapple with the destroyer.

TROLLEY LINES AND ELEVATED RAILROADS.

We frequently hear it stated that the reason that overhead trolley wires are not permitted in the streets of large cities is because of the unsightliness of the line construction—that the poles would mar the appearance of the streets, etc. Other reasons suggested are that the streets in a city like New York, for instance, are narrow and crowded, and that it would be out of the question to run electric cars on such thoroughfares. The fallacy of this reasoning is proved in the case of the West End line, in Boston, where the streets are much narrower than they are in New York.

As regards marring the appearance of the New York streets with trolley lines, Mr. H. A. Everett, in his paper on "A Perfect Electric Motor," read at the Pittsburg Convention of the American Street Railway Association, referred to a conversation he had held with a gentleman touching the same subject. The gentleman objected to trolley lines in New York City mainly on the grounds above mentioned. Mr. Everett asked him if it was consistent to object to trolley lines in the streets of New York and at the same time permit the operation of elevated railways, which were noisy and shut out both light and air along the streets through which they passed. The gentleman was forced to admit, when the matter was presented to him in that light, that he thought the elevated roads were "about as bad as the overhead wires."

HONORS TO THE PIONEERS.

At a meeting of the Committee on Electricity, Electrical and Pneumatic Appliances of the World's Columbian Exposition, held in Chicago, October 26, the following names were decided upon as those of eminent electricians not now living, to be placed over the Electrical Building at the Exposition, namely:

Franklin, Galvani, Ampère, Faraday, Ohm, Sturgeon, Morse, Siemens, Davy, Volta, Henry, Oersted, Coulomb, Ronald, Page, Weber, Gilbert, Davenport, Soemmering, Don Silva, Arago, Daniel, Jacobi, Wheatstone, Gauss, Vail, Bain, De la Rive, Joule, Saussure, Cooke, Varley, Steinheil, Guericke, La Place, Channing, Priestley, Maxwell, Coxe, Thales, Cavendish.

This is an elegant tribute to the memory of these men who did so much in their times for the benefit of this and future generations. Their names should be perpetuated in the most enduring manner possible.

MAGNETIC RELUCTANCE.*

BY A. E. KENNELLY.

On the vein theory, the intensity of magnetization at any point of the magnet would be defined as the amount of magnetic matter cut through in the veins per unit area by a plane section perpendicular to their direction, at the point in question.

A unit magnetic pole situated in free space, at the end of a very long thin bar magnet would by definition repel with unit force a similar pole one centimetre distant, that is resident on the surface of a sphere one centimetre radius, of which it occupied the centre. The surface area of this sphere would be 12.57 (4π) sq.c., and over all this surface the pole would thus establish a magnetic field of unit strength and exert a magnetic stress equal to unity. Each square centimetre of the surface bounds an area of stress which emanates from the pole, and consequently the latter must emit 4π units of stress-flux. In the language used by Faraday it would throw off 4π lines of force. This stress-flux has somewhat unfortunately received from Maxwell the name of induction, and the induction through the surface surrounding the pole would be 4π units.

The interest connected with the nature of this stress demands a moment's pause at this point. While its real character is still as great an enigma as the real character of magnetism itself, some of its laws are well understood. There exists along the direction of the stress a tension accompanied by a general pressure at right angles, just as in the case of stimulated muscular fibre which tends to shorten and to expand laterally, or as it is generally expressed, the lines of force tend to contract while repelling one another. Since the time of discovery that the plane of undulation in polarized light-waves twists in passing through certain magnetized substances it has been supposed that the stress might be of a rotatory character. Like an incompressible fluid it can neither accumulate or vanish locally, and as much stress-flux must leave any region as enters it, if no magnetic pole exist within the confines. Its intensity is very remarkable, for it is far in excess of any stress that we can exert without the aid of cohesion in matter. This may be judged by comparing the quantities of energy that can be stored in a given volume of space—say air-space. It is of course easy even without the assistance of iron to magnetize a cubic centimetre of air to a flux density of 5,019 C. G. S. lines when it will possess an energy stored up in magnetic stress of one megaerg (1,000,000 ergs or 0.0737 foot-pound), while if this magnetization be alternated 227 times per second the average rate of absorption and discharge would be 45.5 watts, and one cubic inch of this air would stow and release energy with the average activity of one standard British horse. Under electrostatic stress, air not in the immediate neighborhood of a conductor appears to break down when the E. M. F. per linear centimetre exceeds 32,000 volts or 110 A. E. S. U., so that the maximum electrostatic energy that one cubic centimetre will hold without rupture is about 500 ergs or two thousand times less than that resident in air stressed magnetically to 5,000 lines, while a cubic centimetre of air near the earth's surface illumined by bright sunlight does not hold more radiant energy than about 50 microergs.

An alternating-current transformer is a device in which the secondary coil absorbs the energy out of air and iron, pervaded by the stress-flux from the excited primary coil. Unfortunately while magnetically-stressed air yields so far as we know all its stress energy back into either the primary or secondary circuit, stressed iron fails to do so entirely, and absorbs energy at every cycle, a process known as absorption by hysteresis. The iron directly converts the magnetic stress energy into heat energy, just as a spring absorbs some of the energy imparted to it during every cycle of compression and recoil.

These 4π units of stress-flux are not confined to a spherical surface of one centimetre radius, but would be found by summation over any enveloping surface containing a single unit pole, just as the delivery of material liquid must be the same in a steady stream at any section of its course independent of the channel area there existing; for at ten times the distance, the spherical area would be 100 times greater and the stress by Coulomb's law 100 times less, leaving the total area of total stress unchanged, and it follows in fact that the stress-flux over any boundary is always 4π times the strength of pole enclosed, no matter whether that pole be alone in space, or be the sum of any number of magnetic systems, in molecules or in massss.

On the vein theory, however, the strength of a pole is the quantity of magnetic matter on its surface, assuming that the veins meet it perpendicularly, or it is the aggregate surface intensity of magnetization, so that the stress-flux through each unit of polar surface is 4π times the intensity of magnetization. This is true not only for the polar surface, but also for the interior of the magnet, and every unit vein of magnetic polarized matter carries associated with it a stress-flux of 4π.

The magnet may itself be situated in a field of force so that its substance may be pervaded by a stress-flux independent of that in its veins. It may, and generally does, happen that part of this separate stress-flux issued from its own poles, in which case it will enter in the opposite direction to the vein or internal flux and will tend to reverse the molecular polarity of the vein structure, but whenever such additional flux is present, the resultant total flux at each point will be the geometrical resultant of that in the veins compounded with the external flux by the parallelogram of forces. In the important case of a long bar of homogeneous soft iron submitted to the influence of a uniform magnetic field acting in the direction of its length there will be a uniform induced molecular polarization or magnetization set up along the bar. Suppose, for instance, a bar of iron five square centimetres in uniform cross-section pointed in the direction of the dipping needle near Paris.

(*To be continued.*)

* Abstract of paper read at the meeting of the American Institute of Electrical Engineers, New York, October 27, 1891.

NEW YORK ELECTRICAL SOCIETY.

It is the intention of the New York Electrical Society to devote some of its meetings during the season of 1891–2 to a series of experimental lectures, in which the treatment of the various branches of electricity will be fitly illustrated by practical demonstration.

CANADIAN ELECTRICAL ASSOCIATION PROPOSED.

A Montreal paper of the 17th inst. prints an article concerning the proposed formation of an electrical association in Canada, patterned after the National Electric Light Association. A meeting of those interested was held in Toronto and a committee of organization formed. Mr. A. J. Corriveau, of Montreal, who is a member of the National Electric Light Association, gave it as his opinion that a Canadian association might stimulate electrical interests in Canada to a certain extent, but he believed that it would be better for those interested in electrical enterprises in Canada to join the American Association instead of forming one of their own. He did not think that the meetings of the Canadian Association would be of as much benefit to its members as they could derive from the American body. He, however, thought that Canadian electrical interests were large enough to support such an organization, but greater benefits could be derived by attendance at the meetings of the National Electric Light Association. He acknowledged that the members of the latter body were far ahead of the Canadians in electrical science, and that the latter could learn a great deal more from the Americans than they could expect to learn for a long time to come in the Canadian Association. He was strongly in favor of Canadians becoming members of the American association, particularly since the resolution was passed at the Montreal meeting in September proposing that the name of the association be changed, and that it be known as the International Electric Light Association. Mr. Corriveau hoped that all Canadians interested in electrical matters would join the International Electric Light Association.

ELECTRIC LIGHT NOTES.

The Alton Gas and Electric Light Co., Alton, Ill., will make several additions to its plant in the near future. William Tracy is Superintendent. The American arc system is used.

The Connersville Gas Light Manufacturing Co., Connersville, Ind., using the Westinghouse system, will make extensive additions to its plant in the near future.

C. S. & E. E. Homer, Eaton Rapids, Mich., contemplate several additions to their plant in the immediate future.

The Ellsworth Electric Light Plant, Ellsworth, Kan., will make several additions soon. The Fort Wayne Jenney system is used. C. F. Pohlman is President.

The Fort Smith Gas Light Company, Fort Smith, Ark., will soon add an incandescent dynamo, a 60 H. P. boiler, some shafting, clutch-pulleys and belting to its plant. The Thomson-Houston arc and the U. S. incandescent systems are used.

The Franklin Water, Light and Power Co., Franklin, Ind., will make several additions to its plant in the near future. The Thomson-Houston system is used.

The Grinnell Electric Light Co., Grinnell, Ia., using Thomson-Houston arc and Jenney incandescent systems, will soon make several additions to its plant.

The Howell Electric Light and Power Co., Howell, Mich., using the Western Electric arc system, contemplates the addition of an incandescent plant. Address Chas. G. Jewett, President.

The Hudson Electric Light Co., Hudson, Mass., contemplates several additions to its plant at an early date. F. S. Dawes is President. The company uses the Thomson-Houston system.

The Arcola Electric Light Plant (private company), Arcola, Ill., expects to make several additions to its plant soon. S. L. Woodworth is the owner.

The Atlantic City Electric Light Works (municipal corporation), Atlantic, Ia., may possibly need another engine and dynamo. W. A. Wilken is Superintendent. The Slattery alternating induction system is used, feeding 1,700 incandescent lamps.

The Wisconsin Wood Pulp Company, Centralia, Wis., contemplates changing its United States system of electric lighting to an alternating or storage battery system. The company now has 400 incandescent lamps in use. Geo. L. Williams is President.

The Union Manufacturing Co., Champaign, Ill., contemplates additional equipment. The Western Electric system is used. W. B. McKinley is Superintendent.

The Charleston Gas and Electric Co., Charleston, W.Va., contemplates several additions to its plant. The Thomson-Houston and the Wood systems are used. O. H. Michaelson is Superintendent.

The Chillicothe Water and Light Co., Chillicothe, Mo., will install a new incandescent machine soon. The company now has 75 arc and 600 incandescent lamps in use.

The Brush Electric Light and Power Co., Columbus, Ga., using the Thomson-Houston system, contemplates several additions to its plant in the near future. One hundred and fifty arc and 2,300 incandescent lamps are now in use.

The Iona City Electric Light Co., Iona City, Ia., will soon increase the number of its arc lights.

The New Britain Electric Light Co., New Britain, Conn., will add a power circuit to its plant October 1.

The Oakland Electric Light and Power Co., Oakland, Md., contemplates several additions to its plant at an early date. The company uses 20 arc and 320 incandescent lamps on the Edison system.

The Ocala Light and Power Company, Ocala, Fla., is about to install a 500-light incandescent plant. The company now has 40 arc lamps on the Thomson-Houston system.

The Electric Light Department, Upper Appomattox Co., Petersburg, Va., will add one alternator and 17 feet of main shaft, with cut-off couplings, to its plant in the near future. The company now supplies 200 arc and 1,300 incandescent lamps on the Thomson-Houston system.

D. S. Snyder & Co., Point Pleasant, W. Va., will increase their incandescent plant by 1,500 lamps. The company also has 28 arc lights in use.

The Suffolk Light and Water Co., Suffolk, Va., using the Thomson-Houston system, contemplates additional equipment in the near future. E. Wilkinson is General Manager.

The Tuskaloosa Gas, Electric Light and Power Co., Tuskaloosa, Ala., will require additional equipment soon. A. R. Smith is Superintendent and General Manager.

The Valdosta Electric Light Co., Valdosta, La., needs more incandescent lights. The Thomson-Houston system is used.

The Wayneburgh Electric Light Co., Wayneburgh, Pa., contemplates the addition of a dynamo soon. The company has 600 incandescent lamps supplied on the Brush system.

The Weston Electric Light, Power and Water Co., Weston, W. Va., thinks it will have to increase its arc light plant before long. The company now has 360 incandescent lamps on the Edison system and 30 arc lamps on the Sperry system.

The Jenney Electric Light and Power Company, Peoria, Ill., is making an addition of 150 lamps to its arc plant.

It is reported that J. C. Dias has been refused a franchise for conducting an electric-light business in Fresno, Cal., because the company which he represented was composed chiefly of Chinese stockholders.

The Norfolk Electric Light and Power Company, Norfolk, Neb., using the Edison and Sperry systems, will increase its plant in the near future.

George H. Boscow & Co., Garnet, Kan., supplying 600 incandescent lamps by the National alternating system, will make additions soon.

The Indiana Electric Company, Indiana, Pa., supplying 650 incandescent and 80 arc lamps by the Thomson-Houston system, contemplates several additions to its plant in the near future.

The Stanberry Light & Power Company, Stanberry, Mo., is now installing a 125 horse-power engine and a 125 horse-power Harrison safety boiler. The company intends to double the capacity of its dynamo plant. At present it supplies 500 incandescent lamps by the National system,

The Lincoln Gas Company, Lincoln, Neb., is now supplying 5,000 incandescent and 350 arc lamps by the Westinghouse system. The company uses Corliss and New York Safety engines aggregating 1,100 horse-power.

The Electric Rapid Transit Street Car Company, San Diego, Cal., has a capacity for 1,500 incandescent lamps by the Westinghouse system. The pressure at the transformer is 1,000 primary and 50 secondary. The company uses Hamilton Corliss engines.

The Albany Electric Light and Power Company, Albany, Ore., using Schuyler arc and Westinghouse and Heisler incandescent systems, may possibly make extensive additions to its plant in the near future.

The Wisconsin Wood Pulp Company, Centralia, Wis., is using two Weston dynamos of 600 volts each, supplying 400 incandescent lamps. The power is furnished by a Hercules water-whee..

The Piedmont Electric Illuminating Company, Lynch-

burg, Va., is supplying 1,000 incandescent and 240 arc lamps and power for a street railway. It uses the Easton arc and the Westinghouse alternating incandescent systems and Eickemeyer motors. The power plant consists of two Ball engines aggregating 275 horse-power.

The Antigo Edison Electric Light Company, Antigo, Wis., contemplates installing a complete system of arc lighting in the near future. At present it supplies 1,600 incandescent lamps by the Edison system.

M. M. Bright, representing the municipality of Decherd, Tenn., wants bids on an electric light and an electric street railway plant, including all appurtenances related thereto.

C. R. Wenrick, representing the municipality of Bridgeport, Ala., wants bids on an electric light plant to consist of dynamos and everything necessary for 50 arc and 2,000 incandescent lamps.

Canton, So. Dak., has granted an exclusive franchise to Hon. O. S. Gifford & Co. to construct and operate an electric light plant on the Thomson-Houston system. The plant will cost in the neighborhood of $20,000. It will be completed within 60 days.

Messrs. Thompson and Lord, large shoe manufacturers at Johnstown, N. Y., recently increased their floor space by about 2,000 feet and intend to light the entire building by electricity.

Charlestown, W. Va., is to have an electric light plant.

The Jacksonville (Ill.) Gas Light and Electric Light Company has just bought two 250 horse-power Corliss engines, one 50 arc-light and one 1,500 incandescent-light dynamo, and will make extensive additions to its buildings.

The Electric Light Company of Greensburg, Pa., will erect a brick structure 14 x 60 feet, to be equipped with two 100 horse-power engines and two 50 arc-light dynamos.

The Wausau (Wis.) Electric Company has been given a three-year contract for lighting the city. Forty-one 2,000 candle-power arc lamps will be required.

Pittsburg, Pa., is agitating the municipal lighting of its public buildings. At present the city pays $7,000 for lighting these structures.

The council of Newport, Ohio, has been ordered by the court to rescind its contract for lighting the city with the Suburban Electric Illuminating, Heating and Power Company.

The Bonham Electric Light and Power Company, Bonham, Tex., will make extensive additions to its plant in the near future. The Sperry arc and the Heisler incandescent systems are used. M. W. Halsell is president.

The Texas-Mexican Electric Light and Power Company, Eagle Pass, Tex., will add a 1,500-light Westinghouse dynamo and a Westinghouse engine to its plant in the near future.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE AND STREET RAILWAY NEWS, FIRST FLOOR, WORLD BUILDING,
NEW YORK, Oct. 31, 1891.

Mr. Louis Walsh, the manager of the Thomson & Robertson Company, manufacturer of fibrous dry batteries, reports an active demand for these goods. During the present month it has been necessary to keep the factory, which is located in Bloomfield, N. J., at work until midnight each night, in order to keep up with the orders.

Mrs. A. W. Evans, stenographer and typewriter, Room 57, No. 61 Broadway, city, is down-town agent for the Edison phonograph. This lady is using the Hubbell battery for operating the phonograph in use, and transcribes directly from the cylinder.

Mr. F. A. Mason, the genial treasurer of the Interior Conduit and Insulation Company, of this city, has gone on a six-weeks' vacation. Mr. Mason will spend the time in North Carolina, and he goes for the double purpose of seeking health and pleasure; at least, it is supposed he seeks pleasure as well as health, from the fact that he took his gun along with him.

The Crocker-Wheeler Electric Motor Company, New York City, has just issued a revised and extended catalogue. It is an interesting pamphlet of over fifty pages. To those seeking information regarding the electric motor and its numerous applications, the Crocker-Wheeler catalogue must prove of great value. The text, which is profusely illustrated, discusses at length the construction of the Crocker-Wheeler motors and their special features, with convenient and valuable table of dimensions, etc. There are also directions a-plenty for setting up, connecting and running these popular motors. An interesting chapter on "Windings" engages the attention; also a table of sizes and types of motor manufactured for constant potential circuits. The fire-proof starting, regulating and reversing boxes made by the Crocker-Wheeler Motor Company are described, and considerable space is given to their small motors, 1–6, 1–8 and 1–12 H. P., together with their application to electric fans, electric pumps, etc. The "Arc" circuit or constant-current motors, Crocker-Wheeler type, are fully described and illustrated.

H. A. MacLean, representing the Edison Electric Illuminating Company, New York, is constantly on the alert for contracts. He is very enterprising, and is an able representative of the company in this section.

Mr. G. C. Baillard, formerly with Alexander, Barney and Chapin, and now with Parmly, Mitchell & Co., dealers in electrical supplies, 18 Cortlandt street, this city, is quite a hustler, and is able to talk electricity and business with equal facility. The members of the firm of Parmly, Mitchell & Co. are active and enterprising and are constantly on the alert to the needs of the electric light, power and railway interests.

C. H. W. Copeland, formerly associated with E. T. Copeland & Co., is now connected with Frank McSwegan & Son, 98 Liberty street, this city. Frank McSwegan & Son equip steam plants for all classes of electric work, and represent Russell & Co., of Massillon, Ohio, makers of high-speed automatic engines, and Brownell & Co., Dayton, Ohio, manufacturers of boilers and plain side-valve engines. Mr. Copeland is a thoroughly capable man in this line of business, and we wish him success in his new position.

Mr. Emil Gabil, a popular salesman of oak-tanned leather belts, is now hustling sales of Page belts. His headquarters are with the Page Belting Company, 16 Dey street, New York.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	81 00
Aut. Phon. Exb. Co	25,000	100 00	†20 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	179 00
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y	10,000	100 00	†60 00
Brush Illuminating, N. Y	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	136 50
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	99 25
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000	50 00	*102
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	24 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	27 50
Detroit Electrical Works	1,000,000	10 00	8 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*99
Edison Elec. Ill. 6s, N. Y	30,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	98 00
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	40 00
Essick Printing Tel	5,000,000	100 00	30 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*101
Fort Wayne Elec. Co	4,000,000	25 00	13 50
Fremont E. L. & P. & Gas Co., O	95,000	100 00	125 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*98
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hudson Electric Light, N. J	100,000	100 00	
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*104
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	47 50
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	19 00
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*80
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N. Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J	17,500		*101
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100.000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I	150.000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	16 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel. 6s	1,500.000		*99
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. G. & E. Co. Certs. of Indebt	100,000		†
N. Y. Phonograph Co	20,000	100 00	†20 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50.000		*95
North New York Lighting	150,000	100 00	10 00
Northern Elec. L. & P., Phila	200.000	10 00	
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P. Co. 6s	800,000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	5 50
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	49 00
Thomson-Houston pref	4,000,000	25 00	26 00
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
Twin City Rapid Transit, N. J	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	40 00
Universal Arc Lamp Co	100.000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	1 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	82 75
Westinghouse Electric Co	7,000,000	50 00	13 25
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	
West End L., Boston			16 25
Yonkers L. & P	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

As so many of our readers are customers of the International Okonite Company, Ltd., they will be pleased to hear that the company is in a very prosperous condition, having just declared its second semi-annual dividend of 4 per cent. on its preference shares, payable at Messrs. Winslow, Lanier & Co.'s on October 28th. It is always a pleasure to note the success of an international corporation, as it means foreign as well as home capital catering to our desires.

The market for electric securities continues very strong; there is no desire shown by holders to sell until a purchaser appears who wants it more than they do and is willing to pay a round profit for the privilege. The natural growth of the country necessitates a certain appreciation in the value of every local corporation which continues to carry out the local municipal contracts for light, heat and power. Such corporations naturally adopt all real electrical improvements as fast as they are proven to be worthy of attention. We often note changes of systems in all three industries and consolidations of corporations, yet always with an increase of service, reduction of expense and of course greater income. From a few hundred lights in the original contract the number in a very few years becomes a few thousand. From a few cars on a short line the number is never sufficient after the first year, nor does the road ever reach far enough to satisfy the people or the owners of property beyond the extreme end of the supply. Electric companies are organizing and competing successfully with gas even in the natural gas regions, while the existence of coal-oil, the poor man's illuminant, is not even taken into account when electric light is discussed. Gas and electric corporations combine, but generally it is that the gas barons are forced into it to preserve their very existence. It is often amusing to look through large towns or small cities and witness the effects of the struggle and see the lonely dilapidated gas-posts and unused chandeliers, brackets, etc., while the electric light on the street corners are dangling from flexible cords, showing the will of the people themselves. The gas people must invest in the electric company or retire from business. Stock dividends will soon be the order of the day, and those who invested in the first ten years will find at the end of the second decade that the accumulation will have wiped out or enable them to write off the first cost of their holding besides reaping the benefit of their dividends. Those who follow closely the fluctuations in our list of securities will understand this. There is one notable stock there whose par is $1.00 that has lately sold on merit for $8.00. The bonds generally are worth par and interest; the preference shares, a little over par. Two of the latter, one 6 per cent., the other 8 per cent., both earning more than required, are on the market at par; the business of both is rapidly increasing. Among the other industries, the Russell Co.'s arc lamp is not able to supply the demand. The fact that it burns twenty-four hours without trimming and is the competitor of the double-carbon is much appreciated by local arc corporations.

NEW INCORPORATIONS.

The International Electric Manufacturing Company, Chicago, Ill., was incorporated October 9, with a capital stock of $100,000. Incorporators: John S. Fifield, Edward T. Brainerd and Thomas E. Rushbrook.

The Athens Electric Light, Heat and Power Company, Athens, Pa., has been incorporated, with a capital stock of $5,000. Incorporators: Howard Elmer Waverly, New York, N. Y.; William Stevenson and W. A. Stevenson, Sayre, Pa.

The Omaha Consolidated Electrical Company, Omaha, Neb., has been incorporated, with a capital stock of $10,000. Incorporators: H. A. Kinney, H. P. Kinney and Leavitt Burnham, Omaha, Neb.

The Hero Electric Company, Union Hill, Hudson County, N. J., was incorporated October 7, with a capital stock of $50,000. Incorporators: J. H. Wood, Jersey City, N. J.; J. B. Varick, D. P. Westerfelt and A. W. Tobey, all of Union Hill, N. J.

The Wampa Electric Light and Power Company, Wampa, Idaho, was incorporated October 20, with a capital stock of $24,000. Incorporators: J. N. Jones, P. W. Purdum, both of Wampa, and H. E. Simmons, Summit, N. J.

The McLeod Electric Manufacturing Company, Brooklyn, N. Y., was incorporated October 21, with a capital stock of $3,000. Incorporators: James Macbeth, Joseph N. McLeod, of Brooklyn, N. Y., and Charles Van Winkle, Plainfield, N. J.

The Heisler Electric Company, Gloucester, N. J., was incorporated October 20, with a capital stock of $250,000. Incorporators: W. Shapleigh, Camden, N. J., J. Ball and F. H. Morris, Philadelphia, Pa.

The Atlantic Electric Light and Power Company, Atlantic City, N. J., was incorporated October 19, with a capital stock of $50,000. Incorporators: C. L. Cole, C. J. Adams and C. E. Brown, all of Atlantic City, N. J.

The Lake Erie Electric Light Company, Elyria, Ohio, was incorporated October 23, with a capital stock of $20,000. Incorporators: Frank M. Townsend, Henry W. Worst, Sam Rawson, Charles E. Wilson, W. L. Fay and Lester McLean.

The Gray Electric Company, Chicago, Ill, was incorporated October 23, with a capital stock of $100,000. Incorporators: Elisha Gray, Frederick W. Cushing and Leon O. McPherson.

Electro-Novelty Company, Pontiac, Me., was incorporated October 17, with a capital stock of $50,000 Incorporators: Joseph B. Cupples, Longwood, Mass., W. A. Connelly, John P. Cushing and Lewis H. Rogers, Boston, Mass., and Edward C. Ramsdell, Natick, Mass.

The Union County Electric Company, Roselle, N. J., was incorporated October 19, with a capital stock of $30,000. Incorporators: H. P. Baldwin, Roselle, N. J., H. M. Bylesby, St. Paul, Minn., and W. H. Moore, Plainfield, N. J.

The Springfield Light and Power Company, Springfield, Ohio, was incorporated October 24, with a capital stock of $200,000. Incorporators: Allston Burr, C. H. Pierce, John H. Miller, W. A. Scott and George Martin.

The European-American Electric Corporation, Chicago, Ill., was incorporated October 24, with a capital stock of $2,000,000. Incorporators: Frank Butterworth, Monroe L. Willard and Arthur A. Bliss.

The New York Electric Construction Company, Jersey City, N. J., was incorporated October 21, with a capital stock of $100,000. Incorporators: Thomas H. Howell, John H. Hapgood, Peter B. Vermilya and George E. Hutchinson, all of New York, N. Y., Charles S. Van Nuis, New Brunswick, N. J.

The Acme Light, Heat and Power Company, Chicago, Ill., was incorporated October 19, with a capital stock of $2,000,000. Incorporators: George S. Knapp, James A. Turner and Simeon J. M. Bear.

The Mifflinburg Electric Light and Power Company, Mifflinburg, Union County, Pa., was incorporated October 16, with a capital stock of $1,000. Incorporators: James H. Snodgrass, John A. Beard, Aaron Klose, Wm. A. Ewing and Robert E. Snodgrass, all of Mifflinburg, Pa.

BROOKLYN NOTES.

The Baehr Electric Mfg. Co., 110 Livingston St., Brooklyn, electrical engineer and manufacturer of electrical apparatus, wiring contractor under the authority of the Edison Company, contractor for installing electric-light plants and developers of inventions, is installing a 1,000-light plant in the new *Eagle* Building, corner Johnson and Washington Sts., Brooklyn. George Baehr, general manager and electrician of the company, is supervising the construction of this work, and the building is being wired on the two and three wire system, so that in case of failure of the apparatus on the premises, connection can be made with the street mains of the Edison three-wire system. The dynamo plant for the new building is being transferred from the old *Eagle* Building. The company is using interior conduit throughout this work, and is doing all its Edison wiring under the authority of the Edison Illuminating Co., Brooklyn. Mr. Baehr has lately changed a medical apparatus for Dr. Toppins, dispensing with the primary batteries and introducing a system whereby the Edison current can be utilized for the generation of faradic and galvanic currents. He is also preparing several apparatus of this kind for the medical fraternity in Brooklyn.

On looking up several concerns in Brooklyn, I found the New York Fifth Wheel Co., manufacturers of the Evans patent anti-friction steel fifth wheel, 63 Clymer St., using the Thomson welding system for welding fifth wheels. The generator for the welding machine is run by a 30 horse-power engine. One of the T.-H. automatic secondary coils is used in the welding process.

The Automatic Scale Co., 63 Clymer St., Brooklyn, has produced one of its new Davis automatic electric track scales, and it is now on exhibition at the American Institute Fair, New York. The operation and mechanism of this machine is very delicate and at the same time most practical. In place of the balance weight used on large beam scales a small Elektron motor is set, and on the end of the shaft, coupled directly on a universal joint, is a screw-threaded rod running the length of the beam, parallel with it, and connected to this rod is the movable weight. Through the operation of the motor, which is automatic, this weight is carried back and forth on a roller placed at the top of the beam, and it stops when the correct weight has been reached. Contact is made through an ingenious device which prints the exact weight. Mr. T. J. Young, vice-president of the company, states that they can weigh cars with this system while they are running at the rate of fifty miles an hour. This system can be practically applied where beam scales are used for weighing large and bulky objects. It overcomes the necessity of an operator to push the weight back and forth by hand, and at the same time prints the exact weight. Mr. J. V. Davis, general manager and electrician and inventor of the system, was weighing master for the Chesapeake and Ohio R. R., and he conceived the idea while in its service. This railroad has ordered a sufficient number of these automatic scales to equip all of the scales now in use throughout the whole system.

F. Thill & Sons, large glass manufacturers of incandescent bulbs, arc-light shades, battery jars, etc., Taylor and Kent Aves., Brooklyn, N. Y., were found very busy, requiring the full capacity of their large furnaces, and a large number of men were busily engaged producing various lines of glassware used in the electrical industries.

John Lane, the electrician, has moved to 63 Clymer St., where he is carrying on an exceedingly good electrical business in conjunction with a real estate business. He has a number of lots at Van Pelt Manor, L. I., which he took up some time ago, thinking it a big opportunity for people of moderate means to secure a home for themselves at convenient distance from the City Hall, Brooklyn or New York. He is offering lots on most reasonable terms to his friends and those who wish to locate in this healthful district. It is within forty-five minutes of New York City Hall and thirty minutes of City Hall, Brooklyn.

The Excelsior Machine and Tool Works, 63 Clymer St., Brooklyn, is fitting out a large number of æolian organs for the Æolian Organ Co., 18 West Twenty-third St., New York. Four or five electric bells are used in connection with the production of music, and are struck automatically. These bells are operated by four Burnley batteries made by J. H. Bunnell & Co., 76 Cortlandt St., New York. The Æolian Organ Co. is manufacturing these organs in quantities and offering them to sub-companies throughout the United States for people with extra nickels in their pockets to get a five-cent tune. This is a big opportunity for local phonograph companies who are using the nickel-in-the-slot phonographs to introduce in every city this new organ. They are very handsome machines and play very attractive airs.

W. T. H.

BUSINESS NOTES.

One firm recently ordered eighteen large water-wheels of James Leffel & Co., Springfield, Ohio, builders of the famous James Leffel Water Wheel. The turbines of this large order are to be used for driving a fine wood-pulp mill now under contract for construction in Wisconsin. This mill is situated near large quantities of suitable timber, and where ample water-power can be obtained.

Mr. E. P. Pardee, agent of the Mather Electric Company, Syracuse, N. Y., is meeting with good success in the introduction of its system. He is now installing a plant of 250 lights in the shoe-factory of Buell & Son, Waterville, N. Y., and another in Syracuse in the factory of the P. B. and H. Molding Company. Other contracts are on hand, the work on which will soon be undertaken. The Mather system is one of the best in the field.

H. T. Paiste, manufacturer of electrical specialties, owing to increased business, has been obliged to move his factory and eastern office from 12th and Market Sts. to the new Fuller Building, 10 South Eighteenth St., Philadelphia. He has taken the entire third floor of this elegant building, thereby trebling his floor-space. It is the intention of Mr. Paiste to largely increase his line of specialties.

PLEASED WITH IT.

DUBLIN, WAYNE CO., IND., Oct. 6, 1891.

JEROME KIDDER MFG. CO.

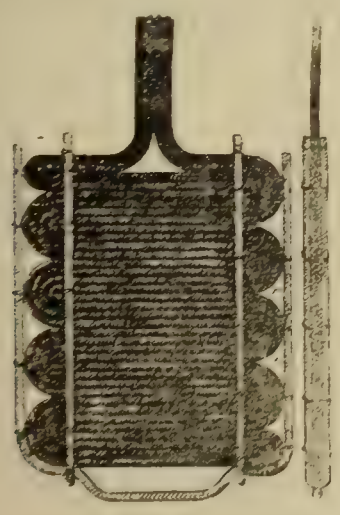
SIRS: Please send ..... I have been using your electrical instruments for many years and value them above others that I have used. Yours truly, A. J. SMITH.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued October 27, 1891.

461,809. Signalling System. Frank P. Benjamin, New York, N. Y. Filed Feb. 9, 1889.

In a system of railroad-signals in which communication between vehicles is established by means of the inductive effects of a current of electricity, the combination of a plurality of separate and independent local circuits arranged on both sides of the track, a vehicle carrying a plurality of conductors respectively parallel to and in inductive relation to



461,823.—SECONDARY-BATTERY ELECTRODE.

different portions of the local circuit, and also carrying a signalling-circuit connected with a suitable source of electric energy, parallel to a separate portion of the local circuit.

461,810. Signalling System. Frank P. Benjamin, New York, N. Y. Filed April 19, 1889.

461,814. Electric Heater. John V. Capek, New York, N. Y. Filed Oct. 30, 1890.

A heating-conductor in the form of a volute spiral, the several turns being separated and covered by insulating material, the whole inclosed in an impervious casing.

461,823. Secondary-Battery Electrode. Justus B. Entz, New York, and William A. Phillips, Brooklyn, assignors to The Waddell-Entz Electric Company, New York, N. Y. Filed Oct. 31, 1890.

A battery-electrode made up of wire bent upon itself to form a mat or plate surrounded by wire loops or straps.

461,858. Secondary-Battery. Montgomery Waddell and Justus B. Entz, New York, N. Y., assignors to The Waddell-Entz Electric Company, same place. Filed Oct. 31, 1890.

In a secondary battery, the combination of a positive and a negative electrode, one contained within the other and one being entirely covered or protected with insulating material.

461,862. Electric Generator. Charles G. Young, New York, N. Y. Filed April 25, 1889.

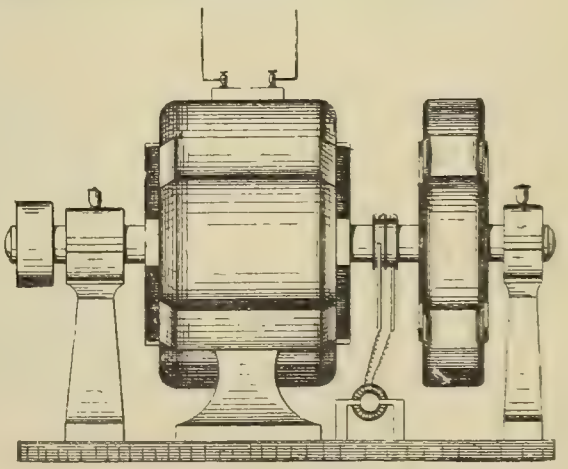
A dynamo-electric machine consisting of the combination of two sets of rotary coils mounted and fixed upon a common rotary shaft, two sets of stationary coils placed within inductive relation of the first-named coils, electrical connections between the terminals of the rotary coils, and a choking-magnet included in circuit with the rotary coils, the rotary coils being provided with pole-pieces which lie at different angles formed in a circle about the shaft.

461,868. Electric Connection. James H. Fleming, Newark, N. J. Filed Jan. 9, 1891.

A tubular sleeve open at opposite ends and receiving the oppositely-projecting ends of the wires, the wires and sleeve having coincident and alternating bends on opposite sides.

461,887. Multiple System for Telephone-Exchanges. William E. McKivitt, St. Paul, Minn., assignor to the Western Electric Company, Chicago, Ill. Filed March 30, 1885.

The combination, with telephone-lines connected with two or more switch-boards through simple spring-jack switches, of pairs of connecting plugs at different boards, the plugs being provided with two terminals and corresponding terminals of each pair being connected together through different test-batteries, and a test-plug at each of the boards connected with a branch leading through the



461,862.—ELECTRIC GENERATOR.

operator's telephone, whereby it may be determined at any given board whether a line wanted or called for is in use or connected at any other of the boards

461,898. Incandescent-Electric-Lamp Socket. Cecil P. Poole, Lynchburg, Va. Filed March 5, 1891.

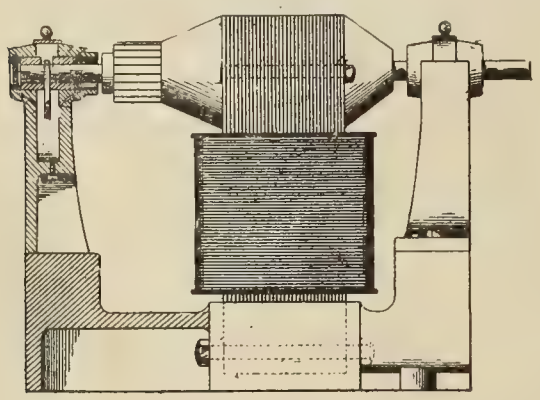
461,965. Galvanic Battery. Calvin N. Souther, Chicago, Ill. Filed March 23, 1891.

In a galvanic battery, the combination, with a suitable retaining-vessel, of a porous wall, an electrode located at

one side of the wall, a metallic sulphate surrounding the electrode and extending to the porous wall, a zinc electrode located at the opposite side of and in contact with the porous wall, and a suitable liquid, preferably water, resting against the zinc and the exposed portions of the side of the porous wall at which the zinc is located.

461,979. Dynamo-Electric Machine or Motor. Max Mayer, New York, N. Y., assignor to the Zucker & Levett Chemical Company, same place. Filed May 5, 1891.

In a dynamo or electric motor, the combination of a base-plate provided with two cavities, one opening downward and the other upward, standards at opposite ends supporting



461,979.—DYNAMO ELECTRIC MACHINE OR MOTOR.

castings which carry the shaft-bearings, field-magnet laminated cores having limbs of a given width and polar extensions thereto of the same width, yokes for the field-magnet core, fitting in the first cavity and fastened therein by bolts, the other cavity being greater than the length of the bolts, field-magnet coils slipped upon the magnet-limbs, and bolts, passing through and bolted to the polar extensions.

461,991. Lightning-Arrester. Edward W. Van Brunt and William M. Raynor, Scranton, Pa. Filed May 16, 1891.

In a lightning-arrester, the combination of a frame, metallic strips secured to one end of the frame, lugs upon the strips, cams pivoted upon the strips in position to bind against the lugs, steps upon the outer ends of the strips, conducting-discs upon the inner ends of the strips arranged near to but out of contact with a conductor connected with the ground, fuses clamped between the cams and lugs and held taut by suitable connectors at the opposite end of the frame, a conducting-pencil connected with the line-wire and arranged in the path of the fuses, and means for holding the fuses in close contact with the conducting-pencil.

462,020. Automatic Regulator for Dynamo-Electric Machines. William L. Silvey, Lima, Ohio. Filed July 5, 1889.

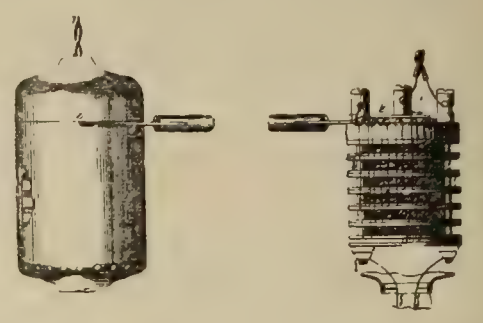
In a system of automatic regulation for dynamo-electric machines, the combination, with the field-magnets and field-magnet coils of a dynamo-electric machine, of an automatically-actuated regulator therefor, consisting of a vessel containing an electrolytic fluid, a solenoid-magnet located above the electrolytic bath, a vertically-actuated iron core free to move through the axis of the solenoid and projecting beyond the solenoid into the electrolyte, a conducting-plate attached to the movable core, a stationary conducting-plate located in the bottom of the vessel containing the electrolyte, an electric conductor connecting the field-magnets and the field-magnet coils of the dynamo-electric machine with the stationary conducting-plate, the movable conducting-plate attached to the magnet-core, the electrolyte, and the coils of the solenoid, all together into a continuous electric circuit.

462,033. Circuit-Controller. William B. Cleveland, Cleveland, Ohio. Filed June 17, 1891.

The combination, with a stationary contact and a movable contact, of a casing and a comminuted non-liquid filling in the casing, the filling being so disposed in the casing as to tumble into the space between the contacts when the movable contact is withdrawn.

462,053. Rheostat for Electric Lamps. Thomas A. Lacey, St. Paul, Minn. Filed May 5, 1891.

Wire resistance-coils formed of wire wound spirally so as to form hollow sidewise-tight cylindrical chambers or central passages and applied and confined between non-conducting discs arranged upon insulated electrical conducting-rods having binding-posts at their upper ends, the coils and discs being arranged between the lamp-socket and the suspending cap, and means for electrically connecting the lamp and rheostat and making and breaking the circuit.



462,053.—RHEOSTAT FOR ELECTRIC LAMPS.

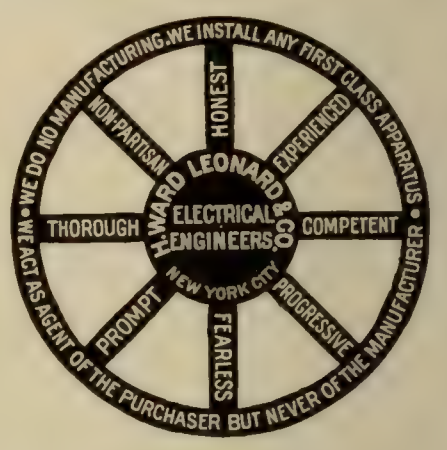
462,207. Method of Welding or Working Metals Electrically. Charles L. Coffin, Detroit, Mich. Filed Dec. 22, 1890.

The process of electrically heating metal for working or welding, consisting in connecting the material to be heated with one pole of a generator, placing it in contact with a conductor in proximity to the point of contact between such conductor and a second conductor, which is conneted with the other pole of a generator, and passing a heating-current through the material and the conductors, whereby the material is heated directly by the action of the current and also by the heat developed at the point of contact between the two conductors.

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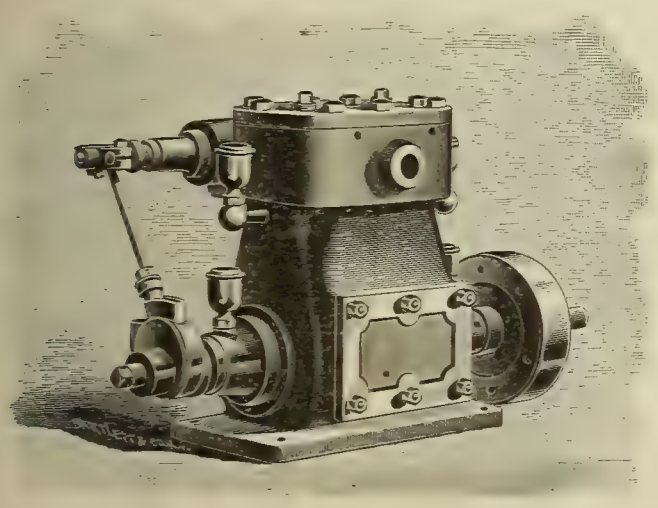
THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, NOVEMBER 14, 1891. No. 46.

THE EVOLUTION OF THE DIRECT-CONNECTED DYNAMO.

It is said that the Westinghouse Machine Company was the builder of the first direct-connected dynamos in the United States, if not in the world; and that the idea of connecting the dynamos directly to the engines led to the designing of the Westinghouse single-acting engine.



FIRST WESTINGHOUSE ENGINE (1880).

In 1880 the Brush Electric Company conceived the application of the electric arc for locomotive head-lights. Belt transmission being out of the question, the problem of a direct engine was laid before Mr. H. H. Westinghouse, of Pittsburg, for solution. The terms of the problem were stated about as follows: The speed must not be less than 1,000 revolutions, and the power developed not less than 1½ net horse-power. The engine must be able to stand up under 150 to 180 pounds of steam; it must be self-contained, so as to be bolted to the locomotive, like a brake-pump; it must be sufficiently rigid, so as to stand all the shock and jar of service; it must be enclosed completely, as a protection from dust and cinders; and finally, it must be capable not only of several hours' continuous running without attention and of continuous service day after day, but must be of such a design as to run for an indefinite time without any attention whatsoever, while the locomotive is side-tracked and the engineer absent.

The solution to this was the single-acting, self-contained and self-lubricating engine, which has propagated itself with very little modification until it has developed a business of enormous proportions involving compound and triple-expansion engines up to 1,000 horse-power.

The original engine (Fig. 1) now fills the position of centrepiece in the office of the Westinghouse Machine Company at Pittsburg.

A more serious attempt following the comparative success of the locomotive experiment was the constructing of several short-stroke engines developing about 10 H. P. for coupling direct to Brush machines at 800 to 1,000 revolutions. A number of these were built and operated successfully—one at least after ten years of service is still regarded as the most reliable engine in the experimental plant of the United States Government Torpedo Station at Newport, R. I. See Fig. 2.

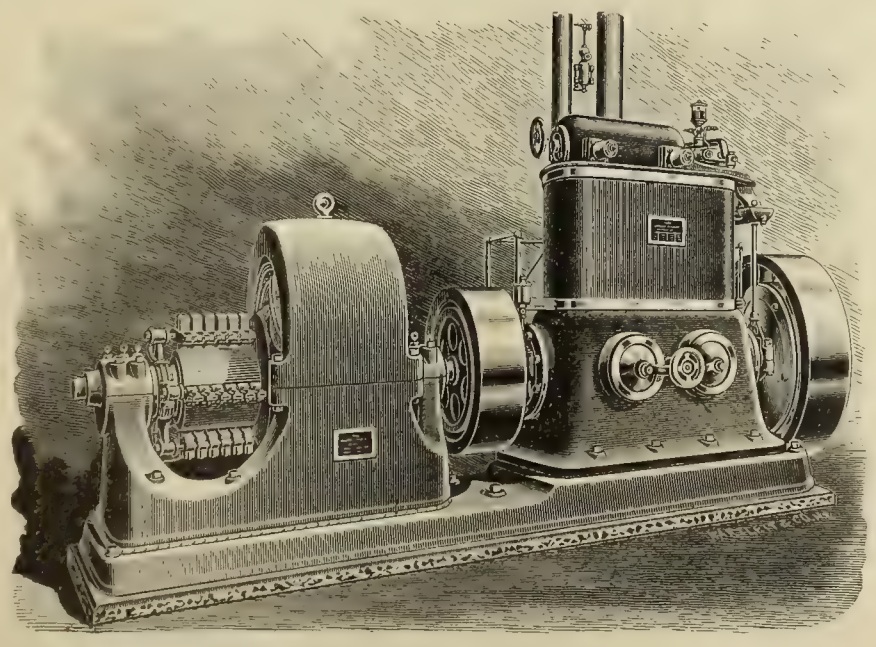
Fig. 3 shows the present Westinghouse electrical generator, coupled direct to a single-acting engine.

CHEMISTRY OF ACCUMULATORS.*

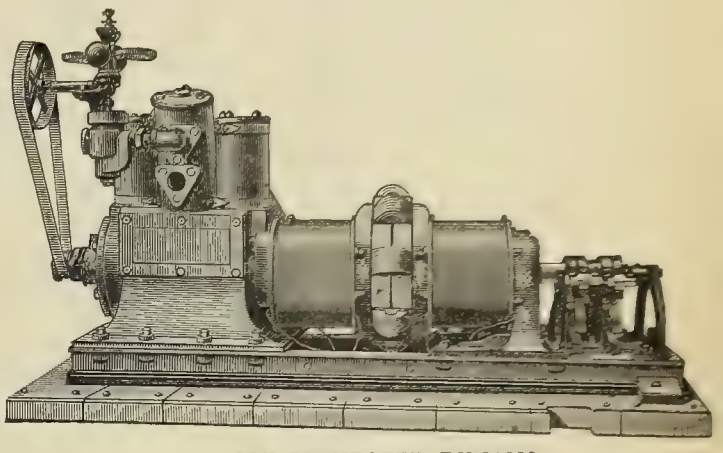
BY MATHIAS CANTOR.

The question as to the part played by hydrogen at the negative plate of a secondary cell is still unsettled. Although Gladstone and Tribe, as well as Frankland, found that lead or lead-sponge cannot take up any appreciable quantity of hydrogen, Streinitz is of an exactly opposite opinion, and regards the amount of gas occluded as considerable and its action as of great importance. Others, Drzewiecki and Schoop, for instance, conclude that a combination occurs between the lead and hydrogen. The author undertook a quantitative investigation into the various chemical processes occurring during charging and discharging, and he believes that by this means it is possible to arrive at a clear understanding of the matter.

Since the escaping gases, hydrogen and oxygen, can only be analyzed quantitatively in the electrolyte, and not on the electrodes (without destroying them), an indirect method was adopted for the analysis of the latter. For one electrode a metal was used which undergoes no noticeable chemical change, so that any variation in the electrolyte depended only on the second electrode. At the positive electrode a plate of platinum was placed in a specially-adapted glass vessel, the negative being formed of an E.P.S. plate, containing two or three sets of four meshes. The electrolyte used was a 28-per-cent. solution of sulphuric acid. In the circuit, which was supplied by eight Meidinger cells, were also included a resistance-box, a galvanometer and a Hoffmann voltameter. Consequently, at corresponding electrodes in the voltameter and the secondary cell, equal volumes of oxygen and hydrogen were produced in the same time. Since the negative electrode consisted of a lead grid filled with lead oxide and lead sulphate, these three substances could enter into the chemical processes that occurred. At the low-current strength employed (6 to 12 milliampères) it was proved, from measurements of the volumes of the gases produced and analysis of the electrolyte, that the only change that took place in the electrolyte was an alteration in its degree of concentration, which agrees with the results obtained by H. Aron and Frankland.



THE PRESENT WESTINGHOUSE GENERATOR.



FIRST DIRECT-CONNECTED DYNAMO.

Before charging, the electrolyte contained hydrogen only in the form of water, while afterwards it existed partly as gas, partly as water, and perhaps, also, in one form or the other, combined with the cathode. The total quantity of hydrogen must remain unaltered after charging, so that the amount of combined hydrogen at the cathode must be equal to the difference between the amount existing at first in the electrolyte as water and that existing in it in the same form after charging together with the quantity of gas produced. Experiments with several plates gave values for this difference, which were all found to lie below the probable error that might be expected, and they could therefore be neglected. It appears, therefore, that the negative plate cannot take up any appreciable quantity of hydrogen either by occlusion or in the form of a lead hydride.

From a comparison with the voltameter it was found that the whole of the hydrogen that might have been expected did not appear in the accumulator; the remainder in the "active" state was used in reducing lead oxide and lead sulphate, probably in the first instance the $PbSO_4$ to H_2SO_4 and Pb, since an increase in the amount of SO_3 in the solution was observed. The proportion between the "active" hydrogen and that which appears electrolytically seems to bear some relation to the capacity of the plate. It does not, as Gladstone and Tribe conclude, increase as the current strength diminishes, but it is highly probable that for every plate a current density exists for which this proportion becomes a maximum.

Although Streinitz wishes to explain the evolution of gas at the cathode of a charged cell by the giving off of occluded hydrogen, and not through the decomposition of the sulphuric acid, it must be re-

*"Exner's Rep.," Vol. 27.

membered that, on the one hand, J. Thomson asserts that lead at high temperatures decomposes water, and, on the other, that several metals, when in a finely divided and freshly reduced state, have properties which ordinarily belong to them only at high temperatures. The author describes experiments which demonstrate the possibility of such a decomposition of the water.

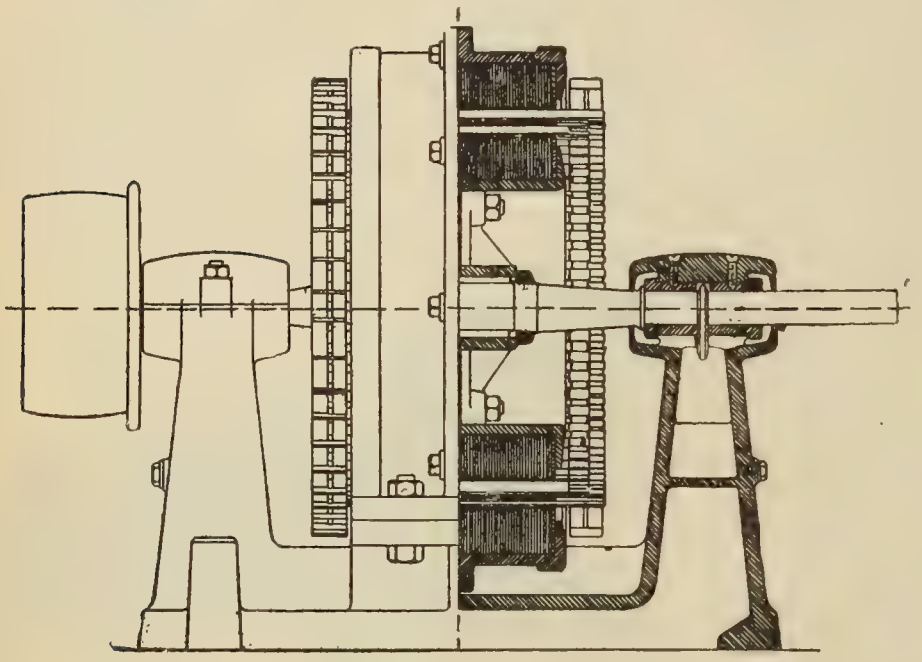
The result of his experiments on the chemical processes occurring at the negative plate during charging is as follows: The lead oxide existing on the plate is transformed to the sulphate. The electrolytic hydrogen reduces the sulphate and forms sulphuric acid. The freshly reduced lead decomposes sulphuric acid again and liberates hydrogen, at the same time forming a sulphate again. The charging can be continued until a stationary position between the two reciprocal actions is reached.

THREE-PHASE ALTERNATE-CURRENT MOTOR.

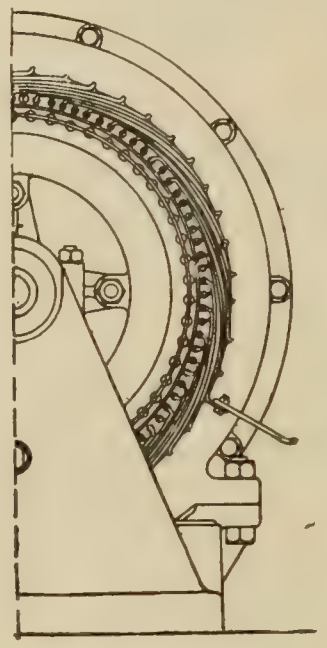
In the middle of last year, says the London *Electrician*, Mr. C. E. L. Brown gave his attention to the use of multiphase currents, since the absence of sliding contacts in multiphase machinery is sometimes of considerable convenience, and may in the future be of great importance in the industrial use of electric motors. The Allgemeine Electricitäts Gesellschaft in Berlin was working in this direction, and the Oerlikon Company eventually joined with it to develop this system. In August, 1890, the first multiphase motor on a commercial scale was built to Mr. Brown's design. This machine developed 2 H. P., and has a perforated or "hole armature;" that is to say, an armature in which solid bars of copper are completely imbedded in holes in the iron core, the connections being made in Gramme fashion. In the same month Mr. Brown applied this perforated armature in connection with drum-winding to the 300 H. P. generator and motor designed for the electric transmission of power between Bülach and Oerlikon, which, though it is not generally known, suggested the Frankfort-Lauffen experiment; one of these machines being, in fact, employed at Lauffen. The perforated armature in this application offers, among other advantages, the possibility of reducing the magnetizing current to a minimum.

From the illustrations it will be seen that the part which may be called the armature is stationary, and that the general arrangement is similar to the 300 H. P. generator. The armature being of a smaller size, it is provided with more than three wires per pole.

The three armature circuits are connected as in a Thomson-Houston armature, and the winding is so arranged that four rotating poles are produced (Fig. 3). With 40 cycles the motor makes about 1,200 revolutions per minute. The motor takes 80 volts normally; a reduction to 50 or an increase to over 100 will not make any practical difference in the speed. Of course, in the first case, the heating of the armature wire is greater, and in the second the heating of the iron is increased. The magnetic field rotates, and is produced by the armature reaction, thus avoiding all sliding contacts. The field-magnet is composed of a laminated ring with holes, in which are placed insulated copper bars. The free ends on both sides are connected by copper rings. It is not easy to imagine a more simple construction. Before giving results of the trials some general data of the motor may be of interest. The armature has 90 conductors of about 40 sq. mm. section. The weight of copper is 20 kg., the iron about 100 kg. The breadth of the armature is 200 mm., the outer diameter about 500. The rotating magnet carries 54 copper bars, with a section of 100 sq. mm. The weight of the copper is 15 kg., that of the iron is 70.



HALF SECTIONAL ELEVATION BROWN'S ALTERNATE-CURRENT MOTOR.



HALF ELEVATION.

Recent trials in Oerlikon with this motor showed that it can easily supply 20 H. P. No part of the motor showed with a continuous run a higher temperature than 20° C. to 25° C. above the temperature of the test-room. It may be of interest to mention that the rotating part shows practically no heating. The difference of speed between no load and full load is about 3 per cent. The torque of the motor at starting is considerable. It easily ran a separately-excited dynamo, which was working on a resistance absorbing 20 H. P. Over 200 kg. torque could be obtained on the 20 cm. pulley. The motor can carry also a considerable overload, and runs without the least noise. The starting of the motor is similar to that of a continuous-current motor controlled by a resistance in series with the armature circuit. Regarding the commercial efficiency no accurate tests have been carried out. The losses in armature copper amount to about 4 per cent. in the magnet copper and iron; inclusive of friction to 4 per cent. From this there would be an efficiency of 92 per cent. A commercial efficiency of 90 per cent. may be relied upon. That the losses are very small is further clearly shown by the very moderate heating, in spite of the small size of the motor and the absence of ventilation. A further advantage is that the commercial efficiency remains high even if it works on a light load. The weight of the motor is 420 kg., say a trifle over 20 kg. per horse-power. For locomotive purposes it might without difficulty be reduced to 300 kg., the result of which would be only 15 kg. per horse-power. This result must be looked at as a very good one, especially considering the low-current density with which the motor is worked. The bearings are automatically oiled, and contain large oil-reservoirs, so that this motor should run without any attention for months.

THEORY OF THE WIMSHURST MACHINE.*

BY M. G. PELLISSIER.

The Wimshurst machine was invented about 1883, and its use has spread rapidly on account of its possessing the valuable properties of quick self-excitation, certainty of action in all weathers, and entire absence of reversal. Its theory is, however, very little understood, and M. Gariel, in his "Traité d'Électricité," has gone so far as to say that it is not possible to give it in a satisfactory manner.

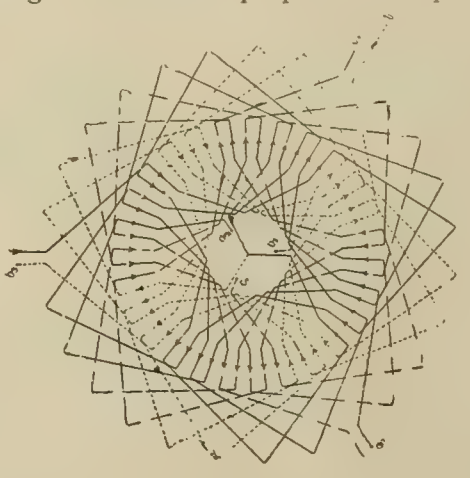


FIG. 3.

It can be ascertained by experiment that a Wimshurst machine works perfectly when the combs and discharging rod are drawn back, and the action of the combs can, therefore, be neglected in the theory of the electrical action. If the distribution on the plates of the machine when it is in motion be investigated, it will be found to be as indicated by the signs in the diagram. In order to prove this Mr. Wimshurst has constructed special apparatus.

One of these instruments, the "sparking machine," is an ordinary one simplified, and consists of two glass plates carrying a large number of tin sectors very close together; these are put in motion with the fingers on a common axle held in the hand; each plate is furnished with a conductor placed along a diameter. As soon as the discs revolve, the sectors become surrounded with halos, sparks fly from point to point, and, when viewed in the dark, a very fine effect is presented. The other instrument only differs from an ordinary machine in having its plates made of an elastic material; when in motion they are seen to attract one another in quadrants I. and III. and to repel in II. and IV.

In the following paper we have sought first to explain how the distribution shown in the diagram can be set up, and then how it is that the charges rapidly increase. In Fig. 1 the front plate is represented by the inner circle; B_1 B_2 are the sectors, of which we will assume there are eight; β β, the diametric conductor. The outer circle represents the back plate, A_1 A_2 its sectors, and a a its diametric conductor. The two wheels turn in opposite directions with the same velocity.

Let us consider one of the sectors, A_1, of the back disc at the instant that it is opposite the diametric conductor, β β, of the other plate; and we will assume that a sector, B_1, of the disc in front is at the same instant in contact with the brush β.

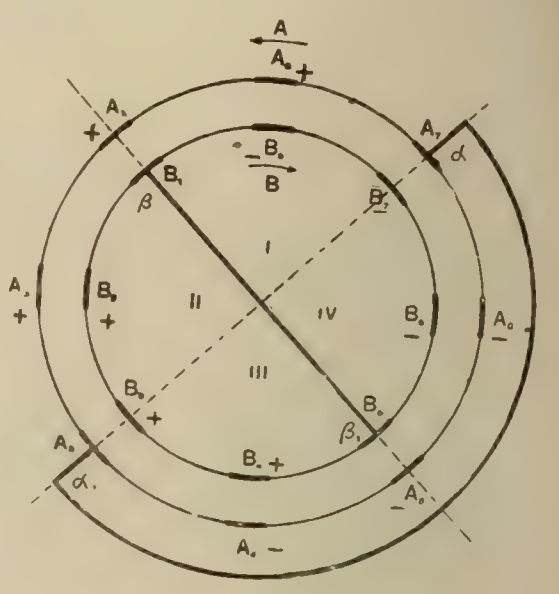
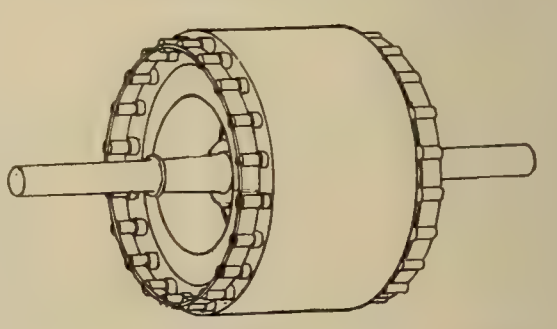


DIAGRAM OF PLATES OF THE WIMSHURST MACHINE.

Let us suppose, without inquiring the reason, that the sector A_1 has a weak positive charge; it will induce on B_1 a negative charge and then proceed itself towards a_1. When it arrives at this point, that is to say, after revolving through 90 deg., B_1 will, on account of the opposite directions of rotation of the two plates, have arrived opposite the brush a, which will be in contact with the sector A_5, while B_5 will be opposite A_1 at a. The charge carried by B_1 will induce on A_5 a positive charge, while A_1, which is positive, will be discharged to earth, since a a_1 is not insulated.

After a further rotation through 90 deg. A_5, carrying a positive charge, will take the place of A_1, while B_1 and B_5 will change places. The series of actions just explained will be gone through again, and, since the induced charges are less than the original, the machine would soon cease to work.*



ARMATURE OF ALTERNATE-CURRENT MOTOR.

But A_1 does not act only on the sectors of the second plate, but also on the neighboring sectors A_2 A_3; when they come in contact with the brush a_1, the positive charge flows to earth and they leave the diametric conductor with a negative charge which they carry towards the brush β_1. This brush acts by induction on the sectors of the second plate, which acquire a positive charge and turn from the brush β_1 in a clockwise direction.

* From *Journal de Physique*.

* This, in fact, is what happens when combs are placed opposite A_2B_2 and A_6B_6 and are put to earth. If the theory of the machine under these conditions be examined, it will be seen that the second series of phenomena about to be described do not take place; the charges then diminish in geometrical progression, while the operations increase in arithmetical. It is this which points to the office of the combs in the electrical reactions.

Thus it is sufficient for the sector A_1 to have at the start a slight positive charge in order to bring about the distribution shown in the diagram. All the sectors of the back plate situated on the left between the brushes a and a_1 are positively electrified; the opposite sectors on the same plate are negative, while on the front plate all the sectors at the top between β and β_1 are negatively electrified and the opposite sectors at the bottom are positive. In the top quadrant I. the charges are of opposite sign and attract one another; the same holds good for III., while in II. and IV. the charges are of the same sign and repel one another; and if combs be placed at these points, the one on the right will collect negative electricity and that on the left positive.

It remains to examine how these charges go on increasing. To do this, let us take the machine in any position whatever and consider the electrical actions that are taking place on any sector, say B_1, in contact with a brush. This sector is under the influence of (i.) the negative sectors, B_8 B_7 B_6; (ii.) the positive sectors, B_2 B_3 B_4; (iii.) the positive sectors A_8 A_1 A_2 of the back disc. Since the two first sets are symmetrically disposed, they neutralize one another, and the action of the three sectors, A_8 A_1 A_2 alone remains, each of these tends to give it a charge nearly equal to its own in quantity but opposite in sign. The sum of these actions will give to B_1 a charge that is approximately three times its original charge.

The same thing holds good for the other sectors, A_2 B_3 B_7, and is renewed for each of the sectors successively. The charges will thus go on increasing in consequence of the mutual reactions up to a point that is determined by the leakage. The action of the machine being independent of the combs, it will continue to work when the knobs of the discharger are separated beyond the sparking distance. This is the explanation of the valuable property that the Wimshurst machine possesses of never failing nor reversing, as is often the case with Holtz and Voss machines.

It is necessary to add to the actions just considered the effects produced on the glass, which are far from being negligible; indeed, the Wimshurst machine can be made of two plates of polished glass, and with combs instead of brushes at the extremities of the diametric conductor. The initial charge has to be given by means of an external source, placed, for example, opposite A_1.*

This form of Wimshurst machine recalls a Holtz of the second kind. A German *savant* had, in fact, made in 1869 a model of this apparatus, with two diametric conductors in the form of a cross, one before each plate; he even added that this machine could be made self-exciting by placing metallic sectors on the plates and substituting brushes for combs on the diametric conductors. It appears that Mr. Wimshurst was unaware of Holtz's work when he invented his machine.

The chief part played by the sectors seems to be to facilitate the self-excitation and to diminish the effect of atmospheric moisture. The greater the number of sectors the more rapid is the excitation. Thus with eight sectors, or any less number, the machine has to be excited from an external source; with 16 or 18 it rapidly excites itself under almost all atmospheric conditions, while with 40 the action is so energetic that it is very difficult to prevent the machine exciting itself even under very unfavorable conditions as to moisture. At the end of a half-turn of the handle Wimshurst machines are completely excited.

The one point that remains obscure in the theory of influence machines is the origin of the original charge. It has been ascribed to (i.) a residual charge on the plates; (ii.) electrification of the plates by friction with the air; (iii.) electrification of the metallic sectors by the natural electricity of the different layers of air, which are at unequal potentials; (iv.) electrification by contact.

Without denying the existence of these various causes, the last appears the most probable, more especially since the self-excitation is only present in machines furnished with metallic sectors and contact brushes—*e.g.*, Bennet doublers, Töpler, Voss, Thomson and Wimshurst machines. It would be interesting to have exact experiments on this subject.

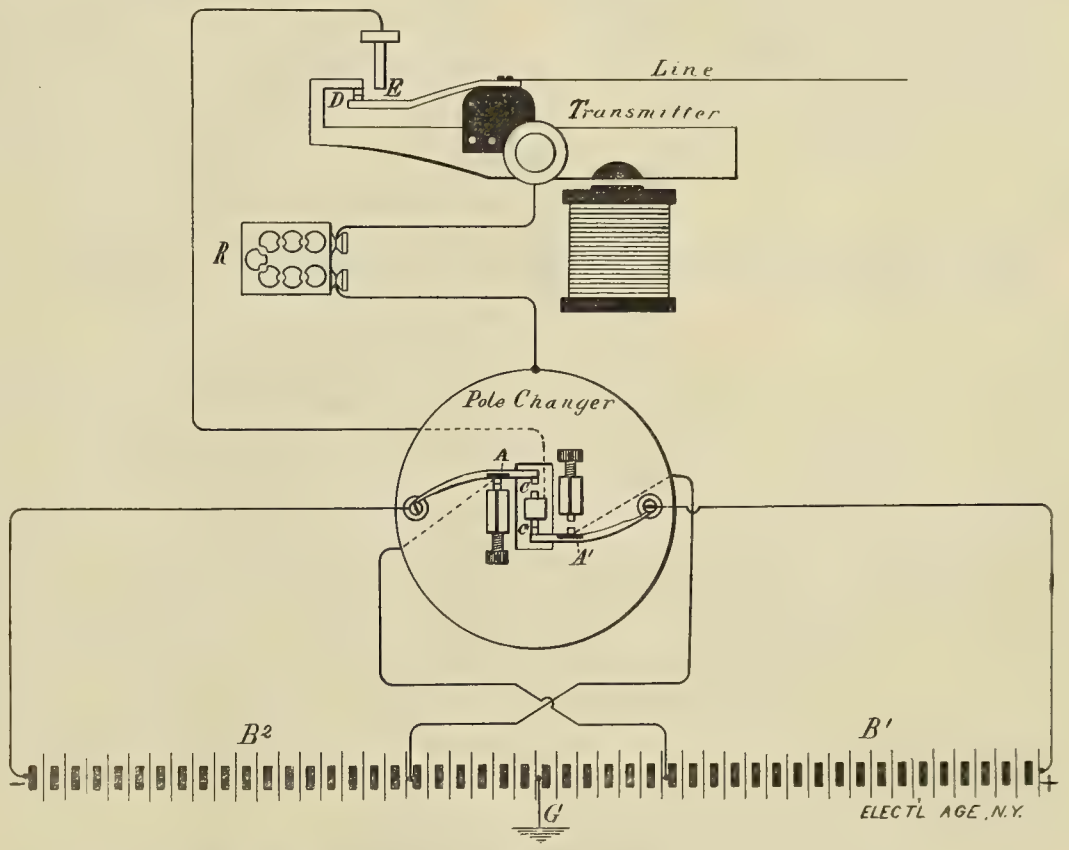
The Electric Installation and Maintenance Company, Limited, Sydenham, England, has arranged for transmitting 500 horse-power of electrical energy from its generating station to the Crystal Palace for light, power and experimental purposes. It will be a continuous current and will be supplied at a pressure of 1,000 or 100 volts. The energy will be metered at 12 cents to 16 cents per Board of Trade unit.

* In the ordinary machine, when the brushes do not touch the sectors the machine can be made to work by starting it with a charge from an electrified body.

WORKING QUADRUPLEX FROM BANKED BATTERIES.

BY J. P. CHURCH.

The only change of instruments necessary is to insulate points A and A^1 from lever of springs to the pole changers. In the position of transmitter shown in the diagram the small end of battery B^1 goes to line through points A and the head of pole changer, the compensation resistance R and point D of single transmitter. When the single transmitter closes, the whole of B^1 goes to line through point C^1 and lever of pole changer and point E of single transmitter. When the pole changer closes all or part of B^2 goes to line, according to the position of the lever of the single transmitter.



WORKING THE QUADRUPLEX FROM BANKED BATTERIES.

MAGNETIC RELUCTANCE.

BY A. E. KENNELLY.

(*Continued from page* 631.)

The earth's field there being 0.46 unit, or its stress-flux 0.46 units over each normal square centimetre, that stress would be active in setting up polarity in the molecules of the iron along the bar. The degree of magnetization would be also influenced by its own resulting polar stress unless this effect could be rendered insensible by sufficiently extending the length and thus carrying the poles out of the field. With a very long bar-magnet the magnetization would be everywhere about 40 times this strength of field, or numerically 18.4 units, and on the vein theory there would therefore be 18.4 units of magnetic matter exposed on the surface of each square centimetre in a slice made across the bar at any point or 92 units over the whole section. The polar surfaces would also be covered by 92 units of positive and negative matter respectively. Associated with each unit vein of polarity, however, would be 4π units of stress-flux giving a total flux of 1,156 units in the bar which would emerge from the polar surfaces and unite in surrounding space. The whole induced system would, however, be immersed in the earth's field that evoked it and which would be superposed upon it throughout. There would thus be $1156+2.3$, or 1158.3 units of flux in ordinary phraseology 1158.3 lines of induction through the bar, a density of 231.6 C. G. S. units per square centimetre. The law that the whole flux is the field flux compounded with the induced flux of 4π times the magnetization, which holds uniformly at all points throughout the bar in this simple case is true at any individual point in the most complex case, however variable the field or magnetization may be.

The fact that the stress-flux has the same total value over any envelope surrounding a magnetic pole, however widely the stress may be diffused and rarified, that it follows curves in space whose existence can be rendered evident by iron filings and curves that form closed loops through the substance of the magnet itself, gradually suggested the notion of a magnetic circuit in which the circulation was neither a fluid nor an energy-exchanging condition like a current, but a stress.

This conception once firmly established proved of great advantage. Not only has the dynamo been greatly aided in development by the applications of this theory, but the inter-relationship between magnetism and electricity has been brought into clearer recognition in consequence. From this point of view the ideas and analogies of the galvanic circuit became paramount and eclipsed the original notions of magnetic matter and magnetization. All that was essential on this hypothesis was a magneto-motive force in a circuit having conductivity, and a flux or magnetic current resulted. The magneto-motive force in permanent magnets was the result of a definite molecular condition in the iron, while in the neighborhood of an electric current it was always active. According to Ampère's theory that magnets had molecules in which electric currents ever circulated the two sources of magneto-motive force were united.

Some contention took place between the claims of the vein theory and the circuit theory for the interpretation of magnetic phenomena, and the question as to their relative merits is yet often raised. It seems, however, early to decide upon the acceptance of any theory while the ultimate origin and nature of magnetism remains unexplained, and it is better to regard both theories as working hypotheses to account for the effects of magnetic laws, equally capable of yielding correct results and therefore closely associated, while the preference between them will depend upon the nature of the problem to be attacked. The circuit theory is the simpler for general purposes of theory and particularly for dealing with the phenomena of electro-magnetism. The vein theory, on the other hand, while very artificial is often more convenient in dealing with the magnetic behavior of the three metals iron, cobalt and nickel, and it is the natural accompaniment of Ewing's modern theory of magnetization which at present appears to best represent the facts.

On the circuit theory the magnetic conductivity of all substances is very nearly the same as that of an air-pump vacuum, and constant, notably accepting the three magnetic metals whose conductivity is enormously greater, but variable with the conditions of the circuit.

The existence of magnetic conductivity known as "permeability" necessarily involved the inverse quality of magnetic resistance.* Some debate has taken place as to the validity of this term or its application for the reason that the resistance which usually enters into practical magnetic circuits is generally far more variable than that found in the metallic circuit of electricity. It is now generally admitted, however, that the term magnetic resistance is fairly applicable in virtue of analogy, if not of exactitude. The term magnetic reluctance then suggested by Heaviside has, however, the advantage that "reluctance" as one word is less cumbrous than "magnetic resistance," and for that reason only it is advantageous to retain it. Similarly the reluctance per unit volume of the magnetic resistance of one cubic centimetre has been called "reluctivity" and is perfectly definite, if not quite euphonious, under that title. It is this quantity which will occupy our further attention.

(*Continued on page* 639.)

* Bosanquet, *Phil. Mag.*, Vol. XXV., 1888, p. 419

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PASSING AWAY.

The history of electrical development is so recent and covers such a comparatively short period that many of the inventors and pioneers are still among the living. Prof. S. F. B. Morse lived to see the highest development and the universal application of his wonderful invention, which has done more than anything else towards the unification of the nations of the world. Gradually, however, these men are passing away. Prof. Morse was probably the first of the illustrious electrical inventors to join the vast majority, and others have since followed.

The latest death among distinguished inventors of electrical instruments is that of Abbé Jean Caselli, in Florence, Italy, at the age of about 76 years.

Caselli's invention is known in this country only by name. It was never practically applied here, but in France and Russia and other continental countries it was used for a time. The name of the system was the "pantelegraph," and its function was the transmission of autographs, designs, handwriting, etc., by electricity.

THE WIMSHURST MACHINE.

The Wimshurst electric machine has in late years rapidly come to the front in the branch of the electrical science relating to statical electricity. Its efficiency is its main property. It is quickly self-excited, and the atmospheric conditions have practically no effect on its action; besides it is not liable to reversal as other machines are.

The Wimshurst machine represents a peculiar condition of the present knowledge of statical electricity and its production. Although it is very well known what the machine will do under all conditions, its theory is understood to a very small extent. We know the effects of the operation of the machine, but the ascertainment of the causes has been a problem which has so far baffled the skill and wisdom of many scientific investigators. Indeed, one prominent French electrician declares that it is not possible to explain the action of the Wimshurst machine in a satisfactory manner. This, however, is an extreme view to take of the case; mind will triumph over matter, and some investigator will erelong solve the problem.

Elsewhere in this issue we publish an interesting article on this machine, which no doubt will aid to some degree in the solution of the difficult question.

THREE-PHASE ALTERNATING-CURRENT MOTORS.

Multiphase current generators have attracted considerable attention among electrical engineers in the past few months. The most notable example of this system of current generation was that used in transmitting electric power generated at Lauffen to Frankfort, to be used in connection with the exhibition at the latter place. Our readers are now familiar with this plant, and its success has brought multiphase machines prominently to the front.

Among those who have given attention to the use of multiphase currents may be mentioned Mr. C. E. L. Brown, of Berlin.

On another page will be found a description and illustrations of a three-phase alternate-current motor designed by Mr. Brown.

The winding of the armature of this machine is rather peculiar. The method consists of imbedding solid bars of copper in holes in the iron core of the armature, in connection with drum winding. This "hole armature," as it is called, is said to possess some advantages, among which may be mentioned the possibility of reducing the magnetizing current to a minimum.

The general arrangement of this motor is similar to that of the 300 H. P. generator which was designed by Mr. Brown for the transmission of power between Bülach and Oerlikon, and incidentally it may be mentioned as an interesting fact that from the latter machine the suggestion of the Frankfort-Lauffen experiment is said to have sprung.

In the motor under consideration the part which corresponds with the armature is stationary. There are three armature circuits, and these are connected in a manner similar to the method employed on Thomson-Houston armatures. The winding is so arranged that four rotating poles are produced.

Another peculiar feature of this machine is the fact that the magnetic field rotates and is produced by the reaction of the armature; by this method all sliding contacts are avoided.

The article referred to, while brief, is interesting, and more information concerning these novel machines will be looked for with interest by electricians.

HYDROGEN IN ACCUMULATORS.

Those who are most familiar with the accumulator in its theoretical aspect have not yet been able to determine definitely the part played by hydrogen gas at the negative plates. Gladstone, Tribe and Frankland maintain that lead or lead sponge cannot absorb hydrogen to any appreciable extent, while Streinitz takes the opposite view. The latter claims that the amount of gas occluded is considerable and that its action is of great importance. Others hold still different opinions.

Mr. Mathias Cantor made a quantitative investigation into the various chemical actions and reactions during charging and discharging of the cells, and thinks that by this method it is possible to satisfactorily determine the question.

In another column we publish an article by Mr. Cantor, giving a description of the method employed and the results of his investigation into this interesting and important subject.

STANDARDS.

The Piano Manufacturers' Association of New York has adopted a standard pitch. This action, according to the reports, was accomplished after long consideration. The manufacturers of electrical apparatus should take similar steps with a view to standardizing their products. It would save much time and annoyance if a standard were adopted for the manufacture of electric machinery. The Electrical Congress of 1893 will take up the subject of standard units and no doubt will settle upon a definite basis. This action ought to be followed by the general adoption of mechanical standards.

BOGUS ELECTRICIANS.

Owing to the newness of the electric-light industry and the comparative ignorance of the details of the same by the general public, it became a very easy matter for an aspirant to electrical fame to assume the title of "electrician" or "electrical engineer." It used to be said—indeed, it may yet be said—that cases are frequent where these titles were appropriated by ambitious young men with no other warrant for their claim to the distinction than the fact that they had run or assisted to run the wires for an electrical door-bell circuit at one time or another.

The assumption of the title of "Professor" by many of the same class on similar grounds has been of frequent occurrence, too. The result of all this is that there are more "electricians," "electrical engineers" and "professors"—of electricity, presumably—to the square mile than there are peas in a pod.

Of course it is not given to us to judge this self-titled class. Some of them—many of them in fact—undoubtedly have, by hard work and close study, fully qualified themselves, and are now justly entitled to the distinction; but of others the contrary may be said. They claim the title, and trust to luck for the rest.

Things and men are not always what they seem to be. We have heard of a case where a *bona-fide* "professor of electricity" in a prominent institution of learning not many miles from New York City obtained a couple of cells of a well-known primary battery for the purpose of carrying on some small electric-light experiments. A few days after he received the cells the inventor of the battery received a letter from the "professor," in which the latter stated that the battery was not doing satisfactory work. He had been trying to incandesce 16 C. P. lamps with his two cells, but he got not even a "flicker"—he wanted to know what was the matter. He undoubtedly was very much surprised when he learned that the trouble was with his knowledge of the simple laws of electricity, and not with the battery.

Against the case of this "professor," who probably came into the possession of his title in a legitimate manner, we set the facts in one which recently came under our observation.

Within a stone's-throw of the Electrical Exchange Building, on one of the most prominent streets in New York, is an establishment in a basement. The front part of the room is devoted to the business of blacking boots, while in the rear an alleged "electrician" has his headquarters. What led to the discovery of this secluded electrical headquarters was the fact that there were a couple or so electric bells and as many small switches. The wiring of this plant was so unique that it attracted our close attention. It was a veritable electric wire patchwork. Tracing the wires with our eyes to the back end of the room we discovered there a safe, on the door of which were painted the magic words, "Prof. Johnson, Electrician." The "professor" was out, however, so it was impossible to pursue our investigations further.

This combination of trades will strike the reader as a rather amusing one, and whether the effect in this case is degrading to the electrical profession or elevating to the boot-black trade, it is hard to say.

(Continued from page 637.)

This magnetic circuit differs from the galvanic in one important particular. In the latter we most frequently meet with a conductor carrying the flux or current through an insulating medium such as air in which no current—certainly no measurable current—passes. In the magnetic circuit this condition of things, while approximated to and often for practical purposes assumed in dynamos or electro-magnets, is only realized in one actual instance—that of a closed Faraday ring uniformly wrapped with wire carrying a current. In every other real case the flux is diffused more or less through the surrounding substances and does not follow a simple passage. Magnetic flux, in fact, is not to be enchannelled because there is no known magnetic insulator, and this fetters by complication the quantitative grasp of the subject.

The law of the magnetic circuit is like Ohm's law, that the flux is equal to the magneto-motive force divided by the reluctance. That is regarding the circuit as a whole. For any one point of the circuit the law is that the flux density is equal to the drop in magneto-motive force per centimetre, there existing, divided by the reluctivity—corresponding exactly to the case of Ohm's law at any point in an electric circuit. This "drop" is called the magnetizing force, denoted by H, and is the strength of the magnetizing field at the point. Owing, however, to the great variation that exists in the reluctivity of iron which enters into nearly every practical magnetic circuit, the law is of much less service than Ohm's electric law. The reluctivity depends not only on the magnetizing force but also on the degree of purity of the iron, and iron possessing 12 per cent. of manganese is almost non-magnetic.*

A number of attempts have been made by different observers to establish a definite relationship between the flux density and the magnetizing force or the permeability in order to so amend the magnetic Ohm's law as to give serviceable results for even pure iron. The results obtained, excepting the formulæ of Frölich and Lamont, have generally been regarded as unsatisfactory. They have usually been expressed graphically as curves in one of three types:

1. H—B or curves of magnetizing force and flux density.
2. H—μ or curves connecting permeability and magnetizing force.
3. B—μ or curves connecting flux density and permeability.

It is the object of this paper to show that there is a fourth relation that has not received the attention it seems to deserve—namely, the curves connecting the reluctance with the magnetizing force.

According to the simple circuit theory, the reluctance is of course the ratio of the magneto-motive force to the flux and the reluctivity this quantity locally reduced to the unit of volume. On the vein theory, however, which as we have seen distinguishes the vein flux from the magnetizing flux superposed thereon, the conductivity of a mass of iron is the conductivity of the iron itself added to that of the space it occupies, and consequently applying the vein theory to the magnetic circuit we have the apparent reluctance of the iron mass as the joint reluctance of two paths in multiple arc, one through the iron itself and what might be called its metallic reluctance, the other through the reluctance of the space occupied by the iron, and the removal of the iron would leave this latter unaltered. The difference between the apparent and metallic reluctance is inappreciable while the latter remains small, that is generally speaking when H is below 150, a limit rarely exceeded, and consequently the question does not present itself under practical conditions, but for large values of H, the difference is considerable and the metallic reluctance approaches the linear relationship with H while the apparent reluctance deviates considerably from it.

These assumptions from the vein theory, while they may be convenient, are somewhat artificial, for they postulate that the space reluctance of a given volume of air is not altered when the volume is occupied by iron. This may not be impossible, but it is difficult to imagine any reluctance mechanism of ether that would remain undisturbed by the introduction of a massive substance. On the other hand, while the vein theory imposes this principle not touched upon by the circuital hypothesis, it explains very satisfactorily the fact now apparently beyond dispute, that while iron can be saturated there is no limit yet attained to the flux density that can be made to pass through it. Ewing's results give no limit at the observed flux density of 45,350 *C.G.S.*, nearly three times the flux density at which iron is commonly worked in practice, while at the same time they indicate a limiting value of magnetization long before that density is reached. Following the vein theory, the polarization of the iron is then complete and the intensity of magnetization or magnetic matter per unit cross-section of veins finds its maximum, so that while the total flux can go on increasing indefinitely, it can only do so by adding to the permeating field-flux, the vein-flux having reached its full limit. It is not impossible to represent the observed condition of affairs by the simple circuit theory but the mental picture is not so clear. It would be possible, for instance, to imagine that the molecules of all substances transmitted the stress-flux with the same, or almost the same, facility as the ether surrounding them, but that in the magnetic metals they exalted the stress in transmission. Maxwell supposed that the iron molecules were so constructed that they could take part in the ether spin that might constitute the stress, and if so, by adding to it their momentum of revolution they could augment its value. There would be then perhaps at a certain stress, a speed of revolution which the iron molecules would not exceed and their reinforcement would be a maximum, while for stresses enormously greater than this the molecular augmentation would be lost in comparison with the strength of field and the iron molecules would in the aggregate behave almost like the motionless transmitters of other substances. The consequences of this conception seem more complex even if more nearly true.

* Hopkinson, *Phil. Trans.*, 1885, Part II., p. 462.

WIREMAN'S DRILL.

The accompanying illustration shows a drill which is of particular value for the use of electricians and wire contractors. These drills are made in different lengths up to three feet, and each one forms a most convenient tool for making holes through brick walls. Owing to its construction it does not mutilate the plaster so as to require the services of a mason to finish up after the holes have been drilled. The drills can be sharpened on a grindstone and are not injured by coming in contact with nails in partitions during the drilling process. They will therefore outlast any number of screw-point bits. They are made of an extra quality of steel and fully guaranteed.



ELECTRIC WIREMAN'S DRILL.

A reliable drill is a tool that is very valuable to electric-wire men, but something ordinarily hard to get. This one, however, is claimed to meet every requirement.

These drills are made by the Syracuse Twist Drill Company, Syracuse, N. Y.

HYSTERESIS.*

The molecular theory shows that hysteresis is to be expected whenever the magnetism of iron is caused to alter through anything more than a very narrow range. It occurs when the molecular movements are sufficiently great to involve the breaking up of old ties and the formation of new ones, on the part of some, at least, of the molecules. In other words, the necessary and sufficient condition for hysteresis is that there must be an unstable phase in the movement of some of the molecules. The changes of magnetism will then lag behind the exciting cause of the change, whatever that may be.

When the change is restricted within very narrow limits there is no hysteresis, for the molecular movements are then of the quasi-elastic type, occurring without rupture of the molecular ties. A very weak magnetic force, applied and removed (whether acting alone or superposed on a steady force), or a very small change of mechanical strain will, if it be many times repeated, cause small changes of magnetism which do not involve hysteresis, because the molecular magnets are then suffering deflections with respect to which they are stable. But when the action is extended by using larger magnetic forces or larger variations of mechanical strain, so that the molecules are deflected far enough to become unstable, hysteresis comes into play. We find it, in fact, manifesting itself in all save the narrowest cycles of magnetizing force, of longitudinal pull, of torsional strain, and so on.

The dissipation of energy which has been shown to accompany hysteresis in cyclic variations of magnetism is an obvious outcome of the mechanically irreversible character of these unstable molecular movements. When the molecule's equilibrium is upset it tumbles over, and acquires kinetic energy in falling towards a new position of equilibrium. It oscillates about that, and communicates oscillations to its neighbors, until the motion is damped out by setting up eddy currents in the surrounding conducting mass, and the energy of these currents is in turn converted into heat. The damping effect of eddy currents in the surrounding medium may even be so great that there is no continued oscillation; the molecule may be as it were let down gently like a body connected to a dash-pot. In any case, the ultimate effect is that a magnetic cycle generates heat in the substance of the metal. We have seen already that when the cycle is produced by reversing the magnetizing force **H**, this heat is the equivalent of the quantity $\int I \, d\,\mathbf{H}$.

But what will be the heating effect when a magnetic cycle is performed, not by varying the amount of **H** but by turning the iron round in a constant magnetic field? The question is of much practical interest, since that is the way that the magnetism is reversed in the core of a dynamo armature of the Gramme ring or the drum type. Experiments to answer it are as yet wanting. It appears to have been often taken for granted that the same amount of work is spent in the two cases, but there is no apparent basis for the assumption. In a series of experiments on dynamo armatures by Mr. Mordey, when a successful attempt was made to separate the loss of power due to magnetic hysteresis from that due to Foucault currents, the loss due to hysteresis was found to be rather less than the amount of energy which would be used up in reversing the magnetism by varying the field without rotation.

The molecular theory makes it probable that the work spent in reversing magnetism will be less when the reversal is accomplished by rotation in a constant field, than when it is accomplished by reducing the magnetic force to zero, and restoring it with sign reversed. A difference of this kind is especially to be looked for when the field is strong. In fields of no more than moderate strength, the turning round of the iron will involve breaking of molecular ties, with those unstable movements to which the dissipation of energy is due. But when the field is very strong so that the iron is nearly saturated, every molecule points steadily in the direction of the magnetizing force all the while, and there is no opportunity for irreversible movements. This deduction from the molecular theory seems to have been first pointed out by Mr. Swinburne. The matter is well worth experimental examination.

The dissipation of energy through hysteresis in the cores of transformers is another practical case of magnetic reversals on which the molecular theory seems to have an important bearing. In a transformer, the presence of the secondary coil has of course no influence on the amount of energy dissipated in reversals of the core's magnetism, so long as the secondary circuit is open. But when the secondary circuit is closed, especially through a low resistance, it assists in damping the unstable swings of the molecules, and a part of the energy goes into it which would otherwise be wasted in heating the iron. It appears probable that the damping action of the secondary coil will tend to establish a *régime* in which the molecular magnets swing with some approach to unison, crowds of them keeping step and so to a great extent giving up energy to the secondary circuit, instead of wasting it in local eddies within the iron. This consideration leads us to expect that the waste through hysteresis in a transformer will be less when the load is heavy than when it is light, possibly much less. Experiments on the efficiency of transformers under various amounts of load have in fact led Mr. Mordey and Prof. Ayrton to conclude that this is the case. This subject, like the one referred to in the last paragraph, calls for a fuller examination than it has yet received.

*Abstract of article by Prof. J. A. Ewing on "Magnetism in Iron and Other Metals," in London *Electrician*.

THE FRANKFORT EXHIBITION.—The number of visitors at the Frankfort Exhibition exceeded 1,200,000. The testing jury is at work on the Lauffen-Frankfort transmission plant, and they will probably push the voltage gradually higher and higher till the insulation breaks down. Siemens and Halske made some experiments recently with a pressure exceeding twice that used by them up till that time in the high-voltage experiments they have been showing during the course of the Exhibition. Two oil-insulated transformers were connected in series and current was taken at 2,000 volts from their large alternator and transformed in each transformer up to 20,000 volts. Four hundred 100-volt glow-lamps in series showed that the pressure of 40,000 had been reached. The Siemens (London) cable held out, even though at one time 48,000 volts were on. It is remarkable that the arc produced by this enormous pressure was inferior in point of brilliancy to that made by half the pressure.

NEW STANDARD MEASUREMENT APPARATUS.

The E. S. Greeley & Company, of New York, have recently placed on the market a number of additions to their already large variety of standard testing apparatus. The instruments referred to, which we herewith illustrate, were all designed at the Greeley Electrical Laboratory by Mr. Charles P. Frey, electrician for the company. The chief aim

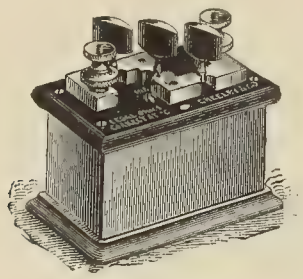


FIG. 1.—STANDARD RESISTANCE BOX.

in constructing these instruments has been to render them as light and portable as possible without endangering the essential features—namely, accuracy and accessibility. A fine example of success in this line is furnished by reference to Figure 1, which shows a one-tenth megohm box consisting of two separately adjusted coils of fifty thousand ohms each. The peculiar arrangement of the brass top connections permit the introduction of an infinity plug without crowding. This box weighs but two and one-quarter pounds complete, and being probably the smallest and lightest of its kind manufactured, will be preferred when portability is a consideration.

Figure 2 shows a megohm box having eight readings, which has four readings of respectively 100,000, 200,000, 300,000 and 400,000 ohms.

Figure 3 illustrates a one and one-tenth megohm box having eight readings as follows: 10,000, 20,000, 30,000, 40,000, 100,000, 200,000, 300,000 and 400,000 ohms. Taking into consideration the large quantity of wire carried in these boxes, they are remarkably light and compact, especially since the wire is (with the exception of the four coils of 10,000, 20,000, 30,000 and 40,000 ohms) all wound on spools of 50,000 ohms each, and separately adjusted in order to secure the greatest possible accuracy. These boxes are all standard and adjusted at given temperature.

Figure 4 shows a four-coil Thomson Reflecting Galvanometer of the Rowland type, placed on the market as a companion to the two-coil instrument of this variety, which latter is already well known. The Greeley Company has recently been engaged in conducting a series of elaborate and expensive experiments at its laboratory, in order to determine what materials can be used to the best advantage in constructing commercial condensers for telegraphic and other purposes, with the object in view of eventually adding instruments of this type to its regular line of Standard Condensers. One of the necessary preliminary steps was to provide an improved Ballistic Galvanometer and some highly-insulated plug switches. Models of these were designed by Mr. Frey and shown to interested parties at the Montreal Exhibition. In response to a general request the Greeley

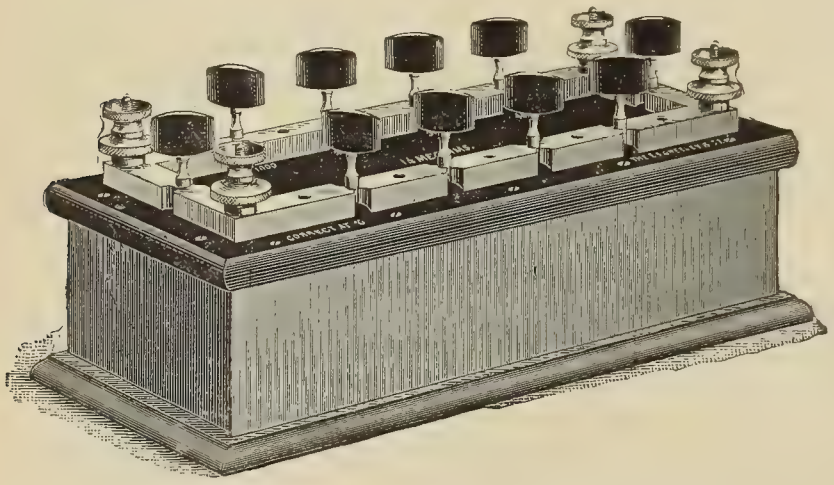


FIG. 3.—STANDARD $1\frac{1}{10}$ MEGOHM RESISTANCE BOX.

Company has decided to regularly manufacture these instruments in the future and add them to its list.

Figure 5 shows a cut of the Ballistic Galvanometer which, although built to a certain extent on conventional lines, embodies several novel features. The casing for the mirror is provided with a hood, which can be turned so that the reflection from the mirror may be observed from either side. The coils, two in number, are usually connected together in multiple, but may be used independently by removing both of the coupling strips between the binding-post blocks. The coils may also be connected together in series by removing but one coupling strip and giving the front coil a half turn. This Galvanometer is

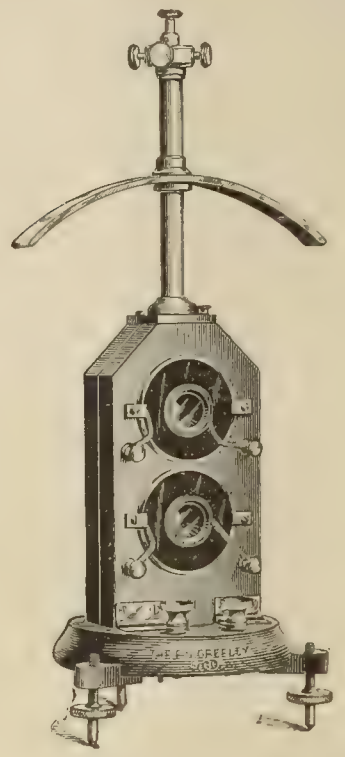


FIG. 4.—FOUR-COIL GALVANOMETER.

equipped with a bell-shaped magnet as designed by Siemens and Halske, is highly insulated, and is of superior construction and finish.

Figures 6 and 7 show plug switches mounted on

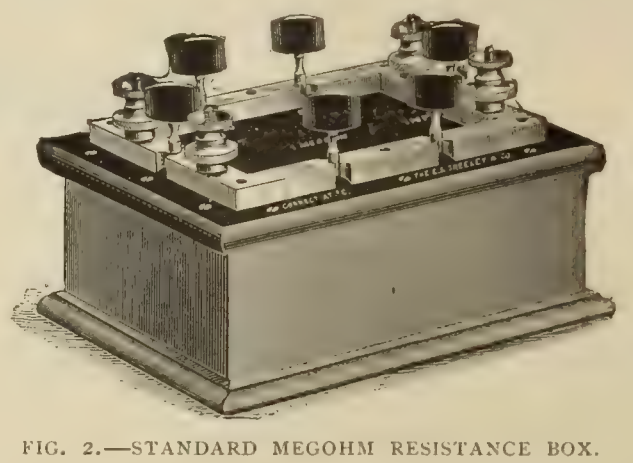


FIG. 2.—STANDARD MEGOHM RESISTANCE BOX.

insulated pillars. The plugs are provided with caps which prevent the pillars from spreading when the plugs are inserted and secures firm contact.

These instruments are on exhibition at the salesrooms of E. S. Greeley & Company, Nos. 5 and 7 Dey street, New York City.

THE GULCHER THERMOPILE.

At the Frankfort exhibition the Gülcher thermopile attracted considerable attention. The official journal of the exhibition gives an account of this apparatus from which the following is abstracted:

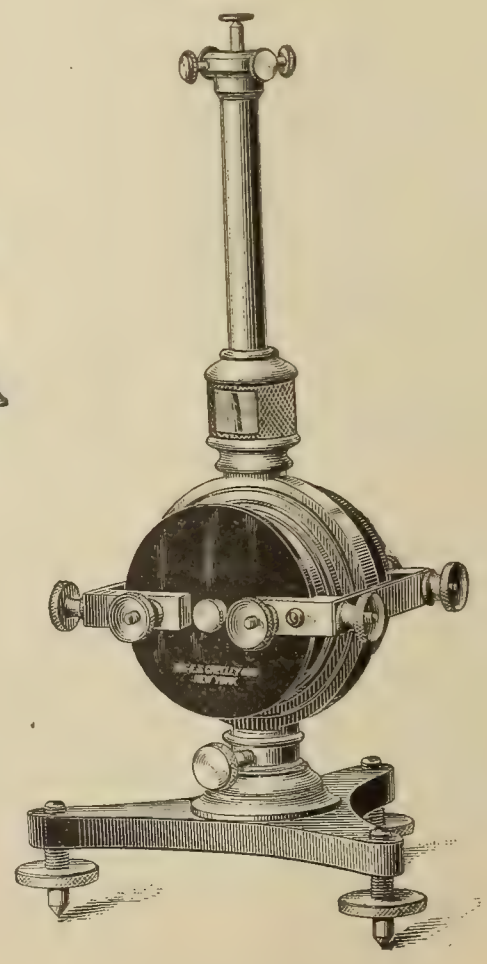


FIG. 5.—BALLISTIC GALVANOMETER.

This thermopile presents a new solution of the interesting but difficult problem of producing electric energy directly from heat. As hitherto constructed these apparatus have never been found of any practical use, owing partly to their short life and partly to their very low efficiency. Herr Gülcher's lately-patented thermopile, however, not only does away with these defects, but appears to be capable of competing with the dynamo.

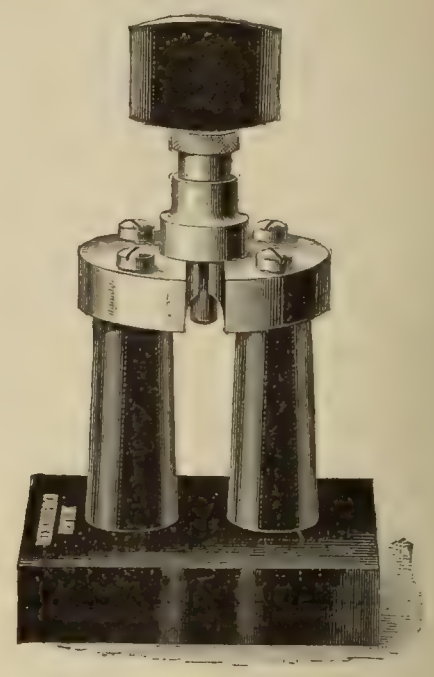


FIG. 6.—SINGLE PLUG KEY.

The piles exhibited are constructed for heating by gas, and are so arranged that overheating is rendered impossible, and, consequently, the pressure regulator (up to now a necessary appendage) is done away with. For comparison with the new type an old form of the apparatus is also shown. In the latter six small gas flames burn outside each negative electrode (formed of a nickel tube); in the new form only one flame is used for each electrode, and this is placed inside the tube. If the pressure in the gas mains is increased, the only result is that these Bunsen flames become longer, and the extra length being beyond the extremities of the tubes the effect, so far as heating the latter is concerned, remains unaltered. As soon as the flames are lighted the apparatus requires no further attention. After about seven to ten minutes it is fully heated, and from that time the E.M.F. remains constant, however the gas pressure may vary.

Three forms of these thermopiles are now being made. Each element consists of a small nickel tube in which is placed a "one-hole" soapstone burner. A connecting piece of nickel is soldered to this tube, and is connected to the prism-shaped positive electrode, formed of an infusible antimony alloy. In order to prevent any mechanical change, such as fissures, occurring in this alloy, and so changing the internal resistance, two steel rings are placed round the connecting tube. At the outer extremities of the

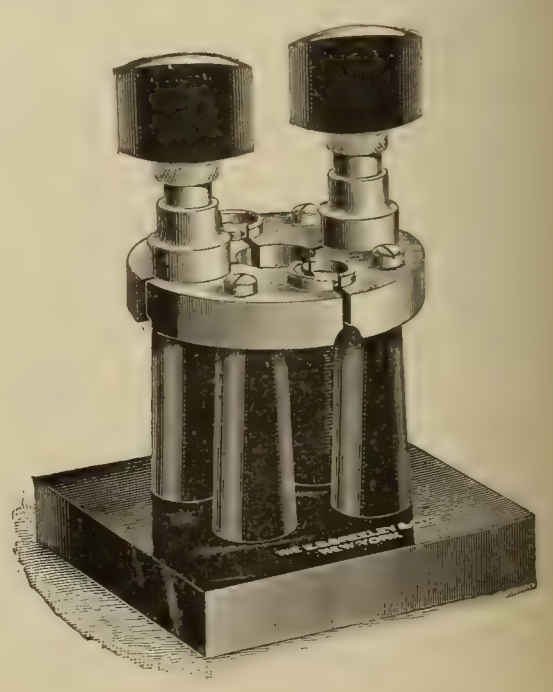


FIG. 7.—DOUBLE PLUG KEY.

positive electrodes are placed cooling pieces of copper, which also serve to form the connections. The elements are insulated from one another by means of asbestos. The larger of the two forms gives 4 volts. The internal resistance being 0.4 ohm, the pile is capable of giving a current of 5 ampères on a circuit possessing the same resistance. The small pile contains 25 elements, and supplies the same current at half the volts. The consumptions of gas are

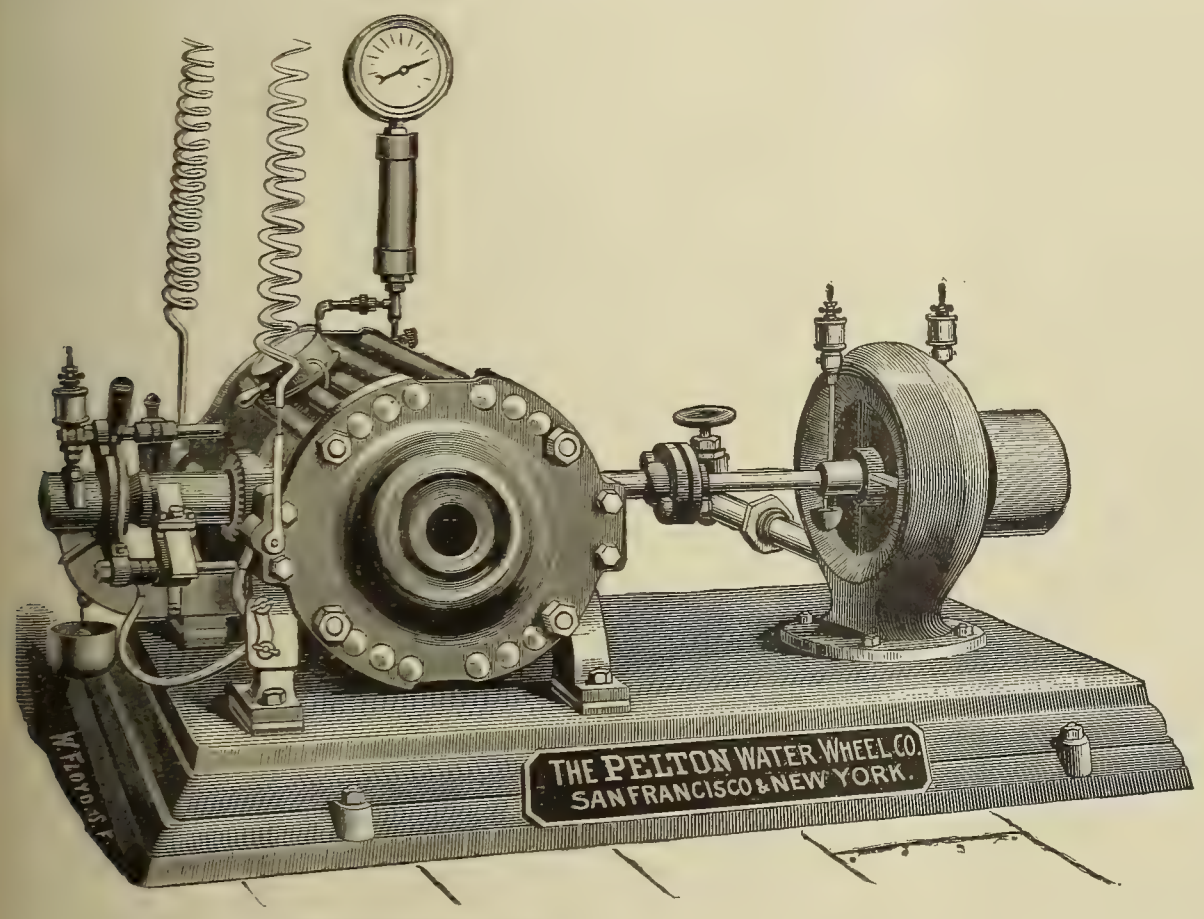
200 and 100 litres per hour respectively, the cost being about .36 and .18 of a penny.

These piles are well adapted for the electro-deposition of metals and also for charging accumulators arranged in parallel. With the help of the latter they are very useful for telegraphic purposes and can also be applied to running small electric-light installations.

PELTON WHEELS AND MOTORS.

The Pelton Water Wheel Co., in response to an urgent demand, some two years ago put upon the market a series of small wheels adapted to a lighter class of service but possessing in the same degree the wonderful energy and power of its larger wheels, which have come to be the recognized standard for this class of work in all parts of the world.

The small wheels above referred to—called motors for purpose of distinction from the larger wheels—embrace all sizes, from 4 in. up to 24 in. in diameter, varying in power, according to head and water supply, from the fraction of 1 up to 100 or more h. p., mounted and enclosed in iron cases ready for pipe connection. Comparative tests of these motors made in the engineering departments of some of the most prominent universities of the country show an advantage over those in common use of 45 to 50 % in efficiency, while their original cost for a given amount of power is less than one-half that of any other.



PELTON WHEEL AND THOMSON-HOUSTON DYNAMO.

It is not surprising that such results should give the Pelton motor a clear field in the race of supremacy. The illustration herewith shows a No. 2 Pelton motor connected direct to the shaft of the T.-H. dynamo with an insulating coupling, both mounted on a cast-iron bed-plate, making a most effective combination. The wheel is 12 in. in diameter and makes 1,350 revs. under a working pressure of 140 lbs., the dynamo under these conditions having a capacity of 65 incandescent lights of 16 c. p. each. This arrangement, as will be observed, is a very compact and economical one both as to original cost and operation.

Where the head or pressure of water does not admit of a direct connection to the shaft of motor, as shown, a belt connection can be made without intermediate gearing.

The Pelton wheels and motors have been adopted by all the principal electrical companies in the country for water-power service, on account of their high efficiency, close regulation and general reliability. While they have a special adaptation to this class of work, it is evident that they afford the same advantages for running any other kind of machinery.

The enormous amount of power that is going to waste in all the water-courses of the world is beginning to attract serious attention.

The Pelton system admits of great results being accomplished from a comparatively small amount of water, especially where any considerable head or pressure can be obtained, and beyond doubt affords the most simple, efficient, reliable means of utilizing this most potent of all natural forces.

The offices of the Pelton Water Wheel Co. are 121 Main St., San Francisco, and 143 Liberty St., New York City.

MEETINGS OF SOCIETIES.

At the stated meeting of the Electrical Section, Franklin Institute, Philadelphia, held on Tuesday, November 3, the following communications were presented: "Jove's Autograph," by W. N. Jennings; "Resistance Standards: their Manufacture and Adjustment," by Mr. Elmer G. Willyoung; "Lauffen-Frankfort Alternating-Current Transmission," by Mr. Carl Hering; "Is Actinism a Species of Electrolysis?" by Prof. Edwin J. Houston; "An Improved Secondary Battery," by Mr. N. H. Edgerton.

OBITUARY.

ABBÉ JEAN CASELLI.

Jean Caselli, the well-known inventor of the pantelegraph, died recently at the Santa Maria Hospital, in Florence, Italy. He was born at Sienna in 1815, and took orders when he was 20. He for a time made politics a study, after which he devoted himself entirely to science, and in 1856 he invented the pantelegraph system, which gave him celebrity. This system of telegraphy was used for some time between Havre and Lyons, France, but owing to the difficulty of maintaining synchronism it was abandoned.

NEW BOOKS.

TESTING OF INSULATED WIRES AND CABLES. By Herbert Laws Webb. D. Van Nostrand Company, New York. 118 pages and 38 illustrations. Price $1.

This book, by the well-known expert on the subject with which it deals, presents in clear and practical form ordinary every-day work of the testing-room—in other words, the rudiments of wire and cable testing; and furnishes to workers in the great fields of telephony, telegraphy, electric lighting and electric railroading a concise guide to the manipulation of a set of testing instruments. Everything, from taking the galvanometer constant to the best method of making official reports of tests, is covered completely, and in such a manner as to make the book one of the best on the science of electricity, whether for the student or the expert.

ELECTRICITY SIMPLIFIED: the Practice and Theory of Electricity. By T. O'Connor Sloane, E.M., Ph.D. Norman W. Henley & Co., New York. Pp. 158; numerous illustrations. Price $1.

This work, by this well-known author, is exactly what is implied by the title—electricity simplified in theory and practice. The book includes a popular review of the theory of electricity, with analogies and examples of its practical application in every-day life. The reader is carried by easy stages from "ether" and its theory, through force, energy, mass and weight to electric potentials and dielectrics, and from thence through all the theories up to the latest instruments used in the electrical field. The work is written in simple language, and we especially recommend it to those who would like to acquire a popular idea of the subject without dealing with technical terms.

TRIAL TRIP.

The trial trip of the elegant double-deck screw propeller ferry-boat *Cincinnati*, of the Pennsylvania Railroad Company was made on Friday last, November 6. A number of guests were aboard on the invitation of Mr. J. R. Wood, General Passenger Agent of the Pennsylvania Railroad Company; and among those present besides Mr. Wood were Mr. William W. Lord, Jr., Assistant Eastern Passenger Agent of the Pennsylvania road, New York; Mr. F. N. Barksdale, press agent of the road, Philadelphia, and other officials. A representative of the ELECTRICAL AGE AND STREET RAILWAY NEWS was also present on the trip. The boat was run up the Hudson River a few miles and back, and a collation was served on board. The boat is an elegant specimen of marine architecture, and the cabins are exquisitely decorated.

The electrical plant has some novel features. There are two plants on board, one the main and the other an auxiliary. The two dynamos are of the United States make, the main machine being series wound and of 250 lights capacity at 60 volts. The main dynamo is run by an "ideal" engine of 20 horse power at 360 revolutions a minute.

The auxiliary dynamo is a 35-light machine and is intended for day work, such as lighting the holds, etc. This dynamo is run by a Beck upright engine, and the combination covers a remarkably small amount of space.

The boat is wired on the three-wire system.

On the switch-board there are three circuit switches and a main switch which throws the circuits into connection with one or the other machine as desired.

The boat is lighted throughout by one hundred and eighty 16-candle-power lamps, which are plentifully distributed throughout the elegant cabins, along the sides. In the upper cabin on each side is an elegant inverted dome made of cut glass, in which there are several incandescent lamps. The effect of the light through the cut glass is very beautiful, and the light is diffused over a large floor-space. There are 39 lamps in the lower cabins and 60 in the upper cabin; and on the upper deck there are 12 lights for the port and starboard lamps and pilot-houses.

The auxiliary plant is also used to supply the side-lights of the boat and those on top of the pilot-houses.

Another valuable feature of the *Cincinnati* is the system of ventilation of the cabins. A large Sturtevant blower forces air into a chamber in which is located a steam radiator. The air is thus heated by contact with the radiator and then forced into the cabin. Thermostats in the cabin regulate the heat and maintain it at the proper temperature; the whole system is automatic in its operation. During the summer time cold air is forced into the cabins in the same manner, and in this way the temperature is kept delightfully cool.

The *Cincinnati* is 206 feet long and 65 feet wide over guards. She is a superior boat in every respect, and reflects great credit on the enterprise of the Pennsylvania Railroad.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE AND STREET RAILWAY NEWS, FIRST FLOOR, WORLD BUILDING,
NEW YORK, NOV. 7, 1891.

The Universal Arc Lamp Company, the well-known manufacturer of arc lamps for arc and alternating incandescent circuits, 527 to 531 West 34th street, city, has appointed the Interior Conduit and Insulation Company exclusive agent for the manufacture and sale of its apparatus, including Universal constant potential lamps for incandescent circuits, Universal short decorative lamps for incandescent circuits, Universal railway circuit lamps for incandescent circuits, Universal series high potential lamps and the Universal theatrical focusing lamp. With the ample manufacturing facilities of the Interior Conduit and Insulation Company the high standard of these lamps will be maintained in the future as in the past. The reputation of these well-known arc lamps could not be entrusted to better hands. The company has devoted a large portion of its extensive factory to this purpose, and will use its best endeavors to promptly fill all existing and future orders. It says its aim will be to furnish the best and cheapest arc lamp for incandescent and railway circuits that a liberal expenditure of money and ingenuity can produce. Besides the well-known arc lights the company is now prepared to supply electric-light switches that fill every requirement in respect to size, appearance, workmanship, ease and quickness of connection, ample capacity and low prices. The switches are all mounted on incombustible porcelain bases, have brass covers and keys, and present a neat and attractive appearance.

The Crocker-Wheeler Electric Motor Company is doing a very flourishing business. Among its recent installations may be mentioned the following in New York City: three 5 H. P. and two ¼ H. P. motors for Mr. Louis Sherry, the well-known caterer, 37th street and Fifth avenue; one 5 H. P. in the Marlborough Hotel, running ice cream freezers; and five ¼ H. P. to the well-known Otis Brothers Elevator Company, to run in connection with its new pump. Four 3 H. P. motors, each driving 48" fan, in the Stock Exchange; two 1 H. P. and several small outfits to the Madison Square

Garden; one 1½ H. P. new style combination motor and organ attachment for Miss K. Drexel, 103 Madison avenue, New York, neatly encased in a black walnut cabinet placed in the elegant music-room at her residence; one 2 H. P. and several smaller sizes to Mr. F. S. Blackall, 239 Broadway; one each ½, ¼ and ⅛ H. P. fan outfits to the Irving Bank, New York; one 2 H. P. running printing-press for the *Jewelers' Review*, 58 Maiden Lane. It has also furnished one 3 H. P. motor for Prof. Browning's Industrial Institute, West 55th street, New York; two 1 H. P. motors in Dennett's restaurant, at 140 East 14th street; one 3 H. P. and two 1 H. P. at Dennett's new restaurant, 25 Park Row; also one 1 H. P. combination triplex pump with automatic tank switch, and a dumb waiter operated by 1 H. P. motor at same place.

The Tucker Electrical Construction Co., of 20 Whitehall street, this city, has on exhibition at the American Institute Fair Mather dynamos of the improved type, running between 700 and 800 sixteen-candle-power lamps. The power is transmitted to the dynamos by American leather link belts.

Mr. Elias E. Reis, of the Reis Electric Specialty Company, Baltimore, Md., gave us a call November 2. Mr. Reis reports very active demand for the regulating sockets for incandescent lamps, of which his company is the sole manufacturer.

Mr. T. J. Murphy will not always be found at his headquarters, 136 Liberty street, but many specimens of his handiwork in marbleized slate in neat and unique patterns can always be seen there. It is worth a visit to his art-room to see the elegance of the work he turns out.

Alexander Henderson, President of the Maine Electric Improvement Co., of Brunswick, Me., and 136 Liberty street, New York, was in town the past week looking after the interests of his company. Mr. Henderson is very sanguine as to the future of his company, as it has some valuable specialties that are now largely sought after by electric-light and other companies using lightning arresters, lamp-sockets, switches, etc. Mr. Henderson is adding valuable improvements to all these goods. He has placed the New York office in the care of J. A. Cross, consulting electrical and mechanical engineer. Mr. Cross will make a specialty of consulting with architects and builders with the object of drawing up plans and specifications, etc., for all classes of electrical and mechanical work. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

Names of Companies.	Capital.	Par.	Price.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	92 00
Am. Elec Exercise Mach. Co., N.Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone, N.Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 00
Aut. Phon. Exb. Co	25,000	100 00	†20 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	184 00
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y	10,000	100 00	†60 00
Brush Illuminating, N. Y	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	135 00
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	99 25
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000	50 00	*102
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	24 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	27 50
Detroit Electrical Works	1,000,000	10 00	8 50
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600,000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*100
Edison Elec. Ill. 6s, N. Y	30,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44,678	100 00	†76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	94 00
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	43 50
Essick Printing Tel	5,000,000	100 00	35 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*101
Fort Wayne Elec. Co	4,000,000	25 00	13 75
Fremont E. L. & P. & Gas Co., O	95,000	100 00	125 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*98
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hudson Electric Light, N. J	100,000	100 00	
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*104
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	19 00
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*78
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N.Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J	17,500		*101
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	15 75
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	50 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*99
N. Y. and N. J. Telephone Stock	2,535,000	100 00	94 00
N. Y. G. & E. Co. Certs. of Indebt	100,000		†
N. Y. Phonograph Co	20,000	100 00	†20 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50,000		*95
North New York Lighting	150,000	100 00	10 00
Northern Elec. L. & P., Phila	200,000	10 00	
Northwest Elec. Co. 6s, Manitoba	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light	100,000	100 00	
Pennock Baty. E.L.& Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P. Co. 6s	800,000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	5 50
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Seibold Electrode Manf. Co., N.Y.	100,000	100 00	
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100,000	100 00	105 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	46 00
Thomson-Houston pref	4,000,000	25 00	26 00
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H.L.H. &P.Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
Twin City Rapid Transit, N. J	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	40 00
Universal Arc Lamp Co	100,000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	1 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	81 00
Westinghouse Electric Co	7,000,000	50 00	13 00
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	
West End L., Boston			15 00
Yonkers L. & P	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

The patent suit between the Julien Electric and the Accumulator companies is reopened by Judge Coxe, of the United States Supreme Court. The Accumulator Company had a perpetual injunction; now it is claimed their patents on which it was granted had run out in Europe last summer, carrying death on that account in this country. A test case should be carried through to final issue and this point settled. The Bell Telephone situation in that regard is a howling cyclone to the electric investor's peace of mind.

Among the late coupons and dividends declared or paid we are pleased to note the 8th quarterly div. of the Edison General 2 %; the 26th quarterly div. of the Edison Illuminating; Brooklyn Heights Railroad Co. coupon; Edison Illuminating 5 % coupon; Fulton Elevated Ry. coupon; Commercial Cable quarterly div., 1¾ %; New York Belting and Packing Co., 8 % on preference and 10 % on common stock; Manhattan Elevated Ry., 1¼ %; Great Western Supply Company preference, 2 % quarterly; Thomson-Houston Co., $1.00 per share quarterly; Holland Trust Co., 2½ % quarterly; Brooklyn Municipal Co., 2½ % quarterly; Brooklyn Citizens, 2 % quarterly; Western Union, 1¼ % quarterly.

GENERAL NOTES.

Mr. Fred. H. Angell, of the Electric Specialty Company, Pawtucket, R. I., is making a trip throughout the West, and is doing exceedingly well in the sale of mast-arms. He has been out three weeks so far, and when last heard from was in Bucyrus, Ohio.

The Electrical Engineering and Supply Company, Syracuse, N. Y., will increase its capital stock from $25,000 to $50,000.

Mr. George S. Pease, of the Westinghouse Company, Pittsburg, is starting a factory in Maryland.

PHILADELPHIA NOTES.

Mr. E. A. Wilbur, 907 Filbert street, this city, agent for the Fort Wayne Electric Co., of Fort Wayne, Ind., is busily engaged on a large order for an electric-light plant. He has cheerful offices and his rotundity indicates that he is at peace with the world. He is also a man of energy and brains, as the business he brings in indicates.

Wm. H. Weston & Co., consulting and manufacturing electricians, 930 Filbert street, this city, were found by your representative taking things a little easier after the large shipment of their celebrated switches to Pittsburg. The lot included fifty 25-ampère switches. This firm furnished the thirty-four 100-ampère switches to the Electric Construction and Supply Co., New York (manufacturer of the "Ward" arc lamp) for the handsome marbleized slate switchboard lately installed with the large "Ward" arc-lamp plant in H. B. Claflin's wholesale dry goods house in New York. Weston & Co. are now building an elegant Italian marble switchboard, 4 x 5 feet, to be fitted with ten 25-ampère Weston switches for the Tucker Electric Construction Co., New York. They are also building a marbleized slate board to be fitted with ten 50 and 250-ampère Weston switches, one voltmeter, two ampèremeters and two rheostats.

H. B. Cutter, 27 South Eleventh street, this city, one of the most popular consulting, constructing and manufacturing electricians in Philadelphia, is hard at work improving his several valuable specialties in push buttons, switches, flexible brackets, cut-outs, etc. W. T. H.

BUSINESS NOTES.

The J. T. Shaffer Manufacturing Co., Rochester, N. Y., has had an experience of 15 years in the manufacture of hydraulic wheel presses, which it manufactures in different sizes. The company claims that its street-railway press is the best in the country, as it is stronger, simpler, more effective and more durable than other makes. The pumps are made of aluminum and bell metal, and are differently constructed from any other. Mr. E. P. Ellis, Milwaukee, Wis., has ordered one of these presses, which, when completed, will be the largest of its kind in the world. The press is to take in a 10 ft. 6 in. wheel; from face of the ram it is 25 feet, and the size of the shaft to be taken in is 29 inches, giving 1,200 tons pressure. The press is to be driven by pumps set up on separate frames, and will weigh completed over 70 tons. The J. T. Shaffer Manufacturing Co. will ship a press to any point in the country on trial, and if not satisfactory and as represented will bear all expense. The company has built and shipped presses recently to the following companies: Salt Lake City (Utah) Street Railway Co., Des Moines (Ia.) Street Railway Co., West End Street Railway Co., Boston, Mass., Covington Machine Works, Covington, Ky., and one to the White & Black River Co., Blinkerville, Ark. It is shipping presses to all parts of this country and is also exporting large numbers. The company also manufactures a large line of presses for bending and forging iron in all shapes, taking the place of drop-hammers, working, it is said, much faster and turning out better work.

P. A. Clum & Co., well-known brass founders, 5 Platt street, Rochester, N. Y., manufactures all kinds of brass and composition material for street cars. The company receives large orders for brass, bronze, composition and zinc castings, car journals and bearings, babbitt metals and everything that is supplied by brass founders for street-car service. The company uses nothing but the best material, and lets nothing but the finest workmanship leave its foundry.

W. L. Denio, 377 Brown street, Rochester, N. Y., says the combination fire-alarm push-button which he manufactures is largely called for. This button is so constructed that the solder holding a cup containing a spiral spring will fuse at a temperature of from 127 to 150 degrees of heat, releasing the enclosed spring which closes the circuit and causes a continuous alarm in any part of the house desired. It is only necessary to unscrew the cap of the button already in use, remove the porcelain knob and put this in its place, using it the same as the ordinary button.

WORKS LIKE A CHARM.

Gloversville, N. Y., August 24, 1891.

Jerome Kidder Mfg. Co.

Sirs: Enclosed find P. O. order. Send me one of your new Milliampère Meters. The apparatus works like a charm. Yours truly,

George H. Canham.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued November 3, 1891.

461,190. Non-Interfering Fire-Alarm Box. Frank F. Loomis, Akron, Ohio. Filed May 1, 1891.

461,178. Electric Boiler-Alarm. Mathias Beckers, Langerwehe, Germany. Filed Dec. 24, 1889.

461,194. Signalling Switch and Circuit. Joseph W Stover, New York, N. Y. Filed May 29, 1891.

The combination, with a normally-closed circuit, of one or more signal-transmitters and a signal-receiver in th circuit, an additional signalling switch mechanism having means for maintaining the circuit closed and for opening the circuit when operated, means for connecting the two sides of the normally-closed circuit to ground, a normally-open ground branch, a signal device in the ground branch, and a magnet in the closed circuit controlling the branch.

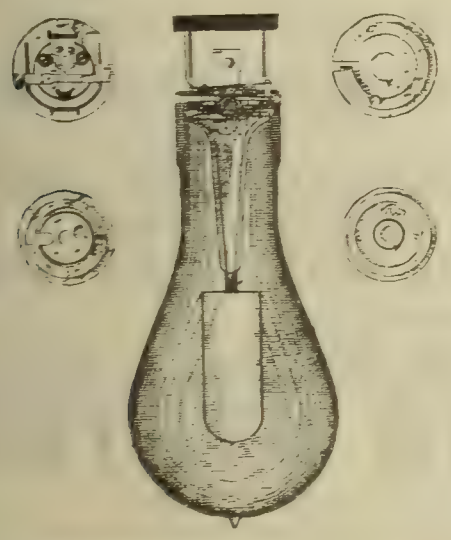
461,195. Connection for Electric Conductors. Joseph Dillon, Larchmont, assignor of one-half to H. J. Reilly, New York, N. Y. Filed May 13, 1891.

The combination of a disc-like holder apertured to receive electric conductors, a cover constructed to be applied to the holder, hooked fingers and lugs on the holder and cover, and a locking device to engage with the holder and cover to prevent the rotation of one upon the other.

461,229. Electric Meter. George R. Baldwin, New York, N. Y. Filed Nov. 20, 1890.

In an electric meter, the combination of a lever, an adjustable fulcrum for the lever, a current-indicating device which controls the fulcrum, a rigid backing-piece by which the adjustable fulcrum is supported when the lever is forced down upon it, a registering device, and a clock-work, each connected to the lever.

461,239. Switch-Box. Horatio A. Foster, New York, N. Y., assignor of one-half to John J. Moore, same place. Filed Oct. 24, 1890.



462,339.—INCANDESCENT LAMP.

In combination, a hermetically-closed box, an electrical mechanism therein, an operating-rod therefor projecting from the box and terminating in a nut, a packing-box therefor, a tube surrounding the projecting part of the rod and filled to above the head of the rod with an insulating-liquid, a plug for closing the head of the tube, a trap for protecting the tube and plug secured to the upper end of the tube, and insulating-conductors leading from the mechanism through snugly-fitting orifices and cemented therein.

461,240. Dynamo-Electric Machine. Ezra T. Gilliland, New York, N. Y. Filed Jan. 31, 1891.

In a dynamo, the field magnets and supports for the armature-axis bored upon a common centre, the boring in one support being a circular opening to admit the armature into the polar cavity, in combination with a support fitting into the opening and having at its centre a bearing for the axis of the armature.

461,262. Galvanic Battery. Philipp Hieronymus, New York, N. Y. Filed Feb. 12, 1891.

In an electric battery, the combination, with a jar, a partition held a short distance above the bottom of the same, electric elements resting on the partition, a tube for filling the lower part of the jar with water, a vent-tube, and a wick for conducting the water from the lower part of the jar to the elements.

461,272. Electric Conductor. Frank A. Perret, Brooklyn, N. Y., assignor to the Elektron Manufacturing Company, same place. Filed May 21, 1889.

As an article of manufacture, an electrical conductor coated with collodion and glycerine.

461,279. Watchman's Electric Time-Recorder. Fred W. Schiefer, Buffalo, N. Y. Filed April 15, 1891.

461,294. Automatic Electric Pump. Charles J. Van Depoele, Lynn, Mass. Filed Feb. 26, 1891.

461,295. Electrically-Actuated Pump. Charles J. Van Depoele, Lynn, Mass. Filed March 27, 1891.

461,296. Armature for Electric Motors. Charles J. Van Depoele, Chicago, Ill. Filed April 7, 1891.

In an electro-dynamic motor, an armature the sections of which are spaced by separating blocks or strips and which is enveloped by an exterior winding or covering, also of magnetic metal.

461,297. Actuating Device for Moving Commutator-Brushes. Charles J. Van De Poele, Lynn, Mass. Filed May 20, 1891.

461,298. Electric Switch. Sterling P. Van Nort, St. Louis, Mo. Filed Nov. 21, 1890.

The combination of an electric conductor connected with a lamp or other load and with ends in connection with two revoluble metal eccentrics on the same shaft insulated from each other, two levers in an electric circuit having contacts at their free ends, and parts adapted to receive the impact of the eccentrics.

461,355. Electrical Drop-Bar for Doorways. Benjamin Lyons, Kansas City, Mo. Filed Feb. 18, 1891.

461,371. Fire-Alarm Apparatus. William C. Shaffer, Milwaukee, Wis. Filed Dec. 14, 1888.

462,237. Electric-Lighting System. Joseph I. Conklin, Brooklyn, N. Y. Filed Feb. 9, 1891.

462,261. Automatic Electric-Welding Machine. Hermann Lemp and Carl G. Anderson, Lynn, Mass.; said Lemp assignor to the Thomson Electric Welding Company, of Maine. Filed Feb. 2, 1891.

462,262. Laminated Die, Hammer, etc., for Electric Metal-Working Apparatus. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric-Welding Company, of Maine. Filed Feb. 24, 1891.

In an electric metal-working apparatus, metal dies, hammers, or other devices or parts which require to be in contact with the heated work for a greater or less time while the current is passing through it, having their working surfaces where they engage with the work laminated or subdivided in planes transverse to the direction of the flow of current.

462,263. Method of and Apparatus for Constructing Electric-Light or other Lines. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed March 30, 1891.

A method of building up structures of material that is a conductor of electricity, consisting in abstracting electric energy from the structure supplied thereto from any suitable point and employing the electric energy so taken as the heating agent for uniting or joining an addition or extension of the structure to the portion previously completed.

462,311. System of Electric Lighting. Frank M. Garland, New Haven, Conn., assignor of two-thirds to Nicholas W. Hubinger and Joseph E. Hubinger, both of same place. Filed Sept. 9, 1890.

462,315. Electric-Wire-Support Bracket. Osborn B. Hall, Malden, Mass. Filed Aug. 6, 1891.

462,321. Electro-Magnetic Separator. Richard R. Moffatt, New York, and Sylvester Chichester, Brooklyn, N. Y. Filed Jan. 20, 1891.

462,322. Electro-Magnetic Separator. Richard R. Moffatt, New York, and Sylvester Chichester, Brooklyn, N. Y. Filed Feb. 2, 1891.

462,338. Incandescent Lamp. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 27, 1886.

An incandescent electric lamp having its entering wires or conductors twisted around one another where they pass through and are imbedded in the material of the lamp-globe, so as to be normally held apart by such material.

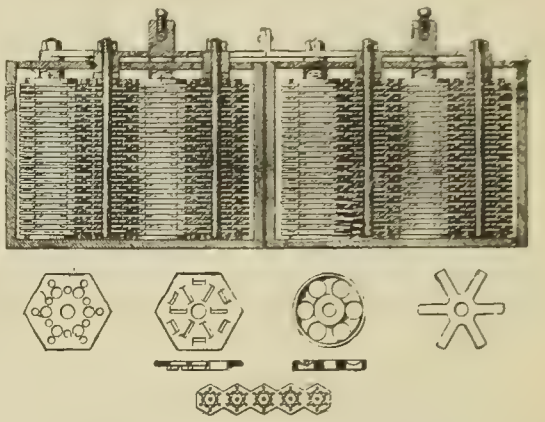
462,339. Incandescent Lamp. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 12, 1887.

A shunting-switch having a bias toward its circuit-closing contact and normally held out of action by a part within the vacuous space of the lamp located to be acted upon by the heat of the electric arc forming on rupture of the incandescing conductor.

462,345. Electric Signalling System. Frank B. Wood, New York, N. Y., assignor to the Brewer & Smith Visual Signal Company, New Haven, Conn. Filed Jan. 6, 1890.

462,348. Gearing for Electro-Magnetic Motors. Chas. E. Chinnock, Brooklyn, N. Y. Filed Aug. 26, 1890.

The combination, with a motor, a rotary part, and an axle upon which it is mounted, of a tubular shaft mounted on the axle and having a driving engagement with the motor, a flanged disc secured to the tubular shaft and fitted within a flange of the rotary part, and levers pivoted to the disc and weighted at one end and the other end extending through a slot in the disc-flange to engage with the rotary part.



462,449.—SECONDARY BATTERY.

462,349. Ceiling-Block. Axel Ekström, Lynn, Mass, assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 29, 1891.

462,353. Electric Switch. Maurice Hoopes, West Chester, Pa. Filed Aug. 4, 1891.

462,369. Controlling Device for Electric Motors. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 13, 1889.

The combination, with an electric motor, of a current-controller and circuit-reverser therefor, a common actuator positively actuating both, but allowing the controller a predetermined amount of lost movement relative to the reverser.

462,381. Electric Alarm-Bell. Charles A. Hale, Cleveland, Ohio, assignor to the Time Electric Company, same place. Filed June 5, 1891.

462,403. Electric Gate. Harleigh Gillette, Highland Park, Ill. Filed Dec. 10, 1890.

462,407. Electric Switch. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 22, 1891.

462,418. Method of and Apparatus for Electrical Conversion and Distribution. Nikola Tesla, New York, N. Y. Filed Feb. 4, 1891.

In a system of electrical conversion, the combination of a generator or source of electricity and a line or generating circuit containing a condenser or possessing capacity, and a working circuit operatively connected with the generating-circuit through one or more air-gaps or breaks in the conducting medium, the electrical conditions being so adjusted that an intermittent or oscillating disruptive discharge from the generating into the working circuit will be maintained.

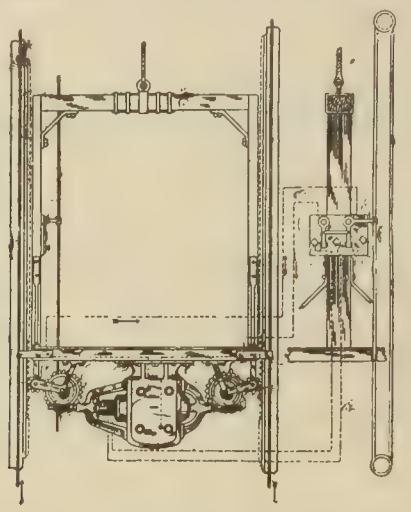
462,444. Electric-Lighting Apparatus. Harrison B. Meech, Chicago, Ill. Filed Nov. 24, 1890.

462,449. Secondary Battery. John H. Palmer, Boston, Mass. Filed Jan. 3, 1891.

462,452. Electric Fuse Cut-Out. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Hous-

ton Electric Company, of Connecticut. Filed Oct. 18, 1890.

A fuse for the protection of electric circuits, comprising a plurality of fuse-wires bundled together, each insulated by a separate insulating-sheath and all attached to a single set of terminals, furnishing means for including the fuse in an electric circuit.



462,527.—ELECTRIC ELEVATOR.

462,463. Switch and Cut-Out Device. Henry P. Ball, Brooklyn, assignor to the Edison General Electric Company, New York, N. Y. Filed March 23, 1891.

The combination of an insulating-base, several metal terminals thereon, means for connecting either of the terminals to an external circuit, another terminal separated from the first-mentioned terminal by an insulating-screen, a fusible conductor connecting each of the terminals on one side of the screen to the terminal on the opposite side, and a screen over the fusible conductors and movable in such manner as to uncover some of the fusible conductors without uncovering the rest.

462,466. Commutator-Brush. Francis O. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed March 5, 1889.

The combination, with a brush-holder, of a containing-box, a number of independent wires placed therein, and a layer of felt or similar substance giving an independent resiliency to each wire.

462,477. Covering for the Bulbs or Globes of Electric or other Lamps. Alexander Duval and Henri Nelson, Paris, France. Filed May 13, 1890. Patented in England.

462,489. Conductor for Three-Wire Systems. Edward H. Johnson, New York, N. Y. Filed Sept. 2, 1891.

A cable having three conductors, one surrounding the other two, and the outer conductor being connected to the neutral wire of the system.

462,504. Electric-Current Meter. Johan W. Th. Olan, New York, N. Y., assignor of one-half to Edward H. Johnson, same place. Filed April 16, 1891.

The combination, in an electrical meter, of a needle or pointer, a coil or magnet for moving it, through which the current to be measured passes, a plate over which the needle moves in a regular arc, a record-sheet between the plate and the needle, mechanism for advancing the sheet, and means operating through the needle while it is out of contact with the sheet for marking on the sheet the position of the needle.

462, 513. Automatic Signal Apparatus. Joseph B. Stewart, Haverstraw, assignor of one-half to William G. Wattson, Tappan, N. Y. Filed Dec. 23, 1890.

462,527. Electric Elevator. Harry H. Blades and William J. McKee, Detroit, Mich. Filed Jan. 11, 1890.

462,532. Electric Cooking-Stove. John V. Capek, New York, N. Y. Filed Dec. 15, 1890.

462,540. Incandescent Electric Lamp. Thomas A. Edison, Llewellyn Park, N. J. Filed March 25, 1889.

An improvement in the method of making incandescent electric lamps, consisting in heating the filament of a lamp to a temperature much below its normal incandescence after the lamp is exhausted and sealed.

462,564. Cross-Tree for Suspended Electric Wires. Jacob Levy, Shreveport, La. Filed Aug. 7, 1891.

462,571. Electric-Lamp Cover and Switch. Emil T. Mueller, La Crosse, Wis. Filed April 30, 1891.

462,574. Key-Socket for Double-Filament Incandescent Lamps. William J. McCutcheon, Jr., Pittsburg, Pa. Filed June 18, 1891.

462,582. Station-Indicator. George W. Robertson, London, England. Filed Nov. 1, 1890.

462,599. Electric Hair-Brush. Alexander Stanton, Lynn, Mass. Filed Aug. 3, 1891.

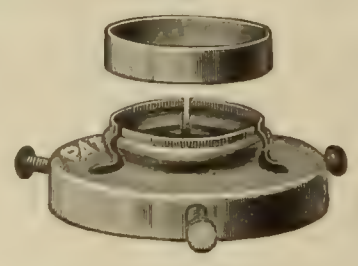
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DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, NOVEMBER 21, 1891. No. 47.

DAWES' ELECTRIC-LIGHT SUPPORT.

In installing electric-light plants, one of the greatest difficulties is to locate the lights where the most benefit can be derived from them. In factories, machine-shops and such places it is almost impossible to have fixed lights where they are of use at all times; sometimes a light is needed on one side of a piece of work, sometimes on the other, and if a lamp is suspended by a flexible cord it is as likely to be swinging in the way or to be broken by swinging against some of the machinery as of being in its proper place. To have fixed lights in a shop of that kind double the lights are needed, unless some device whereby the lights can be shifted from place to place, so that the work being done can be directly illuminated, is devised.

This difficulty is not only found in large factories, machine-shops, warehouses and such places, but also in the office and in the house; and those who have incandescent lights which may be moved a distance of a few feet know the benefit of devices whereby this result is accomplished.

The electric-light support, which we illustrate herewith, has been designed to render such lights adjustable to any desired position within certain limits, and Fig. 1 readily shows how well adapted it is for use in any place where it is desired to bring the light to bear on several sides of an object without moving the object.

It consists of an extensible lamp-supporting arm hung by a ball-and-socket joint from the ceiling of a room, so that the lamp may be adjusted to, and held in, any desired position until forcibly moved to a new position. In the cut A is a flanged metal stand to be secured to the ceiling of the room, and having formed therein a socket to receive a ball secured to one end of the rod B and a set-screw for regulating the friction on



FIG. 2.

the ball. The rod B carries the adjustable rod C, to which the lamp-supporting and current-conducting wire is secured by the screw-eye *a* and the string *b*. The rod C has its bearings in the screw-eyes *cc* set in the sides of the rod B, and is pressed against the bearings so as to create sufficient friction to hold it in any desired position by a spring placed between the rods and adjusted by the set-screw *d*. This electric-light support, in its various forms, is being rapidly introduced throughout the country where adjustable lights are needed, and is proving satisfactory.

Fig. 2 shows its application as a wall-bracket, and Fig. 3 a combination electric bracket-back and gas-fixture.

This support is the invention of Mr. Alfred Dawes, Chelsea, Mass., and is manufactured only by R. Hollings & Co., 547 Washington street, Boston.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the sixtieth meeting of the American Institute of Electrical Engineers held at No. 12 West 31st street, New York, October 27, Mr. Carl Hering, as chairman of the committee, presented the following

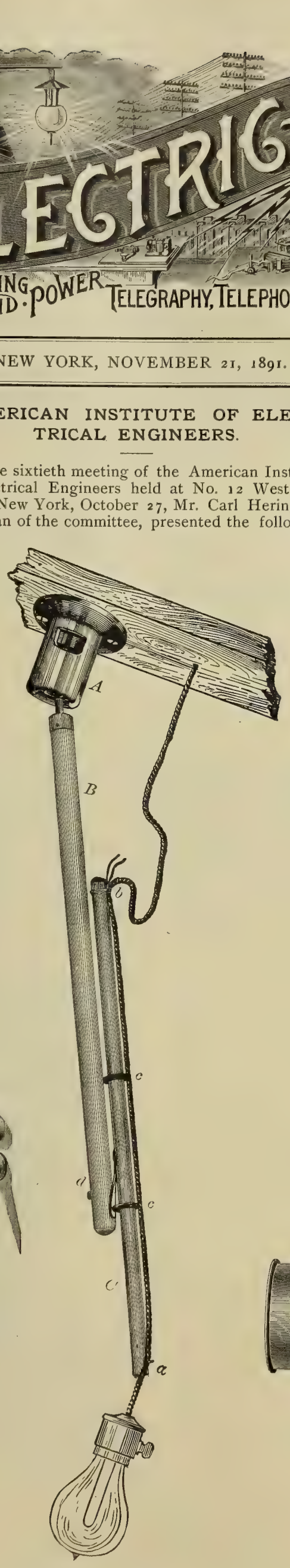


FIG. 1.

report of that society's delegation to the International Congress of Electricians held at Frankfort, Germany, September 7–12, 1891:

Of the members of your delegation the following were present during the whole session of the congress, viz: Mr. L. Gutmann, Prof. Heinrich, Mr. Carl Hering and Prof. Nichols. The only member not present was Mr. Tesla, whose unavoidable absence is to be regretted very much.

Your delegates had received no definite directions regarding matters to be brought before the congress, the choice of which was therefore left entirely to them. They concluded to bring up two or three matters which had occupied the attention of the Institute, namely, the adoption of the name "henry" and a normal value for the resistance of copper, and in addition suggest the adoption of a practical unit of magnetism.

The substance of our propositions as duly announced on the printed programmes was as follows:

1. That the American Institute of Electrical Engineers had adopted the name "henry" for the name of the practical unit of induction, and that we propose that this congress formally adopt the name. This was followed by an explanation of the value of this unit, why this name was preferred to the word "quadrant," and why it was named after Prof. Henry.

2. That this congress ought to adopt a name and value for a practical unit of the intensity of magnetism. To open a discussion we proposed the name "gauss" and a value of 1,000 per square centimetre, or 10^3 absolute units.

3. That it would be desirable to adopt a normal value for the resistance of copper to facilitate relative comparisons for commercial purposes. To this we added that we wished merely to agitate this question here in order that any preliminary test to determine such a value may be made between now and the next congress, so as to facilitate its adoption at that congress.

4. The announcement closed with an invitation to the members of this congress, on the part of the American Institute of Electrical Engineers, to participate in the next International Congress to be held under the auspices of the Institute, in Chicago, in 1893 (at the time your delegates were not informed that this coming congress was in the hands of a committee of the World's Fair).

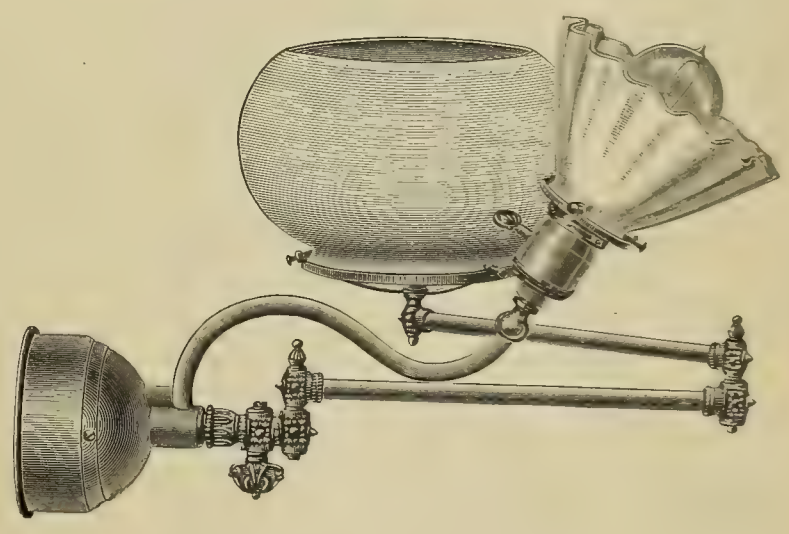


FIG. 3.

There were other matters which your delegates might have added, but it was thought best under the circumstances to limit ourselves to only the most important.

Seeing that there were decided differences of opinion among some of the prominent foreign members of the congress, as to whether the most important magnetic unit to be named was the unit of intensity or one of quantity (flux), the chairman of the delegation added the suggestion that both be named and proposed the name "weber" for the latter.

When the consideration of our proposition came

up at the general session, it was referred—together with the proposition of Mr. Hospitalier to establish a uniform international system of notation and conventional signs and symbols—to a special committee to report at the next general session. This committee was appointed by the chair, and consisted of Prof. Ferraris, Chairman; Mr. Hering, Secretary; and a list of members of which the following were present at the meetings: Braun, Grawinkel, W. Kohlrausch, Loewenhertz, Strecker, Uppenborn (Germany); Ayrton, Preece, Silvanus Thompson (England); Ferraris, Roiti (Italy); Hering, Nichols (United States); Hospitalier (France); Weber (Switzerland).

The programme of the congress provided for almost every hour, so that there was only very little time left (two meetings of an hour each) for the meetings of this committee. Mr. Hospitalier's proposition occupied almost the whole time at these meetings, leaving only a very short time for the consideration of our propositions. The English members appeared to favor the adoption of the name "henry," Mr. Preece saying that he had received instructions from the Royal Society to advocate its adoption. The German, French and Swiss members opposed it on various grounds. Some thought it conflicted with the already adopted name, "quadrant;" others thought it ought to be "franklin;" others "neumann," and some did not acknowledge the work of Prof. Henry in this field. Quite a number had never heard of its adoption by this Institute. The names "gauss" and "weber" for the magnetic units appeared to meet with general approval. The disagreement was as to what the numerical values should be. It appeared to be preferred to make them both 10^8 absolute units. The matter of the normal resistance of copper did not come up at all for want of time.

It was suggested that these subjects were too important to be considered hastily during the few minutes which were left for this meeting. It was thought better not to do anything than to do something which might afterwards be regretted. For these reasons and seeing that this committee (for want of time for preparation) was entirely unprepared to discuss the subjects, our propositions were withdrawn. Had there been sufficient time for proper consideration, I think there is little doubt that our propositions would all have been adopted, except that of the normal resistance for copper, which number the Germans have no use for, because they usually express the quality of copper by the conductivity of a unit of length and cross section.

Although our propositions were not adopted, chiefly on account of lack of time, the effect of our making them has prepared the way for their adoption at the next congress. I would suggest that the Institute profit by this experience, and that, as the leading American electrical society, it ought to take the lead in the matter of establishing and naming practical magnetic units and other similar international matters, by considering the subject now at their meetings, make propositions, publishing them in domestic and foreign journals, inviting the aid and criticism of foreign electricians and societies, and in this way prepare for their final settlement at the next congress. A congress is hardly the place to start a discussion on such matters; it is the place to finally settle a discussion which should precede it in the societies and journals of the leading nations.

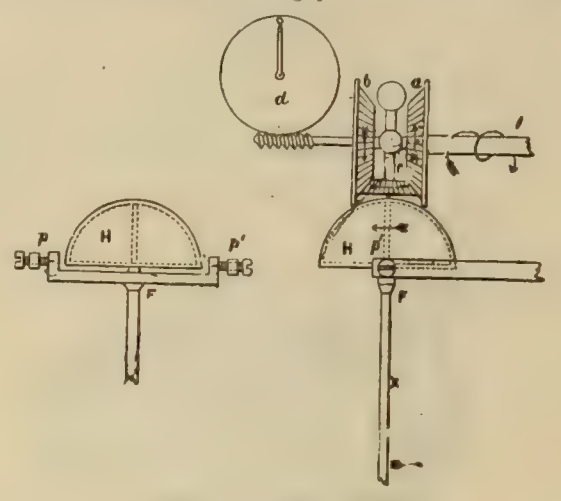
In this connection I would call the attention of the Institute to the important matter of a universal and international system of notation and electrical symbols. This subject was very ably discussed in a paper read before the congress by Mr. Hospitalier, who has for years given the subject much attention and has formulated a complete system, parts of which were adopted at this congress. The committee named above were instructed by the congress to discuss the subject between now and the next congress and bring it to the notice of the public through the journals so as to facilitate the adoption of some such system at the next congress. I would suggest that this Institute take up the matter in this country and that it take a leading part in soliciting opinions and criticisms from others; also, that this be done as soon as possible, as the question of an international system will not be an easy one to settle.

It is in place here to call the attention of this Institute, as a promoter of the next international congress, to one of the faults of this congress. There appears to have been no preparation made for international business; besides the social part of the programme, which was very creditably arranged and was highly enjoyable, there was nothing else but the reading of papers, and of these a number were of such a character that it would have been better to have read them by title, or at least at special meetings designed for such papers. It would have been better if all papers had been passed upon beforehand by a competent committee, and classed by them, preference being given in time and place on the programme in accordance with their merits and general interest. A congress which people visit from all parts of the world is hardly the place to spend much time in a lengthy description of a new piece of apparatus, a proposed invention, priority of inventions, etc.

In conclusion, I wish to add that the high standing of the Institute in Germany was shown by the great kindness and courtesy extended to your delegates. There was nothing left undone by the managing committee to show their appreciation of the high standing of the Institute and to recognize the part it took by sending a delegation to the congress. The Institute will receive a copy of the proceedings when published. It was also presented with a photograph of the original of a very interesting letter of the year 1830, by Gauss, describing what was one of the first electric telegraphs in actual use.

EBEL'S COULOMB METER.*

The feature of this meter is the differential gearing. Two crown-wheels, *a* and *b*, are placed to face each other on the same axis, on which *b* is allowed to turn freely, and *a* is coupled to clockwork, from whence it obtains its driving power. H is a hemi-



EBEL COULOMB METER.

sphere made of a light substance, free to turn on its vertical axis, and is moved by frictional contact with the wheel *a*, by means of which it communicates its motion in the same way to wheel *b*, turning this wheel in the opposite direction. This hemisphere, H, in addition to the vertical motion already described, has another motion which has its centre in *pp'*. The carriage, F, is free to turn on the fixed pivots, *pp'*, and carries the pendulum *x*, whose lower end is in connection with the ammeter which imparts an oscillating movement to it. C, a small planet-wheel, free at the same time to turn on its axis, is in gear with the two crown-wheels, *a* and *b*, and evidently if these two wheels rotate with the same velocity the planet-wheel will keep its position, and is only allowed to turn on its centre, but if either of these wheels is driven with a greater speed than the other, then the planet-wheel will be carried forward bodily in the direction of the wheel having the greater velocity.

When the pendulum *x* is hanging in a perpendicular position the hemisphere imparts the same speed to the wheel *b* as it receives from *a*, but when the ammeter is affected by a current an oscillating movement of the pendulum takes place and alters its vertical position, carrying the hemisphere to an angular one, thus changing the velocity of the wheel *b*. The motion of the planet-wheel is transmitted to a registering arrangement, *d*, indicating the difference of speed of the crown-wheels.

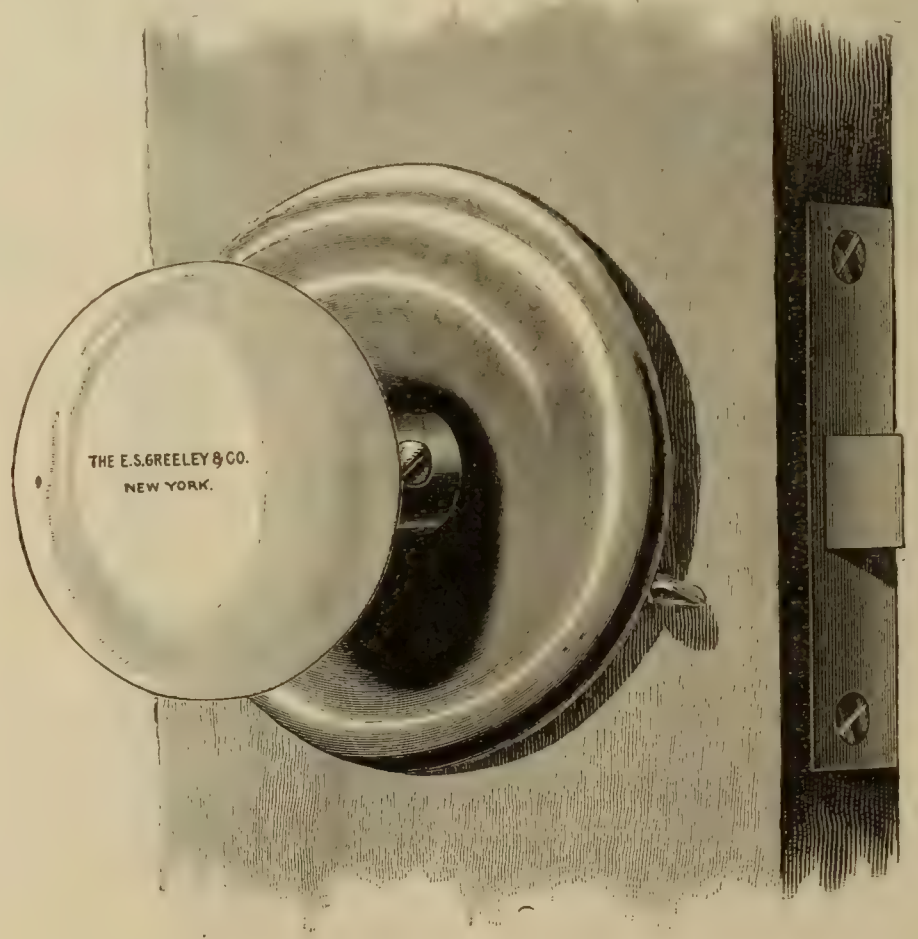
* London *Electrical Review*.

THE CLARK SEARCH-LIGHT.

The Clark Electric Co., 192 Broadway, New York, has one of its well-known search-lights on exhibition at the American Institute Fair, now being held in New York City. This electric arc lamp was made especially for search-light purposes, and it has been the object of the company to place on the market the most reliable and durable search-light for every purpose yet known. It attracts a great deal of attention at the Fair, and it seems to be a centre of attraction to those interested in navigation. It is mounted on swivelled trunnions, and can instantly be turned to throw the light in any direction. Mr. Ernest P. Clark, the inventor of the lamp, illustrated its operation to a representative of the Electrical Age, by revolving it and placing it in every conceivable position, the light burning steadily and uniformly through all the various movements, and it was evident that it was not affected in the least by changes in its position. There are no flexible cables used in the lamp, all connections being made through the trunnions by means of insulated joints. As there are no cords or weights used, and as its action is entirely independent of the effects of gravity, it should work as perfectly and as freely on a vessel in a heavy sea as it does on land. It is claimed that no other search-light possesses the advantages claimed for this lamp. It is said that the attention required to operate it is very much less than for any other search-light.

A NEW MECHANICAL ALARM.

The E. S. Greeley & Co., 5 and 7 Dey street, New York, have just put a novel door-knob alarm-bell on the market, which is a perfect tell-tale and a valuable safeguard. This firm is constantly designing little devices in this line, and some of them are very interesting from a mechanical point of view. This new alarm-bell is only three inches in diameter and about one-half inch in thickness, capable of ready application, and not conspicuous when applied.



DOOR-KNOB ALARM BELL.

It may be applied to the knob, either inside or out, of any door which it is desirable to have a signal given at any attempt of entering, whether the door is locked or not. A half turn of the knob in either direction will ring the signal. A small lever attached to the bell secures silence when desired. No wires or batteries are employed; it is entirely mechanical and complete in itself. The appearance of the bell is readily seen in our illustration. It will be very handy for stores, offices, private apartments and general house use.

HOW TO GET PAYING LOADS FOR STATIONS.*

BY PROF. W. D. MARKS.

When the constructing engineer, who may be called the organ-builder, has completed the station, he will, if he is fond of his own ease and can afford it, give way to the general manager or engineer, who stands towards him in the relation of the organ-grinder.

The manager, if he has not had previous experience, soon finds that he must combine with his knowledge as an engineer the energy of a locomotive, the activity of the Devil, the sleepless vigilance of Cerberus, and the manners of a courtier. In days of prosperity and smooth running his board of directors will gladly share with him the credit and glory of success; in fact, very few will hear of him at all; but let anything go wrong, let a break-down occur, or the enterprise not prove profitable, there is but one man to blame — *the general manager*. It is proper to say right here that this opinion is the result of observation and not of personal experience. The writer desires to express his grateful appreciation of the uniform courtesy and assistance he has received from his own board of directors, who have patiently waited for two and a half years for a dividend now fairly in sight for the first time. But this is, unfortunately, not generally the case.

Those of you who are familiar with the history of central stations know how frequently your kindly inquiries after the manager of early days is answered by "He is dead," "He is in the insane asylum," or "I don't know where he is: he couldn't make the station pay and resigned." These few words form the epitaph of many an able manager who has bravely struggled on against overwhelming difficulties and become discouraged, to be succeeded by another and perhaps another, until the public, becoming acquainted with the light and sure of its permanency, have taken it in sufficient quantity to pay the running expenses of the station, after which the progress and profits rapidly increase. The fortunate manager who came in at that period of the company's history had but to look sharply after the machinery, give a thoroughly good light and make prompt collections, to give great satisfaction to a body of stockholders who had invested their money for the purpose of obtaining dividends, and, as one of ours told me, "are in this business for money."

The question, "How are we to reach this happy condition of affairs in the briefest space of time?" is proposed for discussion. I know that many of my hearers are doubtless quite as well able to discuss it as I am, but they may not have had quite the same conditions to deal with, and I may therefore hope to interest them in my different experiences and expedients.

First of all, the story of the Philadelphia station is not a mere theory. We have a good paying load of 64,000 sixteens and only half the machinery in. The station is designed to carry 80,000 lights burning at once, and we can, when the station is completed, wire 150,000 lights and carry them, basing our estimate on Philadelphia's average burning in the past.

The price of gas is $1.50 per M., which is the same as ¾ of a cent per 16-candle-lamp hour. We fixed the price at 1½ cents per lamp hour at the start, and we ran from March 5 to October 1, 1889, with rather poor success in obtaining lighting. The price was the same as gas at $2.25 per M. We had to acknowledge that electricity cost more than gas and that it was a luxury. After a few months we fixed the price at ¾ of a cent per lamp hour, and directed our agents to say that our light cost just the same as gas and was vastly better and more healthful.

This change was brought about by Mr. Edison's influence. I had had several conversations with him and he always advocated meeting the price of gas squarely. I finally laid his views before our board of directors, and they adopted the price named by him. There was an immediate change. The simple statement "It costs no more than gas" brought many consumers to us who had heretofore refused to consider the matter of using electricity. We did no free house-wiring, but we at first furnished service, meter and lamps free of charge. We did this till October 15, 1890. After that we furnished only a meter free, and the consumer paid for service and the first installation of lamps. We still renew lamps free of charge when not broken. We preferred not to do house-wiring or to sell any particular make of motor. We got out elaborate rules and tables for house-wiring, and established an inspection department and insisted on the rules being obeyed to the letter. We urged upon the gas-fixture men of Philadelphia the establishment of wiring departments, and we wrote to all motor firms we heard of, asking them to appoint agents in Philadelphia.

This has resulted in the establishment of 13 wiring firms and the appointment of agents for 19 motors of different types. We had thus obtained 32 canvassing agents, who made a profit if they secured customers for us, but who did not get salaries from the Philadelphia company.

We paid 15 cents premium for all lights secured and $1.50 per horse power on all motors when the current was turned on.

Each one of our 32 free-lance agents had his own circle of acquaintance and lines of influence.

No injustice is done in saying that new things meet with twice the opposition in Philadelphia that they find elsewhere. But this body of canvassers was invincible. If we heard, or thought we heard, of a man who wanted light or power, we sent a card to each of the 32 firms, and before night that man had surrendered or left town. Very few escaped us. We had tin flags painted red and put on the end of a pointed bar, and on these was painted "The Edison Electric Lt. Co. Apply for services at 909 Sansom St." At night we guarded our ditches by hanging lanterns on hooks on these flags. and in the day-time we left them standing without the lanterns. We advertised every ditch and line of conductors this way. We did not advertise steadily in the newspapers, but we distributed throughout our districts thousands of circulars, giving all the information that an intending customer could possibly want.

We had but one salaried agent as solicitor. He also received a commission on lamps and motors, and earned, I think, three or four thousand in addition to his salary in one year.

Every form of advertising and solicitation paid, and paid well, but *the best advertisement of all is a satisfied customer*. Give a customer an honest 16 or 17 candles all the time but no more, charge him a fixed rate, and stand by the meter record. The meters have proved practically correct. If they err at all it is against the company, because of overloading. Our meter plates are always weighed in succession by two independent weighers, this work keeping them busy all the time for 1100 consumers.

All of the staff of employés are instructed to be uniformly polite and reticent, no matter how unreasonable the consumer may be. If a bill is disputed, we test out the wiring for grounds or crosses and go over all of our meter calculations again. If there still appears the slightest ground for just complaint, an inspector is detailed to keep a lamp hour record by actual count. *We never have found our m ters to overcharge the consumers.*

If a complaint is made of a motor bill we pursue a similar course, and also, by means of an ampèremeter, test the current. We frequently find motors loaded to twice their rated capacity. If we are satisfied that we are correct, we notify the consumer that 15 days after date of bill he will be cut off, and do it, and sue him for the bill. If a customer does not pay his bill in 15 days, the chances of his doing it at all are very slight, and it's no use talking to him after a bill gets old.

Our general agent visits in person many of our consumers who have by misconception felt themselves aggrieved, and we find that a pleasant discussion and explanation of the matter in dispute almost invariably ends in a clear and cordial understanding with our customer.

We try to be unfailingly just with our consumers, regardless of consequences to ourselves, and we feel now that they believe in us.

We sell power to all 110-volt motors at lamp rates. For 220-volt motors our rate is 7½ cents per horse-power hour. If a consumer takes more than 1,000-horse-power hours, and less than 1,500, we fix the price at $75 for four weeks.

All power above 1,500 is sold at 5 cents per h. p. hour.

CONTRACTS VS. METERS.

The question at once arises in the minds of many of my colleagues, Why not sell light, or at least power, by contract, instead of meters?

The answer is, *Because in the long run it is less profitable, and overloads the station too quickly.*

You will recall how our energetic band of 32 canvassers was secured by taking advantage of their desire to make money.

The underlying law of all business is selfish money getting or saving.

Without being deliberately and intentionally dishonest, nine consumers out of ten will fail to keep within the limitations of a contract for light or power. They will forget to turn out lights and to stop motors unless they are reminded of an oversight of this sort by the regular presentation of their meter bills. Making contract consumers pay for lamps does not seem to check them; they simply growl about the short life and price of the lamp; besides, these frequent small charges for lamps serve as a constant irritant to consumers and provoke much criticism of the lamps. Still the meter alone without any contract has its disadvantages.

When we were furnishing lamps free of charge, a gentleman on Rittenhouse square put 400 lights into his dwelling and paid us by meter bills $800, the first year $2 per lamp per year only, and we had furnished free service, free meter and free lamps: certainly not a profitable investment. So we now make all consumers guarantee us 6 cents per lamp per week, and only put in a free meter and cut-out and renew lamps free. If the lamps are burned on an average more than 6 cents' worth a week, a meter bill is rendered. This insures a minimum earning power for each lamp of $3.13 per year, and does not frighten consumers away.

It would appear from our experience as though light consumers were profitable in the following order, although no rigid classification is possible:

Restaurants, gambling houses, etc., clubs for social purposes, hotels, newspaper and telegraph offices, theatres and opera houses, small factories and business houses, stores for sale of dry goods, etc., buildings used for offices, dwelling-houses, Protestant churches.

The latter being open only on Sunday and a few evenings in the week, and on these for a few hours, should never be lit without a contract insuring the earning power of the lamps. The only advantage that can be claimed by churches is, that they burn light when almost every one else does not do so.

At the start we heard a great deal of special inducements to be offered to consumers who use light and power "out of hours"—that is, before 5 and after 11 P.M. and on Sundays.

With the exception of printing-offices and churches, there are very few of these consumers.

It is certainly advantageous to get them, but they do not exist in large numbers. Motors which run during the day, say from 7 A.M. to 6 P.M., are advantageous as giving the machinery of the station a uniform load, but in winter, when the lighting begins at 4:30 P.M., they overlap the lighting load, making a maximum load occurring between 5 and 6 P.M., and sometimes a very high maximum as compared with the average load.

Small factories, business houses, stores and buildings used for offices closing at 6 P.M., all add largely to this maximum load without burning on an average more than 1½ hours in 24, and for this reason should not form too large a proportion of the station load.

We have endeavored in every way to increase the sales of our current, and for this reason we have sold all supplies required by wiremen at 8 per cent. advance on their net price as billed to us, thus reducing the cost of wiring. We believe results to have shown this to be a proper policy.

We have endeavored, by concentrating all our machinery into a single station of large capacity, to obtain great economy of running expenses, and to enable the employment of the best possible men in each special department.

All and every expense of running included, it costs us from $2.50 to $3.00 per lamp per year, and we obtain a revenue of about $5.00 per year from each lamp.

A subject of anxious thought to all managers is how to increase this revenue per lamp.

By getting lamps that burn long hours, is the answer, or by getting motors for day service.

But motors do not pay as high rate for current as lamps, and people who burn light long hours will put in an isolated plant if they have more than a very few lamps.

I cannot give my own views better than to repeat to you my letter of February 17, 1891, addressed to our board of directors.

PHILADELPHIA, February 17, 1891.

To the President and the Board of Directors of The Edison Electric Light Company of Philadelphia.

GENTLEMEN: Touching the matter of the cost and the selling price of electric light and power, it seems to your engineer and manager that with the near approach of the limit of our present machinery and building capacity he should lay before you his views in detail as to the proper method of dealing with our consumers, which, while equitable to all, he hopes will result in increased daily profit to the Company.

At present on an average *all of our lights and motors are profitable to us*, costing us about .35 cent and being sold at from ½ cent to ¾ cent per lamp hour. Had we storage capacity for electricity as has a gas-works, we would be able to continue all and increase indefinitely until the full capacity of our feeders, 50,000 lamps burning at once, or say 100,000 lights wired, had been reached; as it is we must stop when we reach 14,000 ampères or about 30,800 sixteen-candle-power lamps burning at once. This would appear to be the case when we have 67,500 lamps wired.

(To be continued.)

* A paper read at the Seventh Annual Convention of the Association of Edison Luminating Companies, New York City, August 12, 1891.

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THE PROPOSED INTERNATIONAL ELECTRICAL CONGRESS.

Mr. Carl Hering's report on the Frankfort Exhibition, as read at the last meeting of the American Institute of Electrical Engineers, is an exceedingly interesting one.

Mr. Hering was a competent representative in Frankfort of the foremost electrical society in America, and the value of his report lies chiefly in the fact that the exhibition and its results are considered from an American point of view.

Mr. Hering points out some of the errors made in connection with the holding of the Frankfort Electrical Congress, so that the managers of the International Electrical Congress, which is to be held in Chicago during the World's Fair, may avoid similar pitfalls. There were evidently no preparations made for international business at the Frankfort Congress, and there was no classification of the papers read—it was a sort of a go-as-you-please affair.

Germans are fitted by nature and occupation to stand that sort of thing, but the vastly more progressive English-speaking nations are used to more system, and it is of the greatest importance that the Chicago Congress will be made international in character in every sense of the word. As Mr. Hering suggests, the papers offered for reading and consideration should be passed upon and classified by a competent committee, and given precedence in order of merit. Locality should give way to universality, and this principle should obtain both in the character of the papers and the general management of the Congress. On an occasion of this sort the temptation is great to bring to the attention of such an assemblage the merits of some invention or apparatus in which no one has or cares to have any interest except the promoter himself. To be successful the Congress must not be local or even national in character—it must be international. Foreign electricians of eminence do not care to come all the way to America to listen to essays on the electric motor made by John Smith, of New York, or the dynamo invented by Henry Jackson, of Chicago. They will come here expecting to hear and take part in discussions of universal interest, and it is therefore of the utmost importance for the managers of the proposed International Congress to bear that one fact constantly in mind. The whole framework of the Congress should be based on that one idea.

STATION MANAGEMENT.

We print elsewhere in this issue the first paper given out for publication of those read at the Seventh Annual Convention of the Association of Edison Illuminating Companies, held at the Park Avenue Hotel in this city, last August. The author is Prof. W. D. Marks, of the Edison Electric Light Co., of Philadelphia, and information of practical value is given in abundance throughout the paper, which is entitled "How to Get Paying Loads for Stations." Prof. Marks is a practical station manager, and what he has to say in his paper is based entirely on practical experience, and is, therefore, all the more valuable to the most important person connected with an electric-light station—namely, the manager.

The difficulties station managers have experienced in establishing an equitable method of charging consumers for the current used are familiar to all. The contract system and the meter system both have their warm advocates and as ardent opponents. No doubt each method has its advantages as well as its disadvantages—indeed it would be an extraordinary condition of things if either was perfect. Under certain conditions, as all well know, the contract system is the more satisfactory method of charging for current, while under other conditions the meter system is preferable.

There is one statement in Prof. Marks' paper that will be of particular interest to illuminating companies, it is that in reference to lowering the charge for electric light to equal that of gas. It is a difficult task in any line of business to induce a prospective customer to pay more for an article than he has been used to paying, even though the higher-priced article possesses advantages over the cheaper. As a rule, consumers look more to the dollars and cents than they do to improvement in quality. In the experience of Prof. Marks' company, as soon as the price for electric light was made equal to that of gas, consumers of the latter illuminant were perfectly willing to have electric light substituted therefor, and the result was an immediate increase in the number of customers.

In many places electric light is still regarded as a luxury—that is, the cost of the same is greater than that for equal gas-light. Naturally, high prices limit the number of consumers, and, conversely, low prices increase the number. Mr. Edison recognized this principle in commercial electric lighting when he advocated the reduction of electric light to equal that of gas.

In concluding his paper Prof. Marks gives some valuable and interesting facts concerning the operation and management of a station and service.

"Concentration of power, economy of running expenses, simplicity of design, certainty and regularity of action of machinery," are all excellent principles to follow out, and to these might be added "careful and intelligent management."

Prof. Marks thinks that it is preferable to bury a cable in the ground than to put it in a street conduit that is not hermetically sealed. In Philadelphia the cables of his company, which have been forced into wooden conduits by the city authorities, have caused the company a vast amount of trouble and expense.

Altogether the paper is an exceedingly interesting one, and is worthy of the careful consideration of every station manager.

ALTERNATING-CURRENT DYNAMO CURVES.

An interesting exhibit at the Frankfort Electrical Exhibition was an apparatus of Dr. Froelich for showing on a screen the curve of the rise and fall of current in an alternating dynamo. The apparatus consisted of a large telephone iron disc with a small piece of looking-glass stuck on it eccentrically, and at the back is a horse-shoe permanent magnet, the soft iron pole-pieces of which were wound with a coil carrying the current produced by an alternate-current dynamo. The iron disc was therefore pulled more or less by the magnet, depending on the strength and direction of the current passing round its poles. A beam of light from an electric lamp was reflected from this mirror on to a screen, and as the alternating current flowed round the magnet a vertical line of light was formed on the screen, the position of the spot of light on this line being at any moment a measure of the strength and direction of the current produced by the machine. Before the beam of light reached the screen it undergoes a second reflection from one of a series of small plane vertical mirrors, arranged around the surface of a cylinder parallel to its axis. By suitable worm-gearing, the quick rotation of the dynamo caused a somewhat slow rotation of this cylinder, but quick enough to produce an apparently continuous horizontal beam of light along the screen, if there be no current flowing—that is, if the mirror on the telephone plate be at rest. The combination of the vertical and horizontal motions of the beam produced a curve which showed the shape of the current wave extending over some four or five periods.

ELECTRICITY AT THE WORLD'S FAIR.

Electricity is to be the motive force during the construction of the buildings for the World's Fair, in Jackson Park, Chicago. The electric plant has been completed and steam-engines must go. This is done in order to reduce the fire risk. The saw-mills, used in getting out building material, which have been run by steam, are now supplied by electric power, furnished, if desired, night and day. Electrical Engineer Sargeant is prepared with a 60 horse-power plant to supply electric-motor service. In a few days, 300 horse power will be available.

The Department of Electricity is making an effort to secure a complete collection of historical electrical apparatus, in order to show the progress of the science from early times.

NOTES ON THE FRANKFORT ELECTRICAL EXHIBITION.

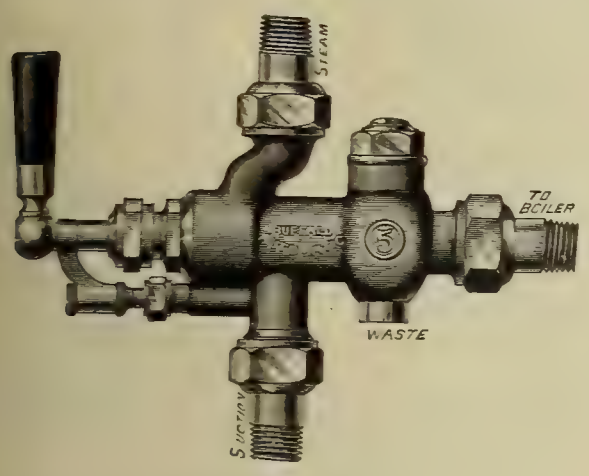
At a joint meeting of the American Institute of Electrical Engineers and the Electric Club, to be held at the club-house, 17 East Twenty-second street, this city, Tuesday evening, November 24, Mr. Carl Hering will present a paper entitled "Notes on the Frankfort Electrical Exhibition," illustrated with lantern slides.

AN INTERESTING MEETING.

The New York Electrical Society will visit the New York City Fire Alarm Headquarters, No. 157 East 67th street, on Thursday, November 19, at 8 P.M. Mr. J. Elliott Smith, Superintendent of the Electrical Department, will be on hand, and explain the fire-alarm system in every detail to the members of the Society.

BUFFALO AUTOMATIC INJECTOR.

We illustrate herewith an automatic injector particularly adapted for use on traction, portable or stationery boilers, which is very simple in its mechanical construction, and which has proven very efficient and satisfactory wherever used. The invention belongs to that class of devices commonly known as re-starting injectors, in which the injection of water is automatically resumed when the flow has been interrupted from any cause. The object of the inventors was to produce mechanism by which the water-valve and the steam-valve could be operated simultaneously, so that the supply of water to the injector would be at all times proportionate to the steam supply, both valves being operated by one handle. By turning this handle, which is clearly shown in the illustration, in the proper direction the steam-valve recedes from its seat and admits steam into the nozzle. During the lengthwise movement of the steam-valve and its stem the water-valve is opened owing to the yoke connecting the water-



AUTOMATIC INJECTOR.

valve rod with the steam-valve stem, thereby actuating the water-valve simultaneously with the steam-valve at all times. The movement of the steam and water valves and their relative positions are such that the supply of water will always be in proportion to the supply of steam admitted to the nozzle, thereby insuring the proper working of the injector and preventing an excess supply of water, which is liable to take place when using a water-valve operating independently of the steam-valve. The simultaneous closing of the water-valve with the steam-valve is very desirable when water is supplied to the injector under pressure, in which case with other machines water is often forced through the injector after the steam-valve has been closed, by neglecting to close the water-valve.

The capacity of this machine can be graded so that in feeding a boiler a quantity of water can be fed equal to the amount that is being evaporated, enabling an engineer to run the injector continuously, producing an economical result.

On a recent test an injector with one inch connections with 65 lbs. of steam pressure fed at its smallest capacity 277 gallons per hour, and could be graded up to 572 gallons per hour under the same pressure, something, it is said, never before accomplished by an injector.

No valves are required in either steam or supply pipe, the machine being operated entirely by the one handle, both in starting and stopping the machine, as well as in grading the supply.

The injector is manufactured by the Sherwood Manufacturing Company, 34 Washington Street, Buffalo, N. Y., who reports large sales to fitters of steam plants for electric light and power purposes.

THE HAVANA ELECTRIC LIGHT STATION.

The Havana electric light station, one of the best-equipped electric light stations in Spanish-America, has just been finished. The station is situated within the premises of the United Gas Companies of Havana. It was started early in 1889 with a plant consisting of one Westinghouse 1,500 light incandescent alternating-current dynamo and two fifty-light arc machines, merely as an experimental plant, and also to provide electric lights for those few people who desired that form of illumination in place of gas.

The demand for the new light increased rapidly, so that the directors of the company, after obtaining from the municipal authorities an assurance that they would agree to have certain public places and streets lighted with electricity for as long a time as the lights continued to give satisfaction, determined to equip a station that would be ample for the prospective demand. A one-story brick building 195x90, with an iron roof has been erected and in this structure have been placed ten engines, the Westinghouse compound condensing and eight Armington & Sims horizontal high-speed engines, aggregating 1,125 H. P. Steam to supply these machines is obtained from seven boilers of a capacity of 150 H. P. each. The generating plant consists of four Westinghouse 1,500-light alternating-current incandescent and eight 50-light arc dynamos, with the addition of one other incandescent and two arc dynamos, the entire capacity of the station being 3,250 incandescent lights and 500 arc lights.

The incandescent switch-board is of massive construction, built of cedar $2\frac{1}{4}$x3 inches. The board is supplied with the latest appliances, including current registering volt-meters, lightning arresters, and testing instruments. The arrangement of the changing devices is very convenient, the attendant being able to change the load from one dynamo to the other, or to make any combination of the eight dynamos and to the circuits leading from these, without altering his position. The arc switch-board is arranged for twelve circuits. The interior of the station is floored with cement. The station is also equipped with an efficient service of pumps for feeding boilers, condensing and fire purposes; also with feed-water heaters, and separators, for the prevention of the inflow of water into the cylinders of the engines from condensation or priming.

It is said that there are few stations in the United States that can compare with the Havana plant for the completeness of both mechanical and electrical appliances that have been installed, taking into consideration the size of the plant, and considering that all the materials have been imported from this country. To the executive ability displayed by Mr. R. A. C. Smith, of New York, the Vice-President and Treasurer of the Spanish-American Light & Power Co., in organizing this enterprise and in successfully shipping this vast amount of material required, and also to Mr. Ricardo Margenas, the general manager of the company in Cuba, in superintending the construction and completion of this station, the success of the Havana electric light plant is due. Mr. F. H. Thompson is the electrician for the company in Havana.

BOOKS, CATALOGUES, ETC.

MODERN PRACTICE OF THE ELECTRIC TELEGRAPH; A Technical Handbook for Electricians, Managers and Operators. By Franklin Leonard Pope. D. Van Nostrand Co. 14th edition. 234 pages and 185 illustrations. Price, $1.50.

One would think, from the length of time that Pope's, "Modern Practice" has been on the market, that every one, from a battery-boy to a superintendent, would be familiar with the contents of the book; but we must say that when we examined this 14th edition we were surprised at the many changes that had been made in the text. The work has been completely rewritten and changed, and, as far as the reading-matter and illustrations are concerned, the book might as well have had a new title, as it is practically a new book—and a better one. The old editions were very valuable to the telegrapher, but they were not exhaustive, nor did they deal with the subject deep enough for the ambitious student; but this last edition is nearly perfect, and deals with every principle, and every application of such principle, used in modern telegraphy. Construction and maintenance of lines are thoroughly handled, as well as in-door work. Testing in all its forms, setting up and working multiplex instruments, and the application of dynamo currents for telegraphic purposes are thoroughly covered and brought up to date. The book as it now stands is the best in the market for telegraphers, and we advise each of them to procure a copy.

The well-known firm of H. Ward Leonard & Co. has just published a neat little pamphlet of 32 pages, containing testimonials and references regarding past work and experience, and the present standing of the company. Besides a large number of letters there are numerous extracts from technical journals and daily newspapers, speaking very highly of the company's work; and a long list of prominent plants installed under the supervision of members of the firm.

A SEVERE TEST.

A most severe and very interesting test was made last week by Wm. Sellers & Co., of Philadelphia, upon a motor operated under the new principle invented by Mr. H. Ward Leonard. The machine used was a 10 H. P. standard shunt-wound Sprague motor. The normal speed was 1,500 revolutions a minute. It was belted to a counter-shaft, upon which was placed a brake, and in addition to this there was placed upon the countershaft a large fly-wheel such as is used upon punching machines, for the purpose of duplicating the inertia and momentum met with in practice in a great many kinds of work.

The motor was made to operate in either direction at any rate of speed desired, and it was found possible to run the motor perfectly and regularly, under the full brake load, at 15 revolutions per minute, that is, one per cent. of its full speed. While operating at full speed in one direction the motor could be instantly reversed, the reversal being perfectly gradual and entirely without any spark or troublesome feature of any kind.

In order to get the most marked effect in overcoming the momentum of the fly-wheel the brake was taken off, and when the fly-wheel was running at its full speed of 300 revolutions a minute the motor was reversed instantly. In thirteen seconds the motor had brought the fly-wheel to rest, and in thirteen seconds more had it running at full speed in the opposite direction, the entire operation being effected with the greatest smoothness and without any spark whatever. The performance of the motor was extremely satisfactory to all concerned, and showed its perfect adaptability to any class of work to be met with in practice.

WESTERN NOTES.

Mr. E. A. S. Barkelew is now connected with the Lane Manufacturing Co., Kenosha, Wis., manufacturer of lamps and lamp goods, and Corthell's adjustable extension for electric lamps.

The Fisher Electric Co., of Detroit, Mich., is equipping the large, new 8-story building, cor. Water and Superior streets, Cleveland, Ohio, with a complete isolated electric-light plant.

The Globe Carbon Co. moved from Cleveland to Ravenna, Ohio, October 1 last. This company is well known in the trade and makes carbon brushes for motors and carbons for general battery use. At its new factory in Ravenna the capacity will be 100,000 carbons per day. The company is independent, and is in no way connected with any other concern.

Mr. S. D. Nesmith, the Cleveland representative of the Thomson-Houston Co., resigned his position Nov. 7. Mr. Nesmith is going into the stock brokerage business, and will deal in street-railway bonds and stocks in Cleveland. He will have connections in Boston and New York.

The Central Thomson-Houston Co. has an attractive display of goods in its Cleveland headquarters, 48 and 50 Arcade. Mr. C. H. Ince takes pleasure in explaining the advantages of his company's goods.

ELECTRIC LIGHT NOTES.

The Queens County Electric Light and Power Co., Brooklyn, is negotiating for the purchase of the property of the Oyster Bay Electric Light Co., Oyster Bay, L. I.

St. Joseph, Mo., is to increase its electric light plant.

The Citizens' Electric Illuminating Co., Pittston, Pa., has contracted to furnish electric lights to the city for the ensuing year at $13 less per lamp than the Borough paid last year.

Quakertown, Pa., is agitating the erection of a municipal electric light plant to cost about $20,000.

An isolated incandescent plant with a capacity of 500 lights is to be installed in the Burke building, Seattle, Wash.

The Stafford Springs Electric Light and Gas Co. (private corporation) will erect an electric light plant at Stafford Springs, Conn., at once A M. Young, of Waterbury, Senator Shumway and E. H. Jacobs, of Danielsonville, and R. S. Hicks, of Stafford Springs, are interested in the enterprise.

The Thomson-Houston Electric Co., of Lynn, Mass., has secured the contract for instal ing the p ant of the Mascoutah E ectric Light Co., Mascoutah, I l.

Efforts are being made to keep the Commercial E'ectrical Co. (Edison) from laying conduits through the streets of Wheeling, W. Va., as it is feared the conduits will injure the business of the City Gas Co.

Braintree, Mass., is taking action in regard to lighting the town with electricity.

The Electric Light and Power Co., Thompsonville, Conn., is erecting a new power-house.

The City of Leavenworth, Kan., has contracted with the Leavenworth Light and Heating Co. for 50 or more 2,000-candle-power arc lights.

Knightstown, Ind., is to be lighted by electricity furnished by a local corporation now being organized.

Bay City, Mich , is to have an electric-light plant.

The village of Stillwater, N. Y., is to have electric lights.

A new dynamo is to be added to the municipal plant of West Troy, N. Y.

The Edison Electric Illuminating Co., Rochester, N Y., is adding a new station to its system, making three in all.

It is said that there are 1,358 arc lights in Pittsburg costing $101.60 each per year; and 318 incandescent lights, costing $16 each per year.

An isolated electric light plant is being installed in the new McFadden compress at Brenham, Texas.

The Citizens' Gas Light Co., Willimantic, Conn., opened its new electric-light station Thursday, November 12, with a house-warming.

Judge Cornish has granted a peremptory writ of mandamus directing the Edison Electric Light and Power Co., of St. Paul, Minn., to allow the inspection of its books by Richard Heckscher, a stockholder of the Edison Company.

It is proposed to use the power of the falls on the Merced river, about 75 miles east of San José, Cal.,

to generate electric energy for light and power purposes in that city.

The Hill City Electric Light Company has been granted a 50-year right-of-way over the streets of Vicksburg, Miss.

The Merchant Light and Motor Company has been granted a franchise to carry on business in Joplin, Mo.

The Livingston Electric Light Company, Livingston, Mont., supplying 20 arc and 1,800 incandescent lamps on the Thomson-Houston and National systems, will increase in the near future.

At a meeting of the stockholders of the Nantucket Electric Light Company, Boston, Mass., October 6, the following Board of Directors was elected: H. Riddell, H. C. Buck, F. H. Raymond and P. A. Underwood.

The Home Electric Company, Seattle, Wash., is now supplying 5,500 incandescent and 305 arc lights on the Thomson-Houston and Westinghouse systems. The company uses five Armington & Sims engines, aggregating 900 horse-power.

The Lyons Electric Light and Power Company, Lyons, Kan., will make an addition of one 50 horse-power Ide engine and boiler and a 300-light incandescent dynamo. E. Kapp, the proprietor, now supplies 30 arc and 200 incandescent lamps on the Ft. Wayne Jenney system.

NEW INCORPORATIONS.

The Walton Electric Light Company, Walton, N. Y., was incorporated October 28, with a capital stock of $20 000. Incorporators: John Babcock, Charles B. Bassett and Samuel H. Francher, all of Walton, N. Y.

The Marion Manufacturing Company of Chicago, Ill., was incorporated October 29, with a capital stock of $20,000, to manufacture electrical and mechanical devices. Incorporators: Sidney N. Johnson, John H. Brown and Frank H. Fenno.

The Suburban Light, Heat and Power Company, Chicago, Ill., was incorporated October 30, with a capital stock of $50 000. Incorporators: Louis W. Johnson, Henry C. Joslin and Ernest C. Barrows.

The Adjustable Telephone Manufacturing Company, Cincinnati, Ohio, was incorporated October 29, with a capital stock of $20,000. Incorporators: James P. Hall, M. A. McGuire, August W. Bruck, J. W. Johnson and H. M. Caldwell.

The John A. Crisp Electric Belt Company, Jefferson, Ohio, was incorporated October 29, with a capital stock of $25,000. Incorporators: John A. Crisp, E. L. Hills, W. M. Kellogg, J. P. Caldwell and A. L. Arner, M.D.

The Taylor Electric Light, Gas and Power Company, Taylor, Tex., was incorporated October 27, with a capital stock of $40,000. Incorporators: J. E. Tucker, E. Mendel, F. L. Welch, Taylor, Tex.

The United States Burglar and Alarm Company, Galesburg, Ill., was incorporated October 31, with a capital stock of $50,000. Incorporators: Octavius J. Colton, Abraham Anderson and Noah M. Powell.

The Decker Electrical and Novelty Manufacturing Company, Detroit, Mich., was incorporated October 29, with a capital stock of $20,000. Incorporators: Charles H. Decker, Charles W. Harrah and L. M. Thayer, all of Detroit, Mich.

The Queens County Light and Power Co., Oyster Bay, N. Y., was incorporated November 7, with a capital stock of $50,000, to generate electricity for light, heat and power. Incorporators: William A. Vail, Horace Ironmonger, Zachariah Latshaw, all of Brooklyn, N. Y.

The Early Electric Light Co., Richmond, Wayne Co., Ind., was incorporated November 10 with a capital stock of $25,000. Incorporators: Charles Morris, W. N. Gray and George P. Early.

The Connecticut Smokeless Fuel Gas Co., Chicago, Ill., was incorporated November 10 with a capital stock of $1,500,000, to manufacture and sell gas and electricity for light, heat and power. Incorporators: Thurston G. Hall, Luke T. Drury and Calvin C. March.

The Astoria Electrical Manufacturing Co., New York, N. Y. (incorporated in W. Va.), has been incorporated with a capital stock of $500,000, to acquire, hold and grant license, letters patent etc., and to dispose of the same. Incorporators, C. N. Jordan, William Steinway, Edward Uhl, New York, N. Y.

The Triple Multiplex Co., New York, N. Y. (incorporated in W. Va.), has been incorporated with a capital stock of $1,000,000, to manufacture and sell electrical and mechanical devices. Incorporators: George Doyle, S. T. Appolonio, J. A. Wyman, E. B. Crane and William Bailey, all of New York, N. Y.

The Wilder Duplex Electric Burglar Alarm and Messenger Co., New York, N. Y. (incorporated in W. Va.), has been incorporated with a capital stock of $500,000. Incorporators: Ferdinand Fersch, I. N. Heidelberg and Morris Mayer, all of New York, N. Y.

The Morgantown Electric Light and Power Co., Morgantown, W. Va., has been incorporated with a capital stock of $100,000. Incorporators: H. S. Sands, O. S. McKinney, Fairmont, W. Va.; G. C. Sturgiss, Morgantown, W. Va.

The Montrose Electric Light and Power Co., Montrose, Pa., has been incorporated with a capital stock of $12,000. Incorporators: James N. Taylor, O. A. Gilbert and J. D. Jenkins, all of Montrose, Pa.

Mr. B. P. Johnson, formerly connected with the Interior Conduit and Insulation Co., New York, is now associated with Walker & Kepler, 531 Chestnut street, Philadelphia. Walker & Kepler are general agents and contractors of the Edison system of electric lighting, and Bergmann & Co.'s electrical appliances. The firm also does electrical construction work.

NEW YORK NOTES.

The Crocker-Wheeler Electric Motor Co. has a large exhibit of its perfected motors and dynamos at the Industrial Exposition now being held in Augusta, Ga. Mr. George C. Field arranged the exhibit, and was later joined by Mr. George La Rue, the general sales-agent, who was making a tour through the South, visiting the many agencies of the Crocker-Wheeler Co. in that section. It is said that the Crocker-Wheeler exhibit is one of the features of the exposition. The Crocker Wheeler Electric Motor Co. has, by the way, found it necessary to very much increase its facilities, in order to keep up with the demand for its popular goods.

Mr. Thomas Towne, for so long a buyer for the well-known Garvin Machine Company, is now connected with Union Drawn Steel Company, Beaver Falls, Pa., as eastern sales-agent, with offices in the Electrical Exchange, Liberty and Washington streets, this city. Mr. Towne won many friends in his former position, and will no doubt be as successful in securing orders for the many specialties of the Union Drawn Steel Company as he was for the well-known and efficient machinery of the company with which he was formerly connected. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	92 00
Am. Elec Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 50
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	420 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	190 00
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y	10,000	100 00	460 00
Brush Illuminating, N. Y	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	138 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	99 25
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000	50 00	*102
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	24 00
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	27 50
Detroit Electrical Works	1,000,000	10 00	7 75
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*100
Edison Elec. Ill. 6s, N. Y	30,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Elec. Ill. Co	44.678	100 00	476 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., Phila	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	95 50
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Equitable G. & E. Co., Utica	4,000		†
Erie Telephone	4,800,000	100 00	42 50
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*101
Fort Wayne Elec. Co	4,000,000	25 00	12 00
Freeman Electric Motor Ry. Co	250,000	25 00	8 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	125 00
G. T. Woods Mfg. Co., Ky	2,000 000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	10 50
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*98
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hudson Electric Light, N. J	100,000	100 00	
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*104
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	18 50
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*77
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30 000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*99
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	32,500	100 00	420 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N. Y	1,000,000	100 00	60 00
Morristown L. H. & P. 5s, N. J	17,500		*101
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100.000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I	150.000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	15 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	420 00
N. E. Tel. & Tel. Co	10,394,600	100 00	49 50
N. Y. and N. J. Tel. and Tel. 5s	1.500,000		*99
N. Y. and N. J. Telephone Stock	2,535,000	100 00	94 00
N. Y. G. & E. Co. Certs. of Indebt	100,000		†
N. Y. Phonograph Co	20,000	100 00	420 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50.000		*95
North New York Lighting	150,000	100 00	10 00
Northern Elec. L. & P., Phila	200.000	10 00	
Northwest Elec. Co. 6s, Manitoba	50.000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Peoples' St. Ry. & E. L. & P. Co. 6s	800,000		par
Peoples' St. Ry. & E. L. & P. Co.	8,000		†
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s	500,000		*95
Ry. T. Dis. Elec. Signal Co., N. Y	200.000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	5 50
Saginaw E. L. & P. Co. 6s, Mich	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Seibold Electrode Manf. Co., N. Y.	100,000	100 00	
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	480 00
Swan Incandescent	800,000	100 00	5 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	45 75
Thomson-Houston pref	4,000,000	25 00	26 00
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50.000	100 00	100 00
Twin City Rapid Transit, N. J.	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	40 00
Universal Arc Lamp Co	100 000	100 00	75 00
U. S. Volta Elec. Bat. Co	2,000,000	10 00	1 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo	100,000		*95
Western Union	86,188,852	100 00	82 25
Westinghouse Electric Co	7,000,000	50 00	10 75
Westinghouse Elec. Co. pref. 7s	3,000,000	50 00	
West End L., Boston	13,550,000		17 25
Yonkers L. & P	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

It is refreshing to note the difference between absolute values as expressed in electric securities, and visionary ones, as quoted in the columns of our daily contemporaries, of the railroads throughout the land. The first are steady strong and substantial, periodically increasing in volume with ever-growing dividends, greater amount of business necessitating additions to the plant, limited only by overplus of earned cash in the treasury, which is pleasurably voted by the happy and contented stockholders, giving satisfaction and luxury to the great mass of the people, who receive a benefit granted as freely as the air they breathe in many cases; while the second is a mass of selfish, scheming, writhing, intangible riddles swayed to-day by a gale in the British Channel, to-morrow by the suspension of a bank in Massachusetts or Monte Video, with dividends subject to the caprice or pleasure of the few in control, and at best the shuttle-cock in the air or mud as may best suit the sweet humor of the bulls or bears. To be sure there are a few exceptions to be found among the imitators of the old régime, who can only believe the whole world is theirs and the public have no interest in it which they need respect; but the placid smile on the countenance of the average owner of a moderate amount of electric stocks compared with the sharp, nervous, unnatural, searching agony depicted on the worried face of the other proprietor as he flits from pillar to post to assure himself that he is not a pauper, is as a glorious May in the tropics to a wild December in Greenland.

The Secretary of the Treasury has issued an order for all monetary institutions to short-circuit any counterfeit money they may be possessed of in excess of $500 to the U. S. Treasury. Can it be possible that he has suspicions that by this course some gigantic source may be unearthed whence periodical floods ripple through our fair land? That he has the authoritative power to enforce the order is a question for those who have at great expense gathered in and indexed a specimen of each counterfeit as fast as issued and obtainable. Another question may also be as to whether many of our most honorable bankers have not been guilty of felony

in exchanging counterfeit notes to fill collections, or even purchased or sold rare specimens to complete collections. All are supposed to know the laws, ignorance is no excuse, nor will the end justify the means. With a rich bank-master to add to a valuable cabinet or a peanut employé to assist in obtaining the periodical return ticket to Rome or Naples, under Government protection, Dickerman's *Counterfeit Detector* advertises that it will pay the face value for any new counterfeit presented to them prior to their knowledge of its existence. I had the honor of serving on the United States Grand Jury lately. A metal dollar was the largest counterfeit we had to deal with, but true bills were found all the same. It is full time the question was settled definitely.

Electric application mechanically and automatically cancelling stamps at the rate of 30,000 per hour successfully in the New York Post-office brings to the front another industry which will soon be in the market seeking capital with which to fill orders. It will not answer in these fast days to earn the money by the ancient method of manufacturing to the limit of cash on hand and resting while the returns are collected. The market must be supplied, and to do this concentrated capital is requisite. To secure it bonds or shares must be sold, and it is much more satisfactory than to borrow on either acceptable indorsement or bills receivable, the discounts or commissions on which eat up nearly all the profits. There will soon be a large demand for these cancelling machines, and the shrewd investor will grasp the opportunity for securing extraordinary returns. A fortune is rusting in the vacuum soon, let us hope, to be filled with an automatic electric machine which will correctly place the stamp on our outgoing letters. A financial establishment carries for years envelopes of the same size, all need a machine for this purpose, and it will be the quickest-selling stock in the market. We want to quote them both, and above par.

PATENTS.

There is no property so valuable as a patent on a good invention. Many good inventions are lost to mankind through lack of proper treatment in the application for a patent. The specifications may be defective at some essential point, thus rendering the patent pregnable. It is of the utmost importance, therefore, to secure the services of a first-class patent solicitor when a patent is desired.

We call the attention of those desiring patents to the patent department of the ELECTRICAL AGE. The applications through us are constantly increasing, and in every case where patents have been granted the utmost satisfaction to the patentee has resulted.

Mr. John Henry Hull, *Times* Building, New York, who has charge of our patent department, is a well-known and reliable patent attorney, and applicants for patents through him may rest assured that their interests will be properly looked after.

CONTRACT SIGNED.

The contract has been signed between the mayor and clerk of Ashtabula, Ohio, and the Westinghouse Electric and Manufacturing Co. for the lighting of that city. The contract provides for the furnishing and erecting of the wire, poles, fifty-one arc lamps, two 60-light arc dynamos and one 500-light incandescent dynamo. Nine bids were submitted for the contract, but only five were considered. After a careful investigation and examination of the different systems involved, the city council committee reported in favor of the Westinghouse company's bid. The system to be used in Ashtabula is the alternating one, and the lamps, instead of throwing the light down at an angle of about 45 degrees, as is the case in most arc lamps, will give a light that will penetrate farther horizontally than any other.

CATALOGUES.

The Manhattan Electrical Supply Co., 36 Cortlandt street, New York, has just issued its illustrated catalogue No. 4, of electrical supplies. It consists of 152 pages and contains illustrations and price lists of nearly everything in the electrical line. This firm deals in general electrical supplies of every description, and those wishing to purchase can call around and get anything they desire, from a common push button to a generator. The catalogue is tastefully gotten up, the paper has an excellent finish, and the wood-cuts are superb. The cover is something unique, being an imitation of lizard skin.

BUSINESS NOTES.

The Central Electric Company, Chicago, reports that its new Gladiator Dry Battery is meeting with the most unexpected success, the factory supplying them already doubling its capacity, so as to meet the increased demand for these cells. The company also reports a very satisfactory trade in the Bryant goods, such as sockets, switches, cut-outs, etc.

The Crocker-Wheeler Electric Motor Co., New York, has recently furnished a 3 H. P. motor of its popular perfected type to run a large church organ in Ottawa, Ont. Other late installations of note are a 5 H. P. special dynamo to the Cornell Electric Company, Hamilton, O.; one hundred and twenty-five ⅛ H. P., and six ¼ H. P., 10-ampère arc motors to a well-known firm in Baltimore, Md.; one 1 H. P. to the Alabama Polytechnic Institute, Auburn, Ala., and one 1 H. P. to the Berlin Dry Goods Store, Brooklyn, N. Y., to run a cash carrier system, besides very heavy shipments to the West Indies and other foreign countries for the Thomson-Houston International Electric Company, Boston, Mass.

IT IS HIGHLY PRIZED.

The following letter speaks for itself:

LEONARDSBURG, OHIO, Sept. 1, 1891.

Jerome Kidder Mfg. Co.

SIRS: Enclosed find express money order. * * * My battery does well. I prize it highly. Respectfully yours,

F. POTTER.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

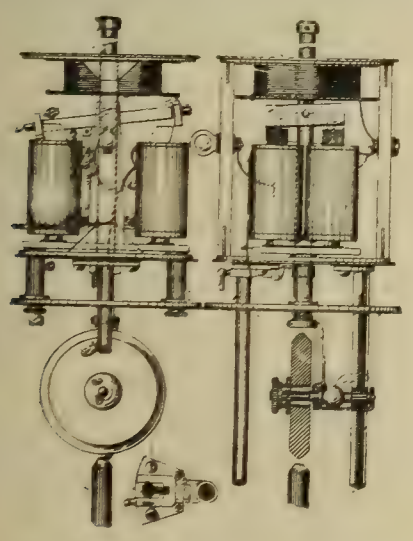
Issued November 3 and 10, 1891.

462,624. Electric-Arc Lamp. Thomas Conroy, Kansas City, Mo., assignor of two-thirds to Albert W. Dold and Lewis P. Fuhrman, same place. Filed Feb. 16, 1891.

462,648. Threading-Rod for Underground Conduits. Frank G. Bolles, Washington, D. C. Filed Sept. 13, 1891.

The combination, in a conduit-needle or threading-rod, of a joint or coupling consisting of two ferrules having projections, the projection of one portion having one or more holes, and the opposite projection having one or more hooks.

462,660. Electric-Arc Lamp. Fred H. Carpenter, Boston, Mass., assignor to the Russell Electric Company, same place. Filed May 1, 1891.



462,673.—ELECTRIC ARC LAMP.

In an electric-arc lamp, a disc carbon and its holder journalled in a supporting-frame, which is attached to a carbon-rod, and a spring provided with a lip secured at one end to the frame, its free end pressing upon one end of the carbon-holder.

462,661. Electric-Arc Lamp. Fred H. Carpenter, Boston, Mass., assignor to the Russell Electric Company, same place. Filed May 7, 1891.

A detachable extension device for electric lamps provided with means for locking with the lamp and means for supporting the globe.

462,662. Carbon-Holder for Electric-Arc Lamps. Henry E. Chapman, Melrose Highlands, assignor to the Russell Electric Company, Boston, Mass. Filed May 1, 1891.

462,663. Pencil-Carbon Holder for Electric Lamps. Henry E. Chapman, Melrose Highlands, assignor to the Russell Electric Company, Boston, Mass. Filed May 7, 1891.

462,669. Stay for Suspended Electric Lights. Fred A. Johnson, Bath, Me., assignor of one-half to Francis W Weeks, same place. Filed July 21, 1888. Renewed April 18, 1891.

The combination, with the frame of a suspended electric lamp, of a stay composed of a coiled spring having its outer end looped and hooked for ready and quick attachment to suitable supports; and a detachable insulator connected to the inner end of the spring and open or divided, so that it can be attached to the side bars of the frame at any point without removing the end bars.

462,673. Electric-Arc Lamp. Edwin C. Russell, Boston, Mass., assignor to the Russell Electric Company, same place. Filed May 21, 1891.

462,677. Incandescent-Lamp Socket. Thomas J. Fay, New York, N. Y., assignor to the Maine Electrical Improvement Company, Brunswick, Me. Filed Jan. 22, 1891.

An incandescent-lamp socket comprising a cylindrical shell enclosing the lamp cut-out and having one end flared or bell-shaped, the outer edge of the flared portion being provided with fastening devices for holding a lamp-shade.

462,681. Electric Conductor. John A. Barrett, Brooklyn, N. Y., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed Jan. 8, 1891.

The combination of a conductor, a fibrous or meshed air-containing serving about the conductor, a sized envelope surrounding the served conductor, and sealing material outside the envelope.

462,698. Electric-Arc Lamp. John E. Giles, Hazleton, Pa. Filed Jan. 29, 1891.

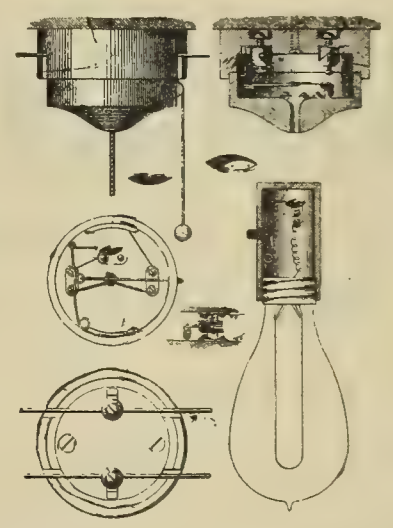
A cut-out for an arc lamp, provided with changeable connections, one set including the cut-out magnet in the main circuit, thereby opening the shunt-circuit on cessation of the main current, the other set closing a by-pass around the regulating-coils when the main circuit is interrupted, whereby the lamp may be used on constant-potential or constant-current lighting systems.

462,720. Telegraph-Table. Katie V. Miller, Lewisburg, Ohio. Filed Sept. 23, 1890.

The combination of a table-frame and revoluble table-top adapted to carry telegraph instruments, one of the parts carrying pairs of insulated contact-rings and the other carrying pairs of insulated contact devices, each ring having electrical connection in all its positions with one and only one contact device, pairs of instrument-wires secured to one set of the co-operating contacts, and pairs of line-wires secured to the other set.

462,741. Police-Signal-Telegraph System. Charles A. Rolfe, Chicago, Ill. Filed March 9, 1891.

A street signal-station comprising a sentry-box having an entrance-door which can be opened and closed by properly authorized officers, and a signal-case arranged upon the inner wall of the sentry-box and provided with a signal mechanism accessible for the purpose of sending signals both from the interior and the exterior of the sentry-box, the sentry-box being adapted to permit access to be had from its exterior to an operating member of the signal mechanism at the back of the signal-box, and the signal mechanism being arranged to be available for all of its uses to authorize officers



462,836.—MECHANICAL CUT-OUT.

who may enter the sentry-box, and having an operating member at its back also available for certain uses from the outside of the sentry-box, both to the officers and to the holders of citizens' keys to whom access to the interior of the sentry-box may be desired.

462,756. Carbon-Holder for Arc Lamps. James J. Wood, Brooklyn, N. Y., assignor to the Fort Wayne Electric Company, Fort Wayne, Ind. Filed Dec. 10, 1890.

A carbon-holder consisting of a hollow shell, two clamping-jaws adapted to grip the carbon between them at their lower ends, and terminating at their upper ends in contact with the internal surface of the shell, reacting against one another and adapted to tilt in clamping the carbon, and a tightening device for acting on the jaws to press their lower ends together and their upper ends apart.

462,786. Fire-Alarm Box. Edmund R. Wilder, Kansas City, Mo., assignor to the Wilder Duplex Electric Burglar Alarm and Messenger Company, of West Virginia. Filed Jan. 2, 1891.

462,808. Police-Signal System. Nathaniel B. Cregier, Chicago, Ill., assignor of one-half to De Witt C. Cregier, Sr., same place. Filed Nov. 26, 1889.

In a signalling system, the combination, with a central station, a street box connected therewith by a closed electric circuit, and a drop and a magneto bell signal at the station, both included in the circuit, of a mechanical generator, and a local battery, both also included in the circuit at the box for producing currents of different characters in the circuit, and a switch at the box for throwing the battery into the closed circuit for operating the usual signal at the station.

462,813. Signal Device for Telephone Pay-Stations. William Gray, Hartford, Conn. Filed Dec. 15, 1890.

In a telephone toll-collector, in combination, a signal-box, a signal sounding device located therein, an adjustable transmitter, and an extensible tubular connection extending from the signal-box to the transmitter.

462,834. Signalling Device for Elevators. Charles G. Armstrong, Chicago, Ill., assignor of one-half to Dankmar Adler, same place. Filed Jan. 17, 1891.

A visual signalling device located within the elevator shaft, an audible signalling device also located in the shaft, and means for actuating it, consisting of a push-button or equivalent device located at a doorway of the shaft outside of the latter, and operative connections extending from the push-button through the wall of the shaft to the signalling devices.

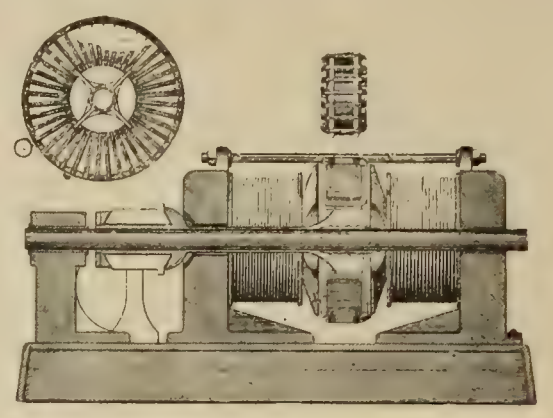
462,835. Electrical Indicator for Elevators. Charles G. Armstrong, Chicago, Ill., assignor of one-half to Dankmar Adler, same place, Filed March 10, 1891.

462,836. Mechanical Cut-Out. Harry W. Burnet, East Orange, N.J. Filed April 7, 1891.

In combination with the other operating parts of an electric switch, a switch-segment presenting successively in the path of the relatively-moving contact of the switch an insulating deflecting-face, a conducting deflecting-face and an insulating deflecting-face, a spring on the free end of the switch-lever or moving arm adapted to press the moving contact against the successive faces of the segment, a retracting device for the actuating mechanism of the switch, and a surface or notch between the first and second of the deflecting-faces on the segment adapted to prevent a backward movement of the switch contact from the second to the first of the faces.

462,880. Commutator. Sidney H. Short, Cleveland, Ohio. Filed May 26, 1891.

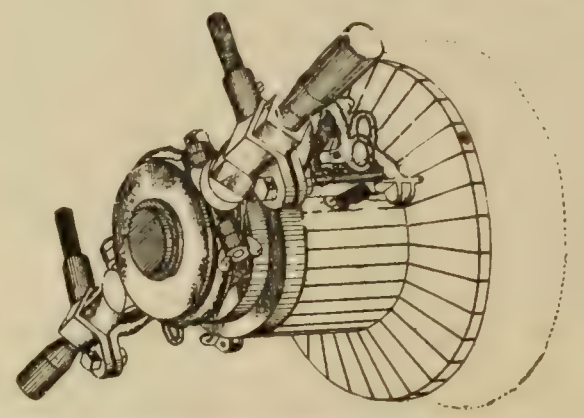
The combination, with a sleeve having an annular flange formed on one end and an adjustable flange encircling the sleeve, both flanges being constructed with inwardly-converging inclined or beveled faces of different angles of inclination, of commutator-bars having bevelled ends conforming to the inclined bearing-faces on the end flanges and a nut for securing the parts in place.



462,881.—ARMATURE.

462,881. Armature for Dynamo-Electric Generators. Sidney H. Short, Cleveland, Ohio. Filed June 12, 1891.

A ring-armature consisting of a laminated core constructed of ribbon wound upon itself, bobbins wound around the



462,673. BRUSH HOLDER.

core, and blocks or separators of non-magnetic material secured between the bobbins near the edges of the armature-core, thereby forming open air-spaces between the blocks and also insuring open air-spaces between the sides of the bobbins.

462,882. Armature for Dynamo-Electric Machines. Sidney H. Short, Cleveland, Ohio. Filed June 19, 1891.

A ring-armature comprising a laminated core slotted at its opposite edges, forming teeth, bobbins wound between the teeth, and flat magnetic rings secured to the sides of the armature outside of the bobbins.

462,883. Brush-Holder for Dynamo-Electric Machines. Sidney H. Short, Cleveland, Ohio. Filed July 6, 1891.

A brush-holder provided with bearings on opposite sides of the brush-rod or plate, one in advance of the other, and springs pressing the rod or plate against the bearings.

462,901. Duplex and Quadruplex Telegraphy. Francis W. Jones, New York, N. Y. Filed Nov. 11, 1885.

In a duplex or quadruplex telegraph apparatus, the combination, with a device for preventing mutilation of signals received on the neutral relay at the instant of reversal, of an induction apparatus whose secondary is connected with such devices, while its primary consists of two coils, one in the main and the other in the artificial line.

462,973. Brush-Holder for Dynamo-Electric Machines. Elihu Thomson, Swampscott, and William O. Wakefield, Lynn, Mass. Filed Feb. 20, 1891.

The combination of the commutator yoke having radially-projecting pins, insulating-sleeves on the pins, clamps radially adjustable on the sleeves, and brush-holders carried by the clamps.

463,001. Electrical Annunciator. Joseph B. Smith, Manchester, N. H., assignor to the Electric Gas-Lighting Company, of Maine. Filed Aug. 21, 1889.

In an electrical annunciator, the combination of two electric circuits, a movable plug or push-button adapted and arranged to close either circuit, an electro-magnet forming in turn a part of each circuit, a vibratory armature, a pawl-and-ratchet mechanism actuated by the armature, and a visual indicator carried by the ratchet.

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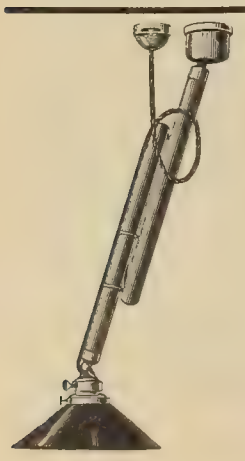
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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, NOVEMBER 28, 1891. No. 48.

RANKIN KENNEDY'S NEW ALTERNATOR.*

This alternator belongs to that class in which both the exciting and the generating coils are fixed, the revolving part consisting of laminating iron inductors. Machines of this class have been made by many inventors, such as R. Knight, Wheatstone, Henley, and lately by Kingdon on a large scale.

The points of novelty in this new machine are chiefly the arrangement of the coils of wire and the construction of the magnetic circuits, whereby only two exciting coils and only two generating coils are required in the machine, however large it may be made and however great may be the pressure and frequency of the alternating current required.

The machine very much resembles a transformer in its parts and is about as simple in construction. The iron field-magnet portions surround the copper coils, which are simple rings of insulated wires; the inductors are carried on gun-metal wheels, and in revolving alternately open and close the magnetic circuit round the copper coils, thus inducing current in them.

There is no reversal of magnetism in any part of the operation of the machine, only a simple rising and falling of the magnetic flow without reversal.

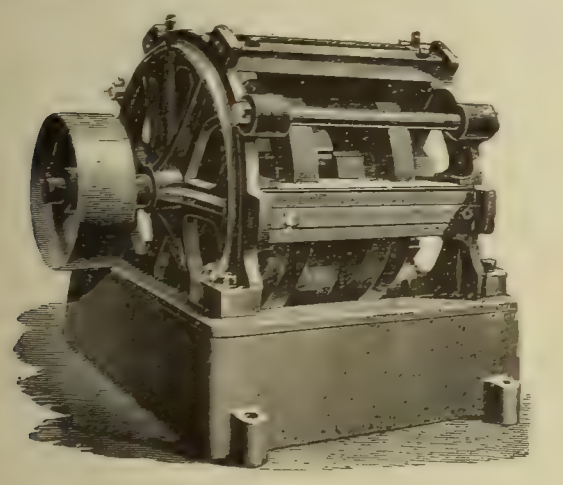


FIG. 1.

The iron is made of very ample sections, so that at no part of the magnetic rise is the density of the flow above the knee of the characteristic curve of magnetic permeability of the iron. And the magnetic flow never falls to zero—in fact, the machine may be said to work on the nearly straight rising portion of the curve of magnetism. The magnetizing force is steady, but the magnetic resistance varies with the position of the inductors, and so accordingly does the magnetic flow; thus, if the magnetizing force is represented by 1,500, and the magnetic resistance when the inductors have closed the magnetic circuit is equal to 2, then the flow of magnetism will be equal to 750. Then, on open circuit, the magnetic resistance may be 100, or say 50, then the flow can only be 30, so that we have a rise and fall equal to $750 - 30 = 720$ lines of magnetic flow; then according to Kapp's formula we get with 600 revolutions per minute and six inductors on each side, $E = 6 \times 600 \times 720 \times 10^{-6} = 2.6$ volts per turn of wire on the generating coil; these figures are hypothetical, taken to show the principle of this machine. In a machine recently built and here illustrated, the E.M.F. was 8 volts per turn of generating coil; the speed 750; the exciting current 15 ampères × 35 volts; the inductors six on each side; the total pressure was 2,400 volts with 300 turns of wire on generating coil; the output was 24,000 watts.

Fig. 1 is a perspective view of the machine; Fig. 2 is a perspective view of the inductors on the shaft; Fig. 3 is a view of one pair of coils, and Fig. 4 is a view of one of field-magnet blocks.

* London *Electrical Review*.

There are two pairs of coils in the machine and two sets of inductors, placed as shown in Fig. 2, one between the other; one pair of coils and one set of inductors would not do at all, as then the induction would be quite as great in the exciting coil as it would be in the generating coil, as they are both wound concentrically. First, the generating coil is wound up and insulated, then the exciting coil is

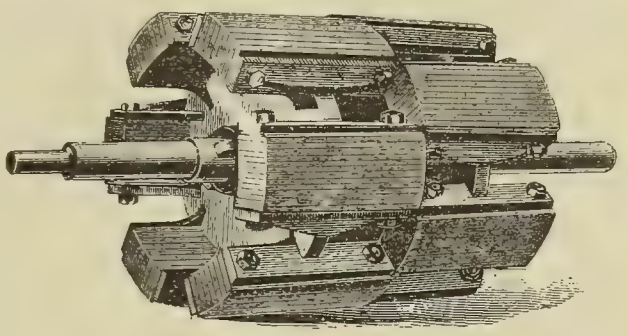


FIG. 2.

wound over or alongside that, and the whole insulated and fixed in the machine in the recesses formed in the field blocks, see Fig. 4, by using two pairs of coils and two sets of inductors, and exciting the coils so that the field blocks are magnetized with a pole in the middle and similar poles at each end, as marked in Fig. 4, where the two exciting coils are in "series" with each other; then any inductive effects on the one exciting coil are exactly and entirely neutralized by those effects on the other exciting coil.

The two generating coils can be coupled either in series or in parallel, but the exciting coils must, for the above reasons, be always in series.

This machine is claimed to be the cheapest and simplest alternator yet brought out; there is no difficulty with insulation, nor in constructing them for any pressure required, practically, and with any frequency.

In large dynamos there are four pairs of coils and four sets of inductors.

In the machine illustrated, the inductors are 21 inches across diameter, the coils being 21¼ inches inside diameter; the efficiency of the generating coil is equal to 1.35 volts per foot, working at very moderate magnetic flow on closed magnetic circuit and

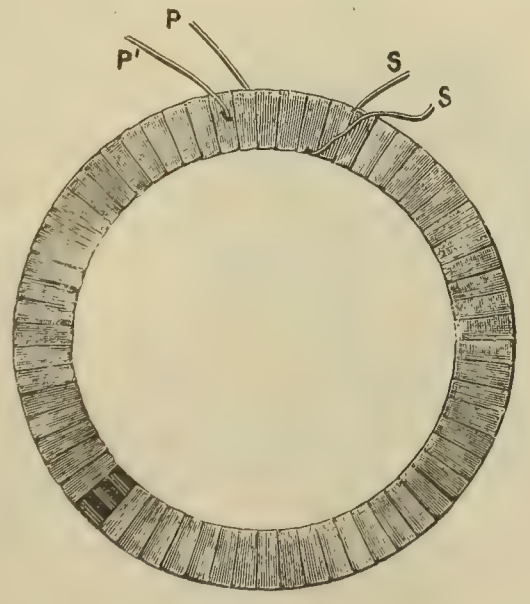


FIG. 3.

at moderate speed, and this efficiency can safely be raised to 2 volts per foot of generating wire in the coils.

For low pressure alternating currents this machine is equally applicable, and has the advantage of not requiring laminated copper for the coils however heavy the currents may be.

At central generating stations for electric lighting supply in districts where the station is surrounded by customers, it is a very good plan to use low pressure dynamos, to supply the immediately surrounding neighborhood direct from the dynamos, and to supply distant customers through step-up transformers.

As a motor, this machine works well, but has to be brought up to synchronism like all other reversed alternators.

A machine with inductors 6 feet in diameter gives an output of 150,000 watts at a speed of little over 200 per minute—100 volts 1,500 ampères; this is suitable for low pressure distribution round about the dynamo and high pressure to a distance with step-up transformers.

In Fig. 3, P^1 P are the terminals of the exciting coil, S^1 S are the terminals of the generating coils. By using only two coils in large slow-speed machines, it is expected that the complications hitherto met with in large machines are obviated, most of them requiring two generating coils for each ∿ per revolution. An ordinary machine making one revolution per second would require 200 coils to give ∿ = 100 per second.

A further advantage claimed is that the machine is easily constructed, of good mechanical design, the revolving part, Fig. 2, being of simple strong design.

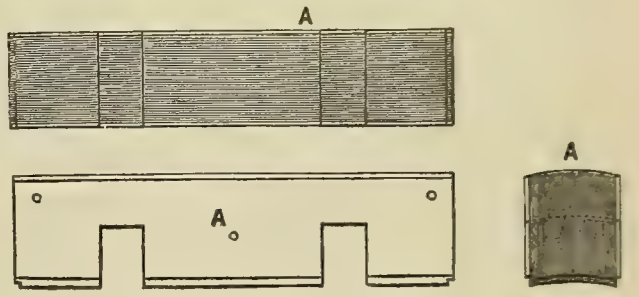


FIG. 4.

The machines are specially designed for the long continuous runs at central generating stations.

HOW TO GET PAYING LOADS FOR STATIONS.

BY PROF. W. D. MARKS.

(*Continued from page 645.*)

While all of our lamps are profitable to us as stated above, still there being a limit to the number attached there must be a sufficient margin of profit on the average to enable us to meet the demands for dividends, interest on and sinking fund for debenture bonds. We can neglect our floating indebtedness, as I am advised that there are enough quick assets to cover this.

Thus we have to meet the following demands the first year:

Sinking fund to retire debentures	$37,500
5% premium on the same	1,875
Interest on $300,000 at 6 %	18,000
Dividend 6 % on $1,000,000 stock	60,000
	$117,375
Am't cash surplus required each month	$9,781.25

The cash surplus for January is $12,766.69.

Thus you will see that this company is already on a dividend-earning basis.

As the sale of merchandise and isolated plants forms but a small part of the duties of those employés having the care of it and will not increase, we can neglect it as not forming a separate and important item.

We have connected 55,064 sixteen C. P. lamps and our gross income is $28,507.09, yielding us 51.4 cents per lamp per month, or 1.71 cents per lamp per day, the average burning of each lamp being 2.56 hours.

This gives us an average selling price of .668 cent per lamp hour.

Then for each sixteen C. P. lamp we have

Average income.....	1.71	cents	per day.
" cost 2.56 hours at .346c.....	.89	"	"
" profit per lamp	.89	"	"

Thus we see that we have reached a moderate dividend earning basis with an average profit of 82 cent per lamp per day, but the risk of the business and the long delay in obtaining any return for capital invested should make us give careful thought to any scheme which promises to enable us to obtain larger dividends.

Each director has offered to him an elaborate analysis of the record of each consumer, and those that are interested can judge for themselves of their value.

Assuming now that it is decided not to continue lights yielding less than .82 cent profit per day and thereby to raise the average above the present, we can construct the following table of prices, yielding the same profit each day:

Selling at per lamp hour.	Profit per hour.	Hours burning required.	Dis. from ¾c.	Remarks.
40/100c.	5/100c.	16 to 24	47%	The hours are given only with sufficient approximation for business purposes.
45/100	10/100	8 to 16	40%	
50/100	15/100	5 to 8	33⅓%	
55/100	20/100	4 to 5	27%	
60/100	25/100	3 to 4	20%	
65/100	30/100	2⅔ to 3	13%	
70/100	35/100	2⅛ to 2⅔	6%	
75/100	40/100	2 to 2⅛	Premium on ¾c.	
80/100	45/100	1¾ to 2	7%	
85/100	50/100	1 64/100 to 1¾	13%	
90/100	55/100	1½ to 1 64/100	20%	
95/100	60/100	1 36/100 to 1½	27%	
1 cent.	65/100	1¼ to 1 36/100	33⅓%	

The cost of lamps is about ⅓ the running expense of the station, and therefore the cost of a horse-power hour is 4½ cents. You are aware that we sell at 7½ cents, save in cases where a consumer uses more than 1,000 H. P. hours in four weeks, in which case he gets his power at 5 cents per H. P. hour for the same reason and upon the principles which I have set forth in the case of lamps.

Careful consideration of the table will convince you that there are cases of burning long hours in which apparently great concessions in price will result profitably to this Company, and, on the other hand, that there are consumers burning short hours who should be charged a higher price than ¾ cent or not be taken at all.

For instance, the Bullitt Building should be charged 1 cent per lamp hour to bring it to the average.

The Aldine Hotel averaged a return of 0.55 cent the first year, but this year has been using the light extravagantly. Its contract should be terminated next September, and no contracts taken based on the former gas bills in any instance.

Besides the greater profit of long hours, there are many advantages to the machinery apparent only to the engineer, which he will not state here.

Since the special order of this board of something more than a year ago, directing your engineer and manager to make all contracts for light and power, he has been guided by the principles set forth above, but now feeling that perhaps you would prefer to have others undertake this work, he is impelled by his interest in the welfare of this Company to enunciate them in writing and to beg your careful consideration of them before taking such action as might diminish the profits of this Company.

Very respectfully and truly yours,
(Signed) Wm. D. Marks,
Supervising Engineer and General Manager.

It is proper to add that we have not a dozen cases in our 1100 consumers in which any concession is made, and that we are actively engaged in getting rid of them, as full-rate consumers offer themselves.

We have had elaborate analyses of the value of each consumer made, and know exactly what he is worth to us.

It does not properly come within our province in this paper to discuss economy of production, but I will state what are the principles upon which the erection of the Philadelphia station was based.

Concentration of power, economy of running expenses, simplicity of design, certainty and regularity of action of machinery.

We use Armington and Sims' single-cylinder engines, making 220 revolutions and developing 440 H. P. at 150 lbs. steam ¼ cut off.

They have performed very satisfactorily, doing all that was promised for them.

Our dynamos are No. 60 Edison type, making 400 revolutions and developing 1000 ampères each. They have performed to our entire satisfaction, giving us great comfort since replacing iron bearings by phosphor bronze. They will pull a station through almost any short circuit that can occur.

Our boilers are the Abendroth & Root water-tube boilers. They have given us infinite trouble because of bad design and careless workmanship. In principle they are no worse than nearly all water-tube boilers at present sold in the United States.

Since being directed by the board to take the repairs out of the contractor's hands, I have completely rebuilt and refitted them, and am enconraged to believe from a three months' test that they will not prove dangerous hereafter.

They have been a great expense to the Company and a cause of much sorrow and distress to the writer.

Those of you who read the technical papers will be able to follow out in detail the cause of their frequent breakages.

Our underground system remains practically perfect wherever we have used the Kruesi tube or the Edison system. Cables, whether lead-covered or not, have given us great trouble and expense where we have been forced by the city authorities to pull them into wooden conduits.

It is far better to bury a cable in the ground than to put it into a street conduit which is not hermetically sealed.

Our services are three-wire lead-covered cables buried in the ground, and of the many hundreds now in I cannot recall a single instance of trouble from them.

To resume, in brief, I would say:

Put the price of light and power as low as you can, and thereby secure the permanency of your business as against competition.

Do no free house-wiring, but get others to do your wiring and make it profitable to them by offering premiums, if necessary.

Put no free lamps in first installation, but renew them free of charge.

Own your own meter and service. It is not good policy to let the consumer own the service.

Do not try to sell any particular make of motor, and be careful not to express any preference. Offer premiums to agents.

Sell current by meter, but have a minimum contract price to insure earning power of lamps and motors.

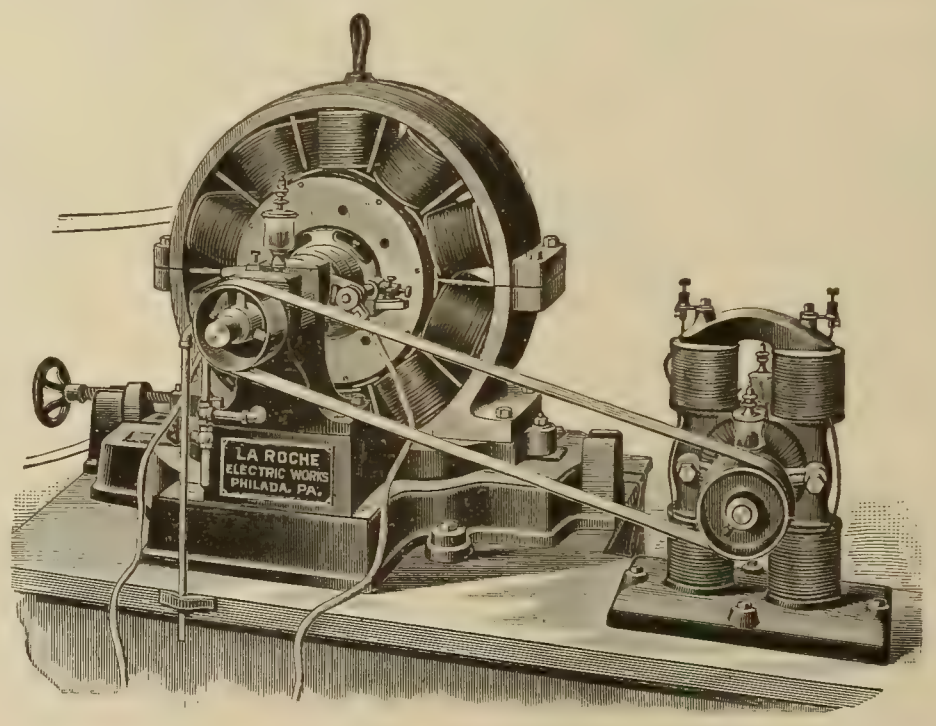
Above all things, always give a good light but not an excessive amount of it.

Don't talk with or write to consumers in a threatening way, who don't pay promptly.

Stand by the meter and cut off the light.

Be open and courteous in acknowledgment of errors and repair any injury unwittingly inflicted, regardless of consequences to yourself or the Company. Don't believe the statements of consumers until fully verified.

At the end of the second year from the start we find our Philadelphia Company on a solid dividend paying basis.



LA ROCHE ALTERNATING-CURRENT DYNAMO.

In any other enterprise of equal magnitude this would be called a great success.

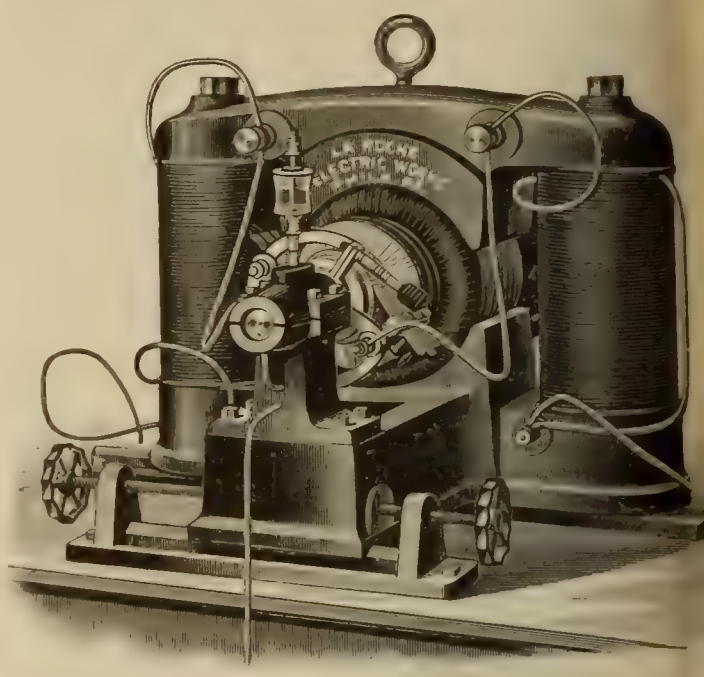
LA ROCHE ARC AND ALTERNATING DYNAMOS.

The arc dynamo, of which the illustrations given herewith give a clear view, is built by the La Roche Electric Works, Philadelphia, Pa. It generates current for fifty 2,000 C. P. lights.

During the present year there has been an active demand for these machines, and one of them, now running over three months with a load of fifty lights, is pronounced a remarkable success. A test recently made with a machine carrying a circuit of nearly forty lights showed that the number could be instantly cut down to even one light without an indication of variation of current in the lamp. Close regulation of this kind is a most desirable feature.

The armature is of simple construction, being built up of annealed iron wire as a core, and allowing of very free air circulation, so as to run perfectly cool. It has only seventy pounds of copper wire wound on it, and is run at a speed of 750 revolutions a minute.

This dynamo has an insulating base fitted with self-oiling bearings. It has an excellent automatic adjustable brush-holder. Carbon brushes are used, so that wear of the commutator is practically eliminated, and there is no sparking.



LA ROCHE ARC DYNAMO.

So well pleased is Mr. La Roche with this type, and so satisfactory has it proved, he is now building a 150-lighter to fill an order from Australia. This dynamo when finished will be one of the largest arc machines, if not the largest, in the world.

The second illustration shows the latest type of alternating dynamo placed on the market by this company. It is set on an insulated base, the belt-tightener being also insulated to avoid any possibility of accident, and is so constructed that in case it should be necessary to remove the armature the top or one-half the fields can be easily taken off by one man. The iron in the fields is made expressly for this purpose, and the coils can be taken off or put on without any adjustment whatever.

The armature has no iron supports, and the brushes and brush-holders are automatic and self-adjustable and are claimed to have absolutely no wear at the collector rings. The insulation is of mica throughout.

These machines are the closest in point of regulation of any in the market, and are made with special care as to electrical and mechanical construction. All bearings being self-oiling, the efficiency of the machine is very high. These machines are made in sizes from 100 to 2,600 lights capacity.

Application Denied.—The application of the Brush Electric Company of Cleveland, Ohio, to have its name stricken from the complaint in the suit of the Brush-Swan Electric Light Company and the Brush Electric Company against the Thomson Houston Electric Light Company, has been denied by Judge Shipman in the United States Court. The suit was for an alleged infringement of patent which the Brush Electric Light company Controls in the State of Ohio, and the latter company claims that its name was used in the suit by the Brush-Swan Company without its knowledge.

MEETINGS OF SOCIETIES.

THE MAGNETIC CLUB.

The autumn meeting of the Magnetic Club of New York was held at Martinelli's restaurant, 136 Fifth avenue, on the evening of November 18. In addition to a large attendance of members, representatives from various telegraph organizations in New York and other cities were present, making about 150 in all who sat down to dinner. After dinner was over speech-making and vocal and instrumental music were indulged in, and every person enjoyed himself. It was a successful meeting.

ELECTRICITY IN MEDICINE.

BY W. M. HUTCHINSON, M.D.

While during the past few years the wonderful advancement made in electrical science has been so great along lines that are industrial and commercial, and by the application of this force so much has been done to further the civilization and enlightenment of mankind, much has also been done during the same time in the way of discovery and observation of its action upon the human body, and of its properties as a valuable agent for the cure and relief of disease.

That medical electricity has developed slowly and has but lately come to occupy the high position that it deserves, is due to several reasons. In the first place, electricity has been for so many years the much-abused tool of the ignorant and unprincipled charlatan, that the physician of repute has hesitated in the past to take up and investigate this remedy, fearing that the rather unsavory reputation of being a "medical electrician" might be his.

For this reason, and from the fact that few, if any, of the medical colleges gave any instruction in the leading principles of electro-physics, graduating the practitioner with little or no knowledge of the nature of electricity or of the laws governing its manifestations, it has been only of late that physicians have given attention to the *technique* of the science of electro-therapeutics, and are now rapidly placing it upon a true and rational foundation, and not merely an empirical basis.

Most important of all reasons, however, why electricity has been thus neglected as a remedial agent, is the fact that it has been only during recent years that the electrician has opened the field for accurate observation, by devising and perfecting measuring instruments of precision and convenience, whereby the physician can determine measurements, first, of the relative difference of current strength and potential, and, of equal importance, the resistance of the various tissues and parts of the body that he wishes to act upon. At the present time, thanks to this assistance from the electrical engineer and instrument-maker, the subject is being rapidly taken up by the rank and file of the profession. Thorough and systematic courses on electro-physics and electro-therapeutics are being given in the colleges, the literature of the subject is becoming replete, and observers all over the country are convening from time to time in local and national organizations, to discuss prevalent ideas and present original ones.

In an article of this nature only a brief *résumé* can be given of some of the more important actions of electricity upon the human body, and a slight account of the uses to which it may be applied medicinally.

Inasmuch as the different manifestations of electric energy produce different effects upon the organism, it may be convenient to consider them separately, and in the following order: First, frictional, or static; second, current, or galvanic; third, induced, or faradic.

The exact position that should be given to the static electric charge is still under discussion by electro-therapeutists. Its primary action, manifested upon the skin and sensory nerve terminals, is one of gentle stimulation or irritation, followed by a secondary state of sedation. It does not penetrate below the surface, because of its tremendous voltage but almost infinitesimal quantity.

Its effect does not appear to be different from any mild cutaneous irritant, such as friction, cold bathing, the needle-douche of the Turkish bath, and so on. Yet that it will, if properly applied, relieve many forms of nerve-pain, such as functional headache due to loss of equilibrium of the blood-pressure, or the neuralgic pain due to a congested spinal cord, there can be no doubt. It is also certain that this form of electrification will act in a curative way in many slight forms of functional disturbance, especially such as are of an emotional or hysterical character. This is not from any action of the electricity itself, however, but is due to the profound mental impression that is produced by the application or withdrawal of sparks from the body.

The attentive expectancy thus induced, together with the active working of the imagination, serves often to bring about a true "faith-cure," but in a perfectly legitimate way.

In taking up the numerous adaptations of the galvanic current to the diagnosis and cure of disease, we enter a field that is large indeed and that is constantly growing. We find that this form, being obtainable at a low "pressure" and in large quantity, will traverse the human body readily and produce its effects upon deep as well as superficial structures. In such passage it meets with considerable resistance, as the body tissues, especially the skin, are poor conductors.

This resistance varies greatly, but averages about 2,500 ohms, when the skin is moist. Among other effects of the current is the acceleration by catalysis of the numerous chemical changes and reactions that are constantly taking place in every portion of the body.

Inasmuch as it is probable that every one of the many complex and varied functions that every tissue and organ of the body is constantly performing is always accompanied by chemical change, it is evident that an agent capable, by catalytic action, of causing decompositions outside of the body, as for instance the splitting up of water into oxygen and hydrogen, must also accelerate and induce the metamorphoses that are taking place within the body. If the current employed be mild, the series of constructive changes called nutrition are assisted by its action, and increase in size and strength of the part galvanized will follow. On the other hand, if a current of considerable intensity be passed through a part, the electrolytic action is destructive, causing decomposition of the tissues, followed by their breaking down and disappearance by absorption. This is exactly what is desired oftentimes, when a removal of tissue is necessary, as in the case of tumors, contracted passages, or hair follicles developing in unsightly places. By using small-pointed electrodes here, concentrating the current, the wished-for loss of structure may be accomplished without any of the shock or hemorrhage usually accompanying a cutting operation.

Another of the effects of the continuous current is its action in conveying fluids through different parts to which it may be applied, and always in the direction in which the current is flowing. This is known as cataphoresis, and depends upon the peculiar property of this current of promoting the interchange of fluids through animal membranes called osmosis. In this way medicinal substances in solution may be carried directly into the deeper parts that may require the direct or immediate action of the drug. This method of applying medicines somewhat resembles that of hypodermic injection, but possesses many advantages over it oftentimes.

There is still another effect produced by the galvanic current, which, unlike those just described, does not immediately cease when the current ceases to pass, but persists for a varying time. This is an effect upon the walls of the blood-vessels, and upon the nerves supplying them, by which the blood's circulation is stimulated, causing a better blood-supply to the part, followed by an increase of its nutrition. This electrotonic action, so-called, is also sedative in its action if the part that is in a state of increased molecular activity be placed in contact with the negative pole, and in this way severe pain may be relieved; or, if the entire body be irritable, as from fatigue, general galvanization will produce a feeling of invigoration and delightful comfort. It is but fair to say, however, that there is considerable difference of opinion among physicians as to whether this increased excitability or increased sedation, according as the positive or negative pole is applied, is of benefit to tissues that are the seat of disease, or not. If the current that is passing through the body be rapidly made and broken, or if it is of the alternating variety, the excitement and stimulation of the tissues is much greater, and if this interrupted or reversed current be somewhat intense, the shock produced upon the body is very severe. When mild, if it is applied to an organ or muscle, the nerve leading to, or even to the part of the brain from which such nerve arises, it will excite a manifestation of the function of the part, without any exercise of the will. This is true of muscles motionless from paralysis, or even after death, for a time; thus a frog's heart may be kept in motion for some hours after decapitation, by the passage of a mild interrupted current. The organs of special sense may be caused to functionate, and flashes of light, salty tastes, ringing sounds, and it is claimed peculiar odors may all be perceived by sending this current through the nerves of the eye, tongue, ear or nose. Furthermore, as in the case of involuntary movement of muscles, sensations of light, touch, sound, taste and smell may be excited by applying it to different portions of exposed brain surface.

As an aid to the diagnosis and treatment of many organs, by furnishing illumination the constant current is being made use of very largely by physicians and surgeons. The eye and ear may be examined and treated by electric light, the rays being reflected directly into them from a lamp upon the forehead of the operator, or the lamp may be mounted upon a suitable instrument and carried into a hollow organ, as the stomach or bladder, and by means of reflectors and condensers the interior of these organs examined visually. The parts so explored may be operated upon by cautery instruments, heated by the same current, and various surgical procedures executed with the white-hot platinum loop or knife, which would be absolutely impossible without the aid of electricity.

As a source of motive-power also, for driving revolving surgical and dental instruments, such as saws, trephines and drills, at the necessary speed, electricity is proving of the greatest value to the practitioner.

The third variety of electricity, the induced or faradic current, produces effects about the same as the rapidly interrupted or reversed galvanic, provided the latter current be of small volume and high E.M.F., but the faradic form is vastly more convenient, as it is generated by a much less cumbersome apparatus.

To briefly summarize the actions of these currents, then, we may say that chemical effects depend upon current quantity and tension, while mechanical effects, such as the contraction of muscles, are governed by the rate of electrical change in the nerves of motion.

In closing this slight account of some of the ways in which electricity affects the human body, and of a few of its many applications as a therapeutic agent, a word may be said concerning its use in the capital punishment of criminals. From what has been observed by examination of the bodies of those dead by electricity, and from experimentation upon lower animals, we are absolutely certain that the alternating current at least, when of sufficient intensity, will instantly and permanently destroy all vital activity in every cell and portion of the body, and this without any burning, laceration or other damage of any part. The suddenness, the certainty, the painlessness, and the absence of abhorrent methods or surroundings, insures to this form of execution the heartiest indorsement of every physician, every electrician and every advocate of humane methods who investigates it.

AN IMPORTANT TELEPHONE PATENT GRANTED.

Letters patent were granted by the United States Patent Office, on the 17th inst., to Emile Berliner for a combined telegraph and telephone. This patent has been pending since June 4, 1877, and will have a very important bearing on the telephone industry in the future. Mr. Berliner has assigned this patent to the Bell Telephone Company, and it is said that the latter believes that this patent covers features which are necessary to the practical operation of telephones. On the other hand there are many who take the opposite view and claim that when Bell's basic patent expires, which will be on March 7, 1893, other practical telephones will be forthcoming which will in no way infringe the Berliner patent.

"The issue of this patent," says a Washington dispatch, "is the second step taken by Commissioner Simonds, and possibly the last which it will be necessary to take practically to dispose of a long-existing tussle of telephone litigation in the Patent Office. The first step was his decision of Oct. 29, 1891, denying a telephone patent to Daniel Drawbaugh on his application of 1880, because that invention had been in public use for more than two years prior to that application, and also because the Supreme Court had decided that Drawbaugh did not invent the telephone. Berliner's application has been in a number of interference suits with other applications, among others one of Edison from 1878 to 1886. For a number of years past it has been held in the office by the application of Drawbaugh, it being necessary to put it into interference therewith, if Drawbaugh otherwise established his right to a patent, which he failed to do. It is said that, with Drawbaugh out of the way, the Berliner patent was entitled to issue as a matter of course. Every other question in the case was finally adjudicated years ago."

FOREIGN NOTES OF INTEREST.

A project is being favorably considered by the Municipal Council of Berlin, with the object of the establishment of an electric boat line on the river Spree for passenger traffic.

Mr. Lindley, the President of the Test Committee of the late Frankfort electrical exhibition, stated recently that the Lauffen-Frankfort plant successfully transmitted current at 27,000 volts.

At the present time two thousand dollars' worth of platinum is used daily in the United States in the manufacture of incandescent lamps.

THE ELECTRICAL AGE
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BERLINER'S TELEPHONE.

The history of the telephone in the U. S. Patent Office is a remarkable one. The telephone, from its infancy to the present time, has had a stormy career as far as the patents are concerned, but through all the fights and obstacles the man with whose name it is inseparably linked came out victorious.

The telephone is one of the greatest inventions of modern times; directly it has greatly facilitated the transaction of the busy world's commerce, and added much to the comfort and entertainment of a large portion of the people, and indirectly it has opened up new fields of scientific investigation, which were hardly dreamed of prior to the birth of the telephone.

A few far-seeing ones at the beginning appreciated the immense value of the telephone; but a vast majority saw nothing in it. As soon as the infant industry began to develop into a gigantic affair, however, the attention of capitalists and inventors was soon directed in that line, and it was not long before interferences, etc., incidental to all successful inventions, began to make their appearance.

The history of the patent litigation over the telephone is too lengthy for us to refer to particularly at this time, but the famous Drawbaugh case is still fresh in the minds of our readers. There are many who believe that the decision of the Supreme Court in that case was not in accordance with the facts developed during the hearing, and that Drawbaugh was clearly entitled to the patent. As to that, every man is entitled to his own opinion, but certain it is Prof. Alexander Graham Bell stands to-day in the eye of the law as the one justly entitled to the honor and profit accruing from the invention.

Emile Berliner, of Washington, has figured prominently at different times in the development of the telephone. In 1877 he applied for a patent on a combined telegraph and telephone, and this application has been pending since that time until November 17 of this year, when the patent was finally granted. This patent Mr. Berliner has assigned to the Bell Telephone Company, and the latter claims that it covers features necessary to the practical use of the telephone. On the other hand, there are many inventors who claim that a successful telephone will be produced after the expiration of the basic Bell patent on March 7, 1893, which will in nowise infringe the Berliner patent. If this is true the effect will be, as it appears to us, to remove the monopoly on the speaking telephone and place it under the head of "public property." In any event litigation will likely be renewed, based on the Berliner patent, and what will be the outcome no man knoweth.

It is said that the issue of this patent to Mr. Berliner is the last step necessary to dispose of the long-continued telephone litigation, but whether it will prove to be the last step or not remains to be seen. The Berliner patent will no doubt add fresh fuel to the slumbering flame, and March 7, 1893, may mark another period of legal activity in the telephones' history.

ELECTRICITY AS A CURATIVE AGENT.

The action and effect of the electric current on the human body is a subject very little understood by most people. The same may be said of drugs as used by physicians, and the reasons for it are the same in both cases. A sick man calls in a doctor when he requires a doctor's care and advice, and he does not depend upon his own knowledge of therapeutics to diagnose his own case and apply the proper remedy. To the physician's art, therefore, electrotherapeutics properly belongs, and it is to the general acknowledgment of the truth of this proposition that the existing ignorance on this important subject may be ascribed.

Electricity is now acknowledged by the rank and file of the medical profession to be a most valuable agent for giving relief and effecting cures in disease or physical ailments, and thorough and systematic courses on electro-physics and electro-therapeutics are now being given in the medical colleges.

Outside of the medical profession little attention has been given to the study of the action of the electric current on the human system, and it is for this reason that the article we print elsewhere in this issue from the pen of Dr. J. M. Hutchinson, of the Long Island Hospital in Brooklyn, on the subject of electricity in medicine, is of especial interest.

This article is written in clear, concise language, and we commend it to our readers as worthy of their careful thought.

The different classes of current, and the effects produced by each on the organism, are considered.

Static electricity acts primarily upon the skin and sensory nerve terminals, and does not penetrate below the surface. When properly applied it will relieve many forms of nerve pain, but the cure is not due directly to the electric current itself, but to the profound mental impression that is produced by the application and withdrawal of the current from the surface of the body.

The galvanic, or constant current, electricity produces effects upon deep as well as superficial structures. It accelerates by catalysis the numerous chemical changes and reactions that are constantly taking place in the body. If the current be mild, a series of constructive changes, called nutrition, are assisted; but if the intensity of the current be too great, its action on the tissues is destructive, causing their decomposition and final disappearance by absorption.

Another very important action of the galvanic or continuous current on the body is known as cataphoresis, which depends upon the peculiar property of the current of promoting the interchange of fluids through animal membranes. By this means liquid medicines or drugs can be carried to the deeper parts requiring the direct action of the drug.

The faradic or induced current produces effects similar to those of a rapidly interrupted galvanic current.

In summarizing the action of the currents mentioned it may be generally stated that chemical effects depend upon current, quantity and tension, while mechanical effects, such as the contraction of the muscles, are governed by the rate of interruption or change of current.

Dr. Hutchinson closes his excellent article with an expression of opinion regarding the use of the electric current for the execution of criminals. He states that it is certain that a proper alternating current will instantly and permanently destroy all vital activity in every part of the body, without damage of any nature.

KENNEDY'S NEW ALTERNATOR.

We describe and illustrate on another page in this issue the new alternating-current machine, lately brought out by Mr. Rankin Kennedy, the eminent English, or rather Scotch, electrical engineer, for his factory is in Glasgow.

Mr. Kennedy is one of the foremost investigators in that department of electrical science relating to alternate currents, and he has made many inventions in alternating-current apparatus, including motors, meters, transformers, etc. The machine under consideration is of that class in which both the generating and exciting coils are fixed, the revolving part consisting of laminated iron inductors.

The arrangement of the magnetic circuits and the coils of wire are the chief points of novelty in this machine. There are only two exciting and two generating coils, and this number remains invariable whatever the size and output of the machine may be.

In one respect this alternator resembles a transformer. The copper coils, which are simple rings of insulated wire, are surrounded by the iron of the field-magnet portions, and the inductors, in revolving, alternately open and close the magnetic circuit round the copper coils, thus inducing currents in them. The flow of the magnetic lines is always in one direction, and not alternating as in other alternate-current generators; they simply rise and fall, and there is no reversal of magnetism in any part of the machine.

This alternator has a wide range of application, and, according to the description, it appears to be a remarkably simple one. It also works well as a motor, but must be brought into synchronism.

Great advances have been made by foreign electricians in the development of apparatus of this class, and this last type seems to possess many features of interest and practical value.

OPERATING MOTORS EFFICIENTLY UNDER VARYING CONDITIONS.

On another page in this issue we print a paper by Mr. H. Ward Leonard on his new system of operating an electric motor automatically at any desired speed or torque, and with maximum efficiency under all conditions.

The first public exhibition of this system in practical operation was at the International Electrical Exhibition held in Montreal last September, and it was briefly described at the time in the daily edition of the ELECTRICAL AGE and STREET RAILWAY NEWS, and later in the regular weekly issue of the same paper.

The system has attracted considerable attention among practical electrical engineers, and at first sight the object sought would seem to be a most difficult one to attain, but according to all reports all that is claimed for it is being realized.

Mr. Leonard, in his paper, goes into the subject with considerable fulness, and explains in a clear manner the various applications of the system, under different conditions.

The paper, no doubt, will be read with great interest, being, as it is, the first and only detailed description of the new system.

A MOTOR OPERATING AUTOMATICALLY AT ANY DESIRED SPEED OR TORQUE AND WITH MAXIMUM EFFICIENCY UNDER ALL CONDITIONS.

BY H. WARD LEONARD.

In the operation of electric motors there are three principal factors to be considered—the speed, the torque, and the efficiency. Under any variations in power the efficiency should remain as nearly constant as possible. For one class of work it is desirable to keep the speed constant when the torque varies. For a second class of work it is desirable to keep the torque constant at one particular amount when the speed varies. For a third class it is desirable to operate at many different speeds, and yet automatically at any particular speed desired regardless of the torque. For a fourth class it is desirable to operate at many different torques and yet automatically at any desired torque regardless of the speed; and for a fifth kind it is desirable to keep the amount of power supplied constant, regardless of a change in torque—that is, so that if the torque changes by the requirements of practice, the speed would automatically change so that the power consumed would remain constant.

The shunt-wound motor, operating on a constant potential circuit, is well adapted to the first class of work mentioned, where but one fixed speed is desired, practically regardless of the torque and with a practically constant efficiency.

The second class of work mentioned, having one particular constant torque and a speed variable at will, cannot be performed by existing electric motors without great sacrifice of efficiency. In this class of work we find hoists lifting a constant weight, certain printing presses, swing bridges, stamp mills, pumps, etc.—that is, such work as requires that we should start up from dead rest with full torque and run at any desired speed with the same torque and with perfect efficiency.

The third and fourth classes of work are more common than would at first appear evident, but since neither the steam-engine nor the water-wheel can be operated under conditions where both speed and torque will vary, and where the speed or torque can be held automatically fixed at any point desired, regardless of variation of the other, we do not find work of this kind existing in such shape as to be operated by an electric motor instead of some other power. Nor has the electric motor been available for such duty heretofore. A familiar instance of the third kind of work is met with in the printing of fabrics, where the presses have a large number of rolls upon which the torque depends, and the speed of the presses must be varied as desired, and yet at any given speed must hold that speed constantly, regardless of the number of rolls set down—that is, regardless of the torque. Similarly, lathes, drill presses, wood-working machinery, etc., belong to this class. Certain variations in the speed are possible by existing methods by the use of cone pulleys and equivalent devices, but no motor of any kind has heretofore existed which, directly applied, would conform to the requirements of this kind of work.

The fourth kind of work has, as a familiar example, the passenger elevator, where the weight, and consequently the torque, is variable, and where at any torque the speed should be controllable at will, with constant efficiency. Another example is the pumping of water against a variable pressure with the speed controllable at will, and independent of the pressure. This result is not obtained directly by any motor to-day.

The fifth class of work, where the speed is automatically varied to keep the power consumed constant, no matter how the torque varies, is not met with in practice as far as I know, yet oftentimes we may have a constant source of power from which we wish to get a torque variable to the requirements of a variable load and do not care particularly about the speed. An electric street railway operated by water-power is a familiar example of this class of work.

It will be seen from the above that of the five principal classes of work there is only one, namely, constant speed and variable torque, which we can take care of with reasonable efficiency and from our existing supply circuits.

It is well known that when a street car is first started and is scarcely in motion the actual power represented by such motion is almost nothing; for, although the pounds pull is large, the feet per minute is extremely small; consequently the power required must be exceedingly small. What do we find in practice? We find that in order to develop a power of but a fraction of a horse-power we must, on account of the slow speed demanded, develop about 30 H. P., and then waste about 98 per cent. of this H. P. in order to utilize the remaining 2 per cent. in the way it is desired. The efficiency of the modern electric street car is not probably more than 2 per cent. when just starting from dead rest and moving at the rate of one-half foot per second.

When we come to investigate this, we find that the explanation is that in order to get the necessary large torque with freedom from excessive sparking we must have a very large current in a nearly constant field; and since our E. M. F. is constant we must use an amount of power which will vary almost directly with the torque, and will be regardless of the speed. Or, in other words, the efficiency of the motor will vary directly as the speed with an efficiency of perhaps 80 per cent. at full speed.

As a result of my investigation of this subject I have concluded that the operation of electric motors should conform to what, apparently, is a new law and which may be stated as follows:

Vary the voltage as the speed desired.

Vary the ampères as the torque required.

In other words, make the speed dependent upon the voltage only and independent of the current, and make the torque dependent upon the current only, and independent of the voltage. Since the product of the speed and torque represents the work being done, and the product of the volts and ampères represents the power supplied, it is evident that if we can operate in conformity to this law, we shall have a constant efficiency under all conditions, disregarding, of course, the small fixed losses in the field and armature.

One way in which this law can be followed is to supply the field of the motor from one source of electric energy and supply the armature from another source, the E. M. F. of which can be varied. It will be noticed that when the speed is fixed a fixed voltage will be necessary in order to conform to the law, and the shunt motor is found to conform perfectly to the law, but it is the only motor I know of which does conform to the law which seems to be generally applicable.

A simple case will be the operation of a printing press for printing fabrics. Suppose the press has 10 rolls—that is, the torque will vary from 1 to 10 in amount. Suppose, also, that it must be run at any speed from that represented by 1 to that represented by 20, and at any speed it must hold its speed constantly, whether 1 or 10, or any intermediate number of rolls be brought into use. Also that the efficiency must be independent of the speed or torque. In order to conform to the law in a simple way, we will install a generator and motor of the same size and connect their armatures by two conductors. We will supply their fields from a small separate exciter in the shape of a shunt-wound dynamo. In the circuit leading to the field of the generator we will place a rheostat. If, now, we drive our generator at a constant speed, the E. M. F. it will produce will depend upon its field, which in turn will depend upon the amount of resistance in the rheostat in its field circuits. The strength of the motor field is constant, being supplied by the constant E. M. F. exciter. Now, evidently the speed of the motor will depend solely upon the E. M. F. supplied to its brushes, and this can be varied from 0 to the maximum limit by varying the rheostat, which will preferably be placed beside the motor itself. The current will automatically vary in proportion to the torque, the speed will vary directly as the voltage, and the efficiency will be constant and independent of the speed or torque.

If we wish to operate an elevator from central station conductors of constant E. M. F., we supply a shunt-wound motor mechanically connected directly with a generator, whose armature is connected to the armature of the elevator motor. The field of the generator is supplied from the central station conductors, but a loop goes up to the elevator car, where a rheostat and reversing switch is placed, so that the E. M. F. of the generator can be varied and reversed at will. The field of the elevator motor is excited from the line constantly.

It will be evident that we can control the elevator perfectly from the car and run in either direction, at any desired speed, and with perfect efficiency. It is worthy of notice that the non-sparking point is entirely independent of the speed, and that for any particular weight the non-sparking point is absolutely fixed and independent of the power used. Also that, since the maximum weight alone determines the maximum ampères, it will be impossible to send more than the normal full load in ampères through the armature; consequently the liability of burning out of armatures is reduced to a minimum. The elevator in coming down generates current to assist the central station, and since the efficiency is practically constant under all conditions, and since as many foot-pounds of work are done by the elevator in descending as it requires in ascending, the consumer will in reality pay only for the energy wasted in charging the fields, in heating the armatures, and that represented by the friction of the gearing, which will be the least possible. The starting up of the elevator requires a minimum of power, and hence does not subject the central station to large, sudden fluctuations of load.

Suppose we want to operate a swing bridge by an electric motor. We connect as in the case of a printing press, but instead of a hand field rheostat we use an automatic field rheostat, such as is used by the Edison Company. We place an ampèremeter in the armature circuit of our motor, and when the ampèremeter needle indicates full load it touches a contact leading to the relay magnets of the automatic rheostat, which causes it to throw in resistance in the field circuit of the generator and reduce its E. M. F. Similarly, just below full load, the ampèremeter needle makes contact, closing a circuit in the automatic rheostat so as to throw out resistance and raise the E. M. F. of the generator.

To start up the bridge we insert all of our resistance in the field of the generator and have, let us say, no volts. Now we close the main-line switch to the motor; we will have no current; hence the ampèremeter needle will be on the lower contact, which will gradually throw out resistance and cause the generator to generate an E. M. F. The current will increase and will finally cause the needle to leave the lower contact. The full torque is now being developed and the bridge, if the motor be of proper size, will start to move. As it does so, the counter E. M. F. of the motor will tend to reduce the current, but this will cause the needle to again make the lower contact and raise the E. M. F. and speed and hold the current and torque constant.

Thus the bridge will start from rest with a minimum of power but full torque, and will gradually accelerate in speed until the full E. M. F. and speed of the motor is reached. To vary the speed by hand we merely move the ampèremeter needle to make either contact desired. In case the bridge should meet an obstruction which would slow it down, the ampères would not increase, but would remain constant, as the volts would be immediately and automatically reduced to just that amount necessary to keep the ampères constant. With this arrangement it will be practically impossible to overload the motor armature.

Another good application of this method of keeping the torque constant will be in any case where a tool is cutting certain material which may vary in hardness or when the feed may vary. If the torque be kept constant it will be impossible to break the cutting tool or injure the apparatus. An electric coal-cutter is a case in point. The cutter may be advancing through slate, fire-clay or coal, and occasionally it will meet a layer of hard iron pyrites, known in the mines as "sulphur." This may stop the cutter-bar entirely, and with an ordinary or series or shunt motor the result would probably be a burnt-out armature. With the system I have described the current would be constant in any event and the cutter would automatically go faster in softer material and slower in hard material.

In pumping by an electric motor operated on this system the head alone determines the torque, and hence the current. Consequently, for any lift the non-sparking point will be fixed and the number of strokes per minutes can be controlled at will from 0 up to the maximum by varying the volts.

For operating an electric railway we will place a shunt-wound motor on the car, and directly driven by this motor will be a special generator, which will be connected to the electric motor below the car. It is evident that the generator and working motor armatures may be wound for any voltage desired, say 20 volts, which will make the problem of insulating the street-car motor an extremely simple one. If desirable, we can supply several cars of a common train from one special generator on the forward car. With this outfit we will be able to take any car up any practicable grade or around any curve with no more power than is required to move the car on a level, and always consume the same power, regardless of weight, grades or curves. That is, the automatic increase of current, to take care of any increased torque, will be compensated for by a corresponding decrease in the volts and speed. We may start a car up on any grade or curve with but a small fraction of the power required for normal speed on a level.

I wish to call attention to a very important development leading out from this, namely, that we will be able to use alternating currents for operating our street cars, for it is well known that the ordinary alternating current generators will operate perfectly as motors, if the speed and torque be kept constant. Since by this system we can, from a constant torque and speed, get any other torque and, automatically, a corresponding speed, we shall be able to run street cars perfectly by alternating currents. This again will enable us to dispense with trolleys, conduits, storage batteries, etc.

[*To be continued.*]

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE AND STREET RAILWAY NEWS, FIRST FLOOR, WORLD BUILDING,
NEW YORK, Nov. 21, 1891.

Bartlett & Co., the engravers, moved to 21 and 23 Rose street on the 16th inst.

The United States Volta Battery Company, 36 Wall street, this city, was sold out at public auction on the 18th inst.

E. T. Copeland & Co., the well-known agents for the Ball and Case engines, have removed from 106 Liberty street to Room 518, Metropolitan Telephone and Telegraph Building, 18 Cortlandt street, where they will continue handling the same line of goods as hitherto, but will carry no goods in stock.

Thompson & Robertson, 261 Broadway, city, manufacturers of the popular fibrous battery for open circuit work, report that they are flooded with orders for this well-known cell. The battery is for sale by all dealers in electrical supplies throughout the United States and Canada, from whom the manufacturers are constantly in receipt of large orders.

The Zucker & Levett Chemical Company, 40 Murray street, New York, has quite an attractive exhibit at the American Institute Fair, under the charge of Mr. Max Mayer, the company's electrician. One of the features of this exhibit is its compactness, showing the possibility of small isolated lighting. A one horse-power Hercules dynamo is driven by a Case engine, and the dynamo supplies current to operate a one-half horse-power motor, which drives a Gould pump and two ⅛ horse-power fan outfits. Besides this it furnishes current for 19 incandescent lamps, the entire current generated being equivalent to that necessary for 32 lights. The company also has on exhibition several fireproof starting-boxes. On a board are sample field and armature laminations set in their relative positions. The Hercules Standard motors and dynamos are doing good work and are highly efficient machines. They are simple in construction and automatic in regulation, and there is practically no sparking at the brushes. In our issue of July 25 last we described these machines with considerable fulness. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 52
American Telephone Co	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	†20 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	204 00
Bell Telephone 7s	2,000,000		*113
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	40 00
Brush Elec. Ill. Co., N. Y	10,000	100 00	†60 00
Brush Illuminating, N. Y	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	18 50
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	140 50
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	99 25
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000	50 00	*100
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	25 00
Detroit Electrical Works	1,000,000	10 00	9 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*98
Edison Elec. Ill. 6s, N. Y	30,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Elec. Ill. Convt. Certs	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	95 25
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Erie Telephone	4,800,000	100 00	46 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*101
Fort Wayne Elec. Co	4,000,000	25 00	12 25
Freeman Electric Motor Ry. Co	250,000	25 00	8 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	125 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*104
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	19 25
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*80
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*94
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N. Y	1,000,000	100 00	40 00
Morristown L. H. & P. 5s, N. J	17,500		*100
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. L	150,000	100 00	100 01
Nat'l Lead Trust	9,000,000	100 00	16 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	49 50
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*99
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	†20 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50,000		*95
North American	39,767,200	100 00	17 50
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light, N. J	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	4 50
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref. N. Y.	100,000	100 00	105 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	47 00
Thomson-Houston pref	4,000,000	25 00	26 00
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
Twin City Rapid Transit, N. J	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100,000	100 00	75 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188,852	100 00	82 50
Westinghouse Electric Co	7,000,000	50 00	13 00
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	
West End L., Boston	13,550,000		16 00
Yonkers L. & P	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

CHICAGO NOTES.

The Chicago Electric Motor Company, 205 and 207 South Canal street, B. D. Southard, president and manager, has a 150 horse-power generator in the shops for repairs, and another large generator is on the way from one of the electric street-railway companies, also for repairs. Mr. Southard's assistant, Mr. J. G. Hart, is now in Ohio making some repairs on a large generator. The Chicago Electric Motor Company manufactures motors for all kinds of stationary power work, fans, ventilators, etc., and the Eastern agents are Skillton & Son, 33 Broadway, New York. A letter from the Keokuk Electric Street Railway and Power Company to the Chicago Electric Motor Company testifies to their satisfaction with the work done by Mr. J. G. Hart. He rebuilt for the Keokuk Company three Edison generators, and overhauled the general equipment of the road to the entire satisfaction of the company.

Mr. Foree Bain is very busy on special work just now. He is building a line of large dynamos, and his apparatus is giving excellent satisfaction to all users of the same. Mr. Bain's experience justly places him at the head of the professional ranks. Mr. Bain has just brought out a new ampère-meter and volt-meter which are said to be perfect in principle and design.

The Knapp Electrical Works, 54 and 56 Franklin street, are well known in the trade as sole Western agents for the Perkins incandescent lamps and fittings. These lamps have given most satisfactory service among users, which include some of the largest isolated and central station plants in the United States. Most satisfactory testimonials are given by users of these lamps concerning their life, brilliancy, etc. The company is also sole Western agent for the Safety Insulated Wire and Cable Co., of New York, makers of the well-known wires and cables. The latter company's goods are well known throughout the East for their serviceability. They have stood the hardest tests in the underground conduits in New York and have not yet failed to perform every duty exacted. The Knapp Electrical Works have placed large orders for this wire, and keep a large stock on hand at all times, which enables them to fill orders promptly. They have just ordered from the factory a large stock of Perkins lamps, so that they can meet any demand at a moment's notice. The company has large sales and stock rooms, and five stories above the main floor, in addition to dry basements. Its quarters are stocked with a line of electric light, power, telegraph, telephone and household electrical supplies in large quantities. It is also the general agent for Grimshaw White Core wires and specialties, of which goods they keep a large stock on hand at all times. The company is said to manufacture a larger number of annunciators, burglar alarms, bells, batteries and household goods than any firm in the United States. Any one desiring electrical goods of whatever class will do well to correspond with this concern.

William Hood, manufacturer and dealer in electrical specialties, 239 Lasalle street, is full of enterprise and business. The Jewel incandescent lamp for which Mr. Hood is the general agent, is a jewel in more than one sense. A few days ago Mr. Hood received orders for 1000 of these lamps. They are made for currents of 100 volts and upwards, and are provided with the Hood filament, the object of which is to prevent excessive vibration. This feature renders the Jewel lamp of particular value for street-railway service. As an evidence of the excellent qualities of the lamps and the satisfaction they give, it may be mentioned that wherever they have been placed in small quantities, orders for 200, 300 and 400 lots have been given by the same parties. Mr. Hood's salesrooms are the headquarters of the electrical fraternity in this section, and prominent electrical people may be seen there at almost any time. During the visit of your correspondent last week the following-named gentlemen were met there: W. H. Patton, inventor of the Patton Motor; Paul Bossart, of the Short Electric Company; Mr. Watson, of the Fibre Carbon Company, of Detroit, and a number of others. In Mr. Hood's salesrooms are found many electrical novelties. The rooms are lighted by accumulators from which he gets current to supply two Mosher arc lamps and 21 Jewel 16 C. P. incandescent lamps. The same current runs fans, motors, etc. The current required for charging the batteries is taken from the circuit of the Chicago Arc Light and Power Company. Mr. Hood is about to place on the market the Atlas dry battery, which tests have proved to be one of the best batteries. William Matterson, electrician for Mr. Hood, is an intelligent young man. He has had large experience with accumulators, and is well versed in electrical science; besides, he is very popular.

The Electric Merchandise Company, under the management of Mr. W. R. Mason, its president, is doing such a large business in street-railway supplies that it has been found necessary to expand its quarters. The offices of the company will be moved to the first floor over the salesroom, and the main floor will be devoted entirely hereafter to the display of supplies and specialties. The clerical force will also go to one of the upper floors. The company proposes to add to its present line of street-railway supplies a number of valuable new goods which will be much appreciated as well as serviceable. Large orders are coming in for the Burton Heaters and Pratt's Portable Registers.

Mr. J. L. Barclay, manager of the Westinghouse Electric Company, reports that business throughout the West is very active for this time of the year. Through Mr. Barclay's enterprise and energy the Westinghouse interests have been carried to the front ranks of electrical enterprise in the West.

Baragwanath & Son, manufacturers of feed-water heaters, Chicago, have just sold a 500 horse-power heater for an electric light plant in Salt Lake City; two 1,500 horse-power heaters, to be placed in the new station of the Chicago City Cable Railway, and have received other orders from different parts of the country. They are doing a good business in this excellent apparatus.

H. W. Caldwell & Son, Chicago, manufacturers of concrete mixers, used for mixing concrete for the construction of cable and electric street-railways, have just begun making a new line of stamped-steel link belt, which they recommend for electric motor cars. They also make a fine line of iron pulleys, and carry a line of the best wood pulleys. This firm is bringing out a new gas-engine for general use.

The Electric Appliance Company has opened a large store at 242 Madison street, and will carry on a general electrical supply business on a large scale. The officers of the company are W. W. Low, President; H. B. Gilbert, Vice-President, and Thomas I. Stacy, Secretary and Treasurer, and are experienced in the electrical supply business. Under their guidance the house will no doubt prosper. The company has already secured several valuable agencies for specialties, and is the general Western agent for Paranite wires and cables. The insulation of these wires is of high-grade rubber, and promises to occupy a foremost position among first-class insulated wires. The company has the best wishes of its many friends for much success. It has a large and well-equipped store, and already has a complete stock of goods. Orders are promptly filled.

Mr. H. G. Issertel, of Alexander, Barney & Chapin, New York, is in Chicago, drumming up business for his house.

The system of the Patton Motor Manufacturing Company, 45 Lakeside Building, is attracting considerable attention among street-railway people. Wires, poles and power-plants are done away with entirely by this system. Each car generates its own power, and is an independent unit. Each motor car is equipped with a gasoline engine, dynamo, accumulator and motor. The dynamo is operated by the gasoline engine continually charging the accumulators. Each motor car carries 100 accumulator cells, developing 80 horse-power when needed. This system has many points of advantage, and is worthy of the careful consideration of railway managers. W. T. H.

WESTERN NOTES.

W. A. Fenn, formerly with J. H. Bunnell & Co. and Fenn & Braxmar, New York, is now General Manager of the American Electric Supply Co., of Buffalo. Mr. Fenn has had large experience in the installation of electrical plants. This company has just received the contract for a complete plant at the Erie County Savings Bank, Buffalo. This plant will consist of 1,500 incandescent lamps and C. & C. dynamos; the latter will be run by a Straight-Line engine. The Interior Conduit Company's system will be used in this installation.

Mr. H. J. Stancombe is the travelling agent for the Cleveland Gas Fixture Manufacturing Co., Cleveland, O. Mr. Stancombe is a designer, and his experience in this line is often used to good account during his travels.

The Cleveland Electric Manufacturing Co., manufacturer of American watchmen's clocks, has a fine line of these goods on exhibition.

The Ford & Washburn Electric Co., Cleveland, Ohio, is manufacturing a fine line of dynamos and motors. Motors are a specialty with this concern, and it makes arc and incandescent dynamos with automatic regulation which are simple and durable. The company claims that it is the only machine having a perfectly ventilated armature.

The Fletcher & Fletcher Electric Co., Cleveland, Ohio, is doing a good business in general electrical supplies. The medical batteries manufactured by this company are well known for their serviceability. W. T. H.

BUSINESS NOTES.

The Typewriter Exchange, 10 Barclay street, New York, is fast assuming proportions which bid fair to make it second to none in its particular line of business. While this establishment cannot boast of its years of existence, yet the appreciation of the public is daily shown in a manner pleasing alike to its patrons and the able manager, George A. Hill, whose success is due to years of experience in the typewriter field, and who counts among his friends nearly every stenographer in New York City. This Exchange has adopted an advantageous mode whereby machines may be obtained on small monthly payments, which seems to be filling a long-felt want. A typewriter of any of the standard makes can be obtained at a saving of from $15 to $30 below manufacturers' prices and receive the guarantee. In connection with buying, selling, renting and exchanging of machines, a complete line of supplies of standard quality may be had; in fact everything a stenographer needs is kept in stock. A call at this excellent establishment will convince the visitor that this is really one of the best places in the world for square treatment, impartial information and absolute bargains.

GENERAL TONIC.

WAMPUNN, PA., September 18, 1891.

Jerome Kidder Mfg. Co.:

GENTLEMEN: Enclosed find P. O. order. Battery has given perfect satisfaction, and use it (electricity) as a general tonic bath twice every week. Yours, respectfully,

C. W. MILLER.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued November 10 and 17, 1891.

Issued November 10.

462,502. Car-Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed May 29, 1890.

In a car-heater, the combination, with the casing and cover having a feed-aperture therein, of a pivoted door having a locking recess, a locking-lug on the casing, and a spring upon the pin holding the door upon the lug.

463,035. Electric-Arc Lamp. James E. Gaston, Sparta, Ill. Filed Jan. 15, 1891. Renewed Oct. 17, 1891.

A carbon-holder for electric-arc lamps, consisting of two semi-tubular jaws suitably pivoted intermediate of their ends to a block within the interior thereof and adapted to receive the carbon at one end, a screw-threaded rod carried by the block, and a tapering plug upon the rod extending from the other end of the device, whereby the carbon may be gripped and released by turning the plug in one or the other direction.

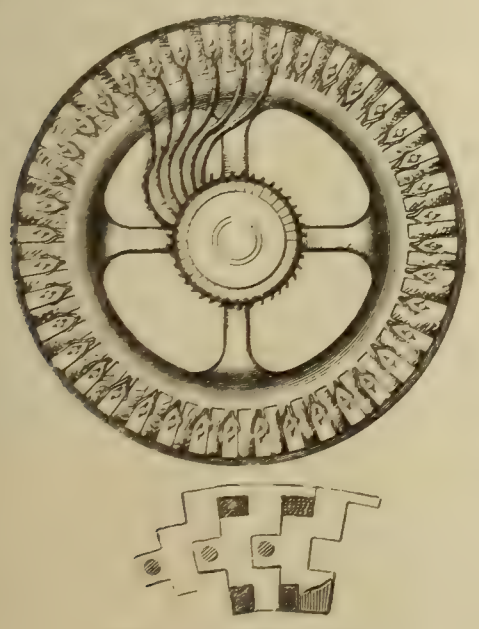
463,072. Station-Indicator. Joseph M. Nelson, Coleman, Mich. Filed May 14, 1891.

In an indicator, the combination, with the casing and indicating device, of a motor for actuating the indicating device, means for reversing the movement of the indicator, oppositely-inclined latches for governing the movement of the indicator, and an electro-magnet for moving the latches out of engagement with the indicator.

463,079. Electric Conductor. Charles T. Snedekor, New York, N. Y. Filed May 8, 1891.

An insulating covering for electric conductors, consisting of a rubber covering, an adhesive substance upon the rubber covering, a powdered refractory material over the adhesive substance, tape saturated with a silicate, and a suitable finish over the tape or braid.

463,086. Electric Safety Cut-Out Device. Addison G. Waterhouse, Hartford, Conn. Filed June 24, 1891.



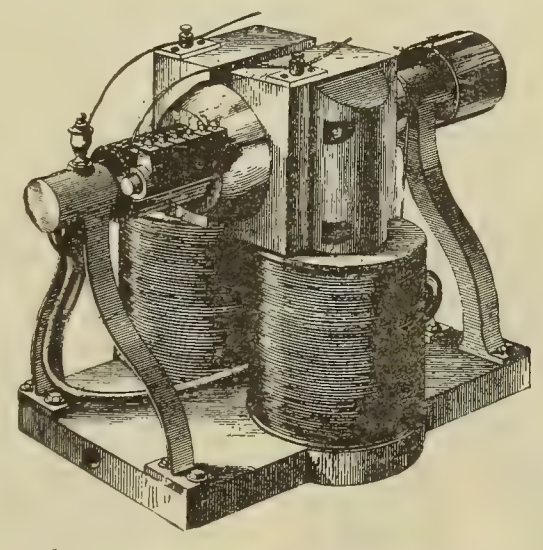
463,174.—ARMATURE.

A cut-out mechanism provided with terminals which are electrically connected to the extremes of the field-magnet coil or coils of a dynamo-electric machine, with an electro-magnet placed in the circuit of the machine, having a movable armature provided with a plate or bridge capable of electrically connecting the terminals, the armature being provided with a dash-pot or retarding mechanism, a prop or hook for supporting the armature, adapted for withdrawing its support when the current energizes the electro-magnets.

463,107. Electric Conductor. Frederick E. Degenhardt, Chicago, Ill., assignor to the Standard Underground Cable Company, Pittsburg, Pa. Filed Sept. 1, 1890.

The combination of a conducting-wire and a strip provided with alternate elevations and depressions surrounding the wire, thereby forming receptacles for the retention of air or gas.

463,121. Steam Dynamo-Electric Machine. Frank M. Garland, New Haven, Conn. Filed Feb. 4, 1891.



463,242.—DYNAMO-ELECTRIC MACHINE.

In combination, in a steam-dynamo, a base having a mount at its centre for an electro-magnet and standards rising from the upper surface each side of the centre, the standards being hollow at their lower part and provided with a plane surface upon the exterior of the hollow portion and shaft-bearings at their upper ends, cylinders bearing pistons held to the plane surfaces on the standards, a shaft bearing an armature supported in the bearings and connected at each end with the pistons, and a field-magnet supported by the base.

463,045. Railroad-Tie. Charles P. Hammond, Birmingham, Ala. Filed Dec. 4, 1890.

The combination, with a tie and integral clip formed on the upper surface thereof, the tie having slots therein, of a clamping-block having grooves in its opposite edges to receive the parallel edges of the slot, and a key for insertion between the outer flange of the block and the clip and seated on the tie.

Issued November 17.

463,154. Electric-Arc Lamp. William Jandus, Cleveland, Ohio. Filed Dec. 4, 1886.

463,155. Electric Lock. Walter J. O. Johnson, Chicago, Ill. Filed Feb. 25, 1891.

463,164. Shoe-Blacking Machine. Frederick G. Norton, Waukegan, Ill. Filed May 5, 1890.

463,172. Insulator-Support. Thomas C. Smith, Philadelphia, Pa. Filed Feb. 12, 1890.

463,174. Armature for Dynamos or Electric Motors. Barron D. Southard, Chicago, Ill., assignor to the Chicago Electric Motor Company, same place. Filed March 2, 1891.

463,188. Telephony. John W. Gibboney, Lynn, Mass. Filed July 28, 1891.

The method of telephoning, consisting in making a record of the sound-waves, causing such record to produce slower electric waves, impulses or undulations of current of corresponding shape or character, transmitting such slow electric waves or undulations of current over an electric circuit and recording such waves at the receiving end of the circuit.

463,192. Electro-Magnetic Switch. Charles H. Herrick, Winchester, and Willis M. Rand, Boston, Mass. Filed Oct. 20, 1890.

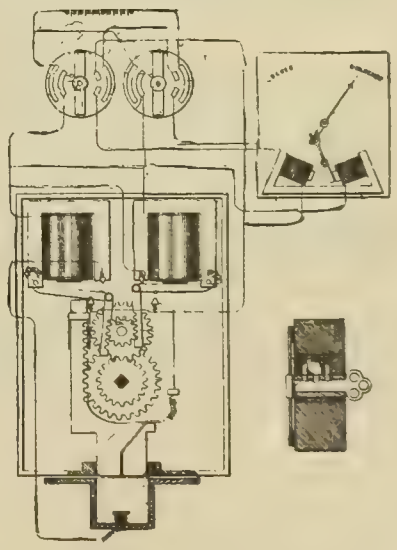
An automatic electric switch comprehending a base, fixed contacts thereon, an electro-magnet arranged on the base, its armature having a hook or projection, a sliding spindle arranged in a vertical plane extended between the coils of the electro-magnet, a switch-plate, movable contacts thereon, a spring to normally separate the fixed and movable contacts, and a locking finger or projection movable with the spindle to be engaged by the hook or projection on the armature of the electro-magnet to hold the fixed and movable contacts in electrical connection with each other while the electric current is maintained.

463,198. Electric Stop Mechanism. Lemuel Mellett, Somerville, Mass. Filed March 21, 1890.

463,207. Telephonic Relay. Ephraim E. Weaver, Philadelphia, Pa., assignor to Lewis O. Howell, Jr, same place. Filed Feb. 18, 1891.

463,213. Cut-Out. Hermann Lemp, Hartford, Conn., assignor to The Schuyler Electric Company, of Connecticut. Filed June 21, 1887.

The combination, with an incandescent lamp having an exhausted globe, of a normally open shunt around it and a manometric circuit closer normally communicating with the exhausted space and positively actuated by the pressure of air admitted to the lamp or gas generated therein to close the shunt.



463,297.—ELECTRIC LOCK.

463,242. Dynamo-Electric Machine. Martin C. Burt, Chicago, Ill. Filed Jan. 21, 1891.

A hollow armature-shaft with a blower geared to it and having its eduction pipe connected with the interior of the shaft, openings in the shaft within the armature, and an armature upon the shaft tightly closed at the ends and loosely wound between the same.

463,247. Galvanic-Battery. Walter A. Crowdus, Memphis, Tenn., assignor to Jo. W. Allison, trustee, same place. Filed Nov. 21, 1890.

The jar of a galvanic battery provided with an overflow-receptacle arranged to receive and hold the excess of electrolytic liquid as it increases in volume and prevent its overflowing the cell.

463,248. Galvanic Battery. Walter A. Crowdus, Memphis, Tenn., assignor to Jo. W. Allison, trustee, same place. Filed Jan. 24, 1891.

A porous cup consisting of an earthenware tube open at both ends arranged with its lower end at the bottom of the cell and a sealing substance around its lower end joining it to the bottom of the cell, whereby its lower end is closed and it is fastened in position in the cell.

463,297. Electric Lock. Floyde H. Starrett, Clinton, Mich. Filed Nov. 3, 1890.

463,298. Thermo Circuit-Closer for Electric Fire-Alarms. John Wrigley and George P. Chambers, Paterson, N. J. Filed June 26, 1891.

The combination, in a thermo-circuit-closer, of a stationary contact-piece, a spring actuated movable contact-piece, and a frangible bulb containing an explosive, the contact-pieces being normally kept out of contact by the bulb.

463,305. Ore-Separator. William D. Hoffman, Brewster, N. Y. Filed July 15, 1891.

In a magnetic separator, a feeding device, a finishing-magnet, a stratifying magnet located intermediate of the feed and finishing-magnet, and an endless-belt carrier for conducting the material to be operated upon within the fields of the stratifying and finishing magnets.

463,311. Electric Switch. Ernest J. Bagnall, St. Louis, Mo. Filed Aug. 3, 1891.

463,314. Alternating or Pulsating Current Motor. Ludwig Gutmann, Pittsburg, Pa. Filed April 7, 1890.

Secondary field-magnet coils placed at an angle to field-magnet coils placed in a single exciting-circuit and an armature inclosed by both sets of electro-magnets and provided with one or more closed windings, each containing an odd number of closed circuits.

463,340. Fire-Alarm-Telegraph Repeater. George M. Stevens, Cambridge, Mass. Filed April 30, 1891.

463,384. Electric Cigar-Lighting Apparatus. William W. Foster, Boston, Mass. Filed Aug. 14, 1891.

463,395. Electric Train-Signal. Joseph B. Strauss, Cincinnati, Ohio. Filed July 20, 1891.

In an electric train-signal, a circuit-breaker consisting of a contact-piece, springs bearing against opposite sides of it, and wires communicating with the springs.

463,396. Electric Switch. Alfred Swan, Orange, N. J., assignor to the Insulite Manufacturing Company, New York, N. Y. Filed May 7, 1891.

The combination, with one or more rotating switch-arms provided with insulating projections, of one or more spring contact-plates held under tension by the insulating projections during the rotation of the switch-arms and thrown into contact with the switch-arms when the insulating projections have passed off the contact-plates.

463,420. Coupling for Electric Wires. Francis X. Gartland, Philadelphia, Pa. Filed July 16, 1891.

A coupling for electric wires, consisting of two heads with an insulating pivotal pin, wires with loops, and insulating-washers.

463,428. Telegraph-Sounder. James Maret, Mount Vernon, Ky. Filed Feb. 3, 1891.

In a telegraph-sounder, the combination of an electro-magnet having the poles bent or turned toward each other, a bracket or standard, an adjustable contact-screw in the standard passing between the inner ends of the poles, a striking armature in the standard, a sleeve adjustable in the bracket, a jam-nut, and spring for the striking armature.

463,487. Electric Welding or Working of Metals. Charles L. Coffin, Detroit, Mich. Filed March 4, 1891.

A method of welding or working metal electrically, consisting in heating the part to be worked by contact with a conductor through which an electric current is passed and simultaneously springing a voltaic arc between the conductor and another conductor in proximity to the point of contact and welding or working the metal when raised to the desired temperature in any desired manner.

463,491. Base-Ball Indicator. James L. Cutler, Piketon, Ohio. Filed Feb. 24, 1891.

The combination of a main line with a mechanically actuated and electrically released rotary carriage or switch provided with a double series of non-conducting and conducting projections, a vibrating contact-pawl adapted to engage the projections and controlled by the main-line circuit, a series of local circuits respectively adapted to be closed by the contact of the pawl with corresponding conducting-pins, a bulletin provided with display-openings, and actuators in the local circuits adapted to display characters or blanks in the openings.

463,512. Electrical Conductor. Philip H. Holmes, Gardiner, Me., assignor to the Holmes Fibre-Graphite Manufacturing Company, Chicago, Ill. Filed June 2, 1891.

463,544. Multiple Telephone Switch-Board. Frank A. Pickernell, Newark, N. J. Filed Aug. 17, 1891.

A multiple telephone switch-board comprising main circuits having normally-discontinuous branches leading to connection terminals at its several sections, a relatively-high-resistance electro-magnetic call device permanently included in each main circuit at some one of the sections, means at each switch-board section for electrically uniting any two circuits by connecting their respective branch terminals, and a disconnecting-annunciator of relatively low resistance bridged between the direct and return conductors of any two circuits when so united in a branch circuit shunting the high-resistance call devices of the circuits.

463,545. Multiple Switch-Board. Frank A. Pickernell, Newark, N. J. Filed Aug. 17, 1891.

463,556. Speaking-Tube Attachment for Telephones. Leondo H. Snyder, Sharon, Pa. Filed Jan. 28, 1891.

A speaking tube attachment for a telephone-transmitter, consisting of a straight tube adapted to enter and cover the transmitter, a curved diaphragm in the tube near the front end, and a V-shaped diaphragm in the tube near the transmitter, and two or more curved tubes connected to the straight tube and leading from points in front of the curved diaphragm to points opposite the V-shaped diaphragm.

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THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER, TELEGRAPHY, TELEPHONY AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

VOL. IX. NEW YORK, DECEMBER 5, 1891. No. 49.

AN INTERESTING RELIC OF EARLY CABLE TELEGRAPHY.

In these later times few can appreciate the difficulties which beset the pioneers in Atlantic cable telegraphy. The laying of the cable itself was an undertaking the practical results of which very few had much faith in, but the few far-seeing ones who were directly concerned in the enterprise were undaunted. They alone foresaw what momentous consequences depended upon the successful accomplishment of their enormous task, and we can imagine the conflict of emotions within their breasts as the work of laying the slender thread between the Old and the New Worlds progressed. Their hopes and enthusiasm, no doubt, often gave way to doubts while the laborious work was going on. "Could a cable of such length be successfully laid, and, if laid, would it work so that signals could be exchanged between America and Great Britain?" was a question often propounded, but as yet unanswered. The results of the great undertaking are now a matter of history; the world is encircled by cables, and the question as to whether a long cable will work successfully has long been answered.

In the rush and bustle of life's activity these days, little thought is given to the experiences of pioneers in any field of investigation, but when we look back and consider how much of the world's present prosperity and happiness is due to the successful issue of the attempt to join two continents by a cable not as big as a fibre of silk in comparison with its length, we cannot help feeling that the impulse which constrained these noble men to perform this duty for humanity was heaven-given. Their names deserved to be inscribed in imperishable characters in places where the whole world can look upon them and say: "These men were true benefactors of mankind."

The most important part of the work was, of course, performed when the laying of the cable was successfully accomplished. There were many things in connection with the practical work to be determined, however; there were no rules or laws to be guided by—everything had to be ascertained and determined by experiment and experience.

The amount of battery necessary to obtain the best results in working so long a cable was one of the problems to be solved.

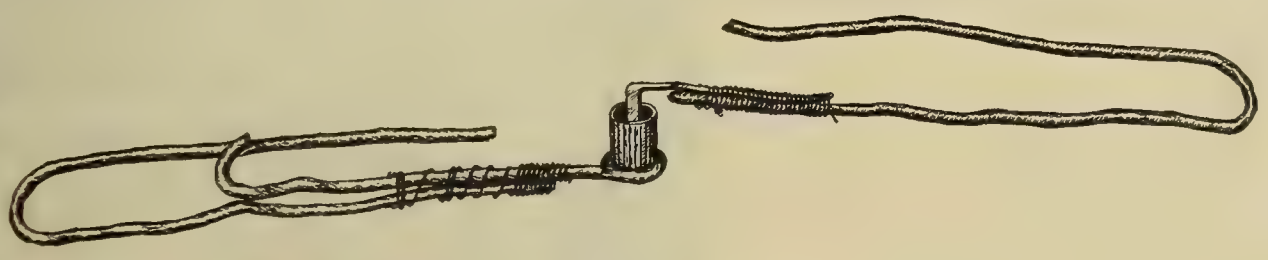
The first working Atlantic cable was supplied with a current from a battery of ten capacious cells constructed on the Smee principle. The elements were silver and zinc, and the total and active surface was 2,000 square inches. The name of this battery was the "Whitehouse Laminated or Perpetual Maintenance Battery," the word laminated referring to the plates or elements, and the "perpetual maintenance" to the replenishing of the fluids and renewal of the zinc plates, which could be accomplished without materially interfering with the working of the cable.

This battery, of course, was in direct connection with the cable, with one pole to earth. According to present practice cables are worked by induced currents generated in them through the instrumentality of condensers, and there is no direct connection between the cables and batteries.

Batteries for cable work have necessarily undergone a process of evolution. It was known in the early days that too much battery current was dangerous to the insulation, so great care had to be exercised in the selection of current generators. It seems that no battery could be made too small to influence the delicate receiving apparatus at the other end. That this is true may be seen by the correspondence which follows.

To determine—probably more out of curiosity and as a matter of scientific interest—how little current would work the Atlantic cable instruments, in 1868 a battery was made out of a lady's silver thimble. As the record shows, messages were exchanged between Heart's Content and Valentia in a satisfactory manner, and vigorous signals were received. The acidulated water in the thimble was diluted until not even a homœopathic dose of acid remained, and still the cable worked. It did not seem possible that a smaller battery could be constructed, but a happy thought occurred to one of the experimenters. He would make a battery out of a gun-cap and try that. That, too, worked, and messages were exchanged by its influence, though it appears from the correspondence that the signals were "awfully small." No wonder! but the battery was a little giant.

This gun-cap battery was a crude affair, and it was lost sight of and forgotten for many years. Fortunately, however, it fell into the possession of a gentleman who appreciated the value it would possess in later years as a historical relic of the early days of the Atlantic cable. It was carefully preserved, and it was our good fortune recently to learn of its existence. Mr. H. H. Ward, the cashier of the Western Union Telegraph Company in New York City, is the gentleman who possesses this interesting relic. It was presented to him, as will be seen by the following correspondence, by Mr. Thomas D. Scanlon, of the Cable Company's office at St. Johns, N. F., and in order to determine its authenticity the correspondence ensued. Mr. Ward has kindly allowed us to produce an illustration of this interesting battery and publish it in connection with the correspondence referred to. The illustration is a faithful likeness and is the exact size of the original. The correspondence is as follows:



GUN-CAP BATTERY USED ON ATLANTIC CABLE.—ACTUAL SIZE.

NEW YORK, April 27, 1887.

My dear Mr. Dickenson:

Some years ago Tom Scanlon sent me what he alleged to be the veritable gun-cap battery with which the cable was worked. It was a common percussion cap with a piece of wire soldered to it and a narrow strip of zinc to insert in it. If the history of it is correct, I wish you would somewhat formally authenticate it to me, as after so many years the real article possesses some historic interest.

With kindest regards to yourself and other friends in Heart's Content, I remain yours, faithfully,

H. H. WARD.

WILLIAM DICKENSON, ESQ., Electrician,
Anglo-American Tel. Co.,
Heart's Content, Newfoundland.

HEART'S CONTENT, June 19, '87.

My dear Ward:

Yours of 27th April *re* gun-cap battery. In 1866 a battery was made at Valentia Station out of a lady's silver thimble and signals sent to Heart's Content. Not to be outdone, I made a battery out of a common percussion cap. Mr. Dean, of the U. S. Survey, was in Heart's Content, and Dr. Gould, his colleague, was in Valentia. "V. A." was called with the usual working battery. It was removed and the gun-cap battery put in the place of it, and the following sent:

"Mr. Dean's compliments to Dr. Gould. How are you?" Ans. Dr. G. to Mr. D.—"Splendid." Clerk at V. A.—"Please increase your battery. Signs awfully small." The same battery made of the gun-cap I gave to T. D. Scanlon, I think in the summer of 1868. Trusting you are in health, I remain

Yours, sincerely,

WILLIAM DICKENSON.

NEW YORK, July 25, 1887.

My dear Scanlon:

Greeting. May you live a thousand years—or to that good old age in which your powers will all have been rounded out and perfected and you are ripe for a saintly title—then may you depart in peace and be gathered to your fathers. But first—before you go—I want your "affidavy;" or, to explain more fully, you remember that you honored me long ago by presenting to me the gun-cap battery with which the cable was worked. I have it still. In the lapse of years it is beginning to be considered an interesting bit of history. In order to make its title clear I wrote lately to Dickenson, and he has verified the facts of its use and given me the message sent at the time, and stated that he gave it to you. I will be much obliged to you if you will write a paper certifying that in the year 1868—or thereabouts—you received from William Dickenson the gun-cap battery with which signals and messages had been transmitted across the Atlantic, and that you gave the battery to me. A simple letter stating the facts signed by you is all I want. With kind regards,

Yours, faithfully, H. H. WARD.

T. D. SCANLON,
St. Johns, Newfoundland.

ANGLO-AMERICAN TELEGRAPH CO., LIMITED.
ST. JOHNS STATION, NEWFOUNDLAND,
Aug. 6, 1887.

Dear Mr. Ward:

It was in 1870, I think, that I presented you with the identical gun-cap used by our Mr. Dickenson when experimenting in '68 on the cables between Heart's Content and Valentia. He commenced using power generated in a lady's thimble, which gave strong deflections in Ireland. Water was added to the battery till nothing but water remained, and still Valentia continued *to receive.* Mr. Dickenson was then induced to try a still smaller cell, and a common percussion gun-cap was connected up and charged with a drop of acidulated water, resulting in complete success. The signals therefrom were distinctly read at Valentia and some messages transmitted.

Yours, truly,

T. D. SCANLON.

HENRY H. WARD, ESQ.,
Cashier W. U. Tel. Co., New York.

REDUCTION OF HYSTERESIS.*

We know that mechanical vibration lessens the differences of magnetic conditions that are brought about by hysteresis. It makes the metal readier to respond to any influence which tends to alter the magnetism. In a soft iron wire, where its effects are most conspicuous, it practically abolishes the distinction between what we have called the first and second stage of the magnetizing process, it destroys the retentiveness almost entirely, and it makes the magnetic effects of strain nearly reversible, so that the "on" and "off" curves for a cycle of loading come to be not far from coincident.

The molecular theory makes all this intelligible. Vibration, producing small periodical displacements of the molecular centres, sets the molecular magnets oscillating. The displacement of the centres, and still more, perhaps, the oscillation to which that gives rise, allows the molecules intervals of comparative freedom, and probably even goes so far as to vary the combinations in which they are grouped. Then if there is an external field the molecules yield read-

* Abstract of article by Prof. J. A. Ewing on "Magnetism in Iron and Other Metals," in London *Electrician.*

ily to it in their freer intervals, and even when there is no external field a kind of shuffling goes on, one effect of which is to reduce residual magnetism. It may be, that in the removal of residual magnetism vibration acts in the first place locally; a cluster of molecules shaken up so that the residual magnetism of the cluster is less than that of surrounding portions will act to some extent like a cavity in the metal, producing a demagnetizing field round about it. In the same way the demagnetization of a long iron rod under vibration no doubt begins at and about the ends, where there is a self-demagnetizing field, and then extends itself towards the central portion.

Any kind of disturbance that will give the molecular magnets intervals of freedom, or of diminished constraint, will tend to do away with hysteresis. Interesting examples of this will be found in a paper by G. G. Gerosa and G. Finzi,† in which experiments are described showing how cycles of reversal of magnetism become modified when a continuous, or periodically interrupted, or alternating current is made to traverse the piece under test, while slow reversal of the field goes on. The experiments dealt with iron, steel and nickel wire in their annealed and hard state. A continuous current, traversing the wire while its longitudinal magnetism was being changed by applying and varying a longitudinal magnetic force by means of a surrounding solenoid, was found, as might be expected, to reduce the susceptibility of iron: the circular magnetization maintained by the current in the wire left the molecules less than their usual freedom to obey the longitudinal force. When the longitudinal current, instead of being continuous, was rapidly interrupted without changing its sign, a molecular oscillation was set up which made the iron more than usually susceptible to weak longitudinal force; but when the field was strengthened the iron was still found to be less susceptible than when no current was passing through it. The mere make and break of the longitudinal current would, in fact, cause no more than a small variation of circular magnetization, and would consequently do little to agitate the molecules. But when a rapidly alternating current of moderate strength traversed the wire, its susceptibility was notably increased; the magnetization curve in that case lies above the normal curve everywhere except in the region of strongest magnetization. The violent agitation brought about by rapid reversals of circular magnetism destroyed nearly all trace of hysteresis, and obliterated the usual distinctions between successive stages in the magnetizing process.

TOMMASI'S ELECTRIC MULTITUBULAR ACCUMULATOR.

At a meeting of the Paris Academy of Science, says the London *Electrical Review*, held on October 12, D. Tommasi, whose name is well known in connection with accumulators, presented one of those which he has recently invented, and which possesses several novel features.

Each electrode is composed of a perforated tube made of lead, ebonite, porcelain, or celluloid, the bottom of which is closed by a plate of ebonite, in the centre of which is fixed a lead rod, which acts as a conductor.

The space between the central rod and the sides of the tube is filled up with oxide of lead. Metallic contacts respectively connect up all the rods of the positive electrodes and those of the negative electrodes.

The tubular electrode is either cylindrical, square, or rectangular, and the shape of the central rod is varied accordingly.

The principal advantages of this accumulator are as follows:

1. The current passes entirely through the active materials, from the surface of the tube to the central rod, or *vice versa*.

2. The quantity of material that is active is a maximum, and then the weight of the accumulator is from two to six times less, and its volume from four to eight times less than in other accumulators of the same strength.

3. A current of more than sixty ampères per kilogramme of electrode can be sustained, whereas in the ordinary types 1 ampère per kilogramme is generally employed.

4. Breakages, which are so frequent in plate accumulators on account of unavoidable weakness in structure, etc., are not to be feared.

5. In this accumulator it is quite impossible to have any dilatation of the tube electrode, therefore no escape of matter, consequently no short-circuiting.

Rectangular lead accumulators are the best for station work, and the celluloid form for tramway purposes.

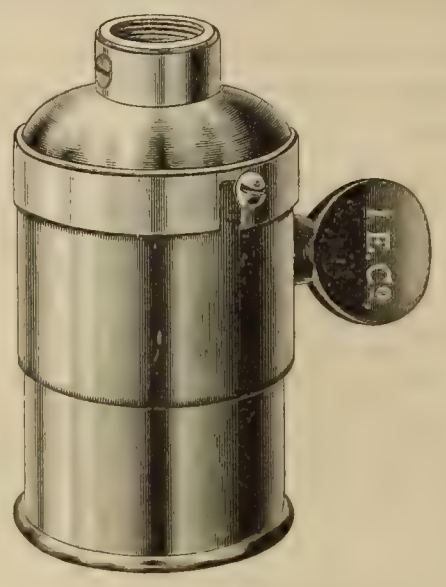
† Rendiconti del R. Istituto Lombardo. Vol. XXIV., fasc. x., April, 1891.

Here are some figures which refer to a rectangular multitubular lead accumulator containing 67 per cent. of active matter:

Electromotive force	2.4	volts.
Capacity per kilo. of electrode	16	ampère-hours.
Output in quantity	95	per cent.
Output in work	80	"

A NEW LAMP-SOCKET.

One of the greatest defects in lamp-sockets is the difficulty with which a good many of them are wired, the binding-screws usually being in such a position that a man with more thumbs than fingers has tedious work making a good connection, and a good deal of time is lost in wiring chandeliers and fixtures. The parts about a lamp-socket are usually so small and so close together, that fastening a wire to the binding-screw is very much like threading the eye of a fine cambric needle, but in the lamp-socket recently placed upon the market by the Imperial Electric Company, 1218 and 1220 Filbert street, Philadelphia, an illustration of which we give herewith, a man with nothing but thumbs will find no difficulty in connecting the wires. As will be seen, there is nothing complicated about the connections, and the socket is especially adapted to chandelier and fixture work. The insulation is made entirely of porcelain, avoiding as far as possible troubles arising from heat or moisture. The socket seems to be as handy as it is possible to make it.



LAMP-SOCKET COMPLETE.

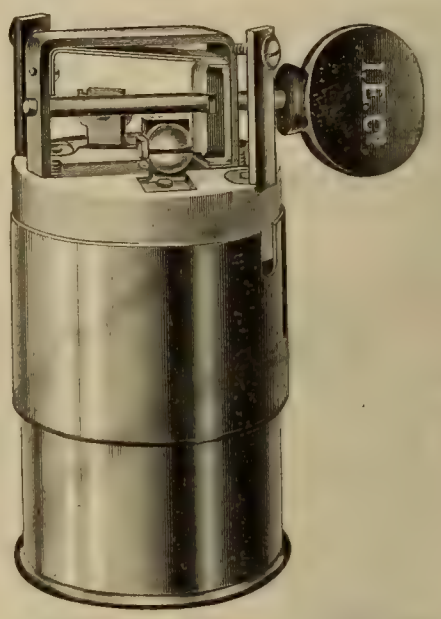
Beaumont, Tex., has just installed a complete electric fire-alarm system.

A COMPLETE MEDICAL CABINET.

With the general adoption of electricity as a curative agent among the medical profession, manufacturers endeavor to supply better and handier apparatus, fully realizing that physicians give as much care and thought in selecting apparatus of this class as they do in their choice of drugs and surgical appliances.

There are numerous forms of electro-therapeutic apparatus on the market, embracing everything from a little induction coil costing one or two dollars to the elaborate cabinets beyond the means of the average physicians, but the cabinet herewith illustrated and described seems to combine cheapness with ready accessibility and neatness, making it one of the best in the market for physicians' use.

The cabinet is made of quartered oak having a high finish, and it contains 50 dry cells of battery, a meter, current controller, rheotome, one of the best induction coils made, and all necessary switches and electrodes, making it as complete an outfit as one would require.



LAMP-SOCKET WITH CAP REMOVED.

The meter is one of the well-known Vetter Standard Direct-reading Mil-ammeters accurately calibrated and standardized.



VETTER'S NEW MEDICAL CABINET.

The current controller is compact, durable and well finished, and controls the current with the greatest nicety. It is a substantial instrument having no glass, no liquids, and dispensing with a mass of wires. The principle adopted in the construction of this rheostat is the effect of variation in resistance, which takes place in carbon with a change in pressure. In this way the current passing can be adjusted with the greatest nicety. The variation in the resistance of the rheostat follows the movements

of the screw through very wide limits, thus controlling from off or no current to the full capacity of the battery.

The rheotome can be seen in the left-hand corner of the cabinet, and is one of Messrs. Vetter & Co.'s best. It can be put in circuit with either the galvanic or faradic current, and can be adjusted to pulsate (with time) either very slow or rapid interruptions. It is substantially made, highly finished and nickel-plated.

This cabinet is made by J. C. Vetter & Co., 214 East 47th street, New York, who also manufacture everything needed in electro-therapeutical practice.

THE "C. S." COMBINATION REFLECTOR, LAMP-SHADE AND STAND.

This lamp-shade, which is about to be put upon the market by the Cutter Electrical and Manufacturing Company, Philadelphia, presents some unique claims to favor. It will carry any size or style of lamp; it is provided with its own shade-holder, which is adapted to automatically fit any and all systems; it permits the renewal of an exhausted lamp with the least expenditure of time and trouble, and it directs the light exactly where it is wanted and to no other point. It is made of aluminum and glass, and weighs less than five ounces, and may be "knocked down" and "nested" for shipment. This shade has but one destructible part—the glass diffusion plate—which, if accidentally broken, is easily replaced at a trifling cost. Briefly, this reflecting shade may be described as a combination of a parabolic with a plane radiating reflector, to which is attached a diffusion plate of ground glass, and the arrangement of these different parts is such as to direct the main portion of the rays of light into a given zone of illumination, while a minor portion is radiated and diffused throughout the room. The diffusion plate is affixed securely to the radiating portion of the shade by means of a simple interlocking device which permits of an easy separation of the two parts when it is necessary to remove or replace a lamp. At the apex of the parabolic reflector is an aperture sufficient only for the passage of the stem or shank of the lamp, and upon the rim of this aperture is affixed the automatic shade-holder, which is a novel arrangement of three spiral springs that close in upon the shoulder formed by the junction of the bulb with its brass mounting when the stem of the lamp is passed through. Thus, the top of the shade fits closely around the stem of the lamp, shutting off all vertical rays, the general result being a strong white light immediately in front of the shade and a gentle diffused light throughout the room, there being no marked boundary to the zone of illumination.

The accompanying cut shows the shade with automatic shade-holder attached. This reflecting shade is particularly well adapted to the portable lamp-stand or bracket illustrated and described below, the two together forming a combination of artistic utility rarely to be met with.

Our second cut illustrates a portable lamp-stand with adjustable arm, now being put upon the market by the same concern. The cut represents the stand mounted and wired, to which is attached one of the combination reflector shades described above. The stand consists of an upright metal tube mounted upon an ornamental base of spun metal and marble. From the upper end of this standard projects a hollow flexible arm, to the end of which is affixed the ordinary lamp-socket. This flexible arm is so arranged that it may be bent in any direction or coiled upon itself and placed in any desired position. The standard is wired by means of a fire-proof flexible cord which, entering the fixture through an ebonite sleeve placed in the ornamental base, passes up through the standard and the flexible arm to the lamp-socket. This flexibility of the arm enables the user to concentrate his light upon any desired point at will. It is also modified into a wall-bracket, which may be curved or coiled into any desired form.

FINANCIALLY EMBARRASSED.

A dispatch from Newport, R. I., November 22, states that the Edison Light Company of that city had assigned in favor of John Whipple, its manager. It provided light for the streets, power for the operation of street cars and commercial lights in Newport, and several well-known millionaires were numbered among the stockholders. It is said that the Company had not been a profitable investment, owing to the large expense in maintaining the plant. Still, no assignment would probably have been made except for the removal of a suit of Miss Dresser for $50,000 damages from the Federal to the State courts.

The Company had erected a plant on Mr. Vanderbilt's lawn, near the street, to furnish light for his grand ball of last year. Miss Dresser's horses, it is alleged, were frightened by it and ran away, injuring her.

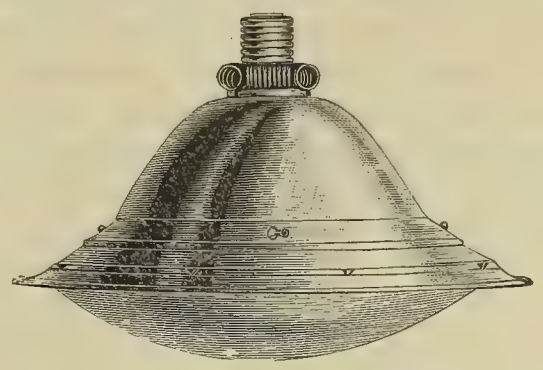
A new corporation will probably be formed to take advantage of an old charter, under which they may place poles where they please instead of being hindered as heretofore.

A MOTOR OPERATING AUTOMATICALLY AT ANY DESIRED SPEED OR TORQUE AND WITH MAXIMUM EFFICIENCY UNDER ALL CONDITIONS.

BY H. WARD LEONARD.

(*Continued from page 655.*)

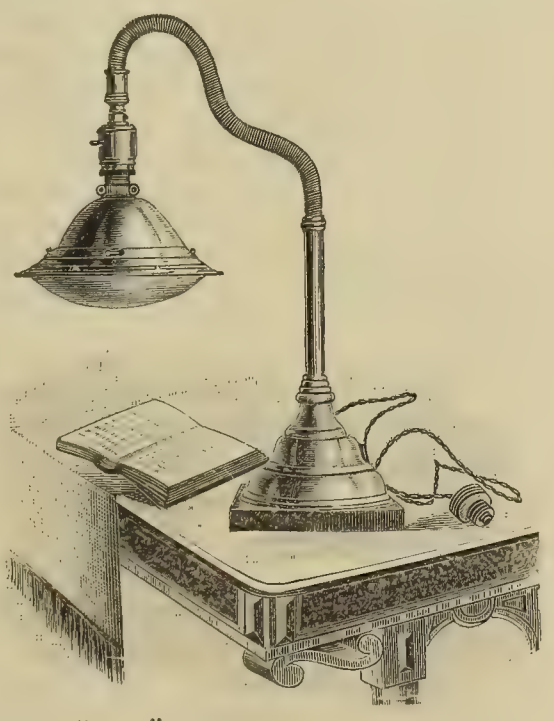
We will place between our tracks, in manholes, converters whose primary pressure can be anything



"C. S." REFLECTOR AND LAMP-SHADE.

required for proper economy and whose secondary will be, say, 15 volts. This secondary circuit will connect directly with the rails. The road will be divided in sections, each a few hundred feet long, and each section will be supplied by its own converter.

This system also lends itself very readily to the transmission of power. We may transmit by alternating currents, and the alternating-current motor running at a constant speed and at a nearly constant torque will drive special generators to operate hoists, pumps, locomotives, etc., at the varying torques and speeds demanded by practice, and yet without subjecting the alternating-current motor to a sudden or wide fluctuation in its torque, and without any necessity of varying its speed. With this system of operating electric motors there seems to be no work met with in practice which cannot be perfectly performed.



"C. S." PORTABLE LAMP-STAND.

On first consideration the additional apparatus necessary would seem to make the system prohibitory in practice; but the capacity of the present single motor is greater than the combined capacity of the apparatus this system would require, and the capacity of the prime motor is very much reduced.

In order to reduce the first cost to a minimum and yet secure the advantages of different automatic speeds and high efficiency, I have devised two modifications of the arrangement described above. The first is adapted to power in which a smooth, efficient acceleration of a load from rest is required, as in the case of passenger locomotives and elevators. The second case is where various automatic speeds are desired, but no especial importance attaches to the starting of the load from rest, as is the case in machinery in general.

For the first case we have the trolley system of electric street cars as the most important. Let us suppose we have two motors of 15 H. P. each for the car. We find that for full speed upon a level we require about 15 ampères at 500 volts. Upon heavy grades we find that about fifty ampères are required, and, as before, we have 500 volts. With this consumption of energy we find that we get a speed upon the heavy grade which is about one-quarter of the speed upon a level. In order to operate upon my system, let us place upon the car a motor generator, the motor part of which is wound for 500 volts and 12½ ampères and the generator part of which is wound for 125 volts and 50 ampères. The fields of the motor and generator part are distinct and are wound for 500 volts, as are the fields of the two propelling motors under the car. All these fields are supplied from the 500-volt trolley circuit. In the field of the auxiliary generator is placed a rheostat.

Now, suppose the car at rest upon a grade. The motor generator is running, but the generator has a very weak field. Its armature is connected by a controlling switch to the propelling motors. We now gradually cut out resistance from the generator field circuit, and finally get about 20 volts at the brushes of the generator. With this E. M. F. we get sufficient current to produce 50 ampères through the armatures of the propelling motors in a saturated field. This gives us the full torque, and the car starts at a speed of perhaps half a foot a second. This speed can be maintained constantly and indefinitely, and the consumption of energy will be less than two H. P. This is less than three ampères from the trolley lines. In practice, however, the speed will be rapidly but gradually accelerated until we have 125 volts upon the terminals of the propelling motors. We will now be running at one-quarter speed and will be consuming 125 volts and 50 ampères—that is, 6¼ K. W. instead of 25 K. W.—to get the same result with existing motors. To put it another way, we will not be using as much energy as is represented by the 500 volts and 15 ampères necessary for full speed on a level.

The next step on the controlling switch will disconnect the armatures of the propelling motors from the auxiliary generator and put the two armatures in series across the trolley line direct. We will now go at a speed represented by 250 volts—that is, one-half full speed. The next step of our switch will place the two armatures in multiple across the 500 volts, and the next and last step will place the 120-volt auxiliary generator in series with the main central station generators and give us 625 volts on our armatures and a correspondingly increased speed. We will be able to go up a grade of six to eight per cent. at full speed, with 50 ampères and 500 volts, which, with the present motors, gives us only about one-quarter of that speed.

Under this arrangement it will be noticed that the only apparatus which could be called additional is the small motor of 500 volts for the generator part of our motor generator, which is useful not only for starting but for full speed also. In stopping the car we have an electric-brake action delivering back energy to the line at full efficiency and not through a rheostat, as at present.

If we have a train of, say, three cars, so that we have six motors, we can start from rest with sufficient smoothness by placing all six armatures in series, which will give us something less than one-sixth speed as the first step. Then we can place three in series with two multiples, which gives us one-third speed. Next, two in series with three multiples, which gives us one-half speed; and finally all in multiple, which gives us full speed. Under such conditions, we can dispense with the small converting plant altogether.

For an elevator requiring, say, 15 H. P., we will put in a motor generator of 3 H. P., with which we will control the starting and stopping and the operation up to one-fifth of full speed. Then for full speed we will connect direct to the line and operate without any conversion of energy.

For power in which smoothness of motion in starting and stopping is not essential I have devised a new system of distribution as follows: Three dynamos, all having the same current capacity and having voltages of 62½, 125 and 250 respectively, are placed in series and from conductors led off in multiple one from each terminal of the machines. These conductors will have potentials which can be represented by 0, 62½, 187½ and 437½. Let us now take a shunt-wound motor, and disconnecting the field from the armature circuit, excite the field from the outside two of the four conductors—that is, by an E. M. F. of 437½ volts. By connecting the armature terminals to the four conductors in various ways we shall be able to operate in either direction at six different automatic speeds represented by the following voltages: 62½, 125, 187½, 250, 275, 437½. By varying the field strength of the motor we can, if required, get any intermediate speed.

(*Continued on page 663.*)

THE ELECTRICAL AGE

DEVOTED TO ELECTRIC LIGHTING AND POWER TELEGRAPHY, TELEPHONY, AND ALL PHASES OF ELECTRICAL DEVELOPMENT.

ESTABLISHED 1883.

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LIGHT, BUT NO WATER.

Considerable consternation was created in Brooklyn last week when the authorities notified the citizens and concerns using steam boilers that their supply of water was to be shut off owing to damage to the main conduit. It was bad enough to be deprived of water, but the thought of also being deprived of electric light and gas when darkness came on added to their misery. The authorities, however, interpreted the order as not applying to gas and electric-light companies, so the great "unwashed" had light, if they had dirty faces.

THE WORLD'S FAIR.

As the time for the opening for the World's Fair approaches, the question of the appointment of the various electrical committees becomes more interesting. The work to be done in connection with the department of electricity will be of prodigious proportions, and it will require considerable time to consider and mature plans; therefore, we think a too early beginning cannot be made.

The Electricity Department will necessarily be divided into many sections or branches, and each section will have to be planned and looked after by persons qualified to perform the duties required. There is plenty of material in the country to make the committees up with, and every section of the United States and every electrical society of any importance should be represented. The one great object of the exhibition is to make it an unqualified success, and in order to do this it must be conducted on broad-gauge principles.

DYNAMOS AND ACCUMULATORS IN TELEGRAPHY.

Herr E. Koeffler, in a paper read recently before the Vienna Electrotechnical Society, discussed the subject of the employment of dynamos and accumulators for telegraph purposes. The use of dynamos in any except large offices was uneconomical, he said. Their great first cost and the cost of maintenance and superintendence only permitted of their economical employment where, as in the United States, comparatively strong currents are used. The author admitted, however, that the substitution of dynamos for batteries at the Central Telegraph Office at Paris had effected a saving. The examples of the London and Berlin telegraph offices were cited in support of the economy of accumulators. By employing 12 ampère-hour storage cells on open-circuit lines, and 50 ampère-hour cells on closed-circuit lines at the Vienna Central Telegraph Office, Herr Koeffler makes out a saving of 38 per cent. over Daniell cells in the case of busy wires. He also alluded to the new departure now being made in Germany, where, at the numerous translating stations between overhead and underground lines which exist in that country, accumulators are substituted for primary batteries.

FALSE REPORTS.

The sensational reports which were spread throughout the country a few weeks ago by the valuable aid of the daily press, to the effect that the foundations of the electricity building in Jackson Park, Chicago, were unsafe and would have to be pulled down, etc., have reached the other side of the Atlantic.

A baseless report can effect incalculable damage to a good cause, and a London contemporary—of course not knowing the actual state of affairs in this particular instance—refers in a sarcastic way to American methods.

Our contemporary's information was based on very little fact, however, and it is to be regretted that the report got about so generally, but the speed of a rumor is greater than that of a steed.

HISTORICAL RELICS.

It may be truthfully said that there is little or no sentiment in the souls of the active members of the electrical profession in the present generation. This age is too full of business and practical problems to admit of any sentimentality.

A little of this quality no doubt is a good and commendable thing at certain times. For instance, what is more praiseworthy than the preservation of the tools or apparatus used in or closely identified with the conception and development of some great invention? As a rule, of course, such things have no intrinsic value—they are valuable only as historical relics, and they do not become historical relics until the lapse of years.

Few persons think to preserve such things that are likely to have historic value in later years; still there are some in the electrical trade who have the bump of reverence generously developed, and are quietly doing a work in the matter of the preservation of prototypes and other relics that will in the future be the subjects of veneration, or mild worship.

Take for instance the first arc light, the first dynamo, the first incandescent lamp, etc., etc. There is only one "first" of its kind, and these first-borns are always valuable as relics. Anything at all that has a history is a subject for a historical collection, and the collector and preserver of such objects is always sure to command the respect and admiration of his fellow-men.

So much for generalities. To be more specific—we print on another page an exceedingly interesting story concerning the "gun-cap" battery that was actually used in the operation of the first Atlantic cable. A battery made out of a gun-cap is indeed a diminutive affair, and one would naturally conclude that its influence on such a length of conductor as that in an Atlantic cable would be nothing at all. But, as small as it was, its power was felt at the opposite end of the cable, and messages were actually transmitted by the aid of its current. This may seem incredible, but the correspondence which is given in connection with the article places the stamp of authenticity on the battery and on the story of what it accomplished.

We also give an illustration of this interesting relic, which is a faithful likeness of the battery. Its crudity will strike the observer at once, and many will marvel that it possessed so much vigor.

It may be well to explain that the cable to which this battery was applied was not operated regularly by this infinitesimal power. The battery was constructed simply to determine how little current would influence the receiving instruments on the cable, and was purely an experiment; but it did the work, and that is why it is interesting and of historical value now.

EXCURSIONS TO THE WORLD'S FAIR.

The committee of the Polytechnic Institution, Regent street, London, is arranging trips to the Chicago Exhibition in 1893, especially intended for workingmen and others of limited means. The authorities have already entered into a contract with the Inman Steamship Company, and parties will leave Liverpool weekly during the months of June, July and the early part of August. According to the plans the tour will be accomplished within one month, and it is expected that cost of the whole excursion will not exceed $125.

INCANDESCENT LAMP-BULBS.

An inquiring mind in contemplating an incandescent lamp is naturally led to inquire why so much glass is used in the bulb. It strikes the observer at once that a good deal of this material could be spared from the bulbs as at present made, and the question is, "Why are the bulbs made so large?"

The only answer is that, like many other things, the original practice is still adhered to. People seem to think that they get more value for their money when there is an abundance of glass in the bulbs than if these were smaller. As there is no objection from consumers to the size of the bulbs the lamp-makers continue to manufacture them without change in form or size. In Europe, however, the subject has received some attention, but whether it is based on economical considerations or not it is just now difficult to say. The demand there is for a much smaller bulb than is used in this country.

There is no doubt that considerable glass could be saved in this direction, but, of course, so long as consumers are satisfied with what they are getting at present it would not be wise to make any change, unless a great saving could be effected without affecting the efficiency of the lamp. A smaller bulb could be used without involving any other feature of the lamp, but it would not do to go to the other extreme and make the bulb too small, as there would then be danger of overheating the glass.

It would seem that a bulb of proper proportions, which means that it would be smaller than the present size, would be more convenient for practical purposes, and less liable to fracture from external causes.

(Continued from page 661.)

In many cases two dynamos will answer, one of, say, 110 volts already in use for incandescent lighting, and the second of, say, 30 volts. With this arrangement we could run in either direction and with automatic speeds represented by 30, 110 and 140.

With the four-wire six-voltage system of distribution in a shop we can take out all countershafting, belting, pulleys and gears, if desired, and place a motor upon every tool, which we can operate in either direction at any automatic speed desired. Lathes, planers, and all tools can be perfectly operated, and by getting rid of all countershafts and belts we can introduce the greatest of modern tools, the travelling crane, which we will also operate from our general system. We can also readily operate ventilating fans, hoists, elevators and factory tramways from the system.

The addition of one dynamo and one new conductor to any existing three-wire system will probably give all the flexibility required to meet practical conditions of varying speeds. For the alternating system a synchronous motor driving our three continuous-current generators will give us the four-wire system in any distant factory or town. For 500-volt street-railway circuits a small motor-generator plant for the slow speeds and a direct connection for full speeds will give us perfect results. For storage-battery work we have the most perfect condition, as we can get any E. M. F. desired, with a corresponding speed while keeping the field separately excited.

Now that we have the rotary field at command, I think I may safely assert that the time is not far distant when we shall have transformers which will, without motion, convert an alternating current in the primary into a continuous in the secondary; and this seems to me to be the ideal system of the future —that is, one in which energy will be transmitted by alternating currents of constant E. M. F. transformed without motion into continuous currents for use at the translating devices and used where motors are concerned, in conformity with the law of efficiency for motors: Vary the voltage as the speed desired; vary the ampères as the torque required.

MEETINGS OF SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS AND THE ELECTRIC CLUB.

A good-sized audience composed of members of the American Institute of Electrical Engineers and of the Electric Club assembled at the latter's house, 17 East 22d street, on the evening of November 24, to listen to a paper by Mr. Carl Hering, entitled "Notes on the Frankfort Electrical Exhibition."

Mr. Hering, it will be remembered, was the chairman of the delegation appointed by the American Institute of Electrical Engineers to represent that society at the Frankfort Exhibition.

The "notes" were illustrated by lantern slides. Mr. Hering introduced his subject by briefly reviewing the part electricity played in exhibitions previous to that one at Frankfort, and, coming down to the main subject, he described in considerable detail the electrical apparatus exhibited at the Frankfort Exhibition. This was followed by a general account of the various electrical systems and apparatus made and used in Germany and other continental countries, and the report throughout was exceedingly interesting.

A bird's-eye view of the Frankfort Exhibition grounds was projected on the screen, and Mr. Hering pointed out the various buildings. Views of several individual buildings and exhibits were also shown. Most of the latter have already been described and illustrated in the various electrical journals in the recent past.

Altogether a delightful evening was spent by those present.

It would not be a bad idea to bring these two societies together oftener. The objects of their existence are radically different, yet the members of both are members of a common business, and it, no doubt, would be of mutual benefit to bring both together occasionally.

BROOKLYN INSTITUTE.

The third meeting of the season of the Electrical Department of the Brooklyn Institute was held in the lecture-room of the Y. M. C. A., Brooklyn, on Friday evening, November 20. A lecture was given by Mr. Edward H. Lyon on "Electrical Measurement of Low Resistances." Mr. Lyon described a method—a modification of that of La Coine—by which current could be measured accurately to the third place of decimals.

The following-named gentlemen were appointed a committee to represent the Electrical Department of the Institute at the World's Fair in Chicago: J. Stanford Brown, consulting electrical engineer, New York; William D. Sargent, general superintendent Metropolitan Telegraph and Telephone Company, New York; W. S. Barstow, electrician Brooklyn Edison Electric Light Company; Edward Peck, electrician Brooklyn Municipal Electric Light Company, and F. V. Henshaw, electrician C. & C. Motor Company, New York.

NEW YORK ELECTRIC CLUB.

An entertainment a little out of the usual run will be given by the Electric Club at 8 P.M., December 3. Mr. E. Rosewater, of the Omaha *Bee*, spent some time in Europe recently in the study of the various systems of government telegraphs, and he will deliver a lecture before the club embodying the results of his investigation.

NEW YORK ELECTRICAL SOCIETY.

Secretary G. H. Guy, of the New York Electrical Society, has adopted an excellent method for increasing the interest and membership of this worthy society. He has sent to the members a letter urging active co-operation on their part, and invites them to suggest to one or more friends the advantages to be derived from membership. He also sends with the letter a blank, to be filled out by each member, with the object of greatly enlarging the sphere of influence and usefulness of the society. Mr. Guy invites suggestions of new work for the society to undertake. The blank referred to contains the following questions to be filled out by the members:

1. Names suggested for membership.
2. What new work can the society undertake?
3. What subjects would be good for papers or discussions?
4. Whom would you suggest to write such papers, or open such discussions?

This is an excellent plan to accomplish the object desired, and every member should not fail to do his part of the work, especially when it is already half done for him on the blank.

THE CHICAGO SOCIETY OF OPERATIVE ELECTRICIANS.

The Chicago Amateur Electrical Society has decided to change its name to "The Chicago Society of Operative Electricians."

The objects of this Society are the advancement of its members in the knowledge of electrical science, by lectures to be given by prominent electricians interested in the Society, and by a thorough course of study, using standard works under the supervision of an instructor. Mr. H. G. Brownell, a college graduate of several years' practical experience, has been chosen for this position.

As soon as the finances of the Society will permit, a library will be started, in connection with which a laboratory will be fitted up.

Another feature of the Society will be an amateur electrical display at the World's Fair.

Mr. J. Allen Hornsby, Secretary of the Electrical Department of the Columbian Exposition, in an address to the Society, stated that the department would endeavor to secure for it the same honors given the professionals, in all departments which could possibly come in its sphere. He also promised that heat, light and power would be furnished for the exhibit. A committee has been appointed to make arrangements for an exhibition, and is already hard at work. The regular meetings are held on the first and third Thursdays of each month. On Monday evenings the members come together for informal study and discussions.

It is earnestly requested that all young men interested in the study of electricity will take an interest in the work of the Society, and that similar societies and experimental clubs will correspond and co-operate with this Society in its endeavor to secure a creditable amateur electrical display at the World's Fair.

All communications should be addressed to the Corresponding Secretary, S. G. Arnold, Room 5,120 Quincy Street, Chicago.

INSTITUTE OF TECHNOLOGY, CHICAGO.

The announcement is made by the Institute of Technology, 147 Throop street, Chicago, that evening classes in electricity, as well as other sciences and arts, have been organized to begin the 1st of December. The building occupied by the Institute was designed and constructed wholly by the students.

A new alloy of lead, very malleable, only slightly affected by acids, consisting of 945 parts of lead, 22 of antimony and 13 of mercury, is being introduced by M. Worms for accumulator plates.

CONSULTING ELECTRICAL ENGINEERS.

Large manufacturing companies are quick to appreciate the advantages of having in their employ experienced and neutral electrical engineers to advise them as to applications of electricity in their business. This is evidenced by the success in this line which H. Ward Leonard & Co. are obtaining.

We learn from H. Ward Leonard & Co. that among the concerns of importance who have recently retained them as consulting electrical engineers are Wm. Sellers & Co., the well-known machine tool builders, of Philadelphia, Otis Brothers & Co., of elevator fame, and the Ingersoll-Sergeant Drill Co.

No large manufacturing concern whose product involves the use of power can afford to neglect the rapid progress of electrical motor applications.

H. Ward Leonard & Co. charge a definite sum per year for their services as consulting engineers, and the manufacturing concerns seem to like this feature of definiteness rather than a percentage charge, or a retainer and individual charge for individual service.

ENLARGING ITS FACILITIES.

The Buckeye Electric Co. of Cleveland, O., manufacturer of incandescent lamps, office 257 The Arcade, is building a large new addition factory, at 1925–1929 Broadway. The main portion of the building is nearing completion: it is a brick structure and well built. There is a one-story wing, of brick, in which will be located the steam and engine plants. The wing is divided into two portions by a brick wall; in one a 100 horse-power boiler, made by the Cleveland Ship-Building Co., will be placed, and in the other compartment a Corliss engine of 100 horse-power, made by Cooper & Co., of Mt. Vernon, O., is now being put in. The company is now using two Packard vacuum pumps, and will add six more on the completion of the new factory. The capacity of its present factory is 600 lamps, but after the 1st of January next, with the new apparatus and additional facilities, the capacity will be increased from 1,500 to 2,000. The electric plant at the present time consists of two Continental dynamos, two Excelsior dynamos, one Kimball dynamo, and the company is now adding three C. & C. dynamos of different sizes, and one C. & C. motor to furnish power for the machine shop. A 30 horse-power New York Safety high-speed engine supplies the power for the electrical machines. The new brick addition to the works is three stories in height, and will be well supplied with the machinery necessary to carry on with great facility the work of manufacturing lamps. The first floor will be used as the pump-room, where lamp bulbs will be exhausted; the second floor will be occupied by the glass-blowers, who make the glass bulbs, and the third floor will be taken up by the filament department, where the delicate work of making filaments will be carried on through every stage.

All machinery and apparatus used in the new factory will be of the latest and most improved pattern, and when the improvements are completed this will be a model lamp factory. The company being in touch with the times makes a specialty of street-railway lamps, and turns out goods of this class of excellent quality.

The Buckeye Electric Co. was organized in the spring of 1890, and started with ten employés. It now has on its pay-roll over fifty names, and when the new factory is completed the number of employés will have to be doubled. The new works will have facilities for the employment of 200 hands. The officers of the company are the same to-day as when it first started, namely: F. H. Prentiss, of New York, President, and C. H. Rockwell, of Cleveland, Treasurer and Manager.

ELECTRIC LIGHT NOTES.

Wakefield, Mass., wants a municipal electric light plant.

The municipality of Muncie, Ind., is to have its own electric light plant.

Manchester, N. H., is agitating the municipal lighting of the streets.

The wires of the electric light companies of San Francisco, Cal., are to be removed from the housetops.

The Court House and grounds at Salem, Ore., are to be lighted by incandescent lamps, supplied by the Salem Electrical Light Co.

The Moyamensing Prison, Pennsylvania, is to be lighted throughout with electricity by an isolated plant soon to be installed in the building.

Orange, N. J., has renewed its contract with the Essex County Electric Co. for lighting the city for a term of five years, at $100 per lamp per year.

James Lowell has been appointed Superintendent of the Bay County Electric Light plant, West Bay City, Mich., in place of Frank Armstrong, resigned.

W. E. Bailey, representing the National Electric Manufacturing Company, Eau Claire, Wis., is after the privilege of installing an incandescent electric lighting system in Alton, Ill.

The Atkinson House Furnishing Company, Portland, Me., will install an isolated plant in the near future consisting of one 300 light Chapman dynamo and a 75 horse-power engine and boiler.

The New Cumberland Light, Heat and Power Co., New Cumberland, W. Va., using the Westinghouse alternating system, contemplates extensive additions to its plant in the near future. Address L. R. Smith, President.

The Electric Gas Lighting Co. of Maine has applied for an injunction restraining John Y. Parke, Philadelphia, Pa., from the making of an alleged infringement on complainants' patented improvements in electric gas-lighting devices.

The Gardner Electric Light Co., Gardner, Mass., was in-

corporated November 3, with a capital stock of $30,000. Incorporators: Roderic L. Bent, F. S. Whittemore, Henry Heywood, George Heywood, H. F. Richardson, Charles O. Bent and R. L. Bent.

The Edison Electric Light and Power Co., Newark, N. J., was incorporated November 5, with a capital stock of $1,000,000. Incorporators: Thomas A. Edison, Orange, N. J.; Moses Biglow, Leslie D. Ward, Elias S. Ward and Henry Young, Newark, N. J.; Burd Grubb, Edgewater Park, N. J.

The Edison Light and Power Co. of San Francisco, Cal., which recently purchased the California Electric Light Co.'s property, has executed a deed of trust to the California Safe Deposit and Trust Co. in consideration of security given by the latter company to bonds aggregating $800,000, issued by the Electric Co.

The Bala and Merion Electric Light Co., Cynwyd, Pa., is erecting a one-story engine and dynamo house, 39 x 50 feet, and a boiler-house 35 x 37 feet. The directors of the company are: Charles Hartshorne, G. B. Roberts, Lincoln Godfrey, C. E. Pugh, J. A. Logan, Cyrus Chambers, Jr., and J. L. Stadelman. The officers are: President, Cyrus Chambers, Jr.; Secretary, J. S. Gerhard; Treasurer, J. R. Rhoads; Superintendent, William Hoopes.

CHICAGO NOTES.

The Indiana Electric Manufacturing Company, of Plymouth, Ind., is a large manufacturer of woodwork for electrical uses. Mr. G. M. Marble is at the head of the concern, and its business is a large one.

Mr. John Williams, 245 Lake street, Chicago, does excellent work in the making of mechanical and electrical models for designs. He is so expert in this line that he makes models from a general description of a piece of apparatus. He has large experience in this business, and his work is unexcelled.

A representative of the ELECTRICAL AGE AND STREET RAILWAY NEWS was recently shown through the extensive works of the Chicago Rawhide Manufacturing Company, 75 and 77 Ohio street, Chicago, by Mr. Prebles, the secretary and treasurer of the company. This is said to be the largest concern of the kind in the country, and the first to manufacture and introduce the famous rawhide belting, which is especially adapted for electric plants. These belts are manufactured by the company's own peculiar process, by which the life and strength of the hide are preserved, making the strongest, most pliable and durable leather for such purposes. Besides belts the company makes a rawhide rope, which for the transmission of power is claimed to be unequalled. Its lasting qualities are great, and it is said to be the most economical belting known to the trade. These rawhide ropes are from ⅜ of an inch to any desired diameter. The raw hide belts are made from one inch to 48 inches. Judging from the large number of testimonials published in the catalogue of the Chicago Rawhide Manufacturing Company it is evident that the goods are all that is claimed for them, and general satisfaction seems to be given by the use of these belts.

George H. Meeker, 78-82 Franklin street, Chicago, the Chicago agent for the New York Insulated Wire Company, carries a very large and complete stock of insulated wires, cables and Vulca ducts. Mr. Meeker claims that he can fill at a moment's notice an order for 1,000,000 feet of No. 14 B. & S. gauge White Core and B. D. wire. The latter goods, while of lower price, are of excellent quality, and as for the insulation there is nothing better for the price. In his stock Mr. Meeker carries 100,000 feet of No. 0000 Grimshaw insulated White Core wire, which wire is considered by experts and buyers to be the best. The stock also includes White Core wire of all gauges from No. 18 to No. 0000. Thousands of feet of Vulca ducts in ten-feet lengths lie around the large lofts; they vary in size from ¼ to 1¼ inches in diameter. In addition to this stock of wire Mr. Meeker has a large quantity at North Pier, Chicago, waiting for storage-room. A large portion of this stock, however, will be shipped to Milwaukee, Memphis, Kansas City and St. Louis, to fill orders recently taken by Mr. Meeker. The New York Insulated Wire Company makes a full line of hard and soft rubber tubing, and the celebrated Grimshaw tape and compound is well known everywhere as one of the best, if not the best, for electrical uses. It is used extensively in the United States and Europe. W. T. H.

NEW INCORPORATIONS.

The Marshall Electric Light Company, Marshalltown, Ia., was incorporated November 2, with a capital stock of $60,000. Incorporators: J. M. Parker, B. E. Surry, T. L. Seevers and George Martin, all of Marshalltown, Ia.

The Little Falls Electric Light and Power Company, Little Falls, N. Y., was incorporated November 1, with a capital stock of $20,000. Incorporators: J. H. Ives, J. E. Fox, J. W. Fitzgerald, W. T. Loomis, Jacob Zoller, W. F. Lansing, H. A. Tozer and others.

LAMP-SHADES.

While electric incandescent light is far less severe on the eyes than gas-light or any other form of artificial illumination, it is yet trying. Protecting devices of various shapes and material are used, but at best these are clumsy and unhandy things. The McCreary Electrical Specialty Company, Electrical Exchange, New York, has just secured the exclusive control of a device of this nature shown in the accompanying illustrations. It is to be called the "Adjustable Electric Light Shield," and is fitted with a spring clamp, which can be attached to any socket. The shield can be moved to any place along the wire, and the latter holding the shield



ADJUSTABLE ELECTRIC LIGHT SHIELD.

will remain in any position either above or below the lamp. As the shield is intended to protect the eyes only and not to obstruct the light, it will be found invaluable to book-keepers, printers, workmen in factories, and for use in all other places where the close application of light is necessary. This device, on account of its convenience, will no doubt find a ready market.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE AND STREET RAILWAY NEWS, FIRST FLOOR, WORLD BUILDING,
NEW YORK, Nov. 28, 1891.

The American Institute Fair closed last Saturday night after a successful season. The exhibits of electrical apparatus and appliances were numerous and attracted a good deal of attention.

Charles A. Schieren & Co., 45–51 Ferry street, corner of Cliff, city, have just shipped a 20-inch perforated electric double-ply leather belt to the Franklin Electrical Company, Franklin, Venango County, Pa. Messrs. Schieren & Co. shipped the Franklin Company a number of belts last spring when the station was installed, and they proved so satisfactory it has ordered a main belt. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone, N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	80 50
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	†20 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	200 00
Bell Telephone 7s	2,000,000		*113
Brooklyn Edison Electric Light	1,500,000	100 00	83 00
Brooklyn Citizens' Electric Light	500,000	100 00	128 00
Brooklyn Municipal Light	500,000	10 00	13 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill. Co., N. Y.	10,000	100 00	†60 00
Brush Illuminating, N. Y.	1,000,000	100 00	50 00
Brush Illuminating, N. Y., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	141 75
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y.	35,430,000	100 00	99 75
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y.	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C.	15,000	50 00	*100
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	24 60
Detroit Electrical Works	1,000,000	10 00	9 00
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y.	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C.	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y.	5,000,000		*97
Edison Elec. Ill. 6s, N. Y.	30,000		*99
Edison Elec. Ill., Lebanon, Pa.	80,000	10 00	13 75
Edison Illuminating, N. Y.	4,500,000	100 00	76 00
Edison Elec. Ill. Convt. Certs.	70,000		†
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	95 00
Edwards Manuf. Co., N. Y.	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y.	120,000	15 00	16 00
Elizabeth E. L. Co., N. J.	100,000	10 00	4 00
Erie Telephone	4,800,000	100 00	46 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y.	300,000		par
Fargo Gas & Elec. Co. 6s, Dak.	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*101
Fort Wayne Elec. Co	4,000,000	25 00	12 25
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky.	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill.	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	18 50
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*79
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co.	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*95
Mount Morris Electric Light, N. Y	1,000,000	100 00	40 00
Morristown L. H. & P. 5s, N. J.	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I.	150.000	100 00	100 01
Nat'l Lead Trust	9,000,000	100 00	16 50
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co.	12,500	100 00	†20 00
N. E. Tel. & Tel. Co.	10,394,600	100 00	49 50
N. Y. and N. J. Tel. and Tel. 5s.	1,500,000		*99
N. Y. and N. J. Telephone Stock.	2,535.000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	†20 00
N. Y. Storage Baty. Co.	100,000	100 00	58 00
Newark L. & P.	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio.	50.000		*95
North American Railway Co.	39,767,200	100 00	17 75
North New York Lighting	150.000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000.000	100 00	30 00
Paterson Electric Light, N. J.	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500.000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston.	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100.000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200.000	100 00	60 00
Richmond L. H. & P., S. I.	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75.000		*94
Russell Electric Co., Boston	300,000	5 00	4 00
Saginaw E. L. & P. Co. 6s, Mich.	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co.	6,000,000	25 00	47 00
Thomson-Houston pref.	4,000,000	25 00	26 00
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s.	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50,000	100 00	100 00
Twin City Rapid Transit, N. J.	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100.000	100 00	75 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188.852	100 00	82 50
Westinghouse Electric Co	7,000.000	50 00	13 00
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	
West End L., Boston	13,550,000		16 50

Yonkers L. & P.....	50,000	100 00	75 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

A patent was issued on November 17 (which has long been assigned) to Emile Berliner for what is claimed to be fundamental principles absolutely requisite for a complete commercial telephone. It has been pending since June 4, 1877. This is another case wherein the public, as well as the shareholders, are largely interested. It is strictly a financial question and one of vast importance to both, for the telephone in business is no more of a luxury to-day than a water-main, or a country road; it is an absolute necessity. The two interests face each other, the one represented by $15,000,000 capitalization selling on current earnings at 180 to 200%, the other by the American people, who for over fifteen years have loyally paid—and paid handsomely—for an invention which is openly acknowledged as of universal service to all men. The benefits have been, let us say, equally divided and enjoyed, for surely many of us have received through the 'phone responses carrying satisfaction equal to the possible pleasure of the largest shareholder at the moment of cashing his dividend check. It is not the province of this department to discuss a point of law, and our lips are sealed in that direction, but as a financial problem it is in good form to say that the intent and theory of the United States Patent Department extending protection to inventors has been exhaustively applied in this case, and that the limit will have been reached at the expiration of the Bell patent of present record. The decision raised the shares to 208, from which there was a drop of 3 points next day.

A Pittsburg dispatch says that the following circular letter has been received by the local banks holding evidences of indebtedness: "I am pleased to be able to state to you that all the arrangements necessary to clear up the affairs of the electric company, and put that concern on a sound basis have been effected. (Signed) George Westinghouse, Jr., President." Vice-President Bannister is reported as saying the reorganizing committee has fulfilled its promise to place the Westinghouse interests in their former good condition; everything is now in a satisfactory state. He further said it would be impossible to name the exact date when all the indebtedness would be paid off, but that little would be left after the 1st of December. He would venture no opinion as to what had caused the recent drop in stock; that it was a matter which did not interest the company. The officials were satisfied with the present state of affairs and cared nothing about outside manipulations. The late Commodore Vanderbilt used even less parliamentary language, but it turned out that he was not only an official but a principal owner. That song will be changed in time and the public will appear in the first-person. We hope to be able by the 1st of January to report the company clear out of the woods, and to quote the preferred shares at a premium as per the then current sales on the floor of the New York Stock Exchange.

The Citizens' Light and Power Co., Montreal, Que., has been incorporated with a capital stock of $50,000. Incorporators: Thomas Badenenach, J. B. Clarkson, J. T. Hagar, T. J. Drummond, Charles Morton, Richard Wilton, H. M. Linnell, J. E. Vanier, D. W. McLaren and W. J. White.

BUSINESS NOTES.

B. F. Goodrich Company, Akron Rubber Works, Akron, O., has just published a comical circular describing its well-known specialties. The circular is amusing and very original. This company deals in rubber goods of all kinds.

The Page Belting Company, Concord, N. H., reports a very active business for October, with sales very largely in excess of one year ago. This company's belts are being shipped to foreign countries, including Japan, Cuba and the West Indies. In dynamo belting, both plain and Eureka, the company reports a very large business.

W. S. Bleckert & Co., 16 and 18 Franklin street and 226 and 228 Lake street, Chicago, do a large trade as manufacturers of electroliers, combination and gas-fixtures. They have their own designer and manufacture these goods on a very large scale. Their prices are the very lowest, and they can fill orders for any quantity of goods on ten days' notice. They have just put into the Grand Opera House, Chicago, some electroliers of their own design, and they have also furnished some for one of the largest dry-goods houses in Aurora, Ill., and the City Hall, Urbana, Ohio. The company has several contracts to furnish opera-houses and State buildings in the Northwest with its goods, aside from its regular trade among the electric supply-houses in Chicago and Western cities.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued November 17 and 24, 1891.

Issued November 17.

463,558. Apparatus for Measuring and Recording Electric Currents. William Thomson, Glasgow, Scotland. Filed Feb. 18, 1891. Patented in England, France, Belgium and Italy.

An instrument for measuring and recording electric currents, comprising right-angularly-arranged straight bars having adjustable weights, an indicator having connection with one of the bars, and a recorder pivoted to the lower end of the indicator by an axle supported by a suspended bracket.

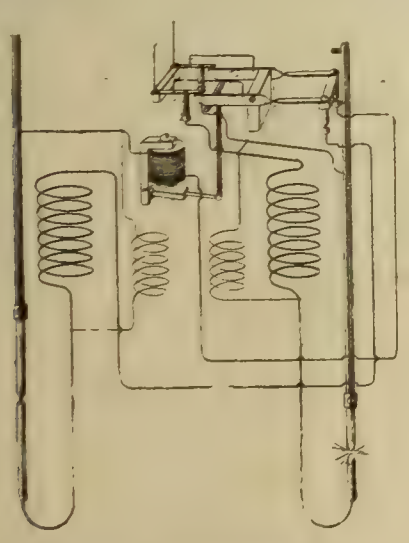
463,569. Combined Telegraph and Telephone. Emile Berliner, Washington, D. C., assignor to the American Bell Telephone Company, Boston, Mass. Filed June 4, 1877.

The method of producing in a circuit electrical undulations similar in form to sound-waves by causing the sound-waves to vary the pressure between the electrodes in constant contact so as to strengthen and weaken the contact and thereby increase and diminish the resistance of the circuit.

463,570. Fire-Alarm. Alphonse Bichet and Robert W. Whitney, Florence, Kas. Filed Feb. 19, 1891.

The combination, with a turbine wheel, a supply-pipe, and an electrically-controlled valve, of a crank-disc on the shaft of the turbine wheel, a pitman, a vertically-movable arm, a pivoted hammer-arm, the latter being connected with the arm, and bell arranged to be struck by the hammer.

463,585. Electric Blower or Fan. Walter B. Snow,



463,595.—DUPLEX-ARC LAMP.

Watertown, assignor to the B. F. Sturtevant Company, Boston, Mass. Filed April 7, 1891.

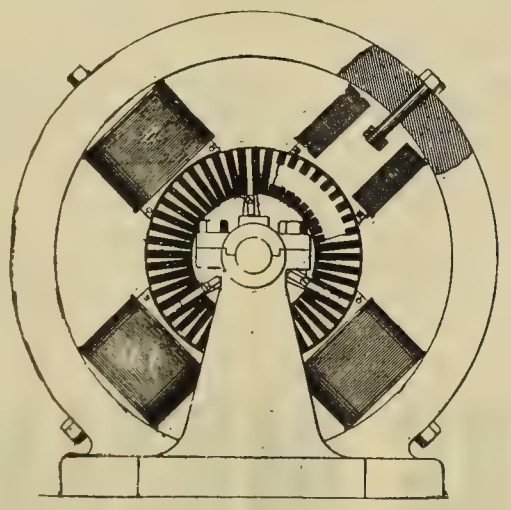
In a blower or fan, an inclosing shell having a side opening, through which the fan-shaft is extended, combined with an independent shield to close the side opening and a bearing for the fan-shaft carried by the shield.

463,586. Mast-Arm for Electric Lights. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross, same place. Filed Oct. 6, 1890.

The combination, with a mounted mast-arm provided with parallel tracks insulated from each other and electrically connected with the poles of an electric-lighting circuit, of lateral braces, and angle-braces connecting and steadying the lateral braces.

463,587. Insulator-Bracket. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross, same place. Filed May 21, 1891.

An insulator-bracket, consisting of a base portion having



463,704.—ELECTRIC MOTOR AND DYNAMO.

bent laterally-separated projecting sides or legs, and an insulator-carrying portion secured to the base portion.

463,588. Insulator-Bracket. Van A. Thomas, Providence, R. I., assignor of one-half to Andrew D. Ross, same place. Filed May 21, 1891.

An insulator-bracket, consisting of an attaching or base portion provided with arms or hooks adapted to receive insulators, the axes of the hooks being inclined to the direction of the base and having the plane of the attaching-face of the base parallel to the hooks.

463,595. Duplex-Arc Lamp. Ernest P. Clark, New York, N. Y. Filed Feb. 16, 1891.

The combination, with two levers, each having one rigid end and the other end elastic, of contacts carried by the elastic ends, and spring-operated contacts located adjacent to the rigid ends and adapted to be operated by them.

463,605. Circuit and Switch for Electric Motors. Wilhelm Lahmeyer, Frankfort-on-the-Main, Germany, assignor to W. Lahmeyer & Co., same place. Filed March 26, 1891. Patented in Germany.

The combination, with the motor-armature and the coils of the field-magnets, of a secondary armature fixed on the same shaft and means of switching the driving-current through both the armature-coils and the magnet-coils, and to switch the driving-current through the main armature-coil and the current from the secondary armature-coil through the coils of the electro-magnet.

463,608. Automatic Fire-Alarm System. Gilman W. Brown, West Newbury, Mass., assignor of one-half to Hayden Brown, same place. Filed Aug. 21, 1891.

Issued November 24.

463,615. Electrical Controller for Elevators. William Baxter, Jr., Baltimore, Md., assignor to the Baxter Electrical Motor Company, of Maryland. Filed Jan. 29, 1891.

The combination, with a suspended car moving in a hoistway, of a rotating motor-shaft, a hoisting pulley and rope for elevating the car, means for coupling the motor-shaft with the hoisting-pulley, an electro-magnetic shifter for operating such coupling device, an electric circuit connected with the coils of the electro-magnetic shifter, and one or more switches provided with suitable contacts connected with the circuit and adapted when the switches are operated to vary the course of the current in the coils of the electro-magnetic shifter.

463,635. Brush-Holder for Electric Motors. James E. Lyons, Cleveland, O. Filed March 19, 1891.

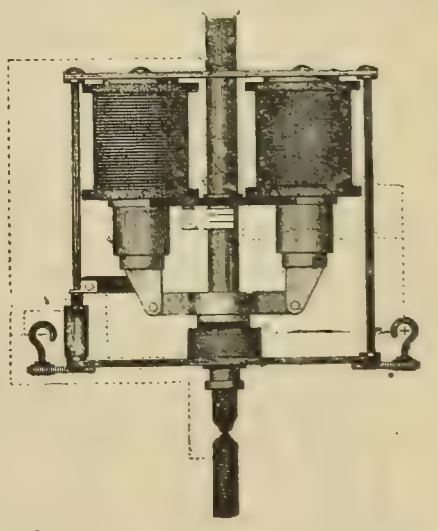
463,671. Armature-Core for Dynamo-Electric Machines. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 5, 1889.

An iron core for electrical apparatus, built up from plates of sheet-iron having a thin adherent scale or coating of hard insulating substance formed naturally in the process of manufacturing sheet-iron and thin interposed distinct separating-plates of zinc, tin, or other non-magnetic metal, all secured together as a solid structure by any suitable means.

463,691. Railway-Signal. Edwin J. Samuels and Frank E. Behrendt, Janesville, Wis. Filed May 14, 1891.

463,693. Electric Motor and Generator. Imle E. Storey, Boulder, Colo. Filed April 6, 1889.

463,694. Commutator for Electrical Machines.



463,720.—ELECTRIC ARC-LAMP.

Willis W. Vail, Quakertown, N. J. Filed June 23, 1890.

463,704. Electric Motor and Dynamo. Albert L. Parcelle, Boston, Mass. Filed April 2, 1891.

A laminated field core having bar passing through the laminations, and a securing bolt or bolts passing through the yoke and into the bar.

463,711. Electric Meter. Anthony Reckenzaun,

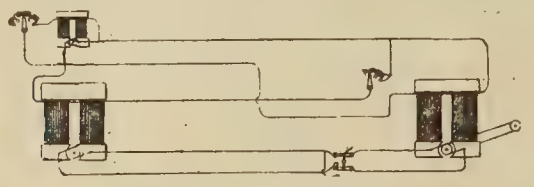
London, England, assignor of one-half to James A. Pentz, Philadelphia, Pa. Filed Nov. 1, 1890.

An apparatus for measuring electric currents or the product of time and currents, comprising indicating mechanism, electro-magnets, gravitating means intermediate of the magnets and indicating mechanism and acting by gravity to move the indicating mechanism, and a member periodically making circuit with the magnets in alternation for energizing them to lift the gravitating means.

463,720. Electric-Arc Lamp. William S. Hays, Troy, Ohio. Filed July 27, 1891.

463,748. Carbon-Brush Clamp for Dynamos. Sherburne Morse, Arkansas City, Kans. Filed July 25, 1891.

A carbon-brush clamp for dynamos, comprising a flexible bar or plate, the rear part of which is adapted to be secured in an ordinary holder, the forward part of the flexible bar or plate being provided with a clamping-plate and tightening screw, adapted in combination with the forward end of the flexible plate, to clamp the carbon-brush.



463,802.—ELECTRICAL TRANSMISSION OF POWER.

463,754. Electric Cigar-Lighter. George N. Engert, Springfield, Ohio. Filed Dec. 24, 1890.

463,762. Electric-Arc Interrupter. Elihu Thomson, Swampscott, Mass. Filed Dec. 15, 1890.

The combination, with an electric-circuit breaker, of a bundle of insulated conducting-plates surrounding one or both of the contacts, and an arc-distorter acting to divert any arc formed at the contacts to the plates.

463,763. Lamp-Socket. Ferdinand Voigt, Bockenheim, near Frankfort-on-the-Main, Germany. Filed Nov. 18, 1890. Patented in Germany, England, Belgium, France and Italy.

In electric screw-contacts, the combination, with one of the elements of the contact having a serrated or toothed thread, of a co-operating element provided with a slot and an elastic or yielding locking-dog projecting through the slot and engaging the serrated thread, the dog operating to lock the elements against accidental rotation in either direction, but yielding and relieving the elements when either of them is forcibly revolved.

463,764. Multiple-Fuse Cut-out. George K. Wheeler, Chicago, Ill., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 26, 1890.

A multiple-fuse cut-out comprising a pivoted rotary disc of insulating material, contacts arranged around the edge of the disc on one of the flat faces thereof, fuses attached to the contacts, and a pair of circuit-terminals making connection with the contacts in pairs as the disc is rotated.

463,770. Electric Cut-Out. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Dec. 2, 1890.

A base provided with contacts for the line-wires flush with its inner surface, with a perforated cap having contact-arms secured thereto, fuses connected to the contact-arms and extended over unperforated sections of the cap, and screw-studs projecting from the base-contacts, with which the contact-arms engage, and located at points in line with the openings in the cap.

463,773. Means for Suspending Electric Lamp. Thos. H. Brady, New Britain, Conn. Filed Feb. 18, 1891.

A lamp-support, consisting of a cross-arm having near one end a crank-shaft and wheel and at the other end a pulley, and the lamp carrying combined chain and cable in the form of an endless band extending over the wheel and pulley, the chain and wheel locking into each other against a slipping motion.

463,785. Electrical Surgical Instruments. Frank L. Connable and Thomas V. Harper, Xenia, Ohio; said Harper assignor and said Connable assignor of one-twelfth to Augusta Mason Connable and Fanny M. Connable, both of same place. Filed Jan. 15, 1891.

463,793. System of Electric Lighting. Edgar J. Hodgson and Joel W. Stearns, Jr., Denver, Colo. Filed Feb. 28, 1891.

463,802. Electrical Transmission of Power. Harry W. Leonard, New York, N. Y. Filed Aug. 14, 1891. Patented in England.

A method of operating and regulating an electric motor, consisting in maintaining the field-magnet of the motor at a constant strength, varying the volts on the armature circuit to change the speed, and varying the ampères on the armature-circuit to change the torque.

463,808. Electric Subway-Switch. Louis A. Fehr, New York, N. Y. Filed Nov. 28, 1890.

463,810. Machine for Covering Conductors. Christopher Klotzbach, Passaic, N. J. Filed Aug. 1, 1891.

463,830. Surface Conduit for Buildings. Robert W. Gibson, New York, N. Y. Filed Feb. 4, 1891.

A surface conduit for wires and other lines, consisting of brackets fixed at intervals to the surface and an elongated hollow shell open on the inside and provided on opposite sides with releasable fastenings which engage the brackets on opposite sides.

463,843. Electric Programme-Clock. John L. McCaskey, Waynesborough, Pa. Filed May 12, 1890. Renewed July 6, 1891.

463,852. Synchronous Telegraph. Charles S. Bradley, Yonkers, N. Y. Filed Jan. 28, 1887.

In a telegraphic system, the combination of two alternating-current machines located at different points, mutually reacting to maintain continuous synchronous movement, an electric connection between them, and telegraphic transmitters and receivers located at such points, the connecting-circuit of which passes through synchronously-driven mechanism controlled by the alternating machines.

463,867. Automatic Safety Cut-Out for Electrical Conductors. Robert A. Morgan, Jr., Boston, and George C. Bosson, Jr., Lawrence, Mass. Filed Nov. 28, 1890.

In combination with an electric main line which has a mechanical circuit-breaker in circuit, a parallel supplemental circuit adjacent thereto, an electrical resistance between the main and supplemental lines, and an electro-magnet in the supplemental circuit to effect the operation of the circuit-breaker.

463,879. Separator for the Plates of Secondary Batteries. Charles F. Waldron, Boston, Mass., assignor of one-half to Charles J. Pillsbury and Walter J. Litchfield, same place. Filed Jan. 12, 1891.

A battery-plate separator consisting of wooden pockets recessed to receive the plate and closed at the bottom to prevent short-circuiting.

463,945. Therapeutic Electric Battery. John A. Crisp, Jefferson, Ohio. Filed Mar. 31, 1891.

463,955. Electric-Wire Insulator. Hiram F. Newell, Manchester, Va. Filed Feb. 28, 1891.

An insulator consisting of a body having a socket in its under side and an annular groove around its upper portion, with separated grooved arms rigid with the body and extending upwardly beside the upper portion of the body, and intermediate downwardly-projecting arms.

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VOL. IX. NEW YORK, DECEMBER 12, 1891. No. 50.

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AN INTERNATIONAL ELECTRICAL EXHIBITION IN ST. PETERSBURG.

It is interesting to note that steps have been taken to hold an International Electrical Exhibition in St. Petersburg, Russia, beginning with the 1st of December, 1892, and to close on the 15th of March succeeding.

We, in this country, are accustomed to hearing and reading reports about Russia and its political system that have a tendency to make most of us believe that Russia would be the last country on earth to encourage such enterprise as is characteristic of the electrical fraternity, and it is a healthy sign to see that such an exhibition is really contemplated. No doubt a display of electrical apparatus in St. Petersburg will do a vast amount of good for electrical industries in general. It will give many of the Russian people an opportunity to see for themselves what progress is being made by the aid of electricity outside of that vast empire, and, incidentally, will stimulate enterprise in that country, not only in the direction of electrical development, but along other lines.

Electricity is a great civilizing agent, and this proposed exhibition, if carried out, will no doubt do much good for the Russian people, and it will pave the way for international business in electrical apparatus.

ELECTROLYSIS IN PLANTS.

We print on another page an abstract of a paper read by Prof. Edwin J. Houston before the Electrical Section of the Franklin Institute, Philadelphia, November 3, on a subject that has, as yet, received very meagre attention from scientific investigators.

Prof. Houston, at a previous meeting, made some informal remarks concerning the possible identity of actinism in growing leaves of plants when exposed to sunlight and electrolytic decomposition, and at the meeting of November 3 he read a paper on the same subject which is full of interest, and which tends to the belief that electricity plays a more important part in the development of vegetable life than has ever before been suspected.

It is now generally recognized by scientists that differences of electrical potential exist in the various parts of a growing plant, but little has as yet been done to ascertain the exact character of these differences. There are so many causes that may produce such differences of potential that it is quite possible that a difference produced by one cause may be neutralized by one or more produced by dissimilar causes, and for this reason alone the determination of these differences would be a most difficult task.

Some of the causes which create a difference of potential in plants are given by Prof. Houston, and he calls attention to another probable source of difference which may still further mask differences already existing and render their detection more difficult. This cause, he thinks, exists in the electrolytic decomposition, under the action of sunlight, of the various oxygenated carbonic compounds derived mainly, if not entirely, from the carbonic acid of the atmosphere.

Prof. Houston bases his inference that the action of sunlight on growing plants should partake of the nature of electrolytic decomposition on Hertz's theory as to the identity between sunlight and electromagnetic radiations of waves.

His remarks, he stated, should be regarded merely as suggestions made in the line of further investigations, and in conclusion he names other directions in which the lines of investigation may be carried.

WIRES LEVELLED BY WIND.

On Friday evening last a violent storm struck this city and did some damage to electric-light lines. The wind which accompanied the storm played havoc with the wires of the East River Electric Lighting Company on First avenue, and levelled the poles for a distance of several blocks. A considerable portion of that section of the city was deprived of its street light in consequence of the damage.

Some of the daily papers in describing the affair tried hard to make it appear that electricity performed its usual "death-dealing" antics, but that mysterious force was not in an obliging mood, and the reporters were deprived of the opportunity to tell a harrowing tale about the "deadly wires." A horse was killed by one of the falling poles striking the animal on the back, and one enterprising reporter was inclined to lay the accident to the "deadly" current, but he had to give up the task.

THE STORAGE BATTERY.

The telephone and the storage battery in one important respect are very much alike, and that is the broadness of the patent claims upon which these industries are based. Each has been assailed time and again in the courts of this country with the result that every one, except the owners of the patents, is practically enjoined from making and using a speaking electric telephone or a storage battery.

The storage battery has figured in the courts for a good many months, and each time a decision has been rendered there has been a narrowing down in the business of manufacturing of storage batteries, until now the industry is practically in the hands of one company.

The Brush patents have been upheld in the courts, and they are owned and controlled by the Consolidated Electric Storage Company, which is, by a decision of the United States Circuit Court for the Southern District of New York, given the exclusive right to manufacture the modern storage battery of every form. This decision practically gives the company as absolute a monopoly in the storage-battery industry as that held by the Bell Telephone Company.

THIS YEAR'S BUSINESS.

In a little more than two weeks hence the present year will have passed away and the new one begun, and the electrical business man will strike a trial balance to see how he stands in his business and financial relations with others.

Taking it altogether we think that the year 1891 has dealt generously with electrical enterprises in the matter of success, and while there may be a few, here and there, who have "seen better days" since they started in, there is every reason to think that the electrical trade has suffered less in proportion than many other older established industries.

We trust that a large balance will be shown on the right side of the ledger and that the new year will bring with it a full measure of confidence in the future.

COMBINATION ALARM CLOCK AND MEDICAL APPARATUS.

Clocks with attachments for bringing an electric circuit into action are not new, but their application has been in connection with more or less elaborate apparatus. The clock shown in our illustration is intended to take the place of the old-fashioned mechanical alarm clock, the greatest difficulty with which has been the short duration of the alarm. The electrical clock in this apparatus is set in the usual manner to ring at a certain hour, and the movement of the clock throws into circuit a handsome three-inch monitor electric vibrating bell which will ring for almost two hours unless switched off. The bell can be placed at any desired distance from the clock and battery. The legs of the clock sit in small receptacles on a finely finished antique oak case and are connected to the battery and bell, and it is only necessary to remove the clock from these connections to open the circuit and stop the bell from ringing.

The electro-medical apparatus shown is very highly finished and is operated by a dry battery, thus dispensing with acids, chemicals and liquids. It is very reliable and convenient for those who do not require the large medical cabinets of the regular electrical physician. The strength of the various currents ranges from those which are so mild as to be scarcely perceptible to the most powerful that can be endured by a strong man. This combination alarm clock and medical apparatus is operated by one cell of dry battery, which with ordinary usage lasts a year or more. Should the battery become exhausted the old cell can be exchanged for a new one at a cost not exceeding 50 cents. The metal parts are all nickel-plated and the case is finely finished.

The outfit, which is manufactured by the Manhattan Electrical Supply Company, 36 Cortlandt street, New York, will make a suitable ornament for any parlor or desk—and an ornament of some use.

ELECTRICAL FIXTURES.

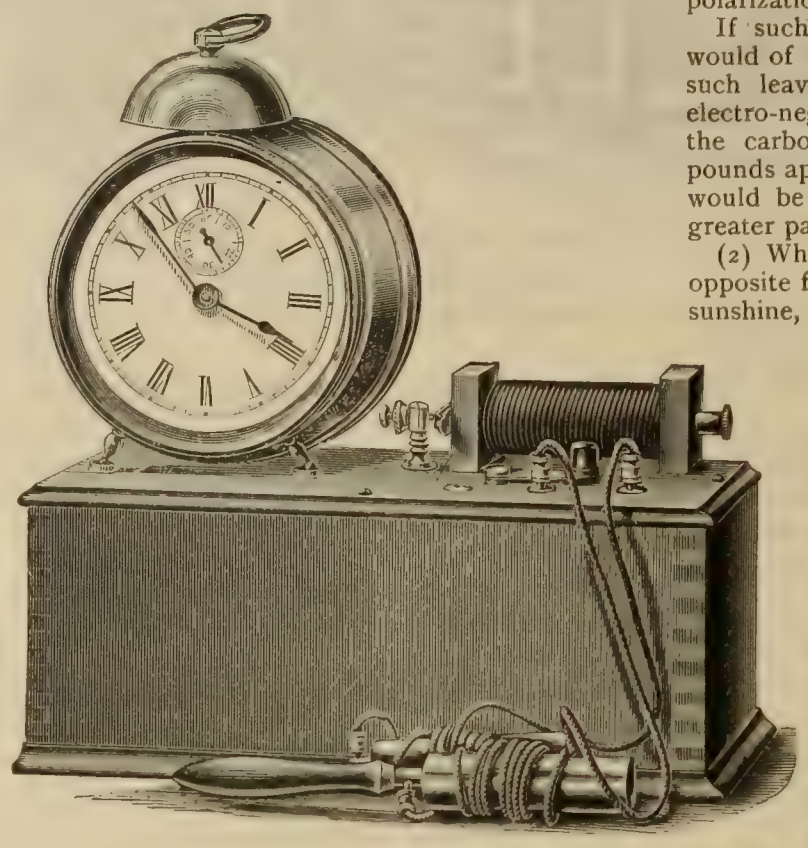
The method of wiring an electrical plant, and the care exercised in its installation, is the first thing that strikes the critical eye of the expert, who rapidly takes in the means of fastening the wires to the walls, the ceiling, the wainscotting, if they are not enclosed in conduits; and the various styles of cut-outs, switches, rosettes, etc., used in the construction work. No matter how well the building is wired, whether the wire is in or ont of sight, if poor electric light fixtures are used the neat effect is entirely destroyed. Next to the wiring comes the appliances for branch circuits, cut-outs, rosettes, etc., which are made so cheaply and ornamental that it seems lack of common-sense to select commonplace materials, which ruin the appearance of the building and the reputation of the electrician.

FIG. 1.

One of the best-known firms in the country for manufacturing articles of this description is the Star Electrix Company, 639–643 North Broad street, Philadelphia—a firm continually making efforts to make just exactly what is wanted, and at the same time of a quality that no company would feel ashamed to place them in the most conspicuous positions.

We illustrate herewith a few of this company's specialties, which will pay an electrical contractor to use. Fig. 1 shows a main line covered cut-out, with the cover removed, and Fig. 2 is a plain rosette, both made of ivory china, a material having a very rich effect. The ivory china may be decorated similar to that shown in Fig. 3, which shows an ivory china switch.

The Star Electrix Company is kept busy manufacturing these specialties, requiring an enormous quantity to supply the demand.



COMBINED ALARM CLOCK AND MEDICAL APPARATUS.

IS ACTINISM A SPECIES OF ELECTROLYSIS?*

BY PROF. EDWIN J. HOUSTON.

I desire to call special attention to the fifth head under which I have classed differences of electric potential in plants, viz.: those arising from the electrolytic decomposition of the various oxygenated carbon compounds derived mainly, if not entirely, from the carbonic acid of the atmosphere.

That the action of sunlight on growing plants should partake of the nature of electrolytic decomposition is, perhaps, to be inferred from the general views now held in accordance with Hertz's theory as to the identity between sunlight and electromagnetic radiations or waves.

These remarks should be regarded merely as suggestions made in the line of further investigations.

As far as our knowledge of growing plants extends, the oxygen which results during the general process of deoxidation, under the influence of sunlight appears to be evolved mainly from the non-illumined or darker face of the leaf, while the carbon, or the less highly oxidized carbon compounds, which are utilized by the plant for the production of its woody fibre and woody tissue, though afterwards deposited in all parts of the leaf, are probably mainly liberated at or near the illumined face.

If these facts be as above mentioned, the decomposition in the leaf under the action of sunlight, of the carbonic acid, or its derivative compounds probably partakes of the nature of electrolytic decomposition.

In this direction I would suggest the following lines of investigation, namely :

(1) To ascertain experimentally whether there exists on the opposite faces of a growing leaf, when exposed to the full action of sunshine, a difference of electric potential resulting from the polarization which always accompanies electrolytic decomposition; and if it be so, what is the nature of such polarization.

If such differences of potential actually exist, it would of course follow that the illumined face of such leaves, under polarization, would be mainly electro-negative, since it is at or near this face that the carbon and less highly oxidized carbon compounds appear, while the dark or less illumined face would be electro-positive, since it is here, for the greater part, that the oxygen is liberated.

(2) Whether electrodes suitably connected to the opposite faces of a growing leaf in the presence of sunshine, will show the presence of an electric current arising from an equalization of the difference of electrical potential.

The value of these differences of potential on the opposite faces of growing leaves, might, of course, be ascertained by the proper use of an electrometer.

(3) Whether a suitable leaf-battery could not be devised by connecting, in alternate succession, the opposite faces of a series of leaves on a plant-stalk.

That is to say, connect the illumined face of one leaf with the non-illumined face of another leaf, and so on in series until any feeble differences of electric potential that there might exist are sufficiently multiplied to sensibly affect the needle of a galvanometer.

(4) A comparison of the effects of sunlight and artificial light, such as the electric light, on such electrolytic decompositions.

(5) Whether any differences exist in the case of the light produced by an alternating-current arc light and that produced by a constant-current arc light.

(6) Supposing the presence of the differences of electric potential due to the electrolytic decomposition, to be established, and the direction of the electric currents so produced, known, to ascertain whether an electric current led through the plant in the same direction as the current produced by actinism, would not tend to increase the assimilation and the subsequent growth of the plant; and, whether, on the contrary, an electric current sent in the opposite direction through the growing leaf would not tend to check such assimilation or growth.

According to some experiments recently made in France, it was shown that electric currents sent through plants under certain circumstances promoted growth. These currents were sent through the soil in which the plants were growing, by electrodes placed in the soil. The nourishing substances in a quantity of manure, placed near one of the electrodes, were clearly carried in the line of the current, or between the electrodes.

(7) To ascertain experimentally whether the converse of the proposition is true, namely: whether an electric current of approximately the same strength as that produced by actinism, when sent through the leaf in the opposite direction, would not result in the production of luminous phenomena in the leaf.

The following facts, well recognized in botany, would seem to show, to some extent, at least, the presence of a species of polarization in certain plants during active growth in sunshine.

In the case of those plants which bend or become concave on the side the most exposed to light: This curvature is due to the fact that a smaller growth occurs on the illumined than on the dark side. This is well recognized in botany, and such



FIG. 2.



FIG. 3.

* Abstract of paper read November 3, 1891, before the Electrical Section of the Franklin Institute, Philadelphia.

plants are called in general *heliotropic* plants. Since they are for the most part highly transparent, considerable light must therefore pass through their entire structure, and the difference in the illumination between the light and dark faces must be comparatively slight. This shows that such differences in growth may occur under comparatively small differences of illumination.

In the case of plants that turn toward the sun: It is a well-known fact that some plants turn towards the light. It is possible that this motion is in some manner the result of the polarization effected, during growth, by the sunlight.

In a series of experiments concerning the effects of the electric light on plant growth, made at the Experimental Station of Agriculture of the Cornell University, some important facts were discovered concerning electric plant-culture.

These experiments seem to show that electric light promotes plant assimilation, and sometimes hastens plant growth and therefore maturity.

The Cornell experiments made during 1889 and 1890 were with the light of a constant current Brush arc lamp. Those made during 1891 were with the light of a Westinghouse alternating current arc lamp.

It would seem to be a matter of considerable interest in the case of these experiments to ascertain definitely, whether any marked differences exist between the action of the light produced by a steady current and that produced by an alternating current. In the line of investigations here suggested, it would of course seem as if the electric decomposition would be less marked in the case of the light produced by an alternating current than that produced by a steady current. And that therefore in those cases where the electric light of the steady current had proved to be injurious to the growth and assimilation of the plants, that with the alternating-current light such injurious effects should be less marked.

AMONG THE BUSINESS MEN.

HORACE IRONMONGER.

The gentleman whose picture we present herewith, Mr. Horace Ironmonger, Electrical Exchange, 136 Liberty street, New York, is well known in the electrical trade.

Mr. Ironmonger may be classed as one of the youngest men in his line of business, but he has a



HORACE IRONMONGER.

large stock of energy and considerable experience to back him. He is prominently connected with several electrical and kindred concerns, prominent among which is the Queens County Light and Power Company of Oyster Bay, Long Island, N. Y., of which he is one of the incorporators.

"Horace," while an active business man, like every other man with a well-balanced mind finds time for recreation and enjoyment. He is a member of the Manhattan Athletic Club of New York City, and has quite a reputation as an all-around athlete. While his name is held in high esteem among his athletic contemporaries, it may be truthfully said that he is held in higher estimation by those of his acquaintances in the electrical fraternity.

Mr. Ironmonger is a gentlemen with whom it is a pleasure to be acquainted.

FOREIGN NOTE OF INTEREST.

An international electrical exhibition will be held in St. Petersburg next year. Several European companies have already engaged spaces, and the Russian railways will reduce their rates for the transportation of goods to the exhibition. The exhibition will be opened by the 1st of December, 1892, and will close on March 15 the following year.

"Q. & S." CORD-ADJUSTER.

All construction companies and users of the numerous devices now made for adjusting electric lights suspended by flexible cord, such as hooks, balls, pea-nuts, etc., will appreciate the little invention just brought out by the McCreary Electrical Specialty Company, 136 Liberty street, and shown in the accompanying illustrations. It has been



CORD-ADJUSTER ON HANGING LAMP.

named the "Q. & S." Cord-Adjuster, as it is both quick and sure. Its advantages are that it can be attached to any cord *after* the lamps are hung and connected, and there is no wear on the cord by taking it up or letting it out, as is the case with nearly all other adjusters. They are made of the best insulated fibre and are very strong and durable.



ACTUAL SIZE OF CORD-ADJUSTER.

Costing but a trifle more than the devices now used, the difference is more than made up in the saving of labor. The "Q. & S." cannot fail to take the place of all other cord-adjusting devices. Being very small and neat, they are ornamental, and they do not take up any of the cord when not in use.

INSULATING WIRE ON ELECTRO-MAGNETS.

The tendency for a leak or short-circuit to occur between any two conductors depends on the difference of their electric pressures. The greater this difference the more likely is the insulating material between the conductors to break down and establish a leak. In an electro-magnet there is generally very little difference in electric pressure between one turn of wire and the turn that lies next to it in the same layer, but there may be a considerable difference in electric pressure between the wire in one layer and the wire that lies over it in the next layer. Hence it is more important to insulate well between layer and layer than between wire and wire in the same layer. For the same reasons it is still more important to insulate well between coil and bobbin, because the wire of all the layers comes close up to the cheeks of the bobbin.

HOW TO DEMAGNETIZE A WATCH.

Prof. Silvanus P. Thompson gives a simple method for demagnetizing a watch. Suspend the watch near a powerful electro-magnet by a twisted cord, gradually removing it to a distance from the magnet while the cord is unwinding. The rapid revolutions of the watch before the magnet induce a series of alternate magnetizing forces in the parts of the watch magnetized, the force becoming weaker as the watch is removed from the magnet. The best method is to place the watch within a tubular coil of wire through which an alternating electric current is being sent, and to withdraw the watch slowly from the coil.

MEETINGS OF SOCIETIES.

BROOKLYN INSTITUTE.

Mr. William Barstow, General Superintendent of the Edison Illuminating Company, Brooklyn, delivered a lecture on the evening of December 4, before the Department of Electricity of the Brooklyn Institute, on "The Direct Application of the Armature of the Motor to the Running of Machinery." The lecture was illustrated by dynamos and appliances.

THE ELECTRIC CLUB.

A large audience met at the Electric Club's rooms, 17 West Twenty-second street, this city, on the night of December 3, to listen to the remarks of Mr. E. Rosewater, editor of the Omaha *Bee* and president of the Old-Time Telegrapher's Association, on the subject of European Government Telegraphs.

Mr. Rosewater was commissioned by the Postmaster-General to investigate the various systems in vogue in European countries, and recently returned to this country. His address was interesting throughout, and was listened to attentively by the large audience, among which were several prominent telegraph officials and others connected with the telegraph service in this country.

Mr. Rosewater advocated government control of the telegraph, but Hon. Erastus Wiman, the chairman of the meeting, in subsequent remarks said he thought if the government wanted to assume control of the existing telegraph service it should first get control of the Standard Oil monopoly, which he thought was a more dangerous one than the telegraph.

Among the telegraph officials present were A. B. Chandler, President of the Postal Telegraph Co., W. J. Dealy, Manager of the Western Union Telegraph office, New York, George G. Ward, General Manager Commercial Cable Company, and others.

NEW BOOKS.

THE ELECTRO-MAGNET AND ELECTRO-MAGNETIC MECHANISM, by Silvanus P. Thompson. E. & F. N. Spon & Co., New York, 450 pages; 213 illustrations. Price, $6.

In 1890 Professor Thompson delivered a series of Cantor lectures on "The Electro-Magnet" before the Society of Arts, London, which at the time were reproduced with great liberality in the electrical journals in this country. The book under consideration embodies these lectures combined with the author's presidential discourse to the Junior Engineering Society on "Electro-Magnetic Mechanism," both in amplified form.

After an interesting historical introduction the author gives some generalities concerning electro-magnets and their forms and materials of construction. In chapter III the properties of iron are considered in the author's well-known able style, and in the next and succeeding chapters we get down to the practical application of the electro-magnet. The principle of the magnetic circuit and the law of traction are treated of in chapter IV; rules for winding copper wire coils are given in chapter VI, and electro-magnets for various purposes, and electro-magnetic motors are considered in the remaining chapters.

Professor Thompson has investigated this subject probably more than any other scientist, and in the light of recent knowledge and practice he has developed many important facts and laws concerning the electro-magnet which are of the utmost value to the electrical engineer.

The book is neatly gotten up, well printed and well illustrated, and certainly will find its way into every electrical library. No electrician can well afford to be without a copy as it contains facts that cannot be found in any other work, and which are of the greatest value and importance to the practical electrician. It stands as the leading work on this subject.

LEGAL.

ENJOINED FROM MAKING ACCUMULATORS.

The United States Circuit Court for the Southern District of New York has granted a perpetual injunction against the Electrical Accumulator Company and its officers, restraining them from making storage batteries in infringement of the patents of Charles F. Brush. The Consolidated Electric Storage Company, which is the successor of the Julian Electric Company, now owns these patents, which cover every form of the modern storage battery.

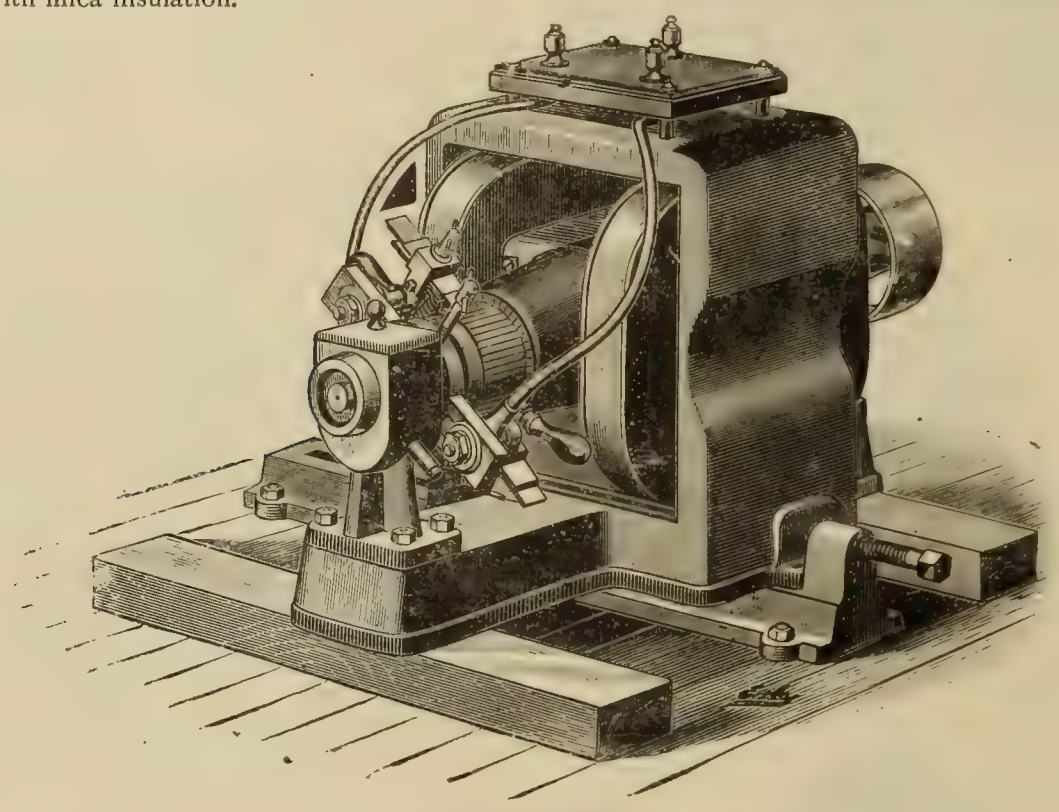
THE BAIN DYNAMO.

The Bain Electric Manufacturing Company, 47 South Jefferson Street, Chicago, is making small, isolated plants complete that will pay those in the country or those not in the lighting district in the city to investigate. The apparatus is designed for practical, every-day use, and is so simplified by the leaving off of every unnecessary feature as to require no knowledge of electricity to satisfactorily run the plant.

The plants are made with capacities from 5 to 30 16-candle power lamps, and includes regulators, sockets, switches, and all necessary appliances. They are very efficient and economical both in first cost and cost of operation.

The dynamo shown in our illustration is made of the softest Juniata sheet-iron. The field magnets are stamped of a single piece of sheet-iron, a number of the pieces being put together to form a laminated field magnet without a joint. The end castings which support the bearing are of mitis iron, making them iron-clad and producing an ideal field. The field coils are placed inside on the poles of the field between the two cast plates, so that every inch of wire on the field contributes to useful effect.

The armature is of the drum type, with Paccinotti projections and the winding of Froelich modification. The shaft is large and of the best steel, and runs in thimble bearings of the best bronze metal, which are easily renewed. The commutator is made of tempered copper; it is large and solid, and put together with mica insulation.



BAIN DYNAMO.

Each plant is sent to the purchaser with all connections on the switchboard made, and with those to be made so plainly marked that no difficulty will be found in putting the apparatus together.

THE WESTON STANDARD VOLTMETER IN GERMANY.

W. Le Conte Stevens, writing to Mr. Edward Weston, Vice-President of the Weston Electrical Instrument Company, Newark, N. J., says that the Weston Standard Voltmeter is held in very high esteem in Germany. At a lecture recently attended by him at the Polytechnic School in Zurich, the lecturer, who was a member of the Testing Commission at the recent Frankfort Electrical Exhibition, said he had subjected the Weston Voltmeter to various tests and found it in the highest degree satisfactory. As an illustration of the excellence of the magnet employed, he stated that an instrument having fallen accidentally upon the floor, its subsequent indications were not affected more than ½ of 1 % by the mishap.

The Weston Electrical Instrument Company is very busy.

CATALOGUES.

The C. & C. Electric Motor Company, 402 and 404 Greenwich street, New York, has just issued a fifty-page catalogue, describing and illustrating its well-known motors and its new type of dynamos. Many of the appliances which the company manufactures are fully illustrated and described; and in the back of the catalogue are fac-similes of letters testifying as to the efficiency of the company's motors.

The Consolidated Electric Manufacturing Company, Boston, Mass., has just published a catalogue of the general electrical supplies which it manufactures. This company manufactures supplies for electric light and power, electric railways, electric signalling and gas-lighting. It is also agent for the well-known Grimshaw wires, tapes and splicing compounds.

The Ries Electrical Specialty Company of Baltimore, patentee and sole manufacturer of regulating sockets for alternating-current incandescent lamps, has just issued a neat little pamphlet setting forth the advantages of this well-known apparatus. By the use of the regulating socket incandescent lights can be varied in brilliancy at will, from the dull red to the full incandescence.

The Nowotny Electric Co., Cincinnati, O., has just published a little illustrated pamphlet describing its many specialties. The pamphlet is neatly gotten up and contains many novelties that are very tempting to electrical students, one of which, the Triumph dynamo and motor, should be in the hands of every one studying electrical science.

ORDERED TO RETURN THE BONDS.

On December 1 the Manhattan Electric Light Company, Charles L. Bernheim, Abram C. Bernheim and others, were directed by Justice Lawrence of the Supreme Court to return forthwith $200,000 in bonds given by the Harlem Lighting Company to the Manhattan Electric Light Company. The order also directed the rescinding of the resolution by which these bonds were transferred. The order was granted on the application of Levi L. Gans, owner of $15,000 in stock of the Harlem Lighting Company. Mr. Gans alleges that the Bernheims and others entered into a conspiracy to merge the Harlem into the Manhattan Company. Circulars were issued inviting the stockholders of the Harlem Company to exchange their stock for Manhattan, then notices were served, as alleged, that a judgment of $142,802 had been entered against the Harlem in favor of the Manhattan, and again inviting exchange of stock. Mr. Gans then began proceedings to set the judgment aside, and the defendants were enjoined from taking any proceedings bearing on the case. It is alleged that the Harlem Company's directors passed a resolution on motion of Charles L. Bernheim after the injunction was granted providing that $200,000 in bonds be transferred to the Manhattan Company. The transfer was made, and now Justice Lawrence holds that both acts were in violation of the injunction, and unless the defendants comply immediately with the order to return the bonds and rescind the resolution, they will be punished for contempt of court.

NEW INCORPORATIONS.

The Western Telegraph and Electric Co., Ouray, Col., was incorporated November 2, with a capital stock of $100,000, to build a telegraph line from Ouray to Red Mountain in Ouray County, Col. Incorporators: L. L. Bailey, J. J. Burns and B. Brooks.

The Crown Electric Manufacturing Co., Bridgeport, Conn., was incorporated November 5, with a capital stock of $10,000. Incorporators: E. L. Smith, C. J. Norton, F. H. Bryant, all of Bridgeport, Conn.

The Woolverton Glove Arc Electric Light Co. of New York, Newark, N. J., was incorporated November 3, with a capital stock of $250,000. Incorporators: J. E. Woolverton, W. McCubbin and J. N. Cox, all of New York, N. Y.

The Proctor Electric Fleet Co., Chicago, Ill., was incorporated November 3, with a capital stock of $30,000, to manufacture, fit out and run a fleet of electric barges. Incorporators: David R. Proctor, Hollis D. Holden and Harry H. Meyers. (World's Fair enterprise.)

The Morgantown Electric Light and Power Co., Morgantown, W. Va., was incorporated October 31, with a capital stock of $500, with the privilege of increasing to $10,000. Incorporators: H. J. Sands, O. S. McKinney, G. C. Sturgiss, J. A. Meyers and W. P. Willey.

The Safety Electrical Co., Newark, N. J., was incorporated November 28, with a capital stock of $25,000. Incorporators: A. Broenel, F. Bralson, R. J. Brittain, all of Newark, N. J.

The Malvern Light and Power Co., Malvern, Mills county, Iowa, was incorporated November 30, with a capital stock of $10,000. Incorporators: J. D. Paddock and L. W. Boehner, Malvern, Iowa.

The Litchfield Light, Heat and Power Co., Litchfield, Ill., was incorporated November 30, with a capital stock of $50,000, to operate gas and electric plants. Incorporators: H. H. Beach, J. B. W. Amsden and Robert M. Foster.

The Astoria District Messenger and Electrical Co., Astoria, Ore., was incorporated November 27, with a capital stock of $30,000. Incorporators: J. W. Crios, J. S. Urquhart, H. B. Loman, all of Astoria, Ore.

The Patton Motor Co., Portland, Ore., was incorporated November 27, with a capital stock of $50,000. Incorporators: W. W. Evans, Frank Dekum, John Hale, Cleveland Rockwell, R. L. Durham, all of Portland, Ore.

The Electric Medical Process Co., Camden, N. J., was incorporated November 25, with a capital stock of $100,000. Incorporators: W. Cohlman and R. M. Stackhouse, of Philadelphia, Pa., and H. Troth, of Camden, N. J.

The Morelton Electric Light and Power Co., Torresdale Mills, Pa., was incorporated November 30, with a capital stock of $1,000. Incorporators: Henry V. Massey, Torresdale, Pa.; Edwin M. Thomas, Morelton, Pa., and Joel H. De Victor, Andalusia, Pa.

The Bowling Green Electric Light and Power Co., Bowling Green, O., was incorporated December 1, with a capital stock of $50,000. Incorporators; George S. Long, Joseph Schauer, E. H. McKnight, Jacob Henne and Samuel J. Miller.

The New England Heat Regulator and Electric Co., Portland, Me., was incorporated November 28, with a capital stock of $50,000. Incorporators: William Stopford, Joseph H. Wallis and Darling L. Trafton, all of Beverly, Mass.

The Paragould Electric Light and Power Co., Paragould, Ark., was incorporated November 18, with a capital stock of $6,000. Incorporators: C. Wall, W. C. McDonald, M. F. Caller and A. Bertig.

The San Francisco Electric Manufacturing Co., San Francisco, Cal., was incorporated November 21, with a capital stock of $1,000,000. Incorporators: Frederick H. Hausman, Samuel H. Brooks, George B. Fraley, William A. Woods, Septimus de Mayer, all of San Francisco, Cal.

The Velasco Ice, Light and Refrigerator Co., Velasco, Tex., was incorporated November 21, with a capital stock of $50,000, to construct and operate an electric light plant, etc. Incorporators: H. Hamilton, J. A. Patton, H. Prince and C. A. Zilker, all of Houston, Tex.

The Cleveland Electric Lighting Co., Cleveland, O., was incorporated November 25, with a capital stock of $100,000. Incorporators: A. L. Bassett, C. E. Shattuck, Charles H. Gill, R. A. Carran and H. C. Bunts.

The Mechanicsville Electric Light, Heat and Power Co., Mechanicsville, N. Y., was incorporated November 24, with a capital stock of $25,000. Incorporators: Cornelius R. Sheffer, Stephen Lee, Joseph H. Packer, all of Mechanicsville, N. Y.

The Ouray and Ironton Electric Railway, Light and Power Co., Ouray, Col., was incorporated November 24, with a capital stock of $800,000. Incorporators: Otto Mears and Fred Walsen, Denver, Col.; Charles Munn, Ouray; Joseph N. Casanova, Phillipsburg, Pa., and William A. Wallace, Clearfield, Pa.

The Santa Paula Water Works, Santa Paula, Cal., was incorporated November 9, with a capital stock of $150,000, to utilize water-power for the generation of electricity. Incorporators: Wallace R. Hardison, Nathan W. Blanchard, C. H. McKevett, Lewis W. Hardison and Dan G. Gailey, all of Santa Paula, Cal.

The Long Island City Electric Illuminating Co., Long Island City, N. Y., was incorporated November 9, with a capital stock of $50,000. Incorporators: Edward M. Tyrrell, James W. Lamb and William A. Christian, all of Brooklyn, N. Y.

The Allegan Light and Power Co., Allegan, Mich., was incorporated November 11, with a capital stock of $10,000. Incorporators: I. P. Griswold, Arthur F. Marsh, Allegan, Mich., and James H. Dewing, Kalamazoo, Mich.

The Electric Appliance Co., Chicago, Ill., was incorporated November 11, with a capital stock of $30,000. Incorporators: Charles S. Grover, Benjamin F. March and William H. Joplin.

The Washburn Electric Light and Power Co., Washburn, Wis., was incorporated November 13, with a capital stock of $20,000. Incorporators: A. C. Prohert, J. F. Meehan and Peter Nelson.

The Bronx Electric Light Co., New York, N. Y., was incorporated November 13, with a capital stock of $15,000. Incorporators: John B. Munn, John S. Bush and Charles C. Leary, all of New York, N. Y.

The Phœnix Electric Co., Duluth, Minn., was incorporated November 14, with a capital stock of $10,000. Incorporators: Joseph M. Anderson, Robert S. Eyster and H. R. Fish, Jr., all of Duluth, Minn.

The Ronceverte Electric Co., Ronceverte, W. Va., was incorporated November 16, with a capital stock of $100,000. Incorporators: Thomas J. Shyock, George F. Houck and James E. Brewer, all of Baltimore, Md.

The B. and S. Storage Co., Sioux City, Ia., was incorporated Nov. 17, with a capital stock of $1,000,000, to manufacture and sell general electrical appliances. Incorporators: E. M. Dunbar, C. S. Wallis and J. Y. Bradbury, all of Sioux City, Ia.

The Eldredge Electric Co., Bloomfield, Essex County, N. J., was incorporated November 13, with a capital stock of $100,000. Incorporators: Charles L. Heins, Bloomfield, N. J.; R. Eldredge, New York, N. Y., and M. C. Kellogg, Mount Vernon, N. Y.

The Electric Ore Reducing Co., San Francisco, Cal., was incorporated November 25, with a capital stock of $2,000,000. Incorporators: Monroe Thompson, W. L. Brown, F. E. Brown, J. Gordon, S. B. Clark, all of San Francisco, Cal.

The Italian Motor and Power Co., Portland, Me., was incorporated November 25, with a capital stock of $500,000, to generate and use motive-power of all kinds. Incorporators:

Richard H. Coe and Michele Russo, Boston, Mass., and D. W. Scribner. Portland, Me.

The Electric Heat Alarm Co., Bangor, Me., was incorporated November 24. with a capital stock of $25,000. Incorporators: E. L. Sterns, Fred S. Palmer and Edward L. Stewart, all of Bangor, Me.

The Electric Reflector Co., Rutherford, N. J., was incorporated November 25, with a capital stock of $10,000. Incorporators: C. M. Becker, M. Hofheimer, W. A. Schiffer, C. L. Gans, New York, N. Y., and L. Shafer, Rutherford, N. J.

The International Supply and Construction Co., San Francisco, Cal., was incorporated November 23, with a capital stock of $5,000,000. Incorporators: Columbus Waterhouse, San Francisco; James Spiers, Berkeley, Cal.; H. S. Crocker, C. O. Swanberg, C. S. Benedict, A. F. Johns, E. E. Parsons, Charles Montgomery, all of San Francisco, Cal., and Andrew Brown, Oakland, Cal.

The Torresdale Electric Light and Power Co., Philadelphia, Pa., was incorporated November 27, with a capital stock of $1,000. Incorporators: Henry V. Massey, James Jardin, Jr., Samuel F. Gillies, Torresdale, Pa.

The Railway Electric Lighting and Heating Co., Chicago, Ill., was incorporated November 25, with a capital stock of $500,000. Incorporators: F. C. Rutan, Louis Spahn and John G. Campbell.

The Ypsilanti Electric Co., Ypsilanti, Mich,, was incorporated November 18, with a capital stock of $25,000. Incorporators: Brainard Rorison, M. V. Rorison, Fort Wayne, Ind., and A. C. Rorison, Ypsilanti, Mich.

The Southern Montana Telegraph and Electric Co., Virginia City, Mont., was incorporated November 16, with a capital stock of $25,000. Incorporators: Henry Elling, A. J. Bennett, Barclay Jones, George Gohn and John Mitchell, all of Virginia City, Mont.

The Point Pleasant Electric Light and Power Co., Point Pleasant, W. Va., was incorporated November 20, with a capital stock of $50,000. Incorporators: D. S. Snyder, Point Pleasant; F. M. Durbin, George E. Milligan, Parkersburg, W. Va.

The Des Moines Water Power and Electric Co., Des Moines, Ia., was incorporated November 19, with a capital stock of $225,000. Incorporators: Lowry W. Goode, Fred H. Goode, C. E. Meade, Des Moines, Ia.

The Farmers' Protective Union, Bradley, Cal., was incorporated November 16, with a capital stock of $50,000, to construct and operate gas and electric works. Incorporators: James A. Haskett, John T. Donaldson, Thomas Bowden, David Manning, Frederick Cochran, Ernest Bergeman, John W. Jones, Bradley, Cal., Hugh C. McDonough, and Joshua J. Betts, Pleyto, Cal.

THE MOSHER ARC LAMP.

The lamp manufactured by the Mosher Arc Lamp Company, Chicago, for use on incandescent circuits, has been rapidly growing in favor with owners of isolated incandescent plants, and others who desire arc lamps to use with their incandescent systems. The lamp is the result of over two years' tests and use, and as now constructed is claimed to possess more novel and economic features than any other lamp on the market. In its construction all clockwork is dispensed with, making it the essence of simplicity. When no current is passing through the lamps the carbons are held apart by a spring. When the current enters the lamp a derived-circuit coil operates to force the carbons together, when an arc is instantly formed and maintained by the operation of two opposing forces, the spring and the solenoid.

The length of the arc is easily adjusted by means of a regulating screw at the top end of the spring. An adjustable resistance composed of fine braided wire is enclosed in a case at the top of the lamp, or it may be located where desired at any convenient place away from the lamp. From the method of its construction a weather-hood is unnecessary. It is adjustable to any voltage of from 50 to 500, making it particularly adapted for street railway purposes. It will use from three to six ampères single, or eight to ten ampères in series of two. When the carbon is burned out it cuts itself out by means of an automatic cut-out, and the regulation of the lamp can be accomplished without removing the jacket.

The company is in receipt of a large number of letters testifying to the efficiency of the lamp. In one of these Mr. J. H. Jenkins, manager of the Winona Electric Light Co., Winona, Minn., under date of Nov. 25, says: "We have been using the Mosher Arc Lamp on our Edison three-wire system since last February, and are now using twenty-five. They are giving good satisfaction to our customers, and are the most economical and profitable lamps for owners that we have for use."

ELECTRIC LIGHT NOTES.

The Dempster Mill Manufacturing Company's works, Beatrice, Neb., is to be illuminated by incandescent electric lights.

It is reported that the Brush Electric Light Co., Indianapolis, Ind., will erect a new power-house on Kentucky avenue, near Mississippi street, at once.

The Ogden Gas-Light and Fuel Co., Ogden, Utah, using the Thomson-Houston and the Westinghouse systems of electric lighting, will increase its plant to the extent of between 1,300 and 1,700 lights in the near future. David F. Walker is president of the company.

NEW YORK NOTES.

Mr. H. P. Lucas, Chicago agent of the Anglo-American Insulated Wire Company, was in town this week.

Mr. W. B. Harding, financial representative of Wm. A. Lombard, was a visitor at our office a few days ago.

H. Ward Leonard & Co., of the Electrical Exchange, this city, have secured the services of Mr. H. W. Hamblin, a well-known business manager of electric light companies in the East.

A dividend of 5 % was paid the stockholders of the Crocker-Wheeler Motor Company November 15 last. A reserve fund was at the same time created, and the balance of the profits was set aside for this fund.

The Interior Conduit & Insulation Co., of this city, has just issued circular letters No. 23—26, both inclusive, giving price lists of brass armored tubes, elbow tees, etc., with couplings attached, and attaching plugs and receptacles.

J. H. Bunnell & Co., the well-known dealers in electrical supplies, 76 Cortlandt street, this city, have just taken a mammoth order for Kerite wire. The order calls for 700,000 feet, and it is to be placed in the New York Central tunnel in this city. It is for telegraph use.

Mr. Wm. H. Tucker, formerly senior member of the general electrical construction firm of Tucker & Hall, which partnership was dissolved on the 1st of last October, carries on the same business at 136 Liberty street, and is kept busy. He does first-class work, and that is the secret of his success.

The report is revived that the American District Telegraph Company and the Mutual District Telegraph Messenger Company, both of this city, are negotiating for consolidation. While the report cannot be confirmed at the present writing, it is generally believed that steps in this direction are being taken, and that the consolidation is a question of but a short time.

Charles S. Forbes, superintendent of pay-stations of the Metropolitan Telephone and Telegraph Company in this city, has been arrested on the charge of forgery. It is alleged that he altered the memorandum sheets kept at the Fifth Avenue Hotel. "Pay" communications were marked "free" on the sheets, and it is charged that Forbes pocketed the money. It is thought that the company has lost more than $500.

The New England Insulated Wire Co. is now represented at 18 Cortlandt street by Mr. H. G. Madden as general sales-agent. Mr. Madden's long experience in the supply business and introduction of electrical goods generally is an excellent recommendation of the quality of the goods he is now introducing. He is meeting with great success, and placing some large orders for electric-light line wire as well as wire for interior work.

W. H. Eckert has assumed the management of the long-established and celebrated insulated wire and cable business of A. G. Day (S. A. Day successor), 16 Dey street, city, and is prepared to supply the wants of the electrical trade any line of high grade insulation. It is unnecessary to refer to the character of Kerite insulation, as it has been in use for a great many years, and is familiar to all dealers and users of electrical goods.

The Zucker & Levitt Chemical Co., 40 Murray street, city, received a medal of superiority for its Hercules dynamos and motors at the American Institute Fair just closed. The company will occupy its new six-story brick building, 75 x 125 feet, at 10–14 Grand street, about the 1st of February, where it will have the latest and best facilities for turning out these machines in all sizes. At the present time the company has ⅛, ½ and 1 horse-power machines on hand, but intends to have its future supply second to none.

The McCreary Electrical Specialty Co., 136 Liberty street, city, the well-known manufacturer and dealer in all kinds of incandescent lamp fittings and electrical specialties, has just received a new calender for the handsome glass calendar and paper-weight which it presented to the trade a year ago. The company will be pleased to furnish the calendar to all those who have the paper-weight. The Electric Age Publishing Company has found the calendar and paper-weight a very useful article during the past year.

The Clark Electric Company, 192 Broadway, this city, was awarded a special silver medal by the American Institute at the close of the exhibition, November 28 last, for the Clark Electric Search Light. This light attracted a great deal of attention during the exhibition. It can be operated in every possible direction without affecting the light in the least. The Clark Electric Company is constantly bringing out new and valuable improvements in arc lighting, of which it makes a specialty. The merits of the company's arc apparatus are well known, and the demand for the same is rapidly increasing.

Scott Electrical Works, 26 Liberty st., city, under the management of Dr. Scott, manufacturer of the Huntington Search Lamp, focusing lamps, theatrical lamps, photo-engraving lamps, etc., has lately enlarged its manufacturing facilities by placing in its works a new Garvin four-spindle drill, a No. 2 screw-machine and two speed-lathes manufactured by the Garvin Machine Works, Laight and Canal sts., this city. The machinery in the shop is run entirely by a five-horse-power Edison motor. The Scott Company has lately brought out a new arc lamp for incandescent circuits, in the successful operation of which it has every confidence. Several of them may now be seen in the company's offices, and these lamps will be placed on the market very shortly.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	52 00
Am. Elec Exercise Mach. Co., N.Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone, N.Y..	50,000	100 00	98 00
American Telegraph and Cable...	14,000,000	100 00	81 00
American Telephone Co., D. C....	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exh. Co	25,000	100 00	420 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y...	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	194 00
Bell Telephone 7s	2,000,000		*113
Brooklyn Edison Electric Light..	1,500,000	100 00	78 00
Brooklyn Citizens' Electric Light.	500,000	100 00	147 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me... ..	50,000	100 00	100 00
Brush Electric Light Co., Balto..	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto..	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s....	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill	1,000,000	100 00	50 00
Brush Elec. Ill., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E....	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s, Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s ...	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	144 00
Complete Elec. Con. Co., N. Y...	50,000	100 00	175 00
Cons. Electric Light Co., N. Y...	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y....	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	97 00
Cons. Gas & E. Co., Batavia, 6s..	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C.....	15,000	50 00	*99
Desant Elec. and Sig. Co., N. Y..	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	24 00
Detroit Electrical Works	1,000,000	10 00	9 75
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*97
Edison Elec. Ill. 6s, N. Y	30,000		*99
Edison Elec. Ill., Lebanon, Pa....	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Electric Light Co., Phila..	1,000,000	100 00	80 00
Edison General	14,000,600	100 00	95 00
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120.000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Erie Telephone	4,800,000	100 00	43 50
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y...	300,000		par
Fargo Gas & Elec. Co. 6s, Dak...	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C..	15,000	100 00	*88
Fort Wayne Elec. Co	4,000,000	25 00	12 25
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky	2,000 000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s....	15,000		*95
Hackettstown Elec. Light, N. J..	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700.000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill....	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	18 00
Laclede Gas pref	2,500,000	100 00	60 00
Laclede Gas 5s	10,000,000		*79
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s....	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Littleton Water & E. L. Co. 6s ..	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co...	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	420 00
Metropolitan T. & T. Co., N. Y..	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2.300,000		*95
Mount Morris Electric Light, N.Y	1,000,000	100 00	40 00
Morristown L. H. & P. 5s, N. J....	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	16 75
New England Butt Co	100.000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	420 00
N. E. Tel. & Tel. Co	10,394,600	100 00	49 50
N. Y. and N. J. Tel. and Tel. 5s..	1.500.000		*98
N. Y. and N. J. Telephone Stock.	2,535 000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	420 00
N. Y. Storage Baty. Co	100 000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio..	50.000		*95
North American Railway Co	39,767,200	100 00	16 75
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50 000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light, N. J....	100,000	100 00	
Pennock Baty. E.L.& Impt. Co., Ill	500.000	1 00	3 00
Peoples' Elec. Light, Trenton....	100,000	100 00	90 00
Pettingell Andrews Co., Boston..	200,000	25 00	30 00
Pittsburg Reduct. Co, Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I... ...	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	4 50
Saginaw E. L. & P. Co. 6s, Mich..	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90

Sawyer-Man Elec. Light Co., N.Y.	125,000	100 00	100 00
Shaver Corporation, N. Y.	100.000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1,000.000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750.000	100 00	100 00
The Hall Signal Co., N. Y.	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y.	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6.000,000	25 00	49 00
Thomson-Houston pref	4,000,000	25 00	26 25
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H.L.H. &P.Co.,Binghamton 6s	100,000		*99
Tucker Elec. Const. Co., N. Y.	50,000	100 00	100 00
Twin City Rapid Transit, N. J.	20.000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1.370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N.Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100.000	100 00	75 00
Utica Elec. & Gas Co. 6s	150,000		par
Utica Elec. Light Co. 6s	150,000		par
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188.852	100 00	82 50
Westinghouse Electric Co	7,000.000	50 00	13 00
Westinghouse Elec. Co. pref. 7s.	3.000.000	50 00	50 00
West End L., Boston	13,550,000		17 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate. but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

Inactivity is the name of the trump card in Wall Street at the moment; all other magnates have passed out or turned down, no doubt stocking the cards for a new deal to be quietly manipulated by themselves. The lamb returned fat and fleecy from his summer pasture and as usual there was great rejoicing, but his gambol on 'Change was of short duration; the fierce demand for his purse and all that was in it dazed him; he was fairly frightened away by those who were most interested in feeding him with tit-bits, and it is extremely doubtful if he returns before spring. There should be a spurt before long, but it cannot possibly attain any magnitude; then comes a week of languid festivity—no business is the other name for it. Next it is safe to say that between the 15th and 25th of December the street will be lively. It must be, or how can the annual settlements be made? There are always enough old-timers of the 4-11-44 description holding a bag somewhere on the outside to fill up that gap. After Christmas stand from under. On the other hand, the general business of the country could scarcely rest on a more solid foundation. It is reliably ascertained that over seven hundred million dollars have been taken out of the ground by the farmers alone, to say nothing of the miners, whose aggregate production, from gold to coal, has been fully up to the average, all of which is a clear gain, inasmuch as nothing was lost out of the country in creating this added wealth. It is not, however, being used for speculating on the street. The hard-fisted countrymen do not seem to adopt the methods of the city broker to any extent; scarcely a man (or woman) among whom could resist flying a lot of kites of all sorts and sizes if they had the same assurance of incoming boodle from their speculations in the near future, only to wake up some day to find their profits had by this means been turned into losses through the speculations they had thus been able to carry on. The fact is, the list of securities actively dealt in at the Stock Exchange needs pruning liberally at both ends. Investment in finished railways secure in their territory and income should be placed in the same position as Governments and protected by, if not statutory law, at least Stock Exchange rule, that a *bona fide* investor or guardian of money in escrow or trust funds might hold, with a certainty that they were not daily at the mercy or whim of a few Bulls or Bears, who for sheer lack of better amusement frequently alter values shamefully. Those which are known to have no value except as collateral should be dropped entirely; it matters little how, but brand them the same as a counterfeit of any other nature and annihilate them. In their place an equal number of industrial securities should be listed and dealt in; the speculation would be equal and more legitimate, because the natural earnings of the security would not, if properly rated by the examining committee, be subject to either loss or excessive fluctuations, while the broker's commission would remain the same. We have no foreign securities, but we have a host of domestic corporations which are legitimate trade for the Stock Exchange of New York. Electrics must be dealt in before long on the New York Exchange, or some enterprising Western exchange will be the first in the field. Would it not be in order to list these stocks for say two or five years at a nominal charge and overcome this general inactivity?

The $3,000,000 of Westinghouse preferred stock has been successfully negotiated by the company, and it again starts out financially equipped to compete with the other parent corporations for the electrical business of the country, but at the time of this writing there is no means of ascertaining how many of the shares are in the hands of the public or what proportion of the holders consented to surrender 40 per cent. of their property to save the other 60 per cent. The facts will no doubt be given to us by the officers of the company when they conclude to take the electrically interested investors into their confidence. At our last application the reply was: "We have not yet received the complete papers and we have nothing to say." There are 50,000 readers of the ELECTRICAL AGE who are anxious to know the result, that they may thereby estimate their own chances of securing capital at a reasonable rate of interest. The plan of reorganization was adopted last April by the management, sanctioned by the shareholders in July and completed in December, about one-third the time usually required for the same result in Europe. The preference shares bear 7 % cumulative dividends, and the assenting stock, we believe, comes in for a preferential 7 %, then all will be equal for the three classes of stock. The company has substantially secured the United States Electric Light Co. and the Consolidated Electric Light Co., heretofore known as the leased concerns, which will enable them to reduce expenses very considerably, possibly half a million a year, and at the same time increase the volume of business. As soon as the preferred shares are listed we shall drop the U. S. and Consolidated from our regular list as the dealings in the few shares held by the discontented ones will cease to be of public interest. There are still a few of the parent Brush Company's shares guaranteed by the Thomson-Houston Co. wandering around the country, putting in a periodical appearance at $40 per share or thereabouts without purchasers; 44 shares are on the market now. Like our friends above they will soon be forgotten by all except their owners. We quote the Westinghouse preferred at par this week, but shall be pleased to have the actual purchaser of a certificate from any source outside of the syndicate notify us of the price paid, when we will correct the quotation. We think a 7 % preferred share should in such a well-known corporation be worth in the market at least 120 %.

As the holiday season is with us, during which it is customary to present those dear to us with souvenirs, we desire to call the attention of our readers to the list of securities regularly published in the ELECTRICAL AGE as offering a medium for selection superior to all others. You can have a single bond for $100, or you may make your friend happy with a few shares at no greater expenditure. If fortune has favored you during the year there is no reason why you need stop at $100. While it is not the intention of this column to boom any particular electric security, the majority of our readers having special facilities for knowing the current intrinsic value of many of them, still it is not bad form to name as the most appropriate in this connection, Ashley Engineering, Bucksport 6's, Circleville 6's, Darlington 7's, Detroit Pref. or Common, Elec. Sup. & Con. (8 %), Florence 6's, Fremont (the whole business, only, to be had), Great Western 8's, Hubbell, Hunt 6's, Interior Conduit, Morristown 5's, Pettingell-Andrews, Rockaway, Russell. To this may no doubt be added in time for the purpose Westinghouse 7's, and a long list of street railway dividend payers.

Dividends in the mining industry hold their own among the solid facts of finance. November figures foot up the fair sum of $1,330,125, making a total of $15,838,342 for the year, with December still to be heard from. The electric industries are an immense source of profit to the miners of coal, lead, iron and copper, while as yet there is very little reciprocity. A few miners use electricity, but the fraction is so small that, like gold in an ordinary specimen, a glass is required to see it. A few years will remedy this; power must be transferred from water to the mines, separation of metals must become more general as well as the lighting of mines by electricity. The Hubbell Portable Lamp is a great stride in this direction, not only giving better light than is possible by any other present method, but absolutely safe against fire damp and more convenient than the candle or oil lamp in present use and quite as economical.

BOSTON NOTES.

NEW ENGLAND OFFICE ELECTRICAL AGE AND STREET RAILWAY NEWS, BOSTON, Dec. 5, 1891.

Your eastern representative called at the works of the Eastern Electric Cable Co., 61-65 Hampshire street (Roxbury District), and was met by Treasurer and General Manager Henry A. Clark. Mr. Clark reports business booming. The Clark wire has been before the public and in actual use the past nine years, and has always met with universal favor. Since the works were established in Boston (five years ago) thousands of miles of the company's wire have been sold and are in use throughout the United States and foreign countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction. The company's specialties include aërial, underground or sub-marine, telegraph and electric light copper wires, rubber insulation with braided covering, also flexible or standard cables for electric light use. The rubber used in insul ting its wires and cables is especially chemically prepared, and is guaranteed to be waterproof, will not deteriorate, oxidize or crack, will remain flexible in extreme cold weather and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole finished with Clark's patent compound, which is water, oil, acid and fire-proof. This company's flexible wire is especially adapted for use for motor and car connections where exposed to moisture and mud.

The Boston Gear Works, of 29 Hartford street, are busy filling orders for its noiseless Fiberoid gears, which are meeting with encouraging success wherever they have been tried. In a six months' test, on a prominent Boston line, a noiseless Fiberoid gear outlasted five gears of other manufacture, two of which were rawhide, two steel and one brass. This, in itself, speaks volumes for this new gear. The noiseless Fiberoid gear is made from a special hard fibre made purposely for gears, and far superior to iron, rawhide or brass for high-speed gears and pinions. They are light and do not shrink, are not affected by oil or the weather, as are gears of other manufacture, and are absolutely noiseless. The new catalogue for 1892 will contain, when published (December 30), a complete list of gears in stock, together with many valuable tables of interest to the fraternity.

The National Telephone Manufacturing Co., of 620 Atlantic avenue, is fast super-eding the "Bell" as far as railroad work is concerned. It has constructed several miles of its service for the Old Colony Railroad with so much satisfaction that the Old Colony is about to place an order for the National Telephone Manufacturing Co. to cover its entiresystem. The Lehigh Valley Coal Co., of Wilkesbarre, Pa., the Pennsylvania Coal Co., of Dunmore, Pa., and the Oliver Ames & Sons' Corporation of North Easton, Mass., are among the few users of the National Telephone system. Its system is now in successful operation in many houses, factories and public buildings, not only in the United States, but throughout Mexico, South America and Europe.

Surely every one in Boston seems to be prospering. I had the pleasure of meeting Mr. Henry B. Cram, of the Bernstein Electric Co., 620 Atlantic avenue, and he reports unprecedented activity in his line, which is the well-known Bernstein incandescent lamps and fixtures. These lamps have been in use for several years, and have established a reputation as being superior to all others for economy of power, long life and brilliancy. Their high efficiency, varying with the type of lamp from 2.9 to 3.2 watts per candle-power, is not obtained at the expense of durability. They are especially designed for use on arc light circuits, and are particularly adapted for street and store lighting. The company also manufactures multiple lamps of the standard candle-powers, for any voltage and capped for any socket, also instruments and special work to order.

I met Mr. George B. Watson, of the Gould & Watson Co., 35 Hartford street. This company has an extensive trade in mica, which it manufactures in all sizes for electrical purposes.

D. L. T.

WESTERN NOTES.

The North American Electric Co, of 69 South Canal street, Chicago, is the manufacturer of the celebrated Gladiator dry battery, which is handled by the Central Electric Co. of this city. The latter company has disposed of its entire stock of dry batteries, in order to handle none but the Gladiator, for which it has the sole agency. The company claims that it is the best dry battery in the market now; it has low internal resistance and gives an initial current of four ampères on open circuit. It is said that the cell does not deteriorate when allowed to stand open, and it is as efficient after several months' idleness as when turned out of the factory.

The Eclipse Clutch Works, of Beloit, Wis., with branch office at 62 South Canal street, Chicago, is installing a 200 horse-power engine in the Central Electric Co.'s plant at 25 Plymouth Place, Chicago, and is at work installing the Lighter building, corner Van Buren and State streets, which will have 450 arc lamps and 3,500 incandescents.

N. D. W.

VALUABLE BOOKS.

EXPERIMENTAL ELECTRICITY. By Edward Trevert.

This is an elementary work, and is valuable to students who are passing through the experimental stage of their electrical studies. It has 164 pages and many scale illustrations. $1.00.

THE ELECTRIC RAILWAY OF TO-DAY. By H. B. Prindle.

This little work explains in a clear and popular manner the operation of the electric railway. It is of extreme interest and should be read by all. 50 cents.

THE ELEMENTS OF DYNAMIC ELECTRICITY AND MAGNETISM. By Philip Atkinson, A.M., Ph.D.

This is a complete, comprehensive treatise on the principles of practical electricity. It is written in a clear, unmathematical style, and has 405 pages and 120 illustrations, and its contents by chapter are: 1. The Voltaic Battery—Definitions. 2. One-Fluid Cells. 3. Two-Fluid Cells—Battery Formation. 4. Magnetism. 5. Electromagnetism. 6. Electric Measurement. 7. The Dynamo and Motor. 8. Electrolysis. 9. Electric Storage. 10. The Relations of Electricity to Heat. 11. The Relations of Electricity to Light. 12. The Electric Telegraph. 13. The Telephone. The price of this book is $2.00.

A DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES. By Edwin J. Houston, A.M.

This work, as its name implies, is an electrical dictionary, and is the most complete and valuable book of this character ever published. No electrician or student of electricity should be without it, as it is a wonderful aid in research and study. It has 656 pages and 397 illustrations. $2.50.

BELL-HANGER'S HANDBOOK. By F. Badt.

This little book gives valuable instructions for wiring buildings, for the operation of electric bells, annunciators, burglar alarms, etc. It contains many illustrations which greatly aid in a better understand-

ing of the subjects discussed. It gives rules and much other valuable information. $1.00.

ELECTRICAL ENGINEERING, for Electric Light Artisans and Students By Slingo and Brooker.

This is a complete work on the subject of electrical engineering, and is valuable alike to the student and the practical electrical engineer. $3.50.

All books on electrical subjects can be obtained of the ELECTRIC AGE Publishing Company, *World* Building, New York.

BUSINESS NOTES.

The Bodifield Belting Company of Cleveland, O., has lately furnished for the East Cleveland Railroad Co. two 48 inch double belts and six 25 inch double belts. These belts are running, and elicit nothing but words of praise from the company and all who see them. This firm has also furnished for the Short Electric Co., for the East Liverpool & Wellsville, O., street railway company, two 24 inch double belts, each 100 feet long; and has likewise belted up the Ashtabula Rapid Transit Co.'s power plant, Ashtabula, O., and that of the Wheeling Electric Railway of Wheeling, W. Va.

WIRE COVERINGS.

In calling attention of those of our readers who are engaged in the business of covering fine electric wires to the advertisement of the Hadley Company, we do so in full confidence that those buying its yarns will get the best that can be made.

The Hadley Company were the first in this country to undertake the manufacture of fine yarns for sale, and for many years was the only concern that made them.

A single customer of the Hadley Company probably uses more fine yarns now for the covering of wires than was used for all other purposes combined a dozen years ago, which has, in a measure, helped to reduce the cost, and also brought about a perfection of manufacture that at one time was not thought attainable by American spinners.

While, as we have said, the Hadley Company was the pioneer in the business of fine spinning, it has kept up to the times, and is constantly adding such improved machinery as the genius of America and England produces, as soon as its merits are proven, so that to-day it is among the best-equipped mills in this country, and its products take high rank in the estimation of the manufacturing community, and "as good as Hadley" is considered to be about the strongest commendation a seller can give his goods. Perhaps one reason for its high repute is that it makes sewing-threads largely, which require a better grade of stock than is used in ordinary spinning, and which goes into all its yarns.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued December 1, 1891.

464,001. Telegraph-Repeater. Richard L. Atkinson, Delaware Township, N. J., assignor to John D. Tustin, same place. Filed March 27, 1891.

464,005. Treating Filaments for Incandescent Electric Lamps. James Bradley, Massillon, Ohio. Filed June 6, 1891.

The combination, in an apparatus for treating carbonized filament, of a tube having vertical portions provided with a hydrocarbon-chamber and an overflow-cup, a cap adapted to hold the ends of the conductors and filaments and to seal the upper end of the chamber, a portion having an enlarged portion adapted to hold a quantity of fluid mercury, a pipe to connect the portion with a blower or compressed-air chamber, and a fluid-mercury piston interjacent the hydrocarbon and the compressed air, whereby the hydrocarbon may be raised to cover the filament and be drawn therefrom.

464,022. Splice for Electric Conductors. Willard J. Hield, Minneapolis, Minn. Filed May 15, 1891.

A splice-bar having longitudinal openings in its end adapted to receive the ends of the conductor-wire and transverse head-holes, in which the bent ends of the conductor-wires are secured.

464,025. Potential-Indicator. Carl E. Kammeyer, Eau Claire, Wis. Filed May 7, 1891.

The combination of an electric generator with translating devices in series with each other, a circuit-closer and connections whereby either one of them may be short-circuited, the circuit-closer responsive to changes in the current delivered.

464,026. Transformer and Armature-Core. Carl E. Kammeyer, Eau Claire, Wis. Filed May 7, 1891.

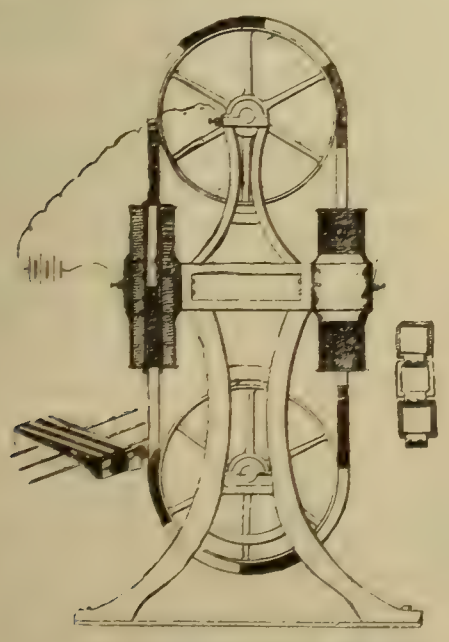
An armature-core consisting of a series of plates provided with permanently-flexible insulating coats of varnish or the like applied permanently to the plates.

464,027. Field-Magnet for Dynamos or Motors. Carl E. Kammeyer, Eau Claire, Wis. Filed May 9, 1891.

A field-magnet provided with core-pieces, each core provided with a groove to receive a coil-retaining washer.

464,055. Electric Heater. Parvin Wright, Denver, Col. Filed March 21, 1890. Renewed Dec. 11, 1890.

464,063. Electric Motor. Martin H. Collom, Denver, Col. Filed Jan. 27, 1891.



464,063.—ELECTRIC MOTOR.

464,090. Electric Apparatus for use on Railway Trains. Rufus A. Wilder, Cressona, Pa. Filed Jan. 9, 1891.

In a railway-train, the combination, with the main traction-wheels and their motor or motors, of supplemental traction wheels on one or more axles, and apparatus for converting the surplus energy of the locomotive and train into electricity, storing the same and applying it at will through the medium of such supplemental traction-wheels to assist the locomotive.

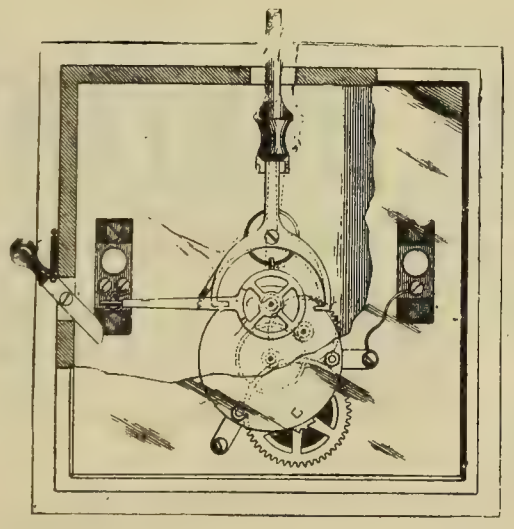
464,125. Method of Testing Insulated Wires. Richard Varley, Jr., Englewood, N. J. Filed Feb. 10, 1891.

The method of testing an insulated wire, which consists in connecting the wire to one terminal of an electric circuit, bringing the other terminal into close relation to the insulating-covering throughout its length, so as to be equidistant from all parts thereof, and charging the circuit with a current of high potential, whereby a flash will be caused where the insulation is below a definite standard.

464,132. Electric-Arc Lamp. William A. Nicholson, New York, N. Y. Filed June 12, 1891.

In an electric-arc lamp, the combination, with the upper disc carbon provided with means for rotating it as it is fed, of a carrier for the disc carbon provided with guide-rods engaged by bearings thereon for steadying the feeding movements of the carbon, feeding mechanism, and a flexible connection intermediate the same and the carbon-carrier.

464,133. Relay. Richard Varley, Jr., Englewood, N. J. Filed Feb. 10, 1891.



464,134.—ELECTRIC-CIRCUIT CLOSER.

464,134. Electric-Circuit Closer. Richard Varley, Jr., Englewood, N. J. Filed Feb. 10, 1891.

A circuit-closer comprising a power-driven arm, circuit-terminals connected by the arm on reaching a definite point in its path of travel, detents for arresting the arm during or after connection of the terminals, and a controlling device for bringing either detent into action at will.

464,136. Electric Regulator. Charles W. Holtzer and George E. Cabot, Brookline, assignors to the Holtzer-Cabot Electric Company, Boston, Mass. Filed April 3, 1891.

The combination, with a dynamo-electric motor, of a rheostat in circuit therewith, adjustable contacts or brushes in circuit with more or less of the terminals of the rheostat, an armature controlling the movement of the brushes, magnets for the armature included in independent electric circuits normally open, a solenoid in circuit with the dynamo or motor, a pivoted core in the solenoid and carrying a circuit-closer for the magnets, and a vertical rotary base-plate carrying the solenoid and adjustable at different angles in the plane of the plate.

464,152. Electric Transmitting-Telephone. Rudolf Eickemeyer, Yonkers, N. Y. Filed May 23, 1883.

The combination with a diaphragm and a clamp for confining the diaphragm at its periphery, of electric contacts or electrodes located remotely from the centre of the diaphragm upon or closely adjacent to its face and in line with the inner edge of the clamp.

464,156. Electrical Generator. Victor Hirbec, Paris, France. Filed Nov. 6, 1890. Patented in Belgium, Spain, France, Italy, Sweden and Norway.

The combination of cylinders, a paper belt thereon, a heating device to heat the belt, a rubbing-roll arranged above the rear end of the heating device to revolve in contact with the belt, conductors each having a set of conducting-points arranged one to receive electricity from the rubber and the other from the belt, and means for rotating the cylinders and the rubber.

464,198. Electro-Magnet. Olof E. Lundstedt, Brooklyn, N. Y., assignor to John M. Glover, St. Louis, Mo. Filed Feb. 2, 1891.

464,216. Armature for Dynamos and Electric Motors. St. John V. Day, St. Louis, Mo. Filed May 1, 1890.

An armature mounted on a shaft and means for securing one end of the armature to the shaft, the opposite end being free to expand and contract longitudinally.

464,231. Electric Motor. John R. Robinson, Salem, assignor of one-half to Theodore F. Lawrence, Peabody, Mass. Filed Feb. 3, 1891.

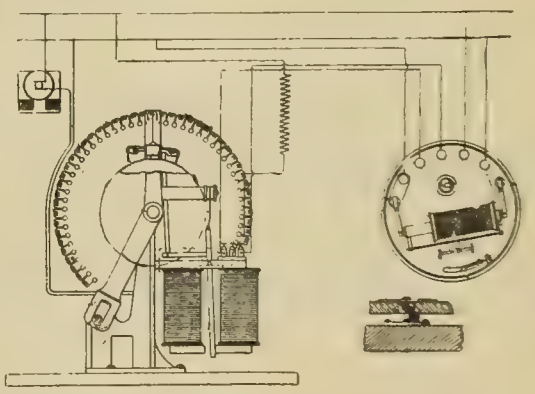
464,244. Electric Fire-Engine. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed Feb. 9, 1891.

In a fire-engine, the combination of a wheeled vehicle having two axles and a frame, a pump fixed to the front part of the frame, a driving-shaft for the pump, extending lengthwise of the vehicle, an electric motor supported upon the vehicle, having its armature-shaft lower than the driving-shaft of the pump, and gearing between the shafts.

464,245. Electric Hose-Carriage. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed Feb. 24, 1891.

464,246. Electrically-Propelled Vehicle. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed March 2, 1891.

The combination, with a wheeled vehicle having two axles and one of the axles adapted to turn on a vertical axis to steer or guide the vehicle, of a circular rack connected to the axle, an electric motor mounted upon the vehicle, two loose pinions on a shaft geared to the rack and driven in opposite directions by the motor, a clutch between the pinions to clutch either pinion and to turn the shaft, and means to operate the clutch.



464,136.—ELECTRIC REGULATOR.

464,247. Electric-Heating Apparatus. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed March 9, 1891.

In an electric-heating apparatus, a plurality of loose independently-movable cases, an electric heat-developing conductor within each of the cases, and a frame to hold or support the cases.

464,248. Electrically-Propelled Vehicle. Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place. Filed March 23, 1891.

464,256. Watchman's Electric Recorder. Harvey Redding, Everett, assignor to the Redding Electric Company, Boston, Mass. Filed April 16, 1889.

In an electric signalling or registering system, the combination of a series of signal-boxes, an electric circuit including the boxes, a drum having a series of pins spirally arranged, electrically-operated mechanism included in the circuit, whereby the drum is rotated step by step by the operation of either signal-box, a spring whereby the drum is returned to its starting position when released, an arresting device whereby the drum is normally held against the force of the spring, an electro-magnet and devices operated thereby whereby the arresting device may be made inoperative, and electrical connections whereby the magnet is energized after the operation of each signal-box.

464,298. Electric-Wire Support. Richard Ellison, Cincinnati, Ohio, assignor to the Walton Architectural Iron Company, same place. Filed May 18, 1891.

464,299. Electric Motor. Herman A. Florian, Detroit, Mich., assignor to Edward A. Florian, Fostoria, Ohio. Filed Jan. 6, 1891.

464,347. Magneto-Electric Ignitor for Combustible Vapor Engines. Leonidas G. Woolley, Grand Rapids, Mich. Filed Sept. 26, 1890.

In combination with an armature rotating between the poles of a permanent magnet and periodically producing electrical tension in a coil around the armature, a rotating shaft journal in the head of the combustion-chamber, a T-head on the end of the shaft adapted to engage a brush in the circuit arranged within the combustion-chamber, and a flexible connection between the shaft and the armature-shaft.

464,367. Insulating Composition. Smith W. Kimble, Denver, Col., assignor to the Mica Asbetite Insulating Company, same place Filed Feb. 24, 1891.

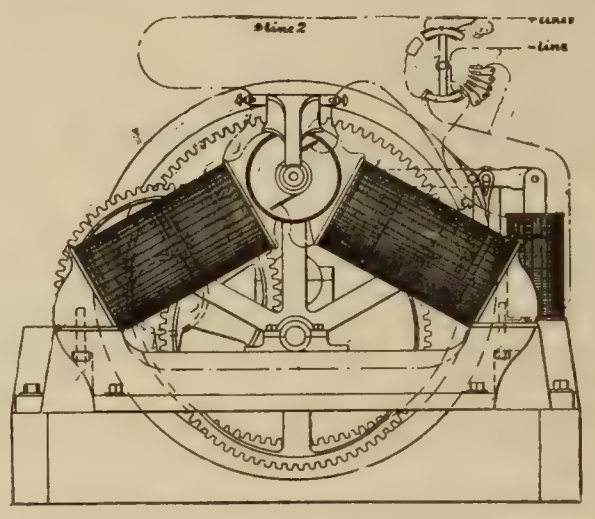
A composition consisting of pulverized mica, silicate of soda and a mineral substance, such as talc free from lime, combined and moulded under pressure.

464,368. Insulating Support for Electrical Apparatus. Smith W. Kimble, Denver, Col., assignor to the Mica Asbetite Insulating Company, same place. Filed Feb. 25, 1891.

The combination, with a non-conducting block, of terminal connectors, each having projecting teeth or lugs embedded in the material of the block which is moulded and compressed around the same, and having on its upper surface projections for the attachment of electrical conductors, the projections serving also to keep the fitting in place while the insulating compound is moulded around it.

464,369. Composition of Matter for Insulating Purposes, etc. Smith W. Kimble, Denver, Col., assignor to the Mica Asbetite Insulating Company, same place. Filed Feb. 26, 1891.

464,452. Controller for Elevators. John H. Clark, Boston, Mass., assignor to the Whittier Machine Company, same place. Filed April 9, 1891.



464,470—ELECTRIC ELEVATOR.

In an elevator mechanism, the combination, with the elevator car or platform, a motor mechanism to operate it, a fixed set of guides, and a movable set of guides carried by the car or platform, of a shipper-rope passed about the set of guides to form multiplying-loops and connected to the motor mechanism and fastened at its ends to a stationary support, and means to operate the movable guides from the car, whereby a limited movement of the movable guides produces a multiplied movement of the shipper-rope.

464,470. Electric Elevator. William Baxter, Jr., Baltimore, Md. Filed Dec. 8, 1890.

The combination, in an electric hoisting-machine, of an electric motor having magnet-cores inclined upward and inward from their bridge, a hoisting-drum and intermediate gearing, and a magnetic frame or bed provided with a transverse bar having upturned lugs at its opposite ends to receive the magnet-cores and provided wtth a lateral extension to support the drum and intermediate gearing.

464,475. Joint for Electric Conductors. Henry W. Fisher, Pittsburg, Pa., assignor to the Standard Underground Cable Company, same place. Filed March 7, 1891.

An electric cable consisting of two or more portions of armored conductors having their ends united by a hollow cast-metal joint forming an integral part with the adjacent sections or armor.

11,207. Open-Circuit Battery. (Reissue.) John F. Wollensak and William E. Gill, Chicago, Ill. Filed Oct. 13, 1890. Original dated Sept. 16, 1890.

In open-circuit batteries, the combination of a cup having holes through its sides, a carbon stick having a hole in a position and direction to be brought into a line with the holes in the cup, and a pin passing through the holes in the cup and stick.

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NEW YORK, DECEMBER 19, 1891.

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WHO IS TO BLAME?

The title "electrician" has become one of very great elasticity in latter days, and it has come to such a pass that about every one in the employ of an electrical establishment is called an electrician, in whatever capacity he may be engaged. The promiscuous application of this title has robbed it of a great deal of its honor and dignity, and when one, in speaking of another, refers to him as an "electrician," the use of the word is as likely as not to provoke a smile of derision, and the utterance of such remarks as "Electrician! Why, every lamp-cleaner is an electrician," "The woods are full of electricians," and so on, *ad infinitum.*

Now, who is to blame for the abuse of bestowal of this title; the person to whom it is applied or the person who bestows it?

We are inclined to think that those persons who pose as electricians, but are without merit, are not wholly responsible for their position in the matter; the public is as much to blame as any one.

To the masses electricity and its effects are a mystery, and it used to be generally assumed that every one in any way concerned in the practical applications of electricity must necessarily be a scientific expert. The result was that the title of "electrician" was applied to every one engaged in electrical work, whether he was worthy of it or not, and as it tickled the vanity of those receiving the distinction, they, with great discretion, kept quiet and offered no objection.

Perceiving this tendency on the part of the public, those of the employés who as yet remained untitled assumed the title on their own account, knowing that no questions would be asked and that the general public would look down upon them, or rather look up to them, as the fountain-head, or part of it, at least, of electrical wisdom and mystery.

Thus the craze started and grew; but it has reached its fullest development, and having passed the zenith it is now on the descension.

The people are becoming more educated in electrical matters, and they are better able to estimate for themselves the fitness of one to carry the title of "electrician;" and on the other hand aspirants to the title are a little more careful about the assumption of it than was formerly the practice, because they are aware that the public is more critical in such matters than it used to be.

It is evident, therefore, that the growth of the practice depended upon gullibility and ignorance on one hand, and taking advantage of these deficiencies on the other. But the separation of the just from the unjust is going on now, and the time will soon come when the "electrician" will be known by his works, as the tree is known by its fruit.

AMMETER FOR A 5,000 AMPERE CURRENT.

It is true that whenever a necessity is created the new conditions arising from that necessity are always met by inventors, and new inventions are the result.

Before the days of practical electric lighting the only instrument used for the measurement of electric currents was the well-known galvanometer. When heavy currents began to be used it was found that the ordinary galvanometer was not adapted to the measurement of these currents; hence the invention of the ammeter and voltmeter.

It became a necessity also to so construct these instruments that the records of the current strength could be read directly, and without any subsequent arithmetical calculation. This necessity was also met, and the excellent ammeters and voltmeters on the market to-day are the result of the efforts of inventors to supply every demand of this branch of the electrical trade.

The comparatively recent application of electricity to the reduction of metals, for which purpose currents of very great volume are required, has necessitated the construction of measuring instruments of special design and make. Currents of 5,000 ampères are not generated for any other purpose than the one above mentioned, and the ordinary ammeter is too small in capacity to use in connection with such currents.

An instrument of a capacity of 5,000 ampères is now being constructed by a Newark, N. J., concern, to be used in connection with the reduction of aluminum by electricity in an establishment in North Carolina.

To measure such a current with accuracy, and to carry it without undue heating, necessarily requirer an instrument of large proportions, and the extraordinary size of this instrument is interesting in itself. The scale alone will be 14 inches long and will be divided into 250 parts, each part representing two ampères.

The question of standardizing such an instrument is, of course, an extremely important one, but the facilities at hand at this company's factory are amply sufficient to undertake this unusual task.

To possess the ability and facilities to make an instrument of so great dimensions, and make it accurately, reflects great credit upon our enterprising electricians.

THE INFLUENCE OF HEAT ON THE BODY.

We print on another page an abstract of a paper read by Dr. J. D. Bonnar before the Buffalo Electrical Society on the 7th instant, which throws some light on an obscure subject. Heat in its relationship to electricity and its influence upon the body in health and disease is an important subject for investigation, and Dr. Bonnar seems to have given the matter considerable well-directed thought. He gives some practical hints that may lead others to investigate the subject on the same and other lines, and in the end some, as yet obscure, facts may be developed which will tend to relieve the human race of some of its suffering and pain.

ELECTRIC ELEVATORS AND HOISTS.

The introduction of electric elevators within a comparatively short period of time has resulted in such general satisfaction to the users of the same that this class of elevator is now rapidly coming into general use.

It is well known that no other form of power possesses as many advantages as electricity, and these advantages are of special value in the operation of elevators. Compactness, simplicity, durability, noiseless and smooth running and economy in maintenance are the features of electric elevator plants, and each one of these points, considered in itself, is a very desirable feature in such an installation.

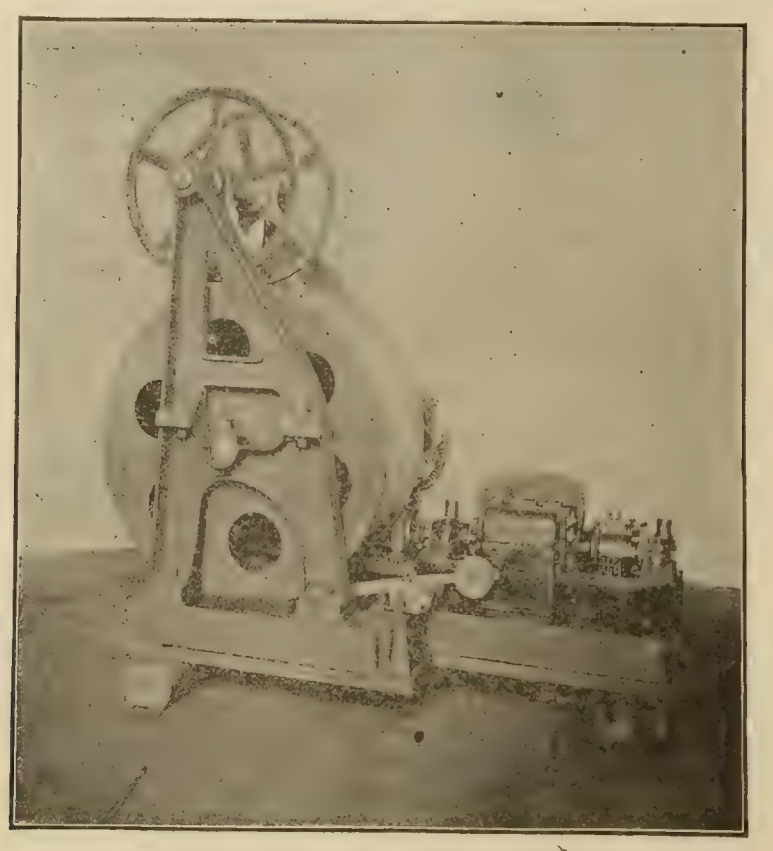


FIG. 1.—ELECTRIC ELEVATOR.

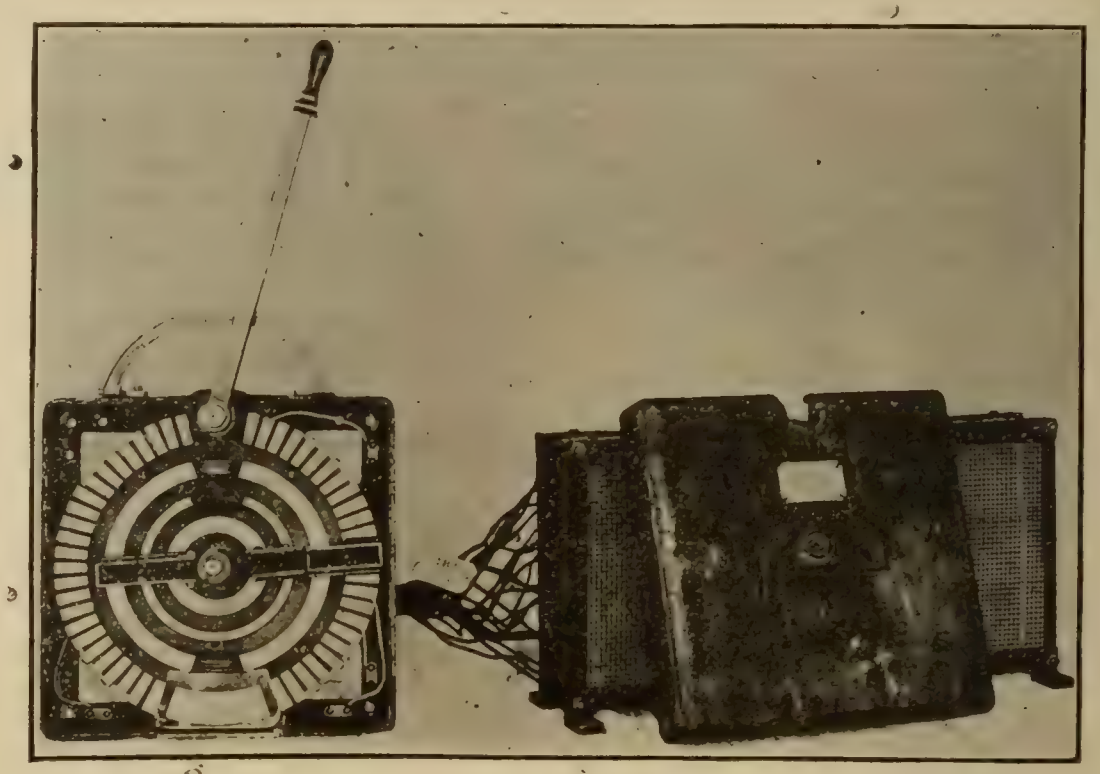


FIG. 2.—CONTROLLER AND RHEOSTAT.

We illustrate and describe below some of the apparatus used by the American Electric Elevator Company, of 15 Cortlandt street, New York.

The average size elevator machine of this company occupies a floor-space of 6 x 4 feet, and the machine is but 4 feet high. On account of the absence of vibration and the small space required for the machine, it can be placed at the top of the elevator shaft, so as to be entirely out of the way, thus rendering it possible to utilize the space usually occupied by such mechanism. The machine is very simple in construction and has but few parts. It consists of an electric motor, worm-gear, drum, reversing switch and rheostat combined, automatic electric brake and automatic stop device for stopping the elevator at the top or bottom of the lift, thus making it impossible for the car to travel too far in either direction.

Fig. 1 gives a general view of one of these machines. The armature-shaft of the motor is coupled direct to the worm-shaft, and this coupling is also a brake-wheel, to which the brake is applied automatically when the current is cut off. This arrangement not only serves the purpose of overcoming the momentum of the armature when stopping, but also serves to hold the car stationary, if through any accident the current should be cut off. The worm actuates the worm-gear, which is attached to the drum-shaft.

Fig. 2 shows the controller and rheostat used by the American Electric Elevator Company on its elevators.

The cut shows the controller and rheostat, with the cover of the controller removed, in order to show the contact plates, the switch-arm and carbon brushes. The controller is built into the side of the elevator car, with the lever placed a sufficient distance from the side to enable its convenient operation. The rheostat is attached underneath the platform, or, if desired, to the top of the car.

The switch is connected with the elevator motor by means of flexible wires heavily insulated, which travel with the car. Provision is made for automatic stopping at the top or bottom, in case the operator neglects to perform this duty by hand.

The magnetic "blow-out" under the neutral point of the switch creates a strong magnetic current and prevents the formation of a spark when the circuit is broken in stopping.

This controller is said to give entire satisfaction on high-speed elevators and high voltages, and elevators equipped with this device stop and start as easily as hydraulic elevators.

The controller is made in two forms, one adapted to 220 volts with 25 contact points, the other to 500 volts with 46 contact points.

In the illustration of the controller four concentric contact rings are shown. The inner, or small one, forms one line terminal; the middle one is divided into halves, the two halves being insulated and forming the armature terminal; the third ring is the terminal of the solenoid brake-spools, the other terminal being connected to the other side of the line, and the next and last ring is broken up into contact points.

The steel operating lever projects 23 inches above the iron case of the controller, and is provided with a spring latch, which catches in the notch in the centre of the quadrant, to insure a positive stop at the neutral position.

In the rheostat all joints are riveted, and it contains no solder or combustible material. The resistance consists of corrugated German-silver ribbon, built up into vertical tiers, the strips being insulated from each other by asbestos paper. The rheostat is

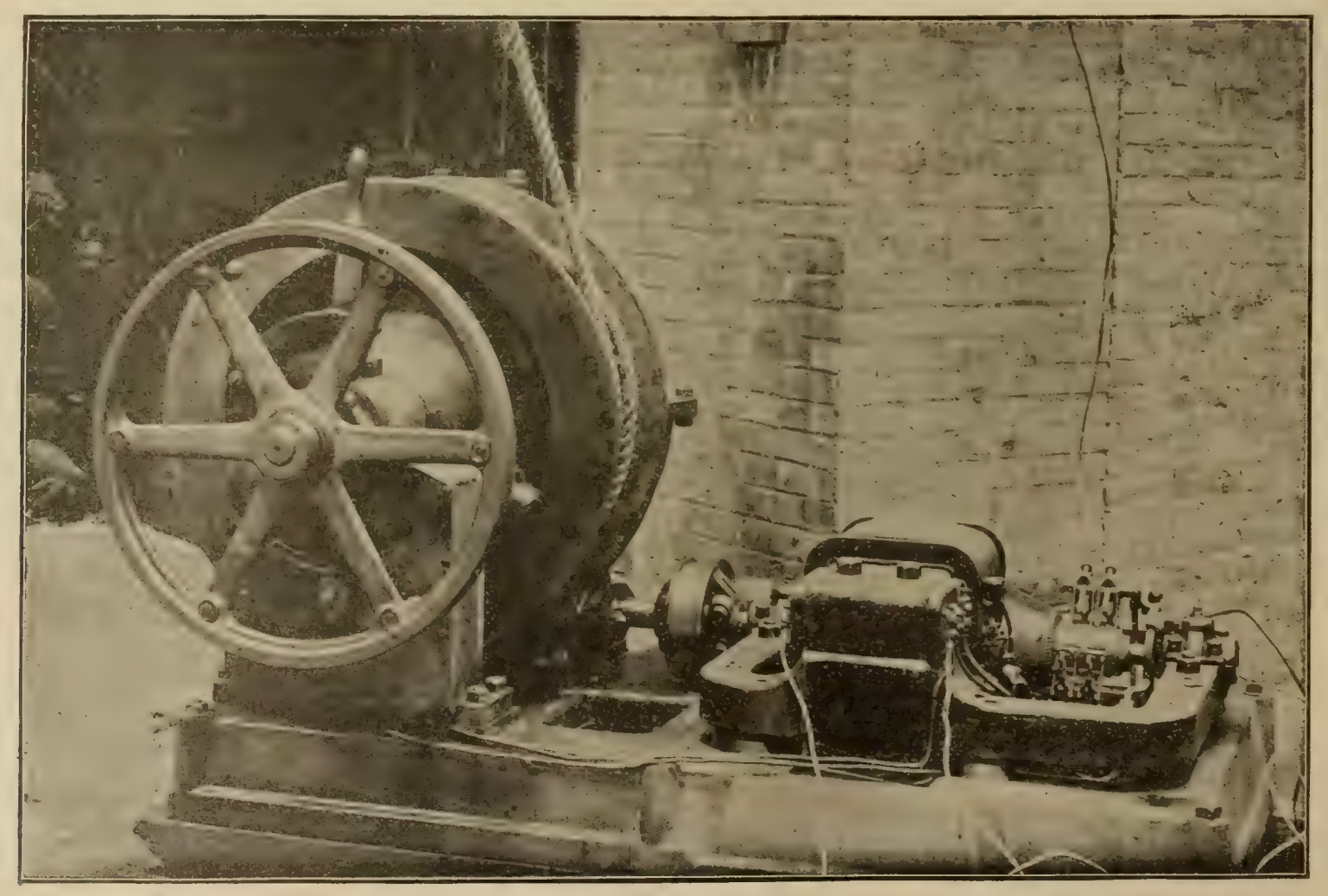


FIG. 3.—ELECTRIC DOCK-HOIST.

constructed in such a way as to provide good ventilation between the layers and tiers. By the use of these rheostats no more current is allowed to pass than is needed for the motor at any time.

Fig. 3 shows an electric dock-hoist made by the same company. The electric dock-hoist possesses the same mechanical and electrical advantages as the elevator machines.

A 10-horse-power hoist assembled upon a bedplate occupies a space of 5 ft. 10½ inches x 2 ft. 9¼ inches, and from the bottom of the bedplate to the highest point in the machine is but 3 ft. 7½ inches. It may be placed on an overhead platform so that it will occupy no dock or deck room if it is desired to use the latter for any other purpose. The switch is completely closed in a cast-iron box, which excludes all dust and dirt and prevents the possibility of anything coming in contact with it. The rheostat, or resistance-box, is placed within the bedplate, and the connections are so made that there are no wires in sight, thus rendering injury to the wires quite an impossibility.

One of these machines is in operation on the dock of the Mallory line of steamers, New York, and one at the dock of the American Manufacturing Company, Greenpoint, L. I.

The company is at work on an improvement in the brake apparatus which, it is said, will prevent all sudden movements of the car whether the load be light or heavy, and the motion attending the starting and stopping will be regular and easy under all conditions.

ELECTRIC DIAMOND DRILL.

The mining industry from its very nature offers a vast field for the use of electricity as an agent of power transmission. Development in the applications of electrical energy not only brings a powerful aid to the successful operation of mines now producing, but also renders possible the working as profitable investments of many deposits of little or no value from their situation or high cost of operation. Throughout the mining localities of the United States are large and reliable water-powers as yet to a great extent unutilized, owing in some cases to their distances from operations requiring power, and in others to the impossibility of locating the necessary buildings upon the banks of the streams to good advantage. The recent rapid strides in electrical engineering now make it possible to utilize these great natural power supplies, transmitting their energy in any desirable quantity to any given point, regardless of the elevation and contour of the surrounding country.

The Thomson-Vandepoele Electric Mining Company, 620 Atlantic avenue, Boston, has given special attention to this line of work, developing and perfecting electric machinery for every possible requirement of power in mines.

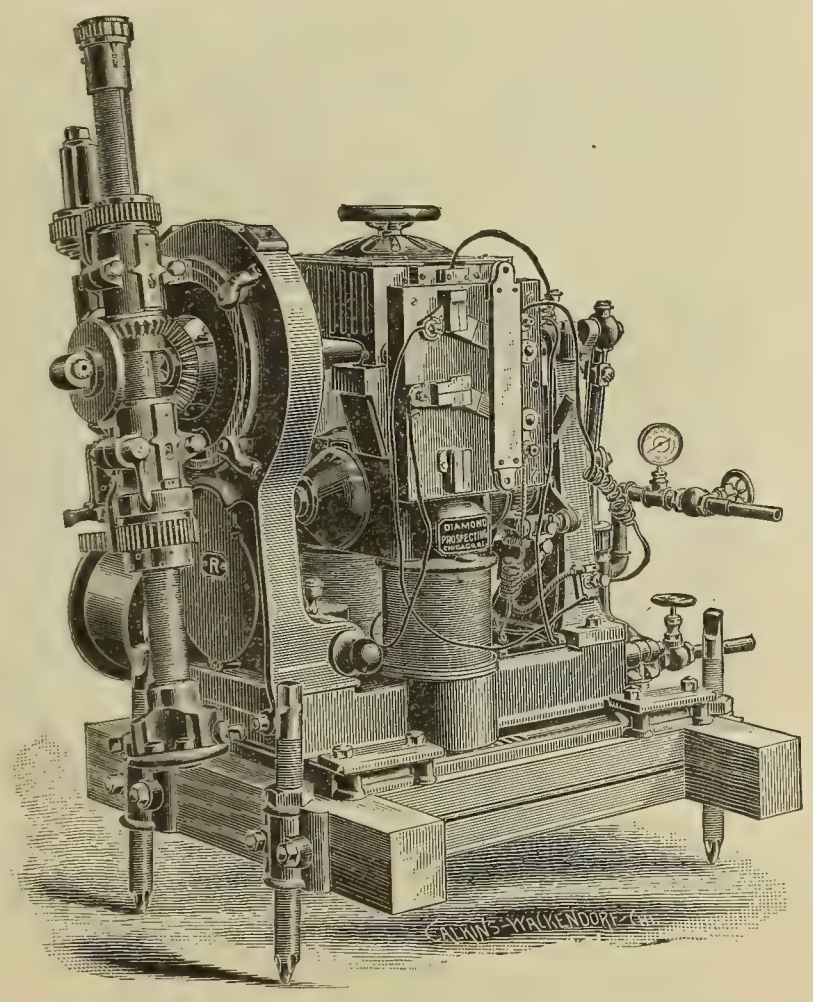
The increasing employment of electricity in mining operations has opened a new field for the well-known diamond prospecting drill made by this company, which has for a number of years been widely used, driven by steam or compressed air, and sometimes by hand or belt power, in nearly all the mining regions in the country. Its use brings to the surface a solid core of all the rock and mineral formations, showing accurately the depth of the mineral deposit, its quality and thickness. The most recent improvement in this class of machinery consists in adapting the diamond drill to be run by electricity. The Thomson-Vandepoele electric diamond drill consists of the well-known diamond drill manufactured by the Sullivan Machine Company and handled by the Diamond Prospecting Company of Chicago, equipped with a special-type Thomson-Houston motor, as shown in the illustration. The perfected type has been in practical and successful operation for many months.

One of the difficulties in the way of the use of the diamond drill underground and in rough, mountainous localities, has been to get power to the machine, as the nature of the surface of the country may make it impracticable to get heavy boilers and machinery close to the mine opening. Even where this can be done there still remains the great difficulty and expense of getting fuel to the boilers if the mine opening is located, as it often happens, on a mountain-top and where timber is scarce; and a further difficulty arises from the fact that the use of steam underground, besides being unsatisfactory for power and uncomfortable for the men, is often a source of great expense, owing to damage caused by the action of the exhaust steam on the mine timber and rock.

The electric diamond drill is said to avoid all difficulty in these respects, and will permit core-drilling to be undertaken to advantage in places where it has hitherto been impracticable. The dynamo can be located near an engine or water-wheel at any distance and the power carried easily and inexpensively to the drill, which can be on a mountain-top, in a deep shaft, or in any part of the mine. Any constant potential electric current of sufficiently low voltage for safe use underground and of sufficient capacity to deliver 3 horse-power at the drill-motor can be used. The current for running the drill can be taken from an electric plant already installed for lighting, hoisting, or other mining operations; or, if no electric plant is in use for such work, a small dynamo and water-wheel or engine can be put in purposely for the drill at slight expense.

The device for feeding the drill-bit forward in this machine is a combination of the ordinary gear-feed, with a friction-clutch intervening, which not only avoids danger to the diamond, but also results in the most efficient and economical drilling. All parts of the machine, including motor, drill, pump and hoisting-drum are conveniently arranged on a single frame, which can be mounted on trucks for moving about the mine. Switches, resistance-box, etc., are provided for safety and convenience.

The Thomson-Vandepoele electric diamond drill is claimed by its makers to be the first and only electric diamond drill that has been in practical operation.



THOMSON-VANDEPOELE ELECTRIC DIAMOND DRILL.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

We learn from President C. R. Huntley, of the National Electric Light Association, that the next meeting of the Association will be held in Buffalo February 23, 24 and 25, 1892.

Mr. George F. Porter, of Philadelphia, has been appointed Secretary of the Association, in the place of Mr. Beane, resigned.

HEAT IN ITS RELATIONSHIP TO ELECTRICITY AND ITS INFLUENCE UPON THE BODY IN HEALTH AND DISEASE.*

BY DR. J. D. BONNAR.

In selecting the foregoing subject for discussion this evening I do so with the full consciousness that there is "nothing new under the sun;" but while we accept such an old statement in its broadest sense we feel that it is a part of the duty common to us all to endeavor, if possible, to find out what are the old truths which have existed in nature since the foundation of the world, and with the aid of such knowledge apply its teachings to an explanation of the multifarious phenomena witnessed upon all sides of us in this the great age of the practical application of scientific truths which, to a greater or less degree, have been known since the earliest periods of time, but in such manner as to make the knowledge of very little practical value in our every-day doings. While I will not attempt to present any new facts here to-night, I will endeavor, if possible, to present in a new light some of the old facts.

Now we all know that the great source of all light and heat is the sun; in fact, we may truly say that all motions, either of masses or molecules, can trace the origin of such motion to the sun, the great luminary of day and night, for the light of the moon is merely a reflection of the sun's rays; and we all know that the rays of light passing through the atmospheric envelope surrounding our earth produce warmth or heat, which is absorbed by the animal and vegetable kingdoms and stored up for future use, nothing being lost. Now the cause of the heat is rays from the sun; and by pressing this investigation still further we will find that heat and electricity bear a very striking relationship to each other. We all know that heat and motion are convertible terms, either will produce the other; and this is true of matter in masses or in molecules, for we find that the combination of substances, having chemical affinities for each other produces heat; and here we must conceive of the motion being a movement of the atoms or molecules together to form a new compound. By so doing we find as an accompaniment of the process heat and electricity, for in the cell of a voltaic battery we have the action of the sulphuric or any other acid which will act upon the zinc, and we find upon investigation that there is a chemical combination of the acid and the zinc. We also find that the temperature of the fluid in the cell is somewhat increased, and that at the same time an electric current flows from the battery through wires which may be attached to the zinc and platinum (or carbon, if you please). If the electrodes are dipped into a trough containing a so-called chemical salt in solution, decomposition will take place in definite proportions to the chemical combination going on in the voltaic cell; but in the trough containing the salt for decomposition no heat is given off. From these facts we must infer that the molecular motion in the voltaic cell made the heat, while at the opposite end of the wires there is no rise in the temperature, the heat generated by the motion being required to keep the minor divisions of the salt in separate existence.

The affinity between molecules, simple or compound, is merely the effort of the positive (+) and negative (−) to combine and neutralize each other. We find that acids are electro-negative and metals are electro-positive, as compared with each other, and the greater the affinity between bodies the greater will we find the electrical differences. Hence we may conclude that chemical affinity, so called, is another name for electrical attraction.

Many experiments can be resorted to in proof of the fact that two electrical conditions exist, *i.e.*, plus (+) and minus (−), or positive and negative.

We are told by astronomers that the sun is a great molten mass, and from our own proven experiments we learn that all bodies that combine chemically with each other have certain opposite electrical conditions and when they unite with each other an electrical current is set up and may be conveyed upon wires to distances from its place of origin; in short atoms or molecules are each endowed with two electrical ends, + and —, the positive attracting negative and so on. May we not, therefore, just as well eliminate or discard altogether that kind of attraction called chemical affinity and substitute for it the term electrical attraction? For we find the electrical conditions in definite and constant proportion to the attraction or force with which bodies seek to combine with each other. Hence, may we not justly conclude that, in the sun, the same conditions control the chemical combinations continually going on in its structure? The diffused light of day may be reasonably regarded as the fruits of the infinitely great number of electrical rays passing from the sun through the resisting atmosphere media surrounding the earth; and when the air is full of moisture the day is darker, due, no doubt, to the fact that moist air is a much better conductor of electricity than dry air, presenting as it does much less resistance to the electrical effort to reach the earth.

With the rays coming from the sun there is no heat until they come in contact with material substances. We find our electricians taking these facts into consideration in the construction of incandescent electric lights. The bulb from which the light is radiated is vacuous, the air having been excluded by delicate and careful processes, because the oxygen

* Abstract of paper read before the Buffalo Electrical Society, December 7, 1891.

of the air if left in contact with the filament would soon burn it out. You find little or no heat in those glass bulbs, still there is an intense light emitted which is capable of causing certain chemical changes similar to those caused by the sun's rays. What is the conclusion? Simply that electrical energy is the prime mover in all these phenomena; and as a friend of mine very tersely remarked, "The sun may then be looked upon as a huge battery," in which the elements are constantly combining and decomposing, and thereby originating electrical rays, which I have been endeavoring to show are the direct agents in the production of light and heat; and when the sun sets at night we generate electrical rays by means of dynamos propelled by energy laid up for ages in the coal fields—detached charges, as it were—deposited there by the sun's rays, in the carboniferous age; or the energy may come from a fall of water. The waterfall in the first place, however, gets potential energy from the sun's rays, which evaporated the water, and in fact is continuously carrying it up-hill again for future use. What I claim is that the agent in all this work is primarily electricity, and it may be expressed in the various conditions of heat, motion, chemical action or light.

I will not at this time attempt to enter upon an extensive account of the physiological effects of electricity nor its effects upon the body in disease, as I have on a former occasion spoken on those points before this society, yet my remarks would be incomplete if I should fail to call your attention now to a few very striking facts, which, to my mind, are the legitimate offspring of the parental principles which I have endeavored to place before your patient consideration this evening. As already mentioned, heat and electricity are so intimately related as to be, in fact, an offspring, the one of the other, and it often tests the discernment of the most astute reasoner and observer to determine which is the parent power. What I wish to draw your attention to just now is the fact that coincident with an increase in the electrical potential in a body or part of a body, there is also an increase in the heat of the same, and when our bodies are in an highly electrical condition, or in high potential, we are warmer than when the potential is lower; so therefore we find people more vivacious and merry in dry and bright weather than in damp conditions of the atmosphere. By the moisture the electrical potential is lessened, from the fact of moisture being a good conductor of electricity. Again, we find that in all inflammations there is an increase in the positive electricity—*i.e.*, the potential electrical energy is increased—and as we all know the rule, that positive repels positive and negative repels negative, we therefore treat inflammation and all diseases which show increased activity in a part by applying the positive pole over the affected part, or, conversely, in affections where there is a deficiency in normal activity, we reverse the electrodes, applying the negative over the seat of disease, while the positive is applied at some point remote from it. Thus we strive to bring about a physiological natural, or normal state of equilibrium.

We have all noticed that there is a peculiar sensation or, in fact, a slight shock when we shake hands with some people; the cause being that the electricity of higher potential in one is flowing over to the lower.

If you connect two rods or pieces of metals together which have been unequally heated, the current of heat, so to speak, runs from the warmer to the cooler metal, following the same law as its parent, electricity; hence we infer that the uses of heat may be similar to those of electricity in the cure of disease. In fact we are using this heat agent oftener than electricity, because its character and effects are vastly better known. I may ask, what physician is there at the present time who fails to avail himself of the great usefulness of hot fomentations, hot water-bags, and the good old-fashioned hot poultice? And why does he use them? Simply to repel the inflammation. The heat of the application being greater than the heat of the affection and its surroundings causes a heat current from the hot application through the inflamed area into the surrounding healthy structures, thereby scattering the swelling or inflammation.

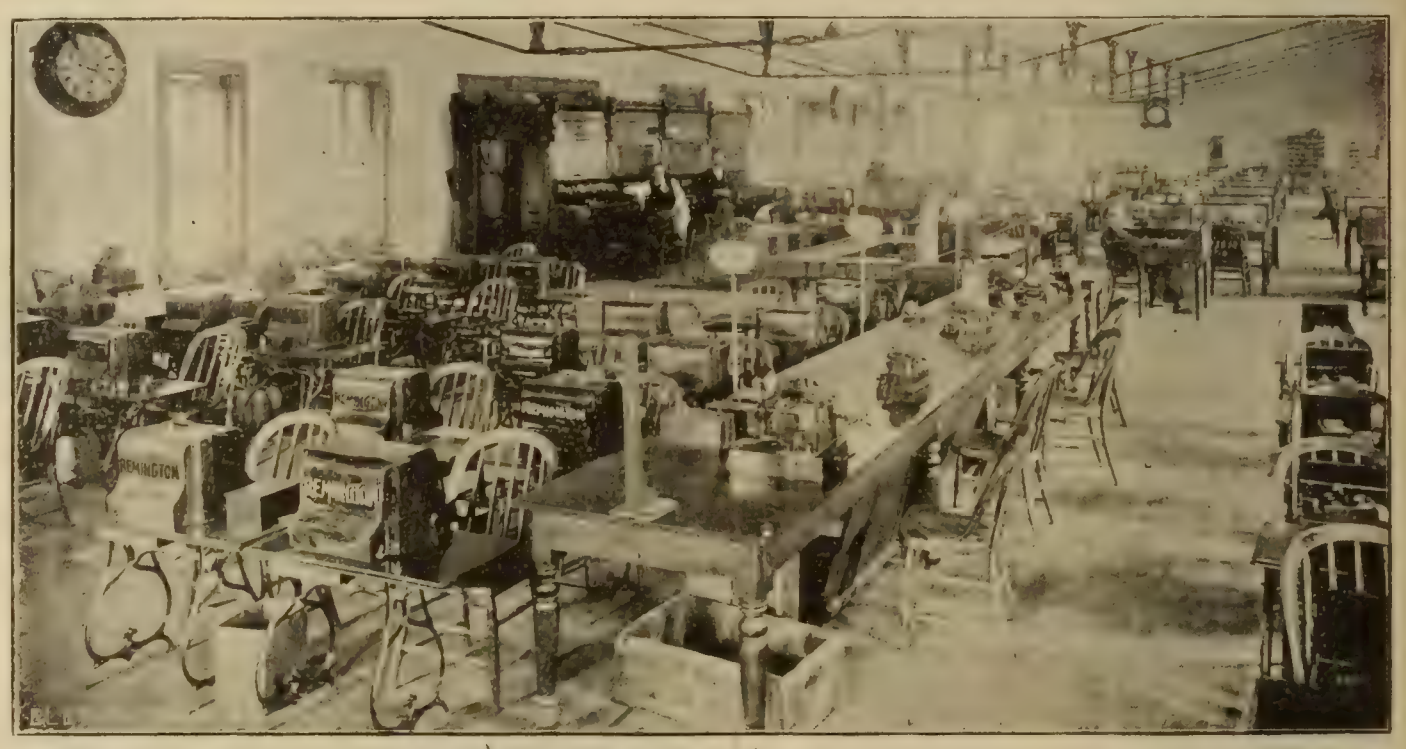
The effect of heat upon the animal body in health is that of a stimulant. All of the usual activities are somewhat increased; the minute cellular elements passing more rapidly through the various changes incident to their work of building up and pulling down the various structures of the body. And what is true of its influence upon a part, within certain limits, is true also of its influence upon the whole body.

Too much heat, however, tends to a destruction of the texture, which is also true of combustible bodies when heated to a point of ignition—*i.e.*, to a temperature at which the oxygen of the air combines with the substance in question, the union being so rapid as to cause light or flame. Now the great disposing power in all these transformations of substances is an affinity which is usually called "chemical," and which I have endeavored to prove is really electrical. I will not attempt, nor do I think it at all necessary, to enter upon a description of the great variety of beautiful and delicate instruments which are so well known to my hearers, and which are simply ingenious contrivances for utilizing this subtle something. But if I have in any degree stirred up a spirit of inquiry by the arguments advanced this evening then I will have accomplished in a large degree the object sought.

KANSAS CITY'S MAIN TELEGRAPH OFFICE.

It is a very few years ago that Kansas City as a telegraph centre was a comparatively insignificant office, but the phenomenal growth of the telegraph and its use in this country has included the enterprising Kansas City in its development as well as other places.

Twenty years ago there where but three operators employed in the Kansas City telegraph office; today there are no less than 266 persons employed in the service in the city. In the main operating-room alone of the Western Union Telegraph Company there are 150 employés, and the number of wires entering this office is 130. Besides these there are 29 quadruplex loops, 46 single-wire loops, 4 sets of Wheatstone and 2 sets of duplex instruments.



OPERATING-ROOM OF WESTERN UNION TELEGRAPH CO., KANSAS CITY, MO.

To supply the current necessary for this vast system 11,792 cells of battery are used, all of which is located in the Kansas City office. The four Wheatstone circuits which are worked out of the office run to St. Louis, Chicago, Denver and San Francisco, and most of the telegraph dispatches received from the wires are copied on Remington typewriters directly from the instruments. This use of typewriters has become very extensive of late years, and in most large telegraph offices a great portion of the dispatches are copied in this way.

We give herewith a view of the Kansas City office from a photograph recently taken, which gives some idea of the great expansion of the telegraph service in the Southwest, particularly in Kansas City.

Mr. M. D. Wood, who is widely known in telegraph circles, is the manager of the Kansas City office, and Mr. George W. Brownson, a well-known telegrapher, is chief operator.

THE WORKS OF THE FORT WAYNE ELECTRIC CO., FORT WAYNE, IND.

Mr. J. J. Wood, electrician of the Fort Wayne Electric Company, Fort Wayne, Ind., took a representative of the ELECTRICAL AGE AND STREET RAILWAY NEWS through the company's large works, recently. The main building is 50 x 250 feet, three stories high and well lighted by electricity. On the main floor are made Slattery alternating-current machines and Wood power-generators and motors. The company is just building three 3,000-light Slattery machines. The bed-plates of these machines are immense masses of iron and weigh several tons. Some improvements are being made in the method of setting these machines on the bed-plates, which will be simpler than heretofore. The three V bearings on the bed-plates as before made, on which the generators are moved in order to tighten or loosen the belts, will be practically done away with. In their place will be three flat surfaces with a tongue in the middle, which will fit into a corresponding groove in the base of the machine. The purpose of the middle groove and tongue is to keep the machine in a straight line, the other two surfaces serving as rests, so that the generator can be moved in either direction with as little friction as possible. Another feature will be the substitution of a rachet-lever for the application of power required to move the generator on its base in place of the hand-wheel. Powful travelling cranes are used to move heavy machinery, etc., from one part of the shop to another.

The second floor of the main building is used for winding the field-coils for alternators, armatures, converters, etc., and on the third floor hanger-boards for arc lamps, cut-out boxes, switches and the new Wood meter are manufactured. The feature of these boards is the absolute cut-out switch for the purpose of cutting the lamps in and out of circuit.

Among other apparatus manufactured in this building are Thomson lightning arresters, circular and straight spirit-levels for use in electric measuring instruments.

The Fort Wayne Company does all its own brass casting, and the Bass Foundry and Machine Works, Fort Wayne, turns out all the iron castings for dynamos, generators, etc.

The Fort Wayne Electric Company has immense warerooms near the railroad depots, which, of course, is a great advantage to it, inasmuch as it can ship its goods in every direction on very short notice. In the warerooms are stored dynamos of all sizes and every class of goods used in interior and exterior construction work, from a small wood bracket-pin to a whole installation outfit.

In addition to the above-named apparatus manufactured at the large works referred to, converters of several sizes, voltmeters, ampèremeters, etc., in large quantities are turned out from the same building.

A second building, about 50 x 150, three stories high, is used exclusively for the manufacture of Wood dynamos and all accessory apparatus. The building faces the railroad, and the first floor is used for the preparation of heavy castings for Wood arc machines. The second floor is used for the assembling and finishing of dynamos, cut-out boxes, etc. At the time of the visit of our representative Wood dynamo No. 477 was just being finished. This machine is the 477th turned out since Mr. Wood first started the manufacture of them in Brooklyn, N. Y., two years ago.

The third floor of this second building is used for the manufacture of Wood arc lamps, of which 26,000 have been sold in two years, and the manufacture of small parts of dynamos, such as commutator-brushes, brush-holders, etc. A new 160-horse-power generator, of the type illustrated in our issue of October 17 last, is now in course of construction in this factory.

In a separate building Electrician Hunting was found experimenting and testing alternating-current motors of various sizes. One of these was running a sewing-machine.

The clerical force of the company is under the able management of Mr. Miller, the secretary, and the purchasing department is managed by his brother.

Mr. J. J. Wood, the electrician, has his hands full at all times, since he supervises operations in every mechanical department of the company, but for all that he always finds time to entertain his friends.

The Fort Wayne Electric Company is said to have the finest arc testing-room in the world. The building is constructed of brick and is 50 x 125 feet and two stories high. The floor is double, perfectly insulated and very solid and substantial, which is a necessary feature of a testing-room where delicate instruments are being constantly used. The engine here is of 200 horse-power. It is a Bass-Corliss and was made by the Bass Foundry and Machine Works, of Fort Wayne The belting used is of the Charles A. Schieren & Co., of New York. An interesting piece of apparatus is a new switch-board on which 300 arc lamps can be tested.

At the time of the visit of our representative one 140-arc-light machine, one 80, one 60, one 40 and one of 25 were all in operation. The 140-light Wood machine is a new departure in the construction of large dynamos. It is said to be the largest dynamo ever built, and will generate a current of 6½ ampères at 7,000 volts.

In addition to the foregoing, the company has just completed a new wood-working department and pattern-shop, which is fitted with all the latest machinery for this class of work.

A LARGE AMMETER.

The Weston Electrical Instrument Company, Newark, N. J., has taken a contract to build a 5,000 ampère ammeter for the Wilson Aluminum Company of Leaksville, N. C. This instrument is to be a very large form of the well-known Weston type of ammeter, with some important modifications to meet the peculiar requirements of the case. It will have a scale about 14 inches long, which will be divided into 250 parts. Each division will equal 20 ampères, and the divisions will be large enough to be easily read to tenths or 2 ampères, and with care to 1 ampère. The scale will be laid out by actual calibration to the full current to be measured by the instrument in practical work, namely 5,000 ampères.

This may seem a somewhat astonishing thing for the Weston Company to do, especially when we consider the work which is commonly done by the use of a current of 5,000 ampères. Thus in incandescent lighting with the direct current each 16-candle-power lamp requires about .5 ampère. The current-required to standardize this instrument would therefore run 10,000 incandescent lamps. Notwithstanding the enormous strength of the current required, it is not beyond the facilities of the Weston Electrical Instrument Company to handle it in the regular course of their work without a single change in their appliances or any special preparation.

The appliances of the company for standardizing work are generally known to be excellent, but we imagine it will be news to our readers to learn that any instrument-making firm in the world was in a position to command in its laboratory such enormous currents as those referred to. It is a fact, however, that this concern is already equipped to do this gigantic work.

Some idea of the perfection of the Weston Electrical Instrument Company's plant in this respect can be formed when we state that the copper conductors in the laboratory for handling ammeter work weigh about 4 tons, and that some of the mains have a sectional area of 5 square inches, and that they are capable of carrying a current of 10,000 ampères without undue heating.

THE WAGNER ELECTRO-MEDICAL APPARATUS.

The faradic battery recently placed upon the market by Wagner & Reid, 24 Custom House Place, Chicago, has a number of features which merit the attention of medical practitioners. The battery is designed to produce a perfectly even current and bring within the easy control of the operator perfect graduation in strength and devices, by which to modify its nature, such as obtaining a higher or lower frequency of interruptions and various degrees of induction; also to allow such changes in slow graduation without shock to the patient or necessity of disconnecting or removing the electrodes.

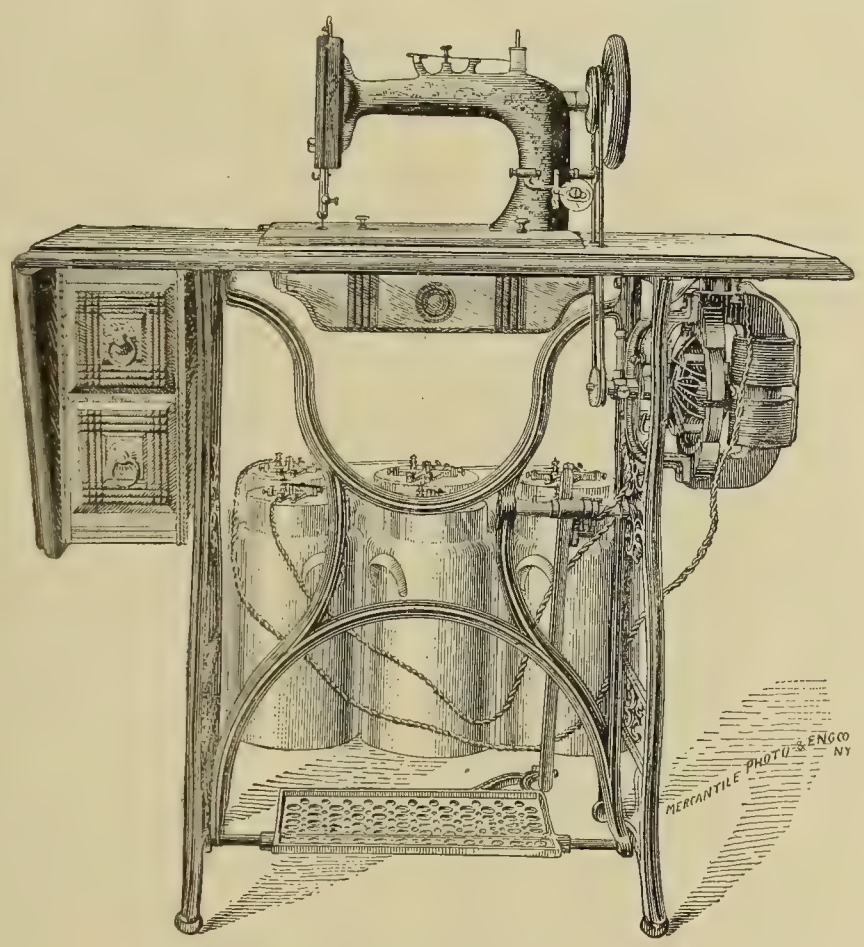
A novel feature of the apparatus is a revolving rheotome, which is practically a very small motor revolving in front of the core of the induction coil, and whose speed may be regulated at will, giving four perfect interruptions for each revolution, and enabling the operator to obtain any frequency of interruptions desired, making the outfit applicable for all purposes to which a faradic battery may be used and without the noise attending the use of the pring vibrator.

The outfit consists of a current-selector, pole-changer, induction coil, binding-posts and switch for using one, two or three cells of battery as may be desired, mounted on a finely finished hard-rubber plate and encased in a handsomely finished oak or walnut box. The battery used with the outfit is composed of dry cells specially adapted for use with the cabinet, and is said to be more durable, cleaner and to cause much less trouble than any of the fluid batteries.

This firm also manufactures a portable medium-size storage cautery battery, which is very handy. It is arranged in a finely finished hard-wood case of two compartments, one containing two 35 ampère-hour storage-cells of the Anglo-American or "Sorley" type, and the other an improved rheostat of German silver wire and large button contact-posts arranged on a polished hard-rubber base, and so constructed that the current may be under perfect control, preventing possibility of burning out electrodes. There is also space provided for carrying cords, handles, electrodes, etc. The firm manufactures and deals in all kinds of electrical medical supplies.

PRIVATE MEETING.

A meeting of the general officers of the Edison General Electric Company was held in Chicago last week. The object of the meeting was to bring the district managers of the company and the heads of the various departments together for general consultation and exchange of views for the good of the general service.



SEWING-MACHINE RUN BY BATTERY MOTOR.

Among those present were Vice-President Samuel Insull; John Muir and S. D. Greene, of the New York office; John Kruesi of the machine works, Schenectady; James F. Kelly, of the wire department; Mr. Langdon, manager of the Canadian works; Mr. Lemaire, manager of the fixture department, New York. Among the representatives of the district offices were Messrs. Mitchell, of the Pacific-Northwestern; Reese, of the Southern District; John I. Beggs, of the Central District; Glass, of the Pacific District; S. B. Paine, of the New England District; M. D. Barr, of the Canadian District, and Charles D. Shain, of the Eastern District. Although the meeting was private, we learn that it was a very harmonious one, and the object of the meeting was fully accomplished. The exchange of notes and views at the meeting were particularly advantageous to all concerned.

EDISON SEWING-MACHINE BATTERY MOTOR.

We illustrate and describe herewith a piece of apparatus which will likely find its way into very many households. It consists of the application of an electric motor to the operation of the sewing-machine, the current for which is generated by a battery of Edison-Lalande cells.

The new Edison sewing-machine battery motor is entirely new in its design and is of Mr. Edison's own invention. The construction of the armature, which is large in diameter, is on the principle of the Paccinotti ring. The field-magnet cores are constructed of steel castings in the shape of the letter E, with polar extension fields, and are in parallel, the armature being in series with the fields. The total resistance of the field-magnets and armature is only ⅛ of an ohm, and the total weight of the motor is 18 lbs. 5 oz. The motor is of the slow-speed type, running at 900 revolutions per minute, and is belted to the sewing-machine in the ratio of 1 to 2.

When doing heavy work the motor takes 4½ ampères of current at a pressure of 3.1 volts at the terminals. The commercial efficiency of the motor is more than 50 per cent., and it is said to work with excellent satisfaction.

In the operation of the sewing-machine by this system the circuit is made by depressing the treadle; this raises the crank-arm to which is attached the sliding contact. The circuit is broken when the foot is removed from the treadle.

The motor is specially designed for the Edison-Lalande battery, the best type of which is the M model, having 600 ampère-hours capacity. Six cells will be found quite sufficient, and these will run a sewing-machine 130 hours without any attention whatever. The E.M.F. of each cell is .7 volt, but as the internal resistance is less than .02 ohm, nearly the whole energy goes into the external circuit.

On account of the total absence of local action the life of the battery is dependent entirely upon the amount of useful work done by it, and in ordinary use will last several months without any deterioration. There is no polarization, and the current is perfectly constant during the whole life of the battery.

The unique feature of this battery is the continued decrease of internal resistance during its whole life. This more than compensates for any slight fall in electromotive force; therefore the battery currents remain constant.

A great improvement in the construction of the Edison-Lalande battery has just been brought out. It consists of a hard-rubber insulating yoke, to the middle of which is attached a binding-post carrying the zinc plates. The extensions of the yoke fit closely into the grooved sides of the copper frame to which they are firmly bolted. Both elements of each cell are by this means held perfectly rigid, and the vulcanite separator buttons, formerly used below the surface of the solution, are now entirely dispensed with.

All cells turned out after the 1st of January next will have this improvement.

It may not be generally known that all Edison-Lalande batteries are standardized for exact capacity, and it is said to be the only battery receiving such attention.

The capacity of the various types of these batteries varies from 15 to 900 ampère hours, and full power is maintained until the battery has delivered the full amount of current based upon its estimated capacity. The consumption of zinc is uniform in each cell throughout the entire battery.

NEW INCORPORATIONS.

The Home Electric Co., New Brighton, Beaver Co., Pa., was incorporated December 3, with a capital stock of $10,000. Incorporators: L. Roggin Strobridge, Joseph E. Mitchell and N. N. Davidson.

The Beatrice Light and Power Co., Beatrice, Neb., was incorporated December 3, with a capital stock of $250,000. Incorporators: Ed. E. Maxwell, F. J. Maxwell and William Pickrell, all of Beatrice, Neb.

The Southern Improvement Co., Dallas, Tex., was incorporated December 2, with a capital stock of $60,000. Incorporators: J. H. Bennett, W. J. Williams, C. J. Baldwin, O. J. Gorman, Dallas, Tex.

Franklin-Morse Electrical and Mechanical Manufacturing Company, East St. Louis, Ill., was incorporated December 7, with a capital stock of $5,000,000. Incorporators: William Keodding, Freeman A. Durgin and William Halleck Jones.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 62d meeting of the Institute will be held at 12 West 31st street, on Wednesday evening, December 16, at 8 o'clock. A paper will be read by M. I. Pupin, Ph.D., on "Polyphasal Generators."

Postponed discussions of Prof. Harris J. Ryan's paper and the report of the Committee on Units and Standards will be in order, if time permits. These have already been printed in the official transactions for October and November.

NOTES OF SOCIETIES.

AN ELECTRICAL SECTION of the American Institute has recently been organized with the following officers: E. T. Birdsall, President; Dr. L. H. Laudy, Vice-President; J. W. Hull, Secretary. The section will meet on the second Wednesday of each month at the rooms of the Institute, 115 West 38th street, New York City. This section will be similar to the Polytechnic, Photographic and other sections of the institute.

DR. S. S. WHEELER, expert electrician of the Board of Electrical Control of this city, delivered a lecture on "The Practical Applications of Electricity," at the Young Men's Institute, No. 222 Bowery, on the night of Tuesday, December 15. A good-sized and interested audience was present.

MR. J. STANFORD BROWN, of New York, will deliver a lecture before the Department of Electricity of the Brooklyn Institute in the Y. M. C. A. Building, at 8 P.M., Friday December 18. The subject of the lecture will be "Electrical Units in Theory and in Practice," and will be illustrated by experiments and lantern diagrams.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE AND STREET RAILWAY NEWS, FIRST FLOOR, WORLD BUILDING,
NEW YORK, Dec. 12, 1891.

ALEXANDER, BARNEY & CHAPIN have on exhibition a combination dynamo and engine on one base, manufactured by the Diamond Match Company, of New Haven, Conn.

H. WARD LEONARD & Co. have secured the contract for wiring the *Mail and Express* building. New York, for 3,500 incandescent lamps, acting as sub-contractors under the Waddell-Entz Electric Company.

THE FIRST ANNUAL BALL of the employés of the New York and New Jersey Telephone Company (Long Island Division) was held under the auspices of the Telephone Mutual Aid Association, in the Criterion Theatre, Brooklyn, N. Y., on the night of December 7. There was a large attendance, and the affair was in every way a great success.

H. WARD LEONARD & Co. have received an order from Wm. Sellers & Co., of Philadelphia, for two 40 H. P. motors for use upon travelling cranes. The motors are to be supplied under rigid specifications as to dimensions and performance, but the decision as to the particular make of motors to be used is left with H. Ward Leonard & Co.

STANLEY & PATTERSON, 32 and 34 Franklin street, this city, are bringing out an electric bell which, it is said, will surprise the trade for novelty and ingenuity. They are also sole agents for the fibrous battery for open-circuit work, their territory embracing, New York City, Brooklyn and Jersey City. They have a full line of household supplies, and are able to fill orders for any quantity of goods on short notice. Their catalogue will be mailed to any one applying for a copy of the same.

GOODING, BEINERT & Co., 80 John street, this city, have every facility for the manufacture of Lelanche and Gravity batteries and electrical appliances in general. They are also dealers in dynamos and motors, both new and second-hand, and they make a specialty of repairing electrical apparatus of all kinds. They keep on hand a full assortment of carbon and copper brushes, and their work is guaranteed to be first class. The firm also gives attention to dynamos and motors by the month.

LLOYD & PAXTON, Limited, 32 Liberty street, this city, electrical dealers and manufacturers of storage batteries, are now agents in the United States for the sale of Sir William Thompson's electrical instruments. The firm keeps these instruments in stock and sells them at English prices. Mr. Robert McA. Lloyd has just returned from Great Britain, where he has been on business. The firm also represents W. T. Goolden & Co., of London, which is paying special attention to mining machinery, and has now a large number of plants in operation in English collieries.

W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y	3,000,000	100 00	92 00
Am. Elec Exercise Mach. Co., N.Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N.Y.	1,000,000	25 00	5 00
American Private T'phone, N.Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	81 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	420 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N.Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bell Telephone	15,000,000	100 00	199 00
Bell Telephone 7s	2,000,000		*113
Brooklyn Edison Electric Light	1,500,000	100 00	78 00
Brooklyn Citizens' Electric Light.	500,000	100 00	147 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill	1,000,000	100 00	50 00
Brush Elec. Ill., 6s	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s., Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00
Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	148 00
Complete Elec. Con. Co., N. Y.	50,000	100 00	175 00
Cons. Electric Light Co., N. Y.	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y.	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	97 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Desant Elec. and Sig. Co., N. Y.	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	24 00
Detroit Electrical Works	1,000,000	10 00	9 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600 000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Electric Light Co., Phila.	1,000,000	100 00	80 00
Edison General	14,000,000	100 00	95 00
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Erie Telephone	4,800,000	100 00	44 00
Excelsior E. L. Co	500,000	100 00	
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C.	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s.	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J.	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	21 25
Laclede Gas pref	2,500,000	100 00	58 00
Laclede Gas 5s	10,000,000		*80
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30.000		*95
Littleton Water & E. L. Co. 6s	75,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		par
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y.	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	40 05
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. L	150.000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	18 00
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	49 50
N. Y. and N. J. Tel. and Tel. 5s.	1,500,000		*98
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	†20 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	30.000		*95
North American Railway Co	39,767,200	100 00	17 00
North New York Lighting	150.000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50.000		*90
Postal Telegraph	10,000,000	100 00	30 00
Paterson Electric Light, N. J	100,000	100 00	
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co, Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500.000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s.	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200.000	100 00	60 00
Richmond L. H. & P., S. I	150,000	100 00	
Richmond L. H. & P. 5s	150.000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300.000	5 00	4 50
Saginaw E. L. & P. Co. 6s, Mich.	50.000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100.000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
South Denver E. L. & P. 7s, Colo.	30,000		par
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y.	1.000.000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750.000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y.	100.000	100 00	105 00
The Railway Impt. Co., N. Y	10,000.000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	49 00
Thomson-Houston pref	4,000,000	25 00	26 25
T.-H Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
Twin City Rapid Transit, N. J	20.000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1.500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100.000	100 00	75 00
Vine Street Motor Co. 6s, Colo.	100,000		*95
Western Union	86,188.852	100 00	82 50
Westinghouse Electric Co	7,000.000	50 00	12 50
Westinghouse Elec. Co. pref. 7s.	3,000,000	50 00	50 00
West End L., Boston	13,550,000		17 50

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

FINANCIAL.

As the profit and loss account is being balanced by all of our readers for the end of the year they must recognize the fact that the grand total has increased, if the division of profits has not been equally distributed, the few more fortunate receiving as usual so large a proportion that the great mass will be obliged to divide a correspondingly small remainder. We predict a red-letter year for 1892, and that the proportionate division of profits will be more widely scattered and the people instead of the banks obtain the great majority of the exceptional increase. It will be the producers' jubilee year. Not since the early sixties have the tillers of the soil been blessed with such remunerative markets for their harvest. The family in hundreds of thousands of instances will be enabled to not only clear the debts off the old homestead but beautify it and introduce many of the modern luxurious improvements, which in turn will tend to lighten the hard struggle for existence of the city population. The one question for the farmer to put to himself is, Will the chances of a war in Europe, short crops there, and a second prolific year here justify him in expending all his unusual gain? It is a good time to take a breathing spell and invest a part of the wealth in such a manner that it will itself produce; then should the tables be turned on us the income will enable you to tide over for some time. A vast improvement has been inaugurated in favor of the northern farmers in shipping direct from the lakes to market an immense quantity of their grain. Another year will see ships, and American ships at that, running regularly from all the large lake ports to the ocean. The first has already successfully crossed the Atlantic and then doubled Cape Horn with a cargo, and there is no severer test on the globe. Who can conceive at this writing the millions of dollars assured by that triumph of man's skill and energy to the capital of the country? And when the wasted power of Niagara shall be utilized both for compressed air and electric generation, millions more of the prolific acres will be cultivated, the bone and sinew being released from present occupations and used to supply the new system with its greater requirements, enabling investors to use their savings to the advantage of more people than at any previous time in our history but at the head of all financial advancement for the year stands the electric industries, taken in the various forms of improvement. Electric light, heat and power have been so widely introduced that one can to-day scarcely find a hundred miles square between the oceans in which these have not gained a foothold and a permanent one. Electric corporations have been launched in every State in the Union, and the promoters are reaping great and constantly increasing wealth from this particular class of investment. The electric railway companies are now the connecting link between the living and the dead, as must certainly have been noticed by many of our readers. The most common application, after the road has commenced regular carrier service, being for a permit to extend the line to the cemetery and in every case it is allowed. The day is not far distant when the funeral electric cars will outnumber those for smoking, and pay better dividends. The electric lines are also liable to create a riot in the accident insurance business. The excessive railway travel is in the immediate vicinity of large towns and cities. This will be served by the extension of the electric lines far enough beyond the municipal limits to supply the demand. Practically there are no accidents on the electric roads. I think I am well within bounds in alleging that there are more on the Long Island than on all the electric roads in the country, if not the world. What the equity will be when equal speed is attained remains to be shown. At present the above challenges successful contradiction. There is no field which offers more substantial returns to investors than the electric local corporations. The few parent companies in the struggle for supremacy are constantly before the public, and may be dealt in by the speculator, but one of the short roads to the White House for a young man is to secure a controlling interest in the bonds and shares of his local electric light, heat and power company and then a course of constitutional law and civil government.

Telephonic capital has held nearly its own the past year; 1892 will decide its status for all future time. My views are well known on the subject. The decision to come from the court, however, must control, and until it is handed down it is a game of chance. Electric printing by typewriting machines is successfully carried on from New York to Boston and Philadelphia and is a safe place for a fair investment. The system will soon reach all over the land. Our suggestion is that it is preferable to invest and grow up with a corporation rather than wait until the large profits are taken by others.

BOSTON NOTES.

NEW ENGLAND OFFICE ELECTRICAL AGE AND STREET RAILWAY NEWS, BOSTON, Dec. 12, 1891.

THE W. S. HILL ELECTRIC CO., 54 Devonshire street, is doing a large business in its well-known dynamos and switches. Mr. Poor reports an unprecedented rush of orders for its goods.

MR. C. B. ELLIOTT, of the Revere Rubber Company, reports that "Flexite," which is known to every electrical man, continues to increase in popularity. Mr. Elliott states that he has a trolley-hanger and a pull-off that will surpass anything yet placed upon the market.

THE BOSTON WOVEN HOSE AND RUBBER CO., manufacturer of rubber belting, etc., will soon move in order to enlarge its facilities to better accommodate its increasing business. Its present quarters are at 226 Devonshire street, and its new warerooms will be at 5 Winthrop square and 275 Devonshire street.

COLONEL BURNHAM, Vice-President and Manager of the Electric Gas Lighting Company, 195 Devonshire street, informs your correspondent that he will publish a catalogue about the first of the year, which, while containing a general description of his company's well-known specialties, will also be a superb specimen of the engraver's and printer's art.

BOSTON is to have an electric club, and a meeting is to be held some time during the middle of the month to effect organization. Already 96 good and substantial names appear upon the roll, representing the heads of firms and departments of the leading electrical industries of Boston and vicinity. The idea is to have a club-house near the junction of Washington and Summer streets, which will contain all the modern comforts and conveniences; and it is likely the charter will be obtained by the first of the new year.

THE GERMANIA ELECTRIC CO., of this city, has recently installed isolated plants in the following places: Hermann Bonitz, Lodi, N. J., 150-light machine; De la Vergne Refrigerating Machine Co., New York, one 500-light machine; J. S. Mundy, Newark, N. J., one 400-light machine; The Newichawanick Co., South Burwick, Me., one machine of 300-light capacity; The Pabst Brewing Co., South Boston, Mass., complete steam and electric plant for 100 lights. These machines, like all Germania dynamos, are giving universal satisfaction, and the demand for them is very great and constantly growing. Mr. H. Bottomley of the company, reports that business is very lively, and they have more than they can do. The company's offices, at 505 Exchange Building, are very handsomely fitted out and give evidence of the prosperity of the concern. D. L, T.

WESTERN NOTES.

D. & D. ELECTRIC MANUFACTURING COMPANY, 745 and 747 Washington avenue, North, Minneapolis, Minn., has been in business about three months, and is meeting with encouraging success. It manufactures electric motors, arc and incandescent dynamos, electric elevators, etc., and deals in general electrical supplies. Mr. Gilbert Donaldson is the president and general manager.

THE CARPENTER ELECTRIC HEATER AND MANUFACTURING CO., corner St. Peter and Exchange streets, St. Paul, Minn., is doing an extensive business in the manufacture of electric flat-irons, hat-irons, tailor pressing-irons, griddle-irons and heaters for buildings and street-car heaters. These goods are giving excellent satisfaction through their convenience and reliability. A representative of the ELECTRICAL AGE AND STREET RAILWAY NEWS called upon this enterprising concern a few days ago, and was shown through the factory by Messrs. Carpenter and Swinton, the latter gentleman being the business manager.

MR. W. D. ALLISON, railway expert of the Thomson-Houston Company, is in Chicago in connection with the installing of the movable sidewalks and settees which it is proposed to constitute a part of the attractions and conveniences at the World's Fair. An experimental walk has been erected in the Exposition grounds under the superintendence of Mr. Allison, and a test of the same recently seems to prove the practicability of the scheme. If the World's Fair committee adopts the movable sidewalk it will be constructed on a large scale, and will be elevated sufficiently so as to give a general view of the grounds therefrom. The experimental walk is 900 feet long and elliptical in shape. It is elevated on a wooden structure 20 feet high, and it is covered so as to protect passengers from the weather. The principle of the sidewalk is simple; it consists of a continuous row of overlapping platforms, each resting on a truck, the trucks being coupled together by a link. The experimental walk is operated by electric power, which no doubt will be the power used for the main or large movable walk, if the same is adopted for use during the Fair. Mr. Allison will remain in Chicago until the opening of the Fair, so as to direct all work in connection therewith.

N. D. W.

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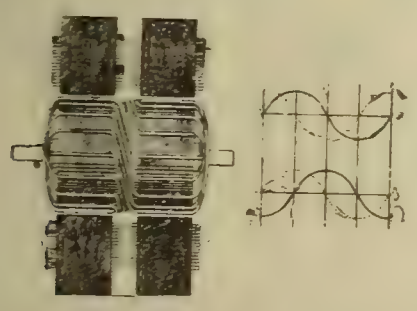
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THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued December 8, 1891.

464,510. Automatic Fire-Alarm Telegraph. Morris Martin, Malden, Mass., assignor, by mesne assignments, to John F. Nielson, Elizabeth, N. J. Filed Feb. 21, 1887.



464,671.—TRANSFORMER MOTOR.

The combination of an electrically-controlled transmitting-instrument and control ing electric circuit therefor, and a circuit-changer or switch in the controlling-circuit, having contacts by which it makes a change in the circuit and immediately thereafter restores the same to its original condition, a signal-receiving instrument, and transmitting-circuit connecting the receiving-instrument with the signalling portion of the transmitting-instrument and including as a part of it a portion of the circuit that controls the transmitting-instrument and is governed by the transmitter-controlling switch, whereby the transmitting-circuit is complete and operative only when the controlling-circuit is in normal condition.

464,519. Spring-Jack Switch. William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 27, 1890.

The combination, with the frame consisting of a tube provided with the projections forming an integral piece, of the block of insulating material placed between the projections, with the lever and its opposing contact-piece properly mounted thereon, the contact between said lever and contact-piece being shielded by the upper projection of the frame, substantially as and for the purpose specified.

464,529. Means for Preventing the Interference with Speech on Telephone-Circuits by Induced or other Currents. William Stanley, Jr., Pittsfield, Mass., and John F. Kelly, New York, N. Y. Filed May 22, 1891.

An electrical signalling system comprising a circuit and a receiving instrument combined therewith which is responsive to currents of both low and high frequency, the receiving-instrument being placed in a portion of the circuit which is adapted by the adjustment of its self-induction and capacity to oppose the passage of current-waves below a certain frequency.

464,540. Time-Registering Device for Electrical Currents. William D. Wilder and Walter Cobb, Jr., Brockton, Mass. Filed Nov. 13, 1889.

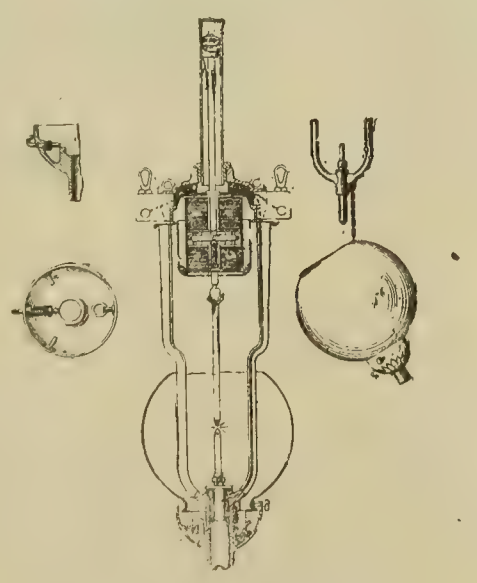
The combination, with a switch or other device for making and breaking an electric circuit, of a pivoted arm provided with a spring-arm, a stop or abutment on a suitable support, a wheel or other moving part of a clock or other operating mechanism, and a registering device.

464,547, Armature-Winding for Dynamo-Electric Machines. Craig R. Arnold, Philadelphia, Pa. Filed Mar. 14, 1885.

In a dynamo-electric machine or motor, a cylindrical armature having its armature coils or bobbins disposed in sections wound in parallel planes the line of division between which intersects the armature, the sections being connected in parallel or multiple arc to one another and the same commutator-segment.

464,548. Cut-Out. Craig R. Arnold, Sharon Hill, Pa. Filed June 11, 1891.

In a fusible cut-out for electric circuits, the combination of an open glass tube having the metal ferrules or rings applied at its ends and a fusible strip or wire within the tube having its ends fastened to the ferrules.



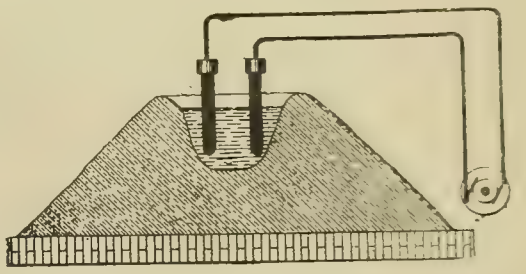
464,682.—ELECTRIC-ARC LAMP.

464,595. Lightning-Arrester. Elihu Thomson, Swampscott, Mass. Filed Oct. 11, 1890.

A lightning-arrester consisting of an electrically-continuous conductor connected to ground, so arranged as to form a series of disruptive insulation-spaces between successive portions of the conductor for the discharge to leap consecutively and of a total resistance sufficient to prevent the passage of much of the line-current to earth.

464,643. Protector for Telephones. John L. W. Zietlow, Aberdeen, S. D., assignor of one-half to Francis A. Burdick, same place. Filed Mar. 31, 1891.

The combination, with a system of ordinary electrical conductors, such as electric-light circuits, carrying currents of great strength, and a system of conductors, such as telephone-wires, carrying currents of less strength, of grounded connections of the conductors carrying weaker currents, an inclosing protector of high conductivity surrounding the



464,933.—PROCESS OF OBTAINING METALS FROM THEIR ORES BY ELECTROLYSIS.

grounded connections, insulation interposed between the protector and the grounded connections, and a conductor of high conductivity in circuit with a generator and connected with the surrounding protector and provided with ground connections outside the area of the conductors carrying the stronger currents.

464,655. Electric Track-Signal. Homer A. Parrish, Jackson, assignor to the Parrish Electric Track Signal Company, Detroit, Mich. Filed Mar. 9, 1891.

In an electric track-signal, the combination of a rail of the track, the tread-bar metal-faced on the upper and lower surface, the metal surfaces being connected, the bar being on the outside of the rail and held by a spring-resistance against lateral displacement, and a spring-bar supporting the tread-bar from beneath and the spring-bar below the former-named spring-bar, the spring-bars constituting the circuit-controllers.

464,665. Secondary Battery. Isaiah L. Roberts, Brooklyn, assignor to the Roberts-Brevoort Electric Company, Limited, New York, N. Y. Filed Dec. 31, 1890.

In a secondary or storage battery, the combination of the electrodes with an electrolyte of a salt of iron, which is capable of absorbing an acid radical, and a non-porous electrolytic diaphragm interposed between the electrodes.

464,666. Electro-Magnetic Motor. Nikola Tesla, New York, N. Y. Filed July 13, 1891.

In an alternating-current motor provided with two or more energizing or field circuits, one of which is adapted for connection with a source of currents and the other or others in inductive relation thereto, the combination, with the secondary or induced circuit or circuits, of a condenser interposed in the same.

464,667. Electrical Condenser. Nikola Tesla, New York, N. Y. Filed Aug. 1, 1891.

An electric condenser composed of plates or armatures immersed in oil.

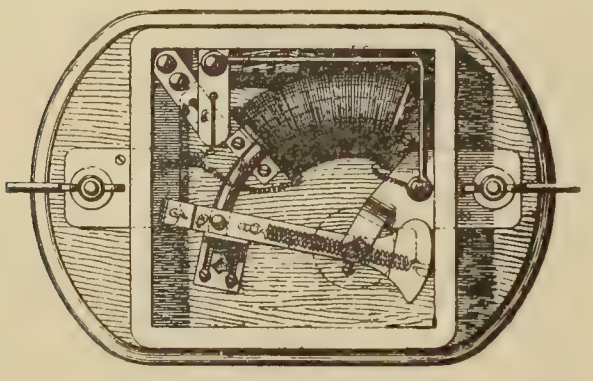
PATENTS—Continued.

464,671. Transformer-Motor. Otto T. Blathy. Buda-Pesth, Austria-Hungary. Filed Nov. 8, 1889.

A transformer-motor for alternate currents, consisting of two field-magnets or groups thereof adapted to receive alternating currents of different phases, in combination with an armature provided with closed coils having one part distorted with reference to the other.

464,676. Electrode for Secondary Batteries. William Morrison, Des Moines, Iowa, assignor to the Hess Electric Storage Battery Company, same place. Filed Oct. 27, 1890.

An electrode for secondary batteries, consisting of a stratum or body portion of active material or material to become active, and a layer, coating, or covering of fibrous glass-wool disposed upon the face or side of the body portion of active material, and perforated confining non-conducting plates of a material not subject to the action of the electricity or solution holding the glass-wool upon the face of the active material.



464,948.—AUTOMATIC CUT-OUT FOR ELECTRIC MOTORS.

464,677. Electrical Transformer. Arcadius Poleschko, St Petersburg, Russia. Filed April 17, 1891.

An electrical transformer having a core of spaced iron plates provided with a vertical slot within the core containing the primary coils, and a slot extending at right angles to the first-named slot and containing the secondary coils.

464,682. Electric-Arc Lamp. Addison G. Waterhouse, Hartford, Conn. Filed April 1, 1891.

An electric-arc lamp frame consisting of a cup-shaped top which will cover and partially surround the regulating mechanism, a top having on its sides sockets for receiving insulating-arms, which project from and surround part of the arms, also side bars which are extensions from the sockets, and unite at their lower end in forming the base.

464,683. Electric Meter. Addison G. Waterhouse, Hartford, Conn. Filed April 10, 1891.

The combination, in an electrical meter, of a vessel adapted to hold a fluid electrolyte provided with electrodes, a gas-collector placed over one or both of the electrodes, the collector being provided with a tube or gas-passage leading from the upper interior of the gas-collector, having the elements within itself for discharging the gas from the collector after a certain amount has been collected.

464,691. Electric Body-Wear. Lauritz Anderson, Chicago, Ill. Filed March 16, 1891.

An electric body appliance comprising a pad having a switch-board, a plurality of flexible cords connected therewith, and a battery connected with the switch-board.

464,719. Incandescent-Lamp Filament. Ludwig K. Böhm, New York, N. Y. Filed Jan. 2, 1890.

The process of making filaments for incandescent lamps, consisting of impregnating carbonizable material with carbonates of calcium or magnesium and carbonizing the same, whereby a filament is produced composed of carbon and oxide of calcium or magnesium.

464,730. Electric Programme-Clock. Charles Lester, Chicago, Ill., assignor to George A. Harmount, same place. Filed April 10, 1891.

The combination, with the clock-work of a clock, of a plate moving synchronously with the hour-hand thereof and an independently radially-adjustable brush carried thereby and constituting one terminal of an electric circuit, with an arm constituting the other terminal of the same, and a gong connected to the arm, so that when the brush is radially adjusted it establishes a transient contact with the arm and causes the gong to sound.

464,732. Switch-Chair. William H. Phillips, Jenkintown, assignor of one-half to Francis G. Bates and Joseph W. Hunter, Philadelphia, Pa. Filed Jan. 21, 1891.

A switch-chair formed of malleable iron, having a platform for the movable rail, a lower platform bounded inside by a shoulder for the fixed rail, spike-holes formed at its sides, and lugs cast outside the holes.

464,770. Clamp for Electric Wires. John J. Green, Boonton, and George C. Brown, Elizabeth, N. J. Filed Oct. 30, 1890.

In a wire-clamp, the combination of a base having an inclined bearing-surface, a rotatable cap having a similar and opposed inclined surface and loosely encircling a central pin capable of longitudinal adjustment, and a groove for receiving the wire.

464,822. System of Distributing Electricity. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed June 26, 1882. Patented in England, France, Belgium and Italy.

In a system of electrical distribution, the combination of a main circuit extending to a distance from the source of electrical energy and having a current of high tension, a constantly-acting tension-reducer connected with such main circuit by a multiple-arc or cross circuit, so as to be independent of other similarly-connected tension-reducers, and a translation-circuit supplied by such tension-reducer with a current of lower tension.

464,897. Telegraph-Key. Louis F. Robare, Au Sable Forks, N. Y. Filed June 4, 1891.

The combination with the base of two pillars having vertical and transverse apertures, screws extending down through the vertical apertures into the transverse apertures to bind the wires, one of the screws and its binding-post being insulated, a key journalled to the pillars and having two contacts with a plate connecting the contact and the insulated binding-post.

464,933. Process of Obtaining Metals from Their Ores or Compounds by Electrolysis. Charles S. Bradley, Yonkers, N. Y. Original application filed Feb. 23, 1883. Divided and this application filed Sept. 14, 1889. Renewed March 16, 1891.

The process of obtaining metals from their ores or compounds, consisting in passing an electric current through a fused portion of the ore or compound contained in an unfused body or heap of the ore or compound.

464,948. Automatic Cut-Out for Electric Motors. Schuyler S. Wheeler, New York, N. Y. Filed July 16, 1887.

A cut-out for electromotors, consisting of a normally open low-resistance shunt, a high-resistance shunt including the coils of a solenoid, a contact-arm connected to the solenoid, means for adjusting the contact-arm, and a spring connected to the arm, so that it will normally hold it away from the solenoid, but operates to assist the solenoid when the arm is moved.

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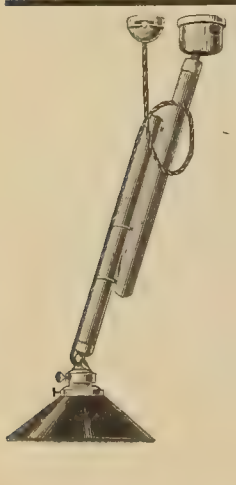
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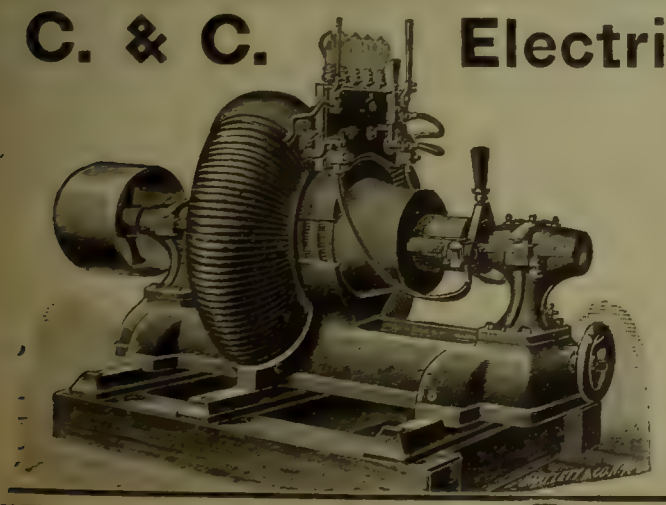
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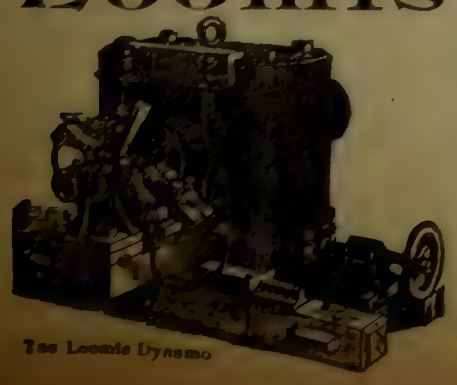
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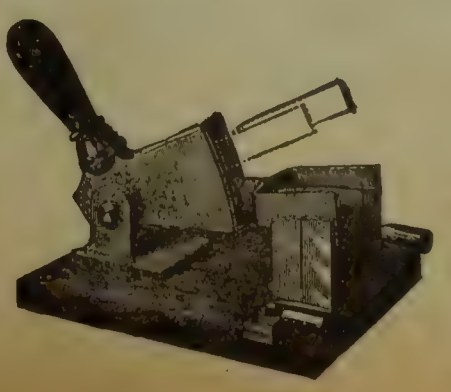
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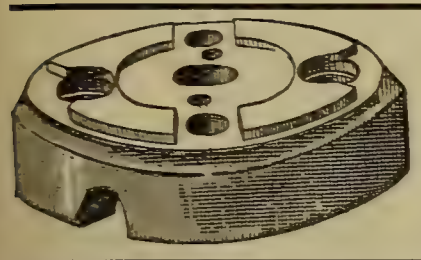
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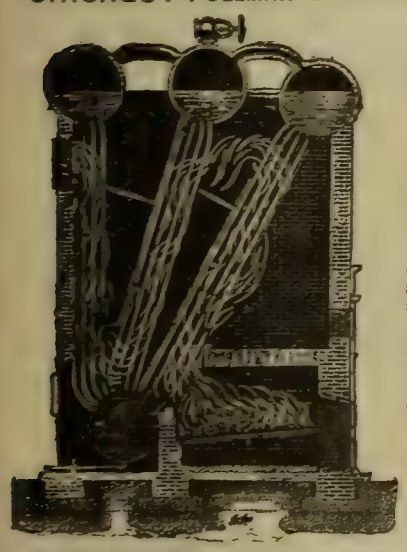
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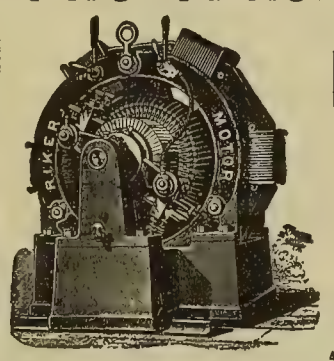
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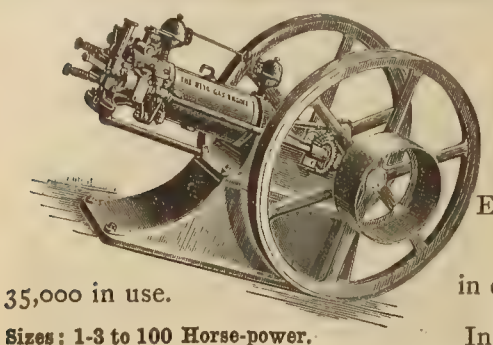
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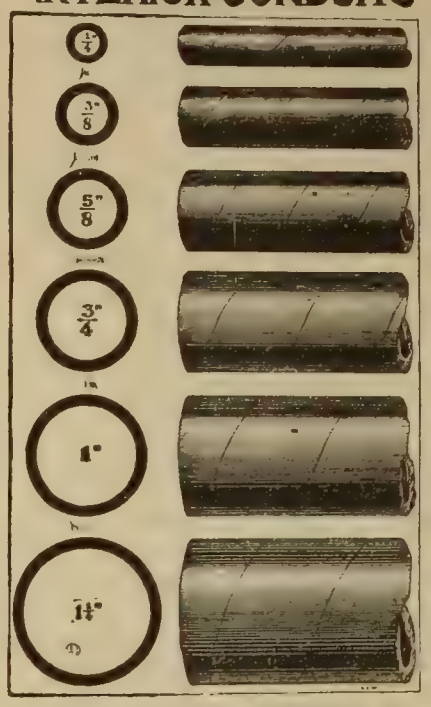
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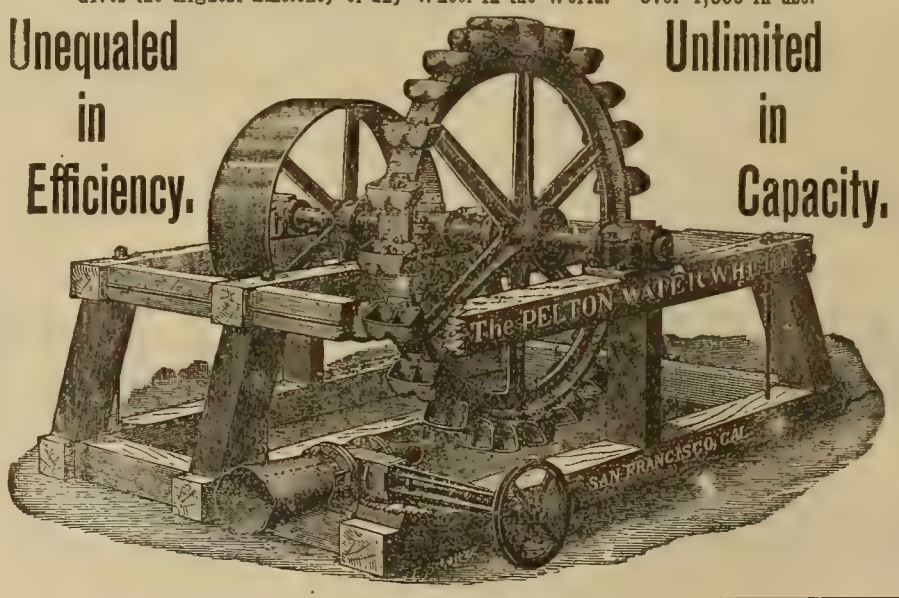
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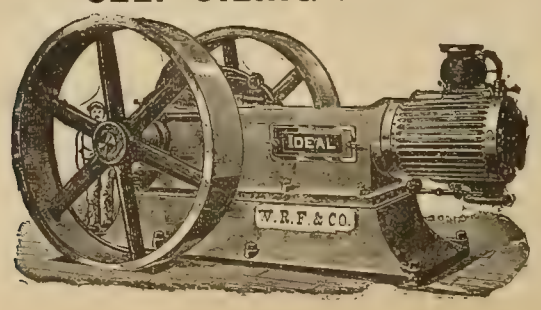
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THE ELECTRICAL AGE AND STREET RAILWAY NEWS wishes each and every one of its many friends and readers a Merry Christmas.

ELECTROCUTION: IS IT A FAILURE?

Beyond all question electrocution, as a form of capital punishment, which the State of New York, after long discussion and investigation, adopted only two years ago, is severely on its trial, and, as such, has become one of the most momentous questions of the day.

We fearlessly assert that thus far electrocution has proved but a partial success; and we go further and insist that, unless it can be made an absolute success and that at once, the public will demand that it shall be abandoned for some other form of capital punishment.

We are not familiar with the evidence upon which those responsible for the alteration in the former mode of inflicting capital punishment originally decided to adopt electrocution; but it is only right to assume that before they incurred so great responsibility they took every available means to satisfy themselves that its adoption would at least fulfil the essential condition of greater humanity in the infliction of the extreme penalty of the law on those found guilty of murder than that previously in vogue.

That this has not, so far, resulted we confidently appeal to the particulars of many past executions, prominent among which our readers will recall those of Kemmler, Slocum, Wood and Myers, and more recently that of Loppy at Sing Sing. We might easily enlarge upon these illustrations, but our object is with the remedy, and we gladly refrain from entering into details of any of the horrors then alleged to have been witnessed.

It will be admitted that electrocution in New York State was entered upon tentatively, other States preferring to await the experimental results (as they considered them) before deciding to adopt it. This State, as pioneer of the movement, must therefore not refuse to justify its leadership in this branch of human progress by a *laissez faire* policy on this vital question.

Now, let it be understood that our purpose is not to discredit the decision arrived at in favor of electrocution; on the contrary, with some knowledge of the power and agency of electrical force, we venture to affirm that electrocution, properly administered, would be a vast improvement on the process for which it has been substituted, and that the State is not at present justified in going back upon itself after having decided in favor of its adoption; our complaint is that the authorities, notwithstanding the disclosures made at some of these executions pointing clearly to some shortcomings if not maladministration of the process of destroying human life by electricity properly administered by those by law entrusted with the carrying out of this form of capital punishment, have neglected to take any means to determine whether—given the power of the agent employed, which on the highest scientific authority must be conceded—the present mode of its administration, or the mechanism employed, are the best that can be used for the purpose, or to try such other means as practical experienced minds—of which these are abundant in this country—can suggest.

What is the remedy, and how shall the question, "Is electrocution a failure," be determined? We venture to suggest that, as it is really a question of *fact* and not of argument, it can only be satisfactorily dealt with by the appointment of an investigating committee to inquire into and report to the proper authorities the experience that has been gained by the executions that have taken place since electrocution has been adopted.

The investigating committee must be so constituted as to command the respect and confidence of all classes of the community. The number should not be too large, but sufficient to guarantee that every branch of the subject will receive such individual attention as to insure its result being the "wisdom of many minds."

We suggest that the committee consist of twenty persons, eight of whom to be men thoroughly versed in practical electricity, the majority being editors or literary writers on electrical journals, six selected from the body of medical practitioners, and six others of positive influence, two, at least, being or having served as judges, and the rest well known to the public as men of business and independent character.

The inquiry of this committee should embrace especially how, in precise detail, the process of electrocution has hitherto been conducted; what force of electric current has been used, and by what mechanism it has been applied; what precautions have been taken as to proper supervision, skilled and otherwise, when electrocutions have been carried out; the consideration of the propriety and sufficiency of the authoritative instructions hitherto issued for the conduct of executions; also as to the policy, in the interest of the public, of excluding the public press from executions, and, generally, whether the present instructions to prison wardens as to excluding spectators (save to a very limited extent) should not be reconsidered, with a view to their being somewhat enlarged.

A report of this character and scope by a body of skilled and independent men would practically exhaust the subject when completed.

It should be at once made public to insure the widest consideration through the columns of the press and so elicit the expression of public opinion; then, after due and proper discussion and investigation, it would remain for the Legislature to determine whether for the future electrocution should be the article for executing, at least in this State, the law of capital punishment.

Now, Governor-elect Roswell P. Flower, who has the reputation, even among his political opponents, of being a thorough man of business, might win some laurels by taking this subject under his special cognizance and support.

By adoption in some form of the means we have ventured to put forward this great scandal will be removed from the page of American justiciary.

As a last word, let there be no undue delay in appointing the committee and getting it to work. There is no disguising the fact that crime of the worst description still stalks abroad in our midst, and that the necessity for another public execution, even in this State, may arise ere this issue reaches our readers. In that case, unless the law allows of delay, the horrors of past execution may be re-enacted before the work of the proposed committee is even begun, far less completed. Therefore whilst commending the subject to the authorities for their serious attention, we do so with a respectful but firm protest against delay.

Other States on this vast continent, equally interested in following the cause of humanity, yet discouraged by our experiences, will be awaiting our action, and let delay no longer afford them reason to discredit us in the pathway of a desired reform.

OBITUARY.

GEORGE W. COSTER.

George W. Coster, the district manager for the Edison General Electric Company at Denver, Col., died Sunday night in Schenectady, N. Y.

LIGHT AND POWER PLANTS.

It is now admitted that the electric motor is the cheapest and best means of transmitting power, and that wherever suitable current can be obtained no one can afford to use other means for driving printing-presses, exhaust and ventilating fans, manufacturing and mining machinery of all kinds, elevators or anything requiring from ⅛ to 100 horse-power. It is very handy to be able to run a loop from an electric-light circuit in the neighborhood and run small motors for driving fans, sewing-machines, small pumps and other small power work about the house or shop.

Very often small isolated electric-light plants are needed for lighting up stores, houses, factories, etc., and the Columbia Electric Company, 207 East Fourth street, St. Paul, Minn., has taken special pains to design dynamos, motors, power-generators and specialties, particularly adapted to such requirements. The dynamos are either shunt or compound wound, as required, and are provided with belt-tighteners on all sizes above 50 lights. The field-magnet cores are made of the best quality of charcoal iron, giving much higher efficiency than is possible to attain with cast-iron cores more commonly used. The armature-cores are thoroughly insulated with pure asbestos and mica, the same materials being used for insulating the spools upon which the field-coils are wound. The commutators are insulated entirely with mica, and are so constructed that it is impossible for the bars to become loose.

The carbon brush-holder is a neat piece of mechanical work, constructed to give the best results with ease of manipulation, and giving a uniform pressure against the commutator until the brush is entirely worn out. All motors over 5 horse-power have subbases and screw for tightening.

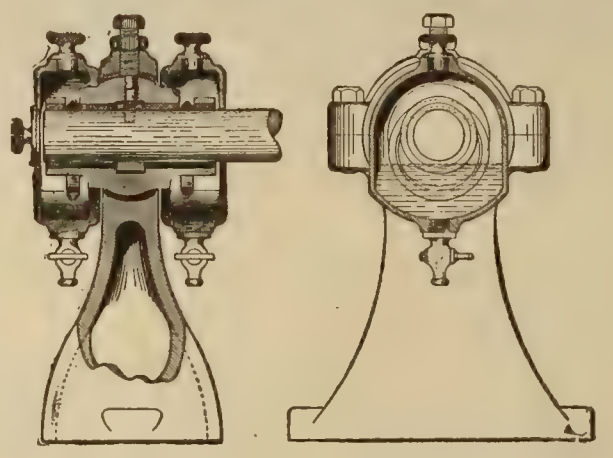
Motors and generators are provided with self-oiling bearings, self-aligning journals, and in large sizes, a perfect belt-tightening device. Carbon brushes are employed on all motors when wound for 220 volts or over, and, when so ordered, may be run in either direction or reversed at will.

In all the machines electrical details are carefully calculated and the mechanical construction so proportioned as to conform strictly to electrical requirements. Each machine is subjected to a rigid inspection and thoroughly tested, carrying a natural load 10 per cent. to 15 per cent. in excess of their running capacity for several hours' duration.

The system as manufactured by the company is complete, and embraces all the necessary parts to make an efficient and satisfactorily working plant. The lamp usually supplied is of 16 candle-power; up to 150 is furnished when desired.

that the domestic patent shall terminate at the same time the foreign patent expires.

Section 4,887, which regulates the law on this subject, is as follows: "No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application; but every patent which has been granted for an invention which has been previously patented in



SECTIONAL VIEW OF OIL-CUPS USED ON COLUMBIA ELECTRIC CO.'S MACHINES.

a foreign country shall be so limited as to expire at the same time with the foreign patent; or, if there be more than one, at the same time with the one having the shortest term; and in no case will it be in force for more than 17 years."

MEETINGS OF SOCIETIES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 62d meeting of the American Institute of Electrical Engineers was held in the society's rooms in this city on Wednesday evening, December 16, and was largely attended. The subject of the paper read was of such a character as to bring out many of the most prominent electricians in this city.

Dr. M. I. Pupin read a paper on "Polyphasal Generators." He considered theoretically the simplest form of polyphasal generator, and his remarks were listened to with very great attention and interest.

THE FRANKLIN EXPERIMENTAL CLUB.

The Franklin Experimental Club, of Newark, N. J., has changed its regular meeting night from the second and fourth Tuesday of the month to the second and fourth Saturday of the month. There has been a considerable increase in the membership of late, and a committee has been appointed to look for larger and more suitable quarters, the club having outgrown its present facilities. Among the subjects that have been taken up at the recent meetings are "Induction," "Construction of Transformers and Applications of Alternate Currents" and "Vibratory Phenomena." A series of talks, illustrated by experiments, are now being given upon the latter subjects by the various members, illustrating in a most interesting way the phenomena of sound, light, heat and electricity and their correlation.

GENERAL NOTES.

The Public Safety Committee of the Pittsburg City Council has recommended a general ordinance providing for the placing of electric wire underground. The committee also recommended an ordinance providing for the removal of all poles from the street by November 15, 1892. Superintendent Mead, of the Bureau of Electricity, thought, however, that this time was insufficient.

A bill of equity was filed in the United States Circuit Court in Pittsburg, December 10, by the Cowles Electric Smelting and Aluminum Co., of Cleveland, O., against the Pittsburg Reduction Company. The suit is brought to restrain the defendant firm from using certain patents for smelting ores by electric currents; the plaintiff company claiming to have prior patents.

NEW INCORPORATIONS.

The Metropolitan Street Lighting Co., Omaha, Neb., was incorporated December 1, with a capital stock of $25,000. Incorporators: George J. Sternsdorff and George E. Specht, Omaha, Neb.

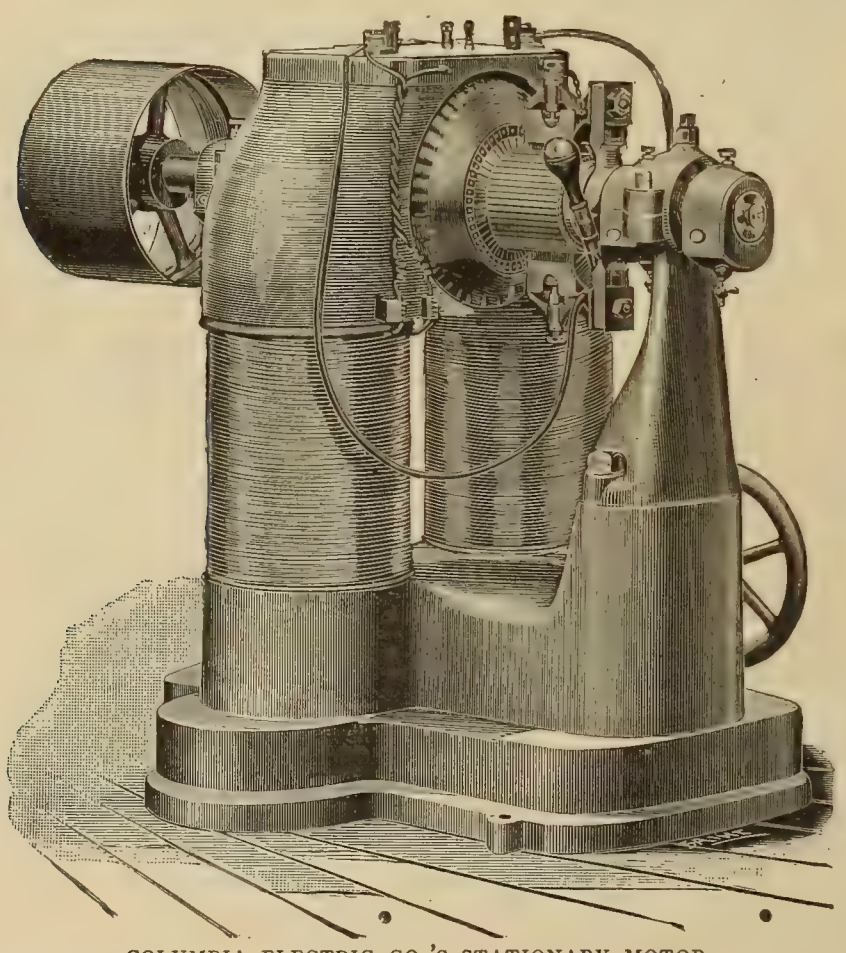
The Electro-Medical Appliance Co., Chicago, Ill., was incorporated December 2, with a capital stock of $50,000. Incorporators: Robert R. Pryor, A. A. Hall and Frank D. Thomason.

The Owatonna Electric Company, Owatonna, Minn., was incorporated December 8, with a capital stock of $25,000. Incorporators: H. M. Byllesby, C. C. Dieffin, W. P. Johnson, B. F. Meck, Jr., H. C. Levis, all of St. Paul, Minn.

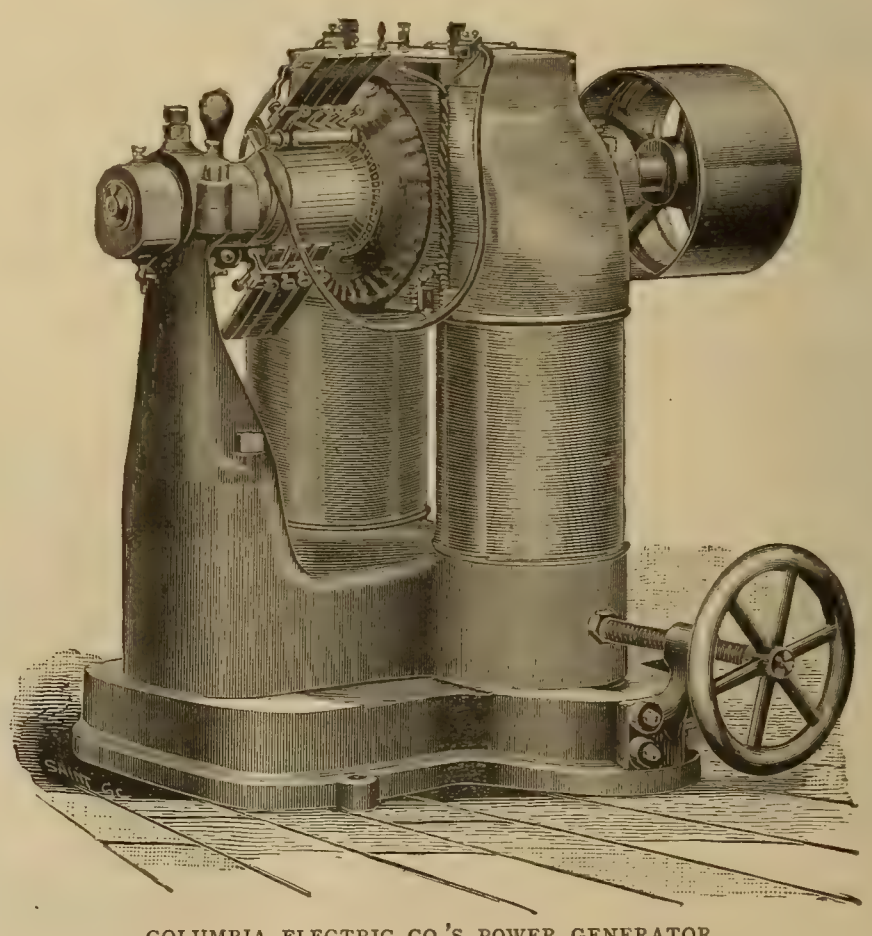
The Hudson Land Company, Spokane, Wash., was incorporated December 4, with a capital stock of $50,000. Incorporators: Theo. Reed, A. McKenzie, E. M. Cheadle, Fred Flint, C. B. Dunning, H. M. Casey, Charles Jasper, of Spokane, Wash., P. W. Lawrence, Garfield, Wash., and J. H. McCabe.

The Shaver Telephone Company of Central New York was incorporated at Albany, December 1, with a capital of $30,000, for operating a telephone line connecting Syracuse, Utica, Rome, Oswego, Watertown and other towns.

The Newville Electric Light, Heat and Power Company, Newville, Pa., was incorporated December 14, with a capital stock of $5,000. Incorporators: W. G. Stewart, Stacy G. Glauser and Joseph A. Woodburn.



COLUMBIA ELECTRIC CO.'S STATIONARY MOTOR.



COLUMBIA ELECTRIC CO.'S POWER GENERATOR.

DOMESTIC AND FOREIGN PATENTS.

Under the United States patent laws an important distinction is made between the inventor who first takes out a patent in the United States, and the one who first takes out a patent in a foreign country. In the former case the term of the patent will be 17 years from date of its issue, but in the latter it will be limited to expire at the same time with the foreign patent having the shortest term. In most countries, except Great Britain and Germany, the laws provide

The National Electro-Therapeutic Alarm Company (incorporated in West Virginia), Washington, D. C., was incorporated December 14, with a capital stock of $100,000. Incorporators: Leonidas G. Wooly, Grand Rapids, Mich.; Frank K. Raymond and Thomas B. Coulter, Washington, D. C.

The Newark Chandelier Works, Newark, N. J., was incorporated December 14, with a capital stock of $25,000. Incorporators: L. F. Mergott, W. A. Mergott and A. T. Oppel, Newark, N. J.

The Electric Reduction Company, Albuquerque,

N. M., was incorporated December 10, with a capital stock of $20,000. Incorporators: A. M. Codington, J. C. Baldridge, H. B. Ferguson, Frederick H. Kent, E. S. Stover, Calvin Whiting, Charles E. Winslow, G. W. Harrison and M. S. Otero.

The Belleville Electric Light Company, Belleville, Essex Co., N. J., was incorporated December 11, with a capital stock of $100,000. Incorporators: A. F. Crawford, Haverstraw, N. Y.; E. S. Frazer, Mount Vernon, N. Y., and H. V. Cole, Belleville, N. J.

The Atlas Electrical Manufacturing Company, Chicago, Ill., was incorporated December 9, with a capital stock of $12,000. Incorporators: W. F. Matteson, Q. A. Stephenson and J. B. Albertson.

The West Jamaica Electric Light Company, Richmond Hill, N. Y., was incorporated December 11, with a capital stock of $2,500. Incorporators: George Lester, William Kessler and O. W. Graves, all of Richmond Hill, N. Y.

The Crocker-Wheeler Electric Company, Jersey City, N. J., was incorporated December 8, with a capital stock of $200,000. Incorporators: F. M. Jeffrey, Jersey City, N. J.; W. H. Geers, G. S. Dunn and H. H. Crocker, New York, N. Y.; A. K. Sloan, Brooklyn, N. Y.

The Card Electric Motor and Dynamo Company, Cincinnati, Ohio, was incorporated December 9, with a capital stock of $100,000. Incorporators: Jos. W. Wilshire, George Bullock, Otto W. Jantz, G. N. Stone, C. B. Simrall, Franklin Alter and Stephen R. Burton.

The Philipsburg Granite Electric Light Company, Philipsburg, Mont., was incorporated December 5, with a capital stock of $50,000. Incorporators: George P. Durham and John Cox, of Philipsburg, Mont., and John W. Evans, Missoula, Mont.

The Massachusetts Wire Company, Malden, Mass., was incorporated December 10, with a capital stock of 25,000. Incorporators: John S. Barlett, Lynn, Mass.; Frank Dewing, Boston, Mass., and Jesse Scribner, Waltham, Mass.

IMPORTANT PATENT DECISION ON ELECTRIC RIVETING.

An important decision has just been rendered by the Commissioner of Patents in the interference proceedings which have been pending for some years past between Mr. Elias E. Ries, of Baltimore, Md., and Prof. Elihu Thomson, of Lynn, Mass., in which

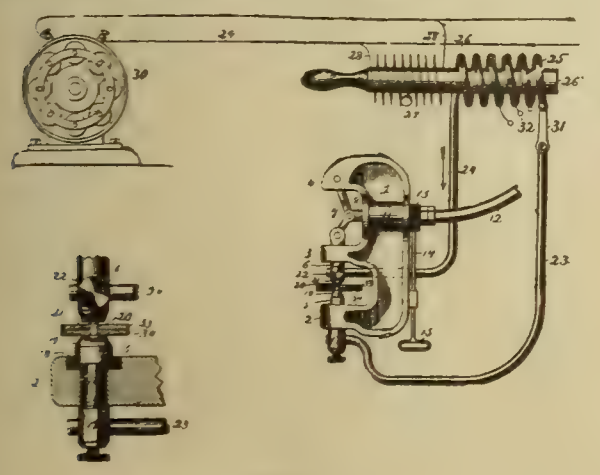


FIG. 1.

the Commissioner sustains, on final appeal, the original decisions of the Examiner of Interferences, awarding priority of invention of the broad art of electric riveting and of the apparatus for practising this art to Mr. Elias E. Ries.

The interference proceedings were hotly contested on both sides, Messrs. F. P. Fish, of Boston, and H. C. Townsend, of New York, appearing for Prof. Thomson, and Mr. Joseph Lyons, of Washington, for Mr. Ries. The interferences were two in number, one covering the method and the other the apparatus for practising this method. The former was between an application of Elias E. Ries, filed as a division of a prior application dated September 15, 1888, and patent No. 396,015 erroneously issued to Prof. Thomson on January 8, 1889, upon an application filed by him on October 12, 1888, while both applications were pending together before the same examiner. The second interference was between the patent of Elias E. Ries, No. 403,374, granted May 14, 1889, and an application of Prof. Thomson filed on June 14, 1889.

The decisions just rendered give Mr. Ries a virtual monopoly of the electric riveting industry, and in our patent record on another page will be found an abstract of the claims of the fundamental patent just granted to Mr. Ries as a result of this decision. In view of the important development this invention will give to the application of electricity to mechanical, structural and engineering operations in which riveting is or may be employed, the case is one of great interest. This process of electric riveting has already been successfully applied to a wide range of work, and it is for many purposes found to be far superior to as well as more economical and rapid than the ordinary and time-honored methods of riveting now in vogue, in which the rivets are first heated to incandescence and then carried to and inserted in the holes in which they are headed. The facility with which the heat is localized and controlled in the electrical process, the advantage of being able to insert the rivet cold and of heating it while in place to the exact degree of plasticity required to obtain the best results, as well as the ease with which the current may be transmitted along the line of a structure being riveted to the precise point at which the riveter may be at work and there converted to produce the local heat effect required, are features that cannot fail to produce a marked revolution in this important industry.

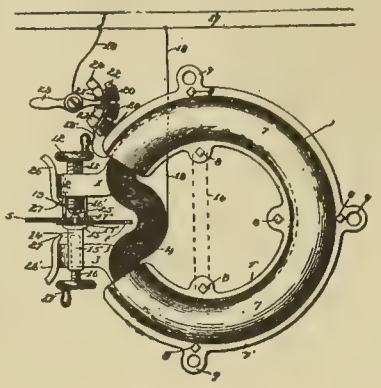


FIG 2.

Fig. 1 shows the method of running the circuits and some of the details of the riveting apparatus, and Fig. 2 gives a somewhat clearer idea of the construction of the apparatus itself. The latter illustration is that used in connection with patent No. 452,042 granted to Mr. Ries on the 12th of May last.

FREY COMPENSATING RESISTANCES FOR GALVANOMETER SHUNTS.

When a shunt circuit is employed in connection with a galvanometer "the effect of inserting the shunt is to diminish the total resistance of the circuit, and therefore, possibly, to so increase the total current that the deflection is not reduced. In order to keep the total current constant a compensating resistance is introduced which is equal to the diminution produced by the shunt."* It is of course possible to combine suitable shunt and compensating resistance-coils in such a manner that they may be jointly or separately thrown in circuit by means of plug or other switches.

A device for this purpose, invented by Mr. Charles P. Frey, electrician for the Greeley Laboratory, is illustrated herewith.

The source of error referred to in the above extract is nullified in the Frey Shunt by providing for each shunt-coil a compensating resistance equivalent to the difference in resistance between galvanometer and shunt in multiple and galvanometer only.

The apparatus consists primarily of three shunt-coils of the usual $\frac{1}{9}$, $\frac{1}{99}$ and $\frac{1}{999}$ proportion. Compensating resistances properly calibrated travel from the insulated terminal B′ (Fig. 2) to the nearest

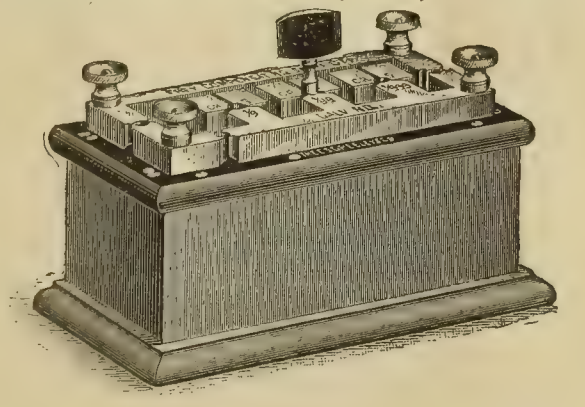


FIG. 1.—FREY'S COMPENSATING SHUNT BOX.

block marked C.R., from thence two additional coils connected in series with the first compose compensators for the two remaining shunts. The selected shunt and compensator are both thrown in circuit by the insertion of a single plug. When maximum sensitiveness is desired, the plug is inserted at F. The current then travels directly through the brass conductors to the galvanometer. Removing the plug entirely leaves the circuit open, placing it between B and B′ short circuits the battery, and finally placing it between G and G′ short circuits the galvanometer and leaves the battery circuit open.

By employing shunts of this description in high-resistance measurements exact proportionate deflections will be secured.

This instrument is being placed on the market by the E. S. Greeley & Co., New York.

* "Electricity and Magnetism," Gordon.

ELECTRIC LIGHT NOTES.

J. J. Ryan, of 1126 North 40th street, Philadelphia, has secured the contract for a portion of the new Philadelphia and Reading terminal buildings, which contract includes the electric plant.

The Goshen Electric Light and Power Co., Goshen, N. Y., expects to be in running order by Christmas. The building is 40 x 60 feet, constructed of brick, and has a metal roof. The steam-plant consists of two 70-horse-power boilers, and is separated from the engine and dynamo room by a fire-proof wall. The power-plant consists of two 60-horse-power engines and the electric of four dynamos of 270 16-candle-power incandescent lights each. The Edison direct three-wire system is used.

WORK RESUMED.

On December 15 the old works of the defunct Cobb Vulcanite Wire Company, Wilmington, Del., again resumed operation under the auspices of the Chicago Electric Wire Company. The plant has been shut down for many months, and the resumption of work will give employment to 50 men. It is said that orders for wire sufficient to keep the works going for two years to come have been received from the city of Chicago alone. Cobb wire has been

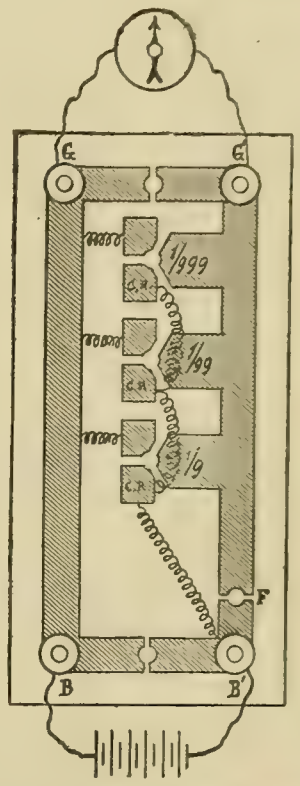


FIG. 2.—DIAGRAM OF FREY'S COMPENSATING SHUNTS.

used in that city for three years and has given complete satisfaction.

The works will be pushed to their full capacity and the number of employés will have to be increased to about 200.

Mr. William Weightman, of Philadelphia, is president of the company, and Henry B. Cobb, the inventor of the wire, is the general manager of the works.

CANADA'S FIRST ELECTRIC ROAD.

It is reported that the Windsor and Walkerville Street Railway (Canada) is about to pass into new hands. This road is known chiefly because it was the first electric railway established in Canada. It was constructed in 1886 under the superintendence of the late Mr. Trugham, but before its completion he died, and it was shortly afterward decided to abandon electricity as a motive-power, and horses were used. Since the construction of the electric road on Wyandotte street, Windsor, it is reported that the manager, Mr. Boomer, has become dissatisfied and an offer from two Americans has received favorable consideration. If the transfer is made they will continue the horse cars until spring, when it will be run as an electric road with all modern appliances. If the bridge at Walkerville is removed and a level crossing made they will, if a charter can be secured, continue the line some distance beyond the sugar refinery on Sandwich street, with the western terminus at the Michigan Central Railway Station. The river road, it is said, will always secure patronage, especially in the summer season, and there is a probability that a large summer hotel will be built at or near Walkerville as a resort for citizens of Windsor and Detroit. It has been learned since the above facts were given out that the road has practically been sold and that electric power will be readopted at once.

UNITS OF ELECTRICAL MEASUREMENT.*

At a recent meeting of Sections A and G of the British Association for the Advancement of Science, Cardiff, the following discussion on electrical units took place :

Dr. Oliver Lodge said : There are a good many things to be said about units at the present time, both mechanical and electrical. I think it will be for the convenience of the section if at the beginning of the discussion we attend principally to the electrical units, and to those units which are of established interest to engineers, and leave the more academical and mechanical units to a later period. With regard to electrical units, one of the most pressing things is the determination of an authoritative statement or agreement as to the coefficient of induction, not only self-induction, but also mutual induction. Now we know that already a great many names have been suggested for this unit. The mere name of the unit is, of course, very unimportant from some points of view, but it is not wholly unimportant whether this unit shall be called secohm or quadrant, or by the name of some man. Henry, mac and other names have been suggested. The name secohm has certain advantages, in that it indicates the relation between this unit and the ohm-second, but there are certain disadvantages in that it tends to express the more simple by the more complicated. It expresses the unit self-inductance as being derived from the ohm, whereas the determination of the ohm itself is based upon a measurement of the inductance ; instead of describing the self-inductance unit as an ohm multiplied by a second, it would be more logical to call the unit of resistance a self-inductance divided by time. In all methods of determining the ohm, some form of coefficient of induction is the length that enters into the expression. If it is to be called a quadrant, it must be remembered that a quadrant is strictly an angular measure ; and even though it be understood as short for earth-quadrant, and therefore a length, still it is not unobjectionable, for it is pretending a thing to be a length when it really is not a length. I think it would be a backward step if we fix it for all time as a length. On the whole, I should suppose that some name of less obvious meaning might be desirable, such as the name of a man. Now, directly we permit ourselves to regard the name of a man as a possible name to be attached to the unit, we have the field open to consider. We are no longer compelled to make it equal to a secohm ; it may be a sub-multiple. Now let us consider whether the secohm is a convenient size. The C.G.S. units were a connected system, or might have been a connected system, before any practical units were invented. Practical units were invented for this reason, that C.G.S. units were not a reasonable size, they were a million times too big or too small. It was out of the question for engineers to be always speaking of powers of ten. Now a secohm is rather big for a practical unit. Very few people—I speak under correction—have to deal with coefficients of induction of more than a secohm. The question is whether it would not be better, therefore, to make our practical unit some sub-multiple, say a thousandth, or something of that sort. We have a consistent system in the C.G.S.; there does not seem adequate need for two consistent systems. I regard it as more important to have the practical units of convenient size than to have them most simply related among themselves. The farad has been useless by reason of the neglect of this idea. The whole object of a practical system is to have units of convenient size, otherwise the C.G.S. would be all that is necessary.

The next unit wanted is a practical unit of magnetic field, or the unit of magnetic induction. Let me just explain what I mean by a practical unit of magnetic field. There is a C.G.S. unit, and it has not at present had a name given to it, although sometimes names are used, but it is too small for engineering purposes ; it is something comparable to the intensity of the earth's magnetism. The total intensity of the earth's magnetic field is about half of one of these units. The magnetic fields with which engineers have to do are usually enormously greater, hundreds or thousands of times. Moreover, the definition of C.G.S magnetic field is not one which immediately applies to engineering practice. We do not deal with a unit magnetic pole ; and although it serves fairly as a fundamental unit for theoretic purposes, it is not very practical. Now consider how magnetic fields do come in ; they come into engineering practice in the case when you have a coil of wire rotating in such a field. You have a certain area through which a number of lines of force pass ; each complete revolution of an armature coil cuts the total lines of force four times, and the voltage which you can get is just equal to the rate of cutting of those lines of force. That is to say, if N represent the total number of lines of force passing through a coil, what would be called total magnetic induction through the coil, and if

$$e = \frac{d\,N}{d\,t}$$

this gives the voltage ; of which the value at any instant is the rate of the change of the magnetic induction. That is the fundamental formula of magneto-electricity. It contains almost the whole philosophy of the dynamo. Here is another formula which contains the whole philosophy of motors.

$$d\,w = C\,d\,N.$$

The work done during any operation is equal to the current multiplied again by the change in the magnetic induction : the power being $P = e\,C$. It would seem as well to have some practical name for this quantity, N, so constantly occurring: the total lines of force, or the magnetic induction. As for magnetic field, that is related to this quantity in the simplest possible way ; for it is the number of lines of force through unit area.

Whether the name shall be given to intensity of field or to magnetic induction—there might be a name for both—the relation between them is quite simple. The important thing to point out in most cases in practice is, that N is related to the coefficient of self-induction in a very simple manner. Suppose you have a closed solenoid, sectional area A, length l, permeability μ, number of turns n, what is the total magnetic induction caused by a current, C, in that solenoid ?

$$N = \frac{(4\,\pi\,\mu\,n^2\,A)}{l}\,C$$

It merely requires a slight modification to make it applicable to dynamo magnets and other things. I only quote the expression in its simplest form. There are more complicated similar forms, but in all cases the induction caused by a coil's own current, or the true self-induction, is equal to *something* multiplied by C ; and that someting essentially is the coefficient of self-induction, or the inductance, a thing which is commonly denoted by L. So the above expression is simply $N = L\,C$. Hence, if we have a name for the coefficient of self-induction we have a name at once without any trouble for the total magnetic induction through an area.

I do not wish to call it any particular name, but supposing *mac* were the unit of self-inductance, then the unit of current being an ampère, the unit induction would be a mac-ampère; thus we should have a name at once for the total magnetic induction, and when you want to express the intensity of a field it would be a mac-ampère per square centimetre. Another name for unit induction is a sec-volt, which is plainly equal to a secohm-ampère, or, as I have just called it, a mac-ampère. Perhaps sec-volt is a good name: of course it is the number of lines of force which if cut in one second gives, in the cutting circuit, an E.M.F. of 1 volt.

Mr. W. H. Preece—The work of the British Association Committee on Electrical Standards has now extended over 30 years. Its first report was issued in the year 1861, at Manchester, and we have, after a great deal of difficulty and trouble, succeeded in impressing those units of measurement not only upon the scientific world of England, but upon that of all countries. During this last year a committee appointed by the Board of Trade has taken into consideration the work of the British Association Committee, and has come to the conclusion which will result, in the month of November, of an order in Council being passed making the ohm, the volt, the ampère and the farad legal standards, such as will for years to come be regarded as the stable standard measurements in England. Now, having run in a groove for 30 years, and having succeeded by dint of great labor in impressing these units on others, I am afraid we are running our heads against a brick wall when we attempt to produce any change upon such a system. Nevertheless, while the difficulty of producing a change is very great, I am going to have the temerity of suggesting a change in another direction, in addition to that suggested by Dr. Lodge. While there is a difficulty in making a change, there is also a difficulty in impressing new ideas into our language, although absolutely essential. New wants arise, and we must have new names to express these new things. The fashion to introduce new meaningless words has practically failed. They tried to thrust upon us the term *barad* as indicative of the standard of pressure, *bole* the unit of momentum, and *kine* the unit of velocity, but I think this attempt has practically failed, and I have met but one case where one of these names was used, and then it was spelt wrong. I am a great advocate for the use of words based on names. They enable us to pay a grateful compliment to those who have passed away. They enable us to attach a useful word to something that requires great precision of thought. The use of such words as ohm and volt and ampère almost render definition unnecessary, and in some cases they remove great difficulties, for I am sure if there was a mistake made by students and by professors, sometimes, it was in drawing distinction between "power" and "work." Now, we have introduced two words, watt and joule—watt as the unit of power and joule as the unit of work—and I think I can confidently state that nobody since the introduction of these words has made the mistake of confusing power with work or work with power. So, I say, words clearly indicating these standards are very useful and valuable. We have several names from which we might draw. We have Gilbert, we have Gauss, we have Weber, we have Franklin, Henry, Maxwell. These names are valuable, and certainly there are some units to which they might be very well applied. I have mentioned the names of men who are dead, for I think it would be unwise to affix the name of the living; and though there is one whose name will be associated with the electrical units some day, it is perhaps better for the present to stick to the old. There are more names wanted still. Prof. Lodge has alluded to the unit of magnetic field or force, and there is not the slightest doubt that the time has arrived when we must adopt the unit of magnetic field, and we must give that unit a name. Some have proposed that this unit shall be based on the C.G.S. unit alone, others have suggested that it should be 10 to the power of 8, and I am going to propose that it should be called 10 to the power of 9. The reason why I suggest that change is depending on another alteration that I am going to suggest, that the volt should be 10 to the power of 9, instead of 10 to the power of 8. That matter is dealt with in a paper by Prof. Stroud, and I would rather adhere to this point only now, because he will in his paper deal with the matter very thoroughly. Ten to the power of 8 was selected by the original committee solely because 10 to the power of 8 was the nearest approach that we could find to the Daniell cell. That cell was *then* universally applied, but it is now surpassed by others, such as the Léclanche or bichromate, the E.M.F. for which is much higher. One great reason I propose that the value shall be 10 to the power of 9 is that it makes the farad the same in C.G.S. as in practical units. I should very much like to have said something on dimensions, but I want to refer to one other unit that requires to have names attached, that is H. There was a time when there was a great demand for unit magnetic pole, but that time has long since passed, and Dr. Lodge himself has referred to induction to N, more particularly in its form per square centimetre, and called B density of field. There are two great quantities that are most important in electrical developments of the present day, and that require a great deal of sifting, not that we can find units for them, one is μ, the other the coefficient of specific inductive capacity, sometimes K, then we come to L, the coefficient of self-induction. I said yesterday that there is more nonsense talked about self-induction than upon any other branch of electrical science. There are those who talk about self-induction who have had very little practical experience of its effects, who have applied self-induction sometimes to a geometrical quantity, sometimes to permeability, and sometimes to the whole induction. It has been my practice for some years never to speak of self-induction, because it is mixed up so dreadfully, but always to speak of electro-magnetic inertia, and that is the term we have met with in practice which is familiar to us. When we find writers misusing this term self-induction it makes one regret that we have not a unit for this term to centralize one's ideas and to avoid friction. I am at one with Dr. Lodge when he proposes a unit of self-induction. Nobody has proposed a better name than that of Henry. Ten to the power of 9 was a very good unit indeed, and if they had this unit 10 to 9 they would wipe out the use of the word secohm. The system of the units now used is absolutely artificial and conventional. I will not occupy your time with dealing with the relations between H and various other quantities. The name of Gauss has been proposed, in fact it was proposed in Paris. If there were two men whose names ought to be used as units, one was Gilbert and the other Gauss, who had done so much to establish the absolute system. We want to know the value of K and R. Perhaps Prof. Rucker, who has worked in this direction, would do something more. We want something more than dimensions; we want a table of specific resistances. At the present moment we have really only the specific resistance of mercury and of copper accurately determined. We also want a new determination of J. A better mode by which the mechanical equivalent of heat could be arrived at. They want to get rid of the obnoxious table of dimensions that every text-book is laden with. In Maxwell's great work there are three or four different systems of dimensions, and in engineers' pocket-books, which are

* London *Electrical Review*.

supposed to contain useful facts, page after page is filled with these useless dimensions. In conclusion, the speaker said he should be very sorry if any decision that the section should come to should interfere with the acceptance of the ampère, ohm and farad as the legal standards. If it were to go abroad that they were disunited, it might perhaps tend to the withdrawal of the order in Council. He thought we should certainly succeed this year in getting these standards made legal, and then these standards will be the legal standards of the world.

Prof. W. Stroud then presented "Some Revolutionary Suggestions on the Nomenclature of Electrical and Mechanical Units," of which we give a summary:

1. The present practical system of units is very objectionable on three grounds:

(*a*) There is no *prima facie* reason why the practical unit of current should be equal to $\frac{1}{10}$ C.G.S. unit.

(*b*) The relation between the other practical electrical units and the corresponding C.G.S. units is much more complex than need be.

(*c*) The units of work and power are far too small for practical requirements.

2. If we were starting to devise a practical system to-day, such a system could best be formed by taking 10^9 cm. as the unit of length, 10^9 gm. as the unit of mass, and the second as unit of time.

3. That in the interests of the "practical" men of the future and in the interests of the electrical students of both the present and the future, it is highly desirable to institute a revolution with the object of dethroning the present practical system of units.

NOMENCLATURE.

1. That the term *Dyne* to indicate 10^7 of our present (1891) dynes is objectionable, as custom has restricted the use of Greek derivatives entirely to C.G.S. units. That 10^7 dynes, *if required*, should be called a Hebdomodyne, suitably contracted of course, or preferably a Joc (joule over centimetre).

2. That the classical languages are of little or no service for the provision of names for modern, more or less complex, physical conceptions; and therefore this method of coining words it is desirable to abandon.

3. That for C.G.S. units some system of *automatic nomenclature*, in which every name shall be self-explanatory, would prove a boon to the teacher and a blessing to the student, and that such a system is quite capable of being devised.

4. That the prefixes *meizo*, to indicate 10^9, and *mei*, to indicate 10^{-9}, may be found useful.

Mr. Swinburne in continuing the discussion, said he was rather inclined to think it would be better to stick to the old units. He did not think Section A realized the enormous difficulties that they put in the way of practical people by making alterations The alterations in the ohm produced a great deal more trouble than will be yet realized. He might say with regard to self-induction that it would not spread much in practical work. His firm made a great number of transformers, and it was necessary to make these with great accuracy, but he did not believe any one in his place could tell in secohms what the self-induction of the transformer was. In regard to names, he would hope that the name of Poggendorf would not be left out.

Dr. Johnstone Stoney said on this question, at the present day, he was a complete conservative. He would wish to see the ohm system of measurement maintained intact, and he believed that only practical mischief would result from any attempts now to diverge from the ohm system. He was a member of the committee which fixed the C.G.S. system of measurement recommended in 1874, Prof. Carey Foster being another. On that committee there were some members who had long practical acquaintance with the metrical system of measurement, but there were other members who had only immediately before been converted to the opinion that the systematic system of units ought to be based on metric measures, and who had had little practical acquaintance with it as a working system. He (the speaker) dissented from the selection that was made on grounds totally different from those attributed to him in Prof. Everett's book. He would wish to take this public occasion for stating that the original note which Mr. Everett put in the first edition, and the subsequent note in the second edition, did not in the least represent what he stated at the committee. No systematic system of units could have been framed without some electro-static and electro-magnetic units belonging to it being inconveniently large or small; but it was quite unnecessary to make a selection which led to the same defect prevailing among the dynamical units. What he (the speaker) had objected to was choosing such fundamental units as lead to a unit of force so inconveniently small as the dyne (about the weight of a milligram), a unit of energy so small as the erg (about the hundred thousandth part of a grammetre), and a unit of power which is the ten-millionth part of the watt. The definite proposal he made to the committee was, that the metre should be the unit of length and the kilogramme of mass; but he would have concurred in recommending any selection of fundamental metric units which would have led to convenient dynamical units. With respect to the unavoidable size and minuteness of some of the electrical units, he suggested that a nomenclature should be introduced which would make it easy to use in practice any decimal multiples or sub-multiples of them. For instance, they had got the farad, a unit of capacity too large for any practical purposes; accordingly, the practice was to make use of the microfarad, as it was unfortunately called. He would prefer to call it the 6th farad (the farad divided by 10^6). It is a very convenient measure for measuring the capacity of submarine cables and in cases where large capacity had to be dealt with; but if they wanted to measure the capacity of an ordinary Leyden jar it would be a great deal better to measure it in 10th farads instead of 6th farads. This nomenclature would enable one to use the 10th farad when convenient, and the 6th farad when convenient, and would tell exactly their relation to one another. To deal with multiples, and in order to make the distinction between sub-multiples and multiples as great as possible, he proposed that the tenth metre should mean sub-multiple, and that the metre-ten should mean multiple, and so on. That system of dealing with the multiples and the sub-multiples would be a very great practical convenience to electrical engineers. It would also avoid entirely the necessity of following what, he understood, was the suggestion of the President, of using a unit for self-induction which did not belong to the ohm system. He certainly thought it would be a very retrograde step for the B.A. to abandon the fundamental principle of making all the measures belong to some definite systematic system. It was a misfortune that such a thing should occur as was mentioned by Mr. Swinburne, that artisans who were habitually engaged in making transformers could not tell in the least, in any definite system of measures, what the self-induction was. He believed it would be a very great increase of their capacity for doing real work if the use of measures at every stage was so facilitated that every artisan could have a clear perception of the measures he was using. Personally, he was averse to any revolutionary change, and although the C.G.S. system, he believed, was not the best that could have been selected, he should be sorry to see it interfered with in any degree now. He proposed an obvious and easy method for converting from electro-static into electro-magnetic measures. There is no doubt for some purposes electro-static measures are more convenient to work. At present engineers were practically precluded from doing so in a case where it would give them a great deal of assistance by the difficulty of easily tracing the relation between the two. Mr. Preece seemed to have a great objection to dimensional equations. He (the speaker), on the other hand, would wish to see dimensional equations made so simple that they would come into very general use. He thought that the natural name for the unit of magnetism would be the Gilbert, who was the first man they could trace who had really studied magnetism, and the natural name for the unit of magnetic field would be Gauss. Poggendorf and some others had been mentioned, though if any name deserves the distinction, it is that of Weber, who was the first person to point out the importance of systematic units. There might be a difficulty in the way of this on account of the pronunciation. He would also very earnestly try to persuade the members of both sections to the opinion that the time had fully come for getting rid of the dreadful misuse of the word force, as in the phrases electromotive force, magnetic force, etc. The speaker in conclusion said he did not like the word pressure, it suggested a misleading analogy. He saw no objection to the word voltage, which was very convenient for practical use and got rid of the false analogy.

Prof. Carey Foster expressed his satisfaction at hearing the expression of Dr. Johnstone Stoney's conservative principles in the matter of nomenclature. If they were to have new standards, they must employ a new name; they might employ a term derived from "Galvani"—say "galv" or "gal."

Prof. Silvanus Thompson said, in relation to the unit of self-induction, that Dr. Lodge had stated that he did not see why its coefficient should be considered as a length, but it *was* a length, and Sir William Thomson had devised an ideal experiment illustrating the point. They needed that a physical fact should be discovered to enable them to determine the absolute value of k or μ.

Prof. T. H. Blakesley wished to introduce to the section a unit with which he had been greatly concerned; this was the particular one which was measured when a current was sent through one coil of a dynamometer, and another current through the other. It was the product of two currents. It was most important to arrive at the power per unit of resistance. At the Physical Society he had given many cases in which the application of the split dynamometer would be the most advantageous, and in some cases, such as the power lost in the revolutions of magnetism in the iron core of a transformer, it was practically the only way to arrive at it. He was very averse to giving the names of people, however eminent they might be, to units.

Prof. Andrew Gray thought the phrase "electromotive force" was unfortunate, but that it would cause much inconvenience to drop it. A clear distinction, ought, however, always to be made between *electromotive force at a point* (that is, the *electric force*) and the electromotive force round a circuit. It would cause serious confusion if one word were used in two senses; if the word "force" were not used alone, but described at the time of speaking, he thought that not much disadvantage would arise. He trusted that more attention would be given to what was of greater importance than finding a name for the unit of inductance—viz., the calculation of coefficients of induction.

The President stated that he hoped the discussion would be continued in the journals, especially as at present it was not quite clear what was actually wanted in practice.

Mr. Preece thought that it would be objectionable for the British Association to suggest any change in the principle of the unit. The farad was as immense as the universe, and the microfarad very small, but useful; he thought that it would be well to call the microfarad the farad, and that they should call the volt and ampère either the 10-volt and 10-ampère, or the *weber*.

CORRESPONDENCE.

PRIMARY BATTERIES AND MOTORS FOR SEWING-MACHINES.

EDITOR ELECTRICAL AGE: I was much interested in the article on the Edison sewing-machine battery motor published in your issue of December 19.

Having had some experience in the adaptation and application of motors and primary batteries to domestic purposes, mainly for running sewing-machines, I desire to offer a few suggestions.

In the first place, every one knows that an article to be successful must be strictly practical. Are the motor and battery offered to the general public to-day for running sewing-machines suitable for this purpose? In one sense I say yes; in another, decidedly, no. I think the sewing-machine companies in general have experimented all they care to with the primary battery. The motor is all right (and there are many to choose from); but to get the necessary motive-power, and economically, too, for household use, is another thing. There are a hundred and one batteries in the market, and we can take any one of them and put to a motor; but, I ask, are they practicable for the operation of a sewing-machine?

We have a sewing-machine fitted up with a motor and battery in our show-rooms, and we sell it. It runs all right until the battery is exhausted, then the users are required to spend their time and money to renew it, and in doing so ruin, perhaps, a new dress or carpet by an accidental spilling of fluid. Do the sewing-machine companies want to handle an article like this? No; the machine itself runs all right; why attach to it something that requires time and trouble to care for? These batteries stand around in the room, liable to be knocked over, and every one must admit they are no ornament. You will say they could be put in the cellar or some out-of-the-way place. Very true; but a lady often desires to move the machine for better light, perhaps; then comes the trouble of changing the connections. Again, as the motor and battery are now offered, should it be applied to the sewing-machine? In my opinion it would be used more for the edification of the children, for running toys, etc., thereby exhausting the battery and rendering it useless for the machine when wanted.

I doubt if the sewing-machine companies will handle the new candidate for household favor for the reasons above mentioned. There are some results to be obtained from the use of the apparatus, of course, but is the saving enough to warrant the expense of first cost and maintenance?

In my estimation the only way the primary battery can be used successfully in connection with the sewing-machine would be for some enterprising parties to form a company and supply both the motor and battery to those who have a sewing-machine, at a nominal rental per month, guaranteeing to keep them in order. This would relieve the rentor of all trouble and expense, other than that of rental, the same as the telephone, burglar-alarms and numerous other

things that are rented out. The motor and battery should be attached to the machine in an enclosed compartment so they could not be disturbed or used for any other purpose than for the sewing-machine. Such a company would undoubtedly be successful, and the president could draw a big salary. This, I think, is the only way the primary battery can be made practicable for the sewing-machine.

LEW. ROGERS,
With The New Home Sewing-Machine Co.
NEW YORK, Dec. 21, 1891.

NEW FIRM OF CONSULTING ELECTRICAL ENGINEERS.

A noteworthy corporation has just been established in this city. It is known as Sprague, Duncan & Hutchinson, Limited, and will carry on the work of consulting electrical engineers. The members of the concern are Mr. Frank J. Sprague, known throughout the world as the inventor of the Sprague motor, and who was one of the foremost pioneers of electric street railroads; Dr. Louis Duncan, who is the head of the Electrical Department of the Johns Hopkins University, Baltimore, and whose authority as expert in both theory and practice has been widely recognized, and Dr. Cary T. Hutchinson (Ph.D. Johns Hopkins University, Baltimore), who was formerly Mr. Sprague's assistant in the Sprague Electric Railway and Motor Company, and afterwards assistant to the chief engineer of the Edison General Electric Company.

Sprague, Duncan & Hutchinson, Limited, will advise municipal corporations as to the best and safest methods of permitting the installation of electric railroads, electric lights, electric power-plants, subways, ducts, etc.; it will advise individuals and corporations on all branches of electrical business; it will prepare plans, specifications, estimates, etc., for electric railways, power plants, light, etc.; it will test and give expert opinions upon all types of electrical apparatus; it will procure opinions by eminent counsel on electrical patent questions; it will furnish railroad companies having a heavy suburban traffic with all the data necessary to determine whether or no the trains devoted to this traffic can be advantageously operated by electricity; it will examine and report upon all questions as to the transmission of power for short or long distances; it will advise bankers and investors as to the practicability, probable profits, etc., of any project involving the use of electricity.

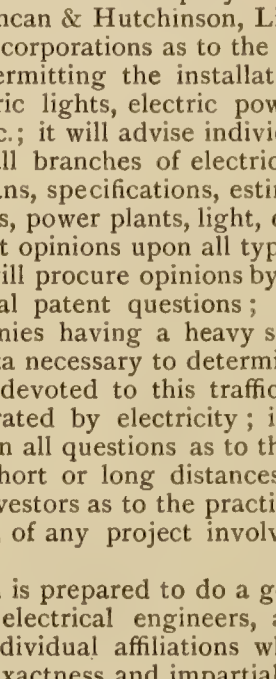
The concern is prepared to do a general business as consulting electrical engineers, and it has no corporate or individual affiliations which can interfere with the exactness and impartiality of its work.

The office of the firm is at 15 Wall street, and Mr. Alfred Bishop Mason is the manager.

ADJUSTABLE EXTENSION FOR ELECTRIC LAMPS.

Where hanging electric lamps are used convenient means for adjusting their height are essential. Many devices with this object in view have been placed upon the market, but the one described and illustrated herewith seems to meet every requirement in a perfect manner.

The device under consideration is known as Corthell's Adjustable Extension for Electric Lamps,



ADJUSTABLE LAMP EXTENSION.

and is claimed by the manufacturer to be the most reliable device for the purpose on the market. It is neat, light and durable, and is not liable to get out of order. Its insulation is thorough and reliable, thus removing the danger of short circuits. The drum holds 8 feet of extra cord, and when drawn all out allows the light to be carried to any part of a 15-foot room. The cord of course can be drawn out to any desired length.

The adjustable extension is made in different styles of finish to correspond with the surroundings in the room, and the parts are all simple and not liable to get out of order.

The Consolidated Electric Manufacturing Company, 154 Franklin street, Boston, is the general agent for the New England States for this device.

THE AMERICAN ELECTRICAL WORKS' XMAS.

The American Electrical Works, Providence, R. I., is sending out to its friends a very neat Christmas greeting in the shape of a card to which is attached a sprig of evergreen and a small cornucopia. The sprig is tied with a neat little bow of ribbon. On the card is printed the following words:

Xmas, '91.

We deeply regret that it is impossible for our many customers to be present with us at our Christmas festivities, but remembering, and desiring to be remembered, we send a twig from our Christmas tree.

AMERICAN ELECTRICAL WORKS,
Providence, R. I.

"Heaven give you many,
many happy days!"

BOSTON NOTES.

NEW ENGLAND OFFICE ELECTRICAL AGE AND STREET RAILWAY NEWS,
BOSTON, Dec. 19, 1891.

MR. MAYBIN W. BROWN, president and general manager of the Eastern Electrical Railway Supply Company, has just returned to Boston after a week's trip to New York.

MESSRS. C. E. WILSON and Chauncey M. Spaulding, representing the electric light and power department of The Electrical Supply Co., 171 Randolph st., Chicago, were in Pittsfield, Mass., last week. This company is the Western Agent of the Stanley Electric Mfg. Co., of Pittsfield.

MR. J. EDWARD WALLACE, manager of the street-railway department of the Eastern Electrical Railway Supply Company, 65 Oliver street, has just returned from a most successful trip throughout northern New York State. Mr. Wallace will next make a trip through Pennsylvania.

THE WATERTOWN MACHINE WORKS, Watertown, Mass., is about to move into larger and more convenient quarters, in order to better handle the increasing business. Mr. Prior, general manager of the company, states that the "Appleyard" safety-fender for electric cars has been tried upon the Newton electric line, and having proved more than satisfactory, an order has been received for these devices from the West End Company, of Boston. The West End Company proposes to adopt this model safety-fender. The Watertown Machine Works makes a specialty of experimental work for inventors, model and pattern makers.

MR. ELMER P. MORRIS, manager of the street-railway department of the Thomson-Houston Company, is head over heels in business. The company's new 10-inch steel-gong promises to supersede many of the gongs now in use. The Thomson-Houston Company guarantees to replace without cost to the user a gong that may become broken, or is in any way defective, and will continue to do so until the gong is entirely unfit for use through ordinary wear. The company's new combination switch and fuse-box, specially designed for car lighting, and its new electric head-light are but a few of the many street-railway specialties recently produced by this department of the Thomson-Houston Company.

A VISIT to the extensive warerooms of the Eastern Electrical Railway Supply Co., 65 Oliver street, showed considerable business activity. Mr. Maybin W. Brown, president and general manager, kindly showed your correspondent through the large and well-stocked building, which is, without doubt, the largest electric and the only electric street-railway supply-house in New England. This company carries a full line of everything pertaining to street-railway equipment, from the sleeper up. It also agrees to organize and operate a road for 30 days, thus assuring the managers of prospective roads of the company's ability to fully maintain its reputation for performing its work thoroughly and efficiently. On the second floor of the building Mr. Brown has fitted up a reception-room, which is furnished in a rich and attractive style, and a most cordial invitation is extended by him to those connected directly and indirectly with street-railway interests to make this room their general headquarters while in New England. Here can be found complete files of all the electrical journals, writing-paper and envelopes and everything necessary to make the stay as pleasant as possible. Letter-boxes are also provided for the reception of mail. The company promises a magnificent souvenir of the new year in the form of a calendar with a metal frame, 12 x 6 inches in size and plated with aluminum. On the frame in raised nickel-plated letters will be the name of the company. Those desiring to obtain one of these elegant calendars should send their name and address at once.

D. L. T.

THE ELECTRIC APPLIANCE CO., Chicago, General Western Agents for the Consolidated Electric Manufacturing Company, of Boston, is putting in a very large stock of the latter company's celebrated goods. Its sockets, wall-sockets and receptacles are examples of the manufacturer's art. The Davis' arc-light cut-out has been demonstrated as being a wonderfully practical article, and is used exclusively throughout Boston by the Boston Electric Light Co. The C. E. M. Co.'s arc-light hanger-boards, switches, etc., are very desirable articles at attractive prices, and its telescope switch-board plug and socket, with auxilary transfer plug fills a long-felt want. The Electric Appliance Company is certainly to be congratulated upon securing the control of so valuable a line of specialties.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE AND STREET RAILWAY NEWS, FIRST FLOOR, WORLD BUILDING,
NEW YORK, Dec. 19, 1891.

THE FIFTH ANNUAL BALL of the Citizens' Electric Illuminating Company's Employes' Mutual Benefit Association was held in Saengerbund Hall, Brooklyn, on the night of December 17, and was largely attended. It was a very successful affair, and all those present thoroughly enjoyed the event.

MR. ROBERT GRIMSHAW, consulting engineer and scientific expert, 21 Park Row, this city, is preparing for publication a record of scientific progress in 1891. Mr. Grimshaw would like to hear from any one who knows of or who has accomplished anything especially noteworthy in scientific lines during the past year.

C. H. W. COPELAND has secured the Eastern agency of the John T. Noye Mfg. Co., Buffalo, N. Y., manufacturers of the Rice Automatic and Compound Engines. He will make his headquarters at room 427, Electrical Exchange, 136 Liberty street, this city. Mr. Copeland is well able to take care of the Rice engine.

MR. C. O. BAKER, JR., has been appointed General Master of Transportation in connection with the next Convention of the National Electric Light Association at Buffalo, February 23, 24 and 25. Mr. Baker's headquarters are at the office of the association, 136 Liberty street, New York, where all communications relative to transportation should be addressed. The Convention will be held at the Iroquois Hotel.

THE DYNAMO-ELECTRIC GAS-LIGHTER, manufactured by A. L. Bogart, 22 Union Square, this city, is having a most successful run. It is always reliable, and never fails to ignite the gas. It is a most convenient piece of apparatus, and is perfectly adapted to light gas in any position. The extension tube is made in such a way as to bring the igniter right over the gas, and as there is a little cup-shaped collector in which the spark is produced, the gas which accumulates in this receptacle never fails to become ignited. The light is by this means unfailingly communicated to the gas-jet.

H. WARD LEONARD is licensing various manufacturing and construction concerns under his recently-patented system of motor regulation. The basis of the license is a charge of $2.50 per K. W. (roughly per horse-power) in the motor. The royalty is not an annual charge, but is paid once for all in each case. Wm. Sellers & Co. have taken a license under Mr. Leonard's patent on this basis, they agreeing to use the method upon all electric cranes they build in the future, during the life of the plant. The royalty is so small that the method will no doubt be rapidly introduced wherever it is applicable.

E. L. POST & CO., 50 Cliff street, this city, are the sole manufacturers of Post's waterproof belt oil and leather preservative for wet or dry belting. Leather dressed with this oil will not crack or rot, as heat, cold, water or gas have no effect upon it. It never turns rancid, and will keep in any climate. The company publishes a pamphlet giving many excellent testimonials from firms who used this oil, and they all speak of it in the highest terms of praise. Messrs. E. L. Post & Co. manufacture by an entirely new process a combination of metals called "Zero," intended for journal bearings. They place it upon the market with their guarantee of its superiority confirmed by official tests. Tests show that the average temperature of "Zero" bearings is much less than that of the best bearings in ordinary use.

HO! FOR THE HOLIDAYS. SANTA CLAUS, riding on a broomstick train through the streets of New York, distributing his presents right and left, would certainly make a halt before the A. B. C. Co.'s store at 20 Cortlandt st., and lay in a stock of electrical toys, with which he is not very well acquainted as yet, but concerning which this obliging firm will furnish him the necessary instructions. He cannot miss the place, for a Christmas tree illuminated by electric lamps and planted in a bed of snow, will certainly attract his attention; and underneath the tree he will find, heaped up in a chaotic pile, the numerous electrical toys the A. B. C. Co. has brought upon the market; tiny electric batteries, motors revolving numerous little wooden figures, books for the learners, and telegraph instruments for growing-up electricians—all can be found at its store. It is wonderful what interest even the children's world takes in the electric science. The A. B. C. Co. has again enlarged its store, and has gone more extensively into railroad supplies. It will soon issue a catalogue devoted entirely to that department. It has already issued a little catalogue of bell-hangers' supplies which is very neat and compact. W. T. H.

ELECTRICAL STOCK QUOTATIONS.

The following are the latest prices for electrical securities in New York, as quoted by Geo. B. Ellery, financial editor ELECTRICAL AGE:

NAMES OF COMPANIES.	CAPITAL.	PAR.	PRICE.
Aluminum Co	$350,000	$100 00	$90 00
American Dist. Tel., N. Y.	3,000,000	100 00	92 00
Am. Elec. Exercise Mach. Co., N. Y.	100,000	10 00	14 00
Am. Carbon Ins. Mfg. Co., Boston	620,000	5 00	2 50
American Electric Motor Co., N. Y.	1,000,000	25 00	5 00
American Private T'phone. N. Y.	50,000	100 00	98 00
American Telegraph and Cable	14,000,000	100 00	82 00
American Telephone Co., D. C.	100,000		*101
Ashley Engineering Co	200,000	10 00	6 00
Aut. Phon. Exb. Co	25,000	100 00	420 00
Averell Insulating Conduit	3,000,000	100 00	5 00
B. & S. Elec. Equipment Co., N. Y.	25,000	100 00	100 00
Ball Electric Light	2,000,000	100 00	
Barr Electric Mfg. Co., N. Y.	50,000	100 00	100 00
Bay Electric Co. 6s, Mich	25,000		*101
Bell Telephone	15,000,000	100 00	199 00
Bell Telephone 7s	2,000,000		*112
Brooklyn Edison Electric Light	1,500,000	100 00	78 00
Brooklyn Citizens' Electric Light	500,000	100 00	147 00
Brooklyn Municipal Light	500,000	10 00	14 00
Brownell Car Co., Mo	100,000	100 00	100 00
Brunswick Elec. L. & P., Me	50,000	100 00	100 00
Brush Electric Light Co., Balto.	650,000	100 00	
Brush Elec. Lt. Co. pref., Balto.	600,000	100 00	80 00
Brush Elec. Lt. Co., Balto., 5s	200,000		*105
Brush Elec. Co., Cleveland, pref.	1,000,000	50 00	37 50
Brush Elec. Ill., N. Y.	1,000,000	100 00	50 00
Brush Elec. Ill., 6s, N. Y.	300,000		*102
Brush-Swan E. L. Co. of N. E.	2,000,000	100 00	20 00
Bucksport Elec. Co. 6s, Me	20,000		*102
Burrell Electric Signal Co., N. Y.	500,000	20 00	10 00

Circleville, O., L. & P. Co. 6s	20,000		*102
Circleville, O., L. & P. Co	100,000	100 00	105 00
City of London Elec. Ltg. Co., Ltd	4,000,000	50 00	60 00
Columbia Canal 6s, Ga	200,000		*105
Commercial Cable Co	7,716,000	100 00	146 50
Complete Elec. Con. Co., N. Y	50,000	100 00	175 00
Cons. Electric Light Co., N. Y	2,500,000	100 00	50 00
Cons. Elec. Storage Co., N. Y	3,000,000	25 00	4 00
Cons. Gas Co., N. Y	35,430,000	100 00	97 00
Cons. Gas & E. Co., Batavia, 6s	80,000		*95
Cons. Subway Co., N. Y	3,000,000	100 00	25 00
Darlington L. & W., 7s, S. C	15,000		*99
Dessant Elec. and Sig. Co., N. Y	100,000	100 00	110 00
Detroit Elec. Lt. & P. Co	300,000	25 00	22 50
Detroit Elec. Lt. & P. Co. pref. 6s	300,000	25 00	24 00
Detroit Electrical Works	1,000,000	10 00	9 25
Direct U. S. Cable Co., Ltd	6,400,000	100 00	50 00
East River E. L. Co. 6s	600,000		par
East River Electric Light Co	1,000,000	100 00	40 00
Easton Elec. Co., N. Y	1,000,000	100 00	20 00
Economic Lt. & P. Co., S. C	100,000	100 00	100 00
Edison Elec. Ill. 5s, N. Y	5,000,000		*99
Edison Elec. Ill., Lebanon, Pa	80,000	10 00	13 75
Edison Illuminating, N. Y	4,500,000	100 00	76 00
Edison Electric Light Co., Phila	1,000,000	100 00	80 00
Edison General	15,000,000	100 00	96 00
Edwards Manuf. Co., N. Y	10,000	100 00	105 00
Elec. Sup. & Con. Co., N. Y	120,000	15 00	16 00
Elizabeth E. L. Co., N. J	100,000	10 00	4 00
Erie Telephone	4,800,000	100 00	44 00
Excelsior Electric Co. 6s, N. Y	300,000		par
Fargo Gas & Elec. Co. 6s, Dak	100,000		*95
Fidelity Trust Receipts	25,000,000		53 00
Florence Im. & Mf. Co., 6s, S. C	15,000	100 00	*98
Fort Wayne Elec. Co	4,000,000	25 00	12 50
Franklin Electric Co., N. Y	5,000,000	100 00	75 00
Freeman Dynamo Elec. Motor Co.	250,000	25 00	25 00
Fremont E. L. & P. & Gas Co., O	95,000	100 00	110 00
G. T. Woods Mfg. Co., Ky	2,000,000	10 00	2 50
Gloucester Elec. Co., Mass	20,000	20 00	
Great Western Elec. Sup. Co	650,000	10 00	9 00
Great West. Elec. Sup. Co. pref. 8s	350,000	10 00	10 00
Guthrie Elec. Lt. Co., Ok., 7s	15,000		*95
Hackettstown Elec. Light, N. J	25,000	20 00	30 00
Harlem Elec. Light Co	250,000	100 00	20 00
Hoboken Land & Imp. 5s	1,000,000		*100
Hubbell Portable El. Lp. & P. Co.	1,000,000	10.00	5 00
Hunt Engineering Co., Brooklyn, 6s	30,000	100 00	*90
Hunt Engineering Co., Brooklyn.	30,000	100 00	105 00
Interior Conduit & Ins. Co., N. Y	1,000,000	100 00	75 00
Int. Okonite, Limited	1,700,000	50 00	49 00
Jamaica Gas & Elec. Light, N. Y	60,000	100 00	80 00
Kankakee Electric Co. 6s, Ill	50,000		*99
Kansas Elec. Co. 6s, Mo	20,000		*98
Laclede Gas Co	7,500,000	100 00	20 00
Laclede Gas pref	2,500,000	100 00	61 00
Laclede Gas 5s	10,000,000		*82
Law Telephone	400,000	100 00	96 00
Lincoln E. L. & P. Co., Ill., 5s	50,000		*94
Little Rock Edison E. L. & P. 6s	30,000		*95
Livingston E. Lt. Co., Mont., 6s.	30,000		*92
Long Branch Electric Light	50,000	100 00	70 00
Manhattan E. L. Co. Ltd 5s, N. Y	1,000,000		*99
Marysville L. & W. Co. 6s, Ohio.	60,000		*104
McLeod Car Heat. & Vent. Co	1,000,000	25 00	35 00
Metropolitan Phonograph	22,500	100 00	†20 00
Metropolitan T. & T. Co., N. Y	3,500,000	100 00	100 00
Metropolitan T. & T., 5s			*105
Mount Morris 5s, N. Y	2,300,000		*90
Mount Morris Electric Light, N. Y	1,000,000	100 00	30 00
Morristown L. H. & P. 5s, N. J	30,000		*102
Morristown L. H. & P.	50,000	100 00	110 00
Nassau M'f'g Co., New York	100,000	10 00	7 00
Nat'l Aut. Fire Alarm, L. I	150,000	100 00	100 00
Nat'l Lead Trust	9,000,000	100 00	18 00
New England Butt Co	100,000	1,000 00	1,000 00
New England Phonograph Co	12,500	100 00	†20 00
N. E. Tel. & Tel. Co	10,394,600	100 00	52 00
N. Y. and N. J. Tel. and Tel. 5s	1,500,000		*98
N. Y. and N. J. Telephone Stock.	2,535,000	100 00	94 00
N. Y. Phonograph Co	20,000	100 00	†20 00
N. Y. Storage Baty. Co	100,000	100 00	58 00
Newark L. & P	150,000	100 00	85 00
Newark E. L. & P. Co. 6s, Ohio	50,000		*95
North American Railway Co	39,767,200	100 00	17 75
North New York Lighting	150,000	100 00	10 00
Northwest Elec. Co. 6s, Manitoba.	50,000		*90
Postal Telegraph	10,000,000	100 00	30 00
Pennock Baty. E. L. & Impt. Co., Ill	500,000	1 00	3 00
Peoples' Elec. Light, Trenton	100,000	100 00	90 00
Pettingell Andrews Co., Boston	200,000	25 00	30 00
Pittsburg Reduct. Co., Aluminum	1,000,000	100 00	105 00
Plainfield Electric Light	100,000	100 00	75 00
Public Wks. Imp. Co., Tenn	500,000	100 00	75 00
Public Wks. Imp. Co., Tenn., 6s	500,000		*96
Ry. T. Dis. Elec. Signal Co., N. Y	200,000	100 00	60 00
Richmond L. H. & P., S. I.	150,000	100 00	
Richmond L. H. & P. 5s	150,000		*90
Rockaway Elec. Light	50,000	100 00	50 00
Rockaway Elec. Lt. Co. 6s	75,000		*94
Russell Electric Co., Boston	300,000	5 00	5 00
Saginaw E. L. & P. Co. 6s, Mich	50,000		*98
San Diego Gas & Elec. Co. 6s, Cal.	750,000		*90
Sawyer-Man Elec. Light Co., N. Y.	125,000	100 00	100 00
Shaver Corporation, N. Y	100,000	1 00	8 00
Short Elec. Ry. Co., Cleveland, O.	5,000,000	10 00	8 00
South Denver E. L. & P. 7s, Colo.	30,000		par
Sprague Elec. Motor Co	16,000	100 00	†80 00
Swan Incandescent	800,000	100 00	6 00
Standard Ug'd Cable Co., N. Y	1,000,000	100 00	80 00
Staten Island L. H. & P. Co	100,000	100 00	95 00
Stuttgart Imp. Co. 6s., Ark	50,000		*99
The Gamewell Fire Alarm Tel. Co.	750,000	100 00	100 00
The Hall Signal Co., N. Y	900,000	100 00	100 00
The Hall Signal Co. pref., N. Y	100,000	100 00	105 00
The Railway Impt. Co., N. Y	10,000,000	100 00	100 00
Thomson-Houston Electric Co	6,000,000	25 00	49 00
Thomson-Houston pref	4,000,000	25 00	27 00
T.-H. Electric Co. 5s, Boston	500,000		*98
T.-H. E. L. Co., Yonkers, 6s	100,000		*99
T.-H. L. H. & P. Co., Binghamton, 6s	100,000		*99
Tucker Elec. Const. Co., N. Y	50,000	100 00	100 00
Twin City Rapid Transit, N. J	20,000,000	100 00	100 00
United Elec. Light and Power	3,000,000	100 00	40 00
United Elec. Traction 6s			*20
United Elec. Traction Co	1,370,000	100 00	
United States Elec. Co	1,500,000	100 00	25 00
United States Illuminating, N. Y.	1,250,000	100 00	20 00
Universal Arc Lamp Co	100,000	100 00	75 00
Vine Street Motor Co. 6s, Colo	100,000		*95
Western Union	86,188,852	100 00	82 50
Westinghouse Electrical Co	7,000,000	50 00	12 50
Westinghouse Elec. Co. pref. 7s	3,000,000	50 00	50 00
West End L., Boston	13,550,000		17 00

*Per cent. †Registered stock.

As very few electrical securities are dealt in on the Stock Exchange, the above prices are approximate, but will be found very near the mark. Corrections cordially made; correspondence solicited.

SCRANTON, PA. ITEMS.

W. H. BEATTY, of the Novelty Electric Specialty Company, 50–54 North Fourth street, Philadelphia, was in Scranton a few days ago and obtained some good orders for "Economic" lamps. He reports a good business with the company's half shades for incandescent lamps, and the new wire gauge recently brought out by the company is meeting with a very large demand. These wire gauges are suitable to carry in the pocket, and are finely finished and graduated with extreme accuracy. Besides giving the gauge of any wire, they give the safe carrying capacity, ohms resistance per foot and the number of lamps the wire will carry.

MR. AUG. HUMMLER, 233 Penn avenue, Scranton, Pa., is manufacturer and dealer in electrical supplies of all classes. He is a prominent electrician in this section, and has had large experience. He makes a specialty of repairing dynamo and motor armature and his large experience renders him particularly competent to undertake this class of work. At his store he exhibits a Bilberg motor made by Dallett, of Philadelphia. This motor is in the window and is run by current taken from the local Edison Company's circuit. The power supplied by this motor is used in running his factory. He also has a floor in a large building in another part of the city.

IDE AND IDEAL ENGINES.

W. R. FLEMING & Co., 174 Fulton st., N. Y. City, representing the Harrisburg Foundry and Machine Works, are installing the "Harrisburg" Ide and Ideal Engines, as well as complete plants. The following are a few of the recent orders they have taken. For the H. W. Johns Mfg. Co.'s new factory, South Brooklyn, two 125 H.P. horizontal steel single-return tubular boilers. Philip Daly's Penna. Club-House, West End, N. J., a complete plant of 60 H.P.; Dunellin Electric Light Co., Bound Brook, N. J., complete plant of 35 H.P.; Mr. Luther C. White, Waterbury, Conn., one 25 H.P. Ideal engine; Hotel "Marlborough," New York City, one 100 H.P. Ideal engine; Mr. Jacob Rothchild, 14th st., city, one 35 H.P. Ideal; Hotel "Endicott," 9th ave. and 81st st., city, two 100 H.P. Ideal engines. All of these contracts for engines were made with most rigid guarantees that the engines would run noiselessly and without vibrations. These people are making a specialty of this class of work, appreciating how important it is that there should be no noise or vibration whatever in plants for hotel and apartment-house service.

BALL ENGINES.

THE BALL ENGINE CO., of Erie, Pa., reports the following recent shipments of engines:

Palace Hotel, San Francisco, Cal., one 200 H.P. Cross Compound; H. C. Hawks, Boston, Mass., one 35 H.P. Single Cylinder; The Linderoth Ceramic Co., Chicago, Ill., one 25 H.P. Single Cylinder; Ohio Baking Co., Cleveland, O., one 80 H.P. Single Cylinder; Lawrence Gas and Electric Light Co., New Castle, Pa., one 150 H.P. Single Cylinder; L. H. Goodnow, Fitchburg, Mass., one 35 H.P. Single Cylinder; Attica Electric Light Co., Attica, N. Y., one 80 H.P. Single Cylinder and one 50 H.P.; The Colonial Club, New York City, two 50 H.P. Single Cylinder; Citizens' Electric Light Co., Braddock, Pa., one 150 H.P. Single Cylinder; Youngstown Electric Light Co., Youngstown, O., one 350 H.P. Cross Compound; Pittsburg and Birmingham Traction Co., Pittsburg, Pa., one 50 H.P. Single Cylinder; California Electric Light Co., San Francisco, Cal., one 300 H.P. Cross Compound; Sauquoit Silk Mfg. Co., Scranton, Pa., one 35 H.P. Single Cylinder; Claremont Electric Light Co., Claremont, N. H., one 80 H.P. Single Cylinder; Johnstown Electric Light Co., Johnstown, Pa., one 200 H.P. Single Cylinder; Abington and Rockland Electric Light Co., North Abington, Mass., one 100 H.P. Tandem Compound; Edison General Electric Co., New York, two 50 H.P. Single Cylinder; Wrought Iron Casting Co., South Boston, Mass., one 100 H.P. Single Cylinder; Cleveland Hardware Co., Cleveland, O., one 50 H.P. Single Cylinder; Union City Electric Light Co., Union City, Tenn., one 80 H.P. Single Cylinder; Brush Electric Light Co., Cleveland, O., one 35 H.P. Single Cylinder; Loraine Electric Light Co., Loraine, O., one 100 H.P. Single Cylinder; Masonic Building, Richmond, Va., two 60 H.P. Single Cylinder.

CHEAP HOLIDAY EXCURSIONS.

The Reading Railroad announces that pursuant to its usual custom, cheap holiday excursion tickets will be sold to all points in its territory, the rate being about two cents a mile. These tickets will be sold from December 23, 1891, to January 1, 1892, and will be good for return passage until January 4, 1892. No such tickets will, however, be sold at less than 25 cents.

ELECTRIC TONIC BATH.

WAMPUM, PA., Sept. 14, 1891.

JEROME KIDDER MFG. CO.: My battery has given perfect satisfaction and I use it (electricity) as a general tonic bath twice every week. Yours respectfully,

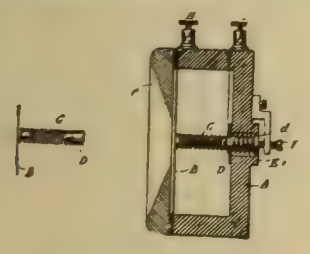
C. W. MILLER.

THE ELECTRICAL AGE'S ELECTRICAL PATENT RECORD.

Issued December 15, 1891.

464,758. Nut-Lock. Thomas McDonald, Jr., Allegheny, Pa. Filed June 16, 1891.

In a nut-lock, the combination of a plate or washer having an aperture for the reception of a bolt, and a recess



464,959—TELEPHONE.

formed in one end, the edges of the plate on both sides of the recess being bent upon themselves to form eyes or sockets, a locking-plate having an aperture to receive the nut on the bolt and provided with a longitudinal flange which has one end enlarged and fitted in the recess in the plate or washer, the outer end of the plate being bent at, and a pin extending through the enlarged portion of the flange and having its ends fitted in sockets, whereby when the plate is turned to engage the nut the tapering portion of the flange and the bent portion of the plate rest against the plate or washer and keep the two plates separate and parallel and the nut is held firmly in place.

464,955. Means for Propelling Boats by Electricity. Otto Büsser, Oderberg, near Berlin, Germany. Filed Feb. 10, 1891.

464,959. Telephone. Charles Cuttriss, New York, N. Y. Filed July 22, 1891.

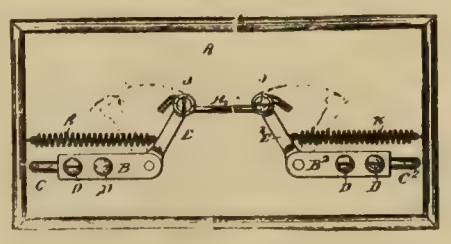
In a telephonic transmitter, the combination, with a diaphragm, of a resilient resistant conducting-strip included in the circuit by the connection of its two ends to the diaphragm and a stationary terminal support, respectively, the strip being bent or wound upon itself spirally in such manner that by the vibration of the diaphragm its convolutions will be closed upon themselves and to a greater or less extent in accordance with the amplitude of such vibrations.

464,979. Electric Signalling Apparatus. George E. Miller, Lynn, Mass. Filed April 3, 1891.

464,986. Electric Conductor. William E. Oehrle, Philadelphia, Pa., assignor to Oehrle Brothers & Co., same place. Filed Sept. 14, 1891.

465,039. Portable Electric-Lamp Holder. John Baker and Henry S. Graham, Indianola, Iowa. Filed March 5, 1891.

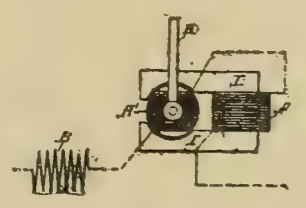
465,046. Automatic Circuit-Breaker. William R.



465,046.—AUTOMATIC CIRCUIT.

McLain, Des Moines, Iowa. Filed Sept. 18, 1890. Renewed Nov. 10, 1891.

In an automatic circuit-breaker, a base-plate of non-conducting material, conducting-pieces secured to the base-plate, to which the leads of the circuit are connected, a pair of arms pivotally fixed to said conducting-pieces, springs the one ends of which are rigidly fixed to the base-plate and



465,078—METHOD OF CONTROLLING ALTERNATING-CURRENT INDUCTION.

their other ends secured to the pivoted arms, a fusible wire inserted in said arms, and set-screws removably held in the ends of the pivoted arms, adapted to adjustably secure the fusible wire, whereby the latter may be severed at predetermined strengths of current.

465,078. Method of Controlling Alternating-Current Induction. Elihu Thomson, Lynn, Mass. Filed April 17, 1889.

Claim.—1. The herein-described method of controlling the flow of current in an alternating-current circuit, consisting in varying the angle of the magnetic axis of two coils placed in said circuit and in inductive relation to a substantially closed magnetic circuit of iron.

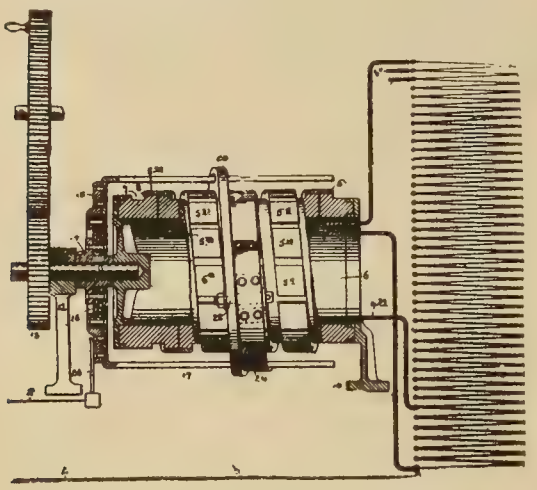
Claim.—2. The herein-described method of adjusting the flow of current in an alternating-current circuit, consisting in breaking or interrupting to a greater or less extent the

coincidence of the magnetic axis of a coil in the circuit of the alternating current with the general magnetic axis of an iron magnetic circuit threading a second coil in circuit with the first, as and for the purpose described.

465,089. Riveting by Electricity. Elias E. Ries, Baltimore, Md., assignor to Ries & Henderson, same place. Original application filed Sept. 15, 1888. Divided and this application filed Dec. 10, 1888

Claim.—1. The method or process of riveting which consists in heating the rivet when inserted in the rivet hole or holes by the passage of an electric current through the same and then heading the rivet, substantially as described.

Claim.—5. The method or process of riveting metal



465,218.—ADJUSTABLE RHEOSTAT.

structures together, which consists in first inserting a rivet into the rivet-hole, then making electrical contact between the ends of the rivet and an anvil and the heading-die, respectively, which constitute the terminals of an electric circuit, then charging said circuit with an electric current or currents until the rivet is heated to the desired degree of incandescence, and then forcing the heading-die upon the rivet until the heading operation is completed, substantially as described.

465,093. Electric Belt. Andrew Erikson, Hawley, Minn. Filed June 25, 1891.

465,104. Dynamo-Electric Machine. William P. Wiemann, Allegheny, Pa. Filed Dec. 30, 1890.

465,202. Coupling for Electric Conductors. William C. Preston, Providence, R. I., assignor of one-half to Richard A. Bright, same place. Filed April 27, 1891.

465,206. Packet or Pad for Electric Batteries. Lewis H. Rogers, Brookline, Mass. Filed Feb. 20, 1891.

465,218. Adjustable Rheostat. Frank J. Sprague and Charles R. Pratt, New York, N. Y. Filed Aug. 25, 1891.

Claim 10 reads: The combination of a resistance-conductor, one end of which is connected, or adapted to be connected, to a circuit, and a switch for throwing more or less of said resistance into or out of circuit, said switch consisting of a suitable body on which are several contact-plates spirally arranged, and a co-operating switch-contact adapted to make contact with the several spirally-arranged contacts, and a connection from each of said contacts to a different point in the resistance-conductor, substantially as described.

465,233. Commutator Connection for Dynamo-Electric Machines. Carl O. C. Billberg, Philadelphia, Pa. Filed October 7, 1890.

465,234. Brush-Holder for Dynamo-Electric Machines or Motors. Carl O. C. Billberg, Philadelphia, Pa. Filed April 25, 1891.

465,278. Electrical Sewer-Gas Indicator. James J. Lawler, Scranton, Pa. Filed March 4, 1891.

465,349. Magnetic Ore-Separator. Clinton M. Ball, Troy, N. Y. Filed Dec. 11, 1890.

465,360. Electric Fan. Philip Diehl, Elizabeth, and Edwin H. Bennett, Jr., Bayonne, N. J. Filed April 4, 1891.

465,361. Electric Fan. Philip Diehl, Elizabeth, and Edwin H. Bennett, Jr., Bayonne, N. J. Filed April 8, 1891.

465,365. Bracket for Supporting Electric Conductors. John A. Duggan, Quincy, Mass. Filed July 15, 1891.

465,369. Production of Insulating Coatings or Linings in Electrolytic Apparatus. Ludwig Grabau, Hanover, Germany. Filed Aug. 9, 1887. Patented in France, Germany, England, Belgium, and Austria-Hungary.

465,404. Switch-Actuating Mechanism for Electric Motors. Charles G. Armstrong, Chicago, Ill. Filed May 11, 1891.

465,423. Electric Heater. Warren H. Boles, Syracuse, assignor of one-half to George E. Waldron and John H. Reynolds, Troy, N. Y. Filed March 21, 1891.

465,430. Electric Connector. William F. Z. Desant, New York, N. Y. Filed May 20, 1890. Renewed July 1, 1891.

A connector or coupler for an electric circuit, consisting of two metallic or conducting parts secured to the ends of the circuit-wire, one of said parts having a conducting-socket and surrounding shield and the other a conducting-plug and sustaining-shoulders, which fit snugly inside the surrounding tube, the whole being arranged substantially as shown and described.

465,442. Electrical Indicating-Instrument. Edward Weston, Newark, N. J. Filed March 11, 1891.

Claim 3 reads: The combination, in an electric indicating-instrument, of a permanent magnet having concentric poles, a coil supported so as to be axially movable in the field between said poles, and means independent of the coil-support for indicating the extent of movement of said coil.

11,210. Electric Motor. (Reissue.) Henry Groswith, Philadelphia, Pa., assignor, by direct and mesne assignments to the Kennedy-Groswith Electric Company, same place. Filed Oct. 26, 1891. Original dated Dec. 2, 1890.

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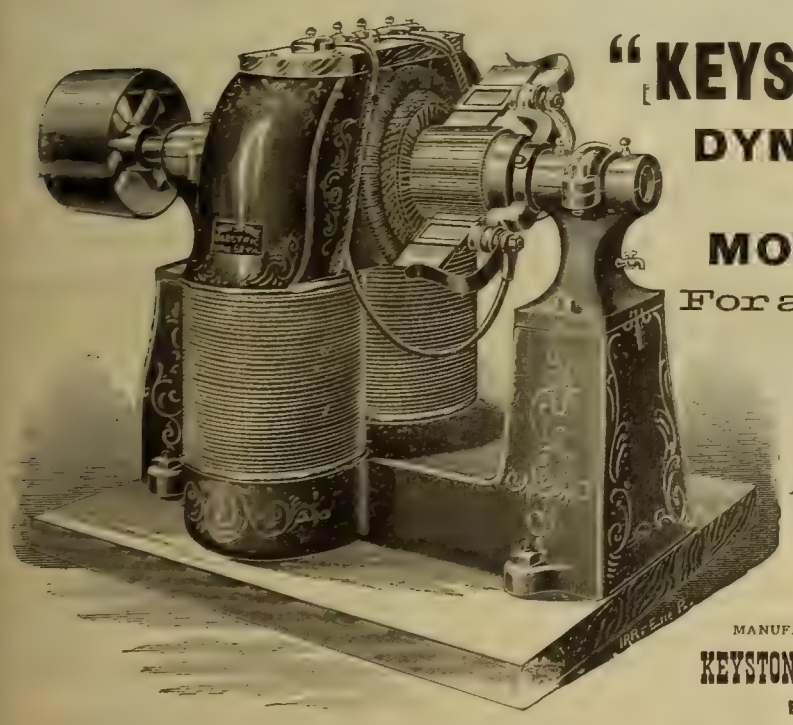
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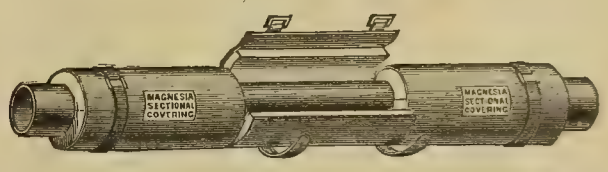
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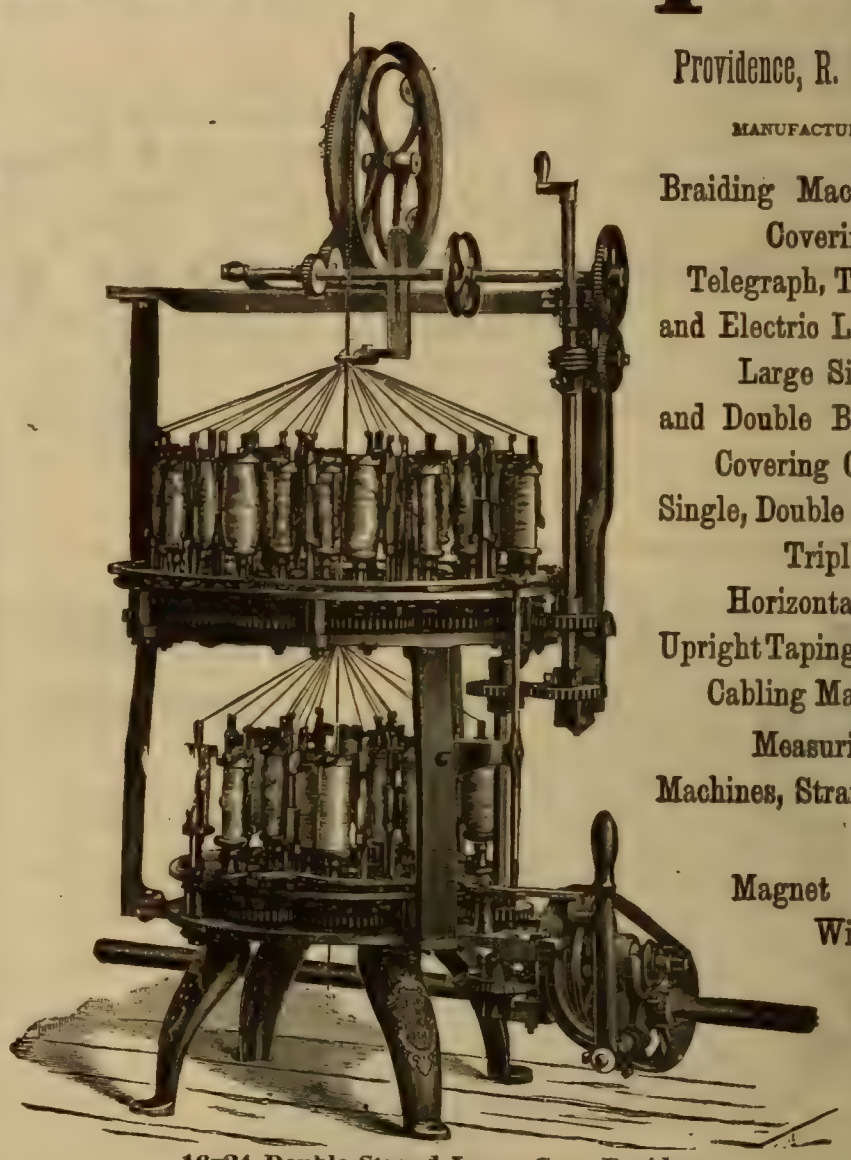
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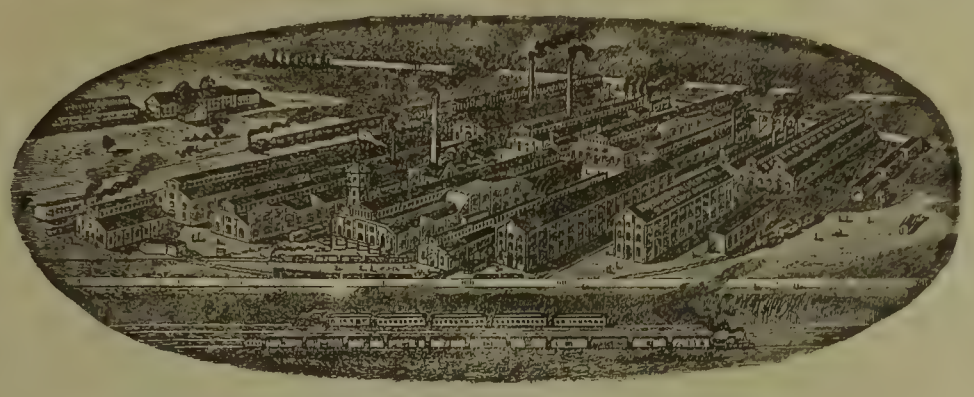
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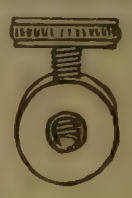
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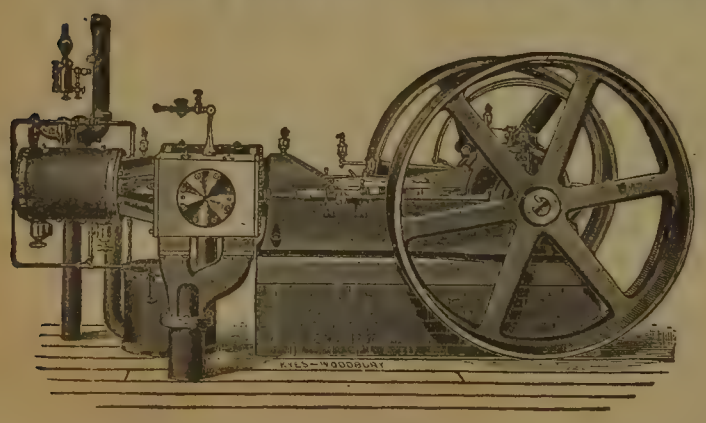
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STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

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RAILWAY DEPARTMENT ELECTRICAL AGE

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COMING CONVENTIONS.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

In view of the close analogy between the electric light and power interests and those of electric street railways, it is but natural that gentlemen closely identified with the latter should feel a more than passing interest in meetings held by the former, and indications point to the presence this week in Montreal, of quite a large number of men well known to the street railway fraternity.

Having been present at a great many of these meetings and conventions we are certainly in a position to state that the interest shown by street railway men in light and power matters is steadily increasing, and that there is a growing tendency toward a general consolidation of those interests is undeniable. At the same time while we fully realize the many salient points that make such interests identical to a great extent, yet we do not, at the present time, feel ourselves justified in the belief that the time has arrived for them to be considered completely so.

When electricity shall have entirely supplanted every other form of motive power for inter-urban transportation, then, and only then, will the interests of street railway and light and power men become identical—not before. Quite a number of electric street railway companies deem it wise policy to purchase more power than they require (for car moving purposes) at the outset, and use the same for lighting purposes and also for the purpose of selling power to users of stationary motors along the line. Such has, in almost every case, been prolific of profitable results—argument sufficient, it would seem to us, to induce others to at least look into the matter of electric heating, not only for cars, but for domestic purposes, is, we feel very sure, one of the possibilities of increased income to light, power and electric street railway companies in the not very distant future, and all of these matters—these brothers in analogy, if the term is admissible—must, one day, bring together and unite as a unit all who may be interested in electricity in all its multitudinous possibilities. Therefore do the light and power men welcome representatives of the street railway industry to their new conventions, and *vice versa*.

NEW YORK STATE TRAMWAY ASSOCIATION.

The annual meeting of this body will be held in New York, at the Hotel Metropole, commencing on Tuesday, the 15th inst., and promises to be well attended.

One of the most interesting features of the meeting will be the result of the work of the special committee appointed to report on the subject of "*Electric Motive Power for Surface Railways*," and let us express the hope that the report itself, no less than the discussion which will follow it, will be the means of not only imparting information, but of awakening, if possible, a still greater interest in electrical matters in the minds of street railway men.

AMERICAN STREET RAILWAY ASSOCIATION.

A splendid programme of committees to report has been arranged for the October convention of the A. S. R. A., at Pittsburg, and the Committee on Arrangements has left nothing undone to make the exhibit of street railway supplies as complete as possible.

In the chartering of a barge or large double-deck excursion boat, the committee showed most commendable judgment, since no hotel could possibly give all exhibitors any chance to show their goods as they would, naturally enough, wish to do—viz.: to their best advantage.

We cordially endorse the arrangements made by this committee, of which Mr. John G. Holmes is chairman, and invoke on its behalf the cordial co-operation of those who desire to exploit their goods before the members' delegates to the convention.

LEICESTER, ENGLAND, TRAMWAYS COMPANY.

The report of the general meeting of the Leicester Tramways Company, of Leicester, England, which appears in full in another column, is very satisfactory inasmuch as it tends to show a determination upon the part of the company to maintain pleasant relations with its men, in spite of the disposition recently shown upon their part to act somewhat differently.

With a total mileage of but eight and one-half or nine, it is hardly to be expected that dividends equal to those of some of our rivals this side the Atlantic--such as the Union Passgener Railway Co., the 13th and 15th Streets Passenger Railway Co., the West Philadelphia Passenger Railway Co., of Philadelphia, averaging from nine to ten per cent.—could be carried, but the declaration of a four per cent annual dividend shows that the property is in a fairly prosperous condition, at least from a stockholder's point of view, and the inference is that the company has now entered upon a new era of prosperity, inasmuch as no dividend at all has been declared since June, 1888, and that only at four per cent.

INCORPORATIONS.

(*Too late for classification.*)

CHICAGO, Ill.—The Northwestern Street Railway Company was incorporated August 28, with a capital stock of $25,000 to construct, maintain and operate street railways in Chicago and a number of suburban towns. Incorporators: Eugene B. Weeks, John L. Pearson and Alfred A. Ellsworth.

The Chicago South Shore Railway Company has been incorporated with a capital stock of $500,000, to construct and operate a street railway in the South Division. Incorporators: James R. Mann, Frank J. Bennett, Charles F. White, Gay Doon and William Richardson.

GOSHEN, Va.—The East Side Land Company was incorporated August 26, with a capital stock of $25,000, to construct and operate street railways. Incorporators: J. R. Jones, C. W. Jones, A. D. Smith, Jr., A. Alexander and T. A. Browning, Jr.

LEICESTER (ENG.) TRAMWAYS COMPANY.

SEMI-ANNUAL MEETING.

The semi-annual meeting of the Leicester Tramways Company, of Leicester, England, was held on August 20, in Leicester. Mr. H. Simpson Gee presided, and Messrs. E. Wood, W. Turton and S. Andrews, Directors; R. S. Mantle, Auditor; T. Wright, Solicitor; F. Grimsley, General Manager and A. F. Lucas, Secretary, were present. The Directors' report was as follows:

The Directors present herewith the audited accounts for the half-year ending June 30, 1891, showing that after payment of debenture interest and adding the balance brought forward from the last account, £436 1s. 10d., there remains a net profit of £2,031 13s. 11d. Several causes have adversely affected the profits of the half-year, viz.: The high price of provender, the exceptionally bad weather during both the Easter and Whitsuntide holidays, and the suspension of traffic on the North section caused by the Corporation taking up the lines to construct new sewers. This section will not be ready to work again until next year. The Directors propose to pay a dividend at the rate of 4 per cent. per annum, amounting to £1,900, and to carry forward the balance of £101 13s. 11d. to next account.

The following table shows the traffic of the company for the past seven years, the mileage of tramways opened being 8½ miles to December 31, 1886, and 9 miles since that date:

Half-year Ending.	Miles Run.	Passengers Carried.	Receipts.	Dividend.
Dec. 31, 1884	257,596	1,437,564	£11,179	10 per cent.
June 30, 1885	251,408	1,310,514	10,237	10 "
Dec. 31, 1885	312,756	1,971,013	11,812	10 "
June 30, 1886	365,688	2,719,098	12,422	10 "
Dec. 31, 1886	351,388	3,269,782	14,804	10 "
June 30, 1887	367,061	2,790,164	13,049	7½ "
Dec. 31, 1887	362,083	3,087,687	13,938	2½ "
June 30, 1888	374,676	3,303,895	14,477	nil
Dec. 31, 1888	380,808	3,612,158	16,132	nil
June 30, 1889	357,874	3,317,646	14,046	nil
Dec. 31, 1889	409,725	3,592,269	15,655	nil
June 30, 1890	382,865	3,502,777	14,938	nil
Dec. 31, 1890	419,466	4,161,646	17,590	4 "
June 30, 1891	389,140	3,770,230	15,999	—

Other reports presented showed there were 42 cars, 27 omnibuses and 7 brakes owned by the company and 305 horses.

The Chairman in moving the adoption of the report, said they had not had quite so profitable a half-year for various reasons, although they had taken more money. One reason was the high price of provender, and another a bad season for out-door traveling early in the year. The business was going on satisfactorily, however, as the turn-over was maintained. As to the capital account the expenditure remained about the same, but the balance of over-spent capital was now reduced to £1,675, which 12 months previously stood at £6,274; within two or three more half-years that would be completely extinguished.

The increase in cost of provender had been considerable, so that for maize, hay and other feed they had spent £4,910 against £4,171 a year ago; principally due to the increased price of maize, viz.: 28s. 10d. per quarter instead of 22s., and hay cost 10s. per ton more. Added to this increased cost of provender, additional wages to the drivers and guards of £230 had to be paid, an addition the company would have to face for the future.

The Directors recommended a dividend of 4 per cent. to be paid, and to carry forward £131 13s. 11d.

The Chairman then entered fully into the question of the relation between the company and its men, which, he said, had been recently much agitated, not only in Leicester but in London, on the demand of the men for diminution of their working hours and for an increase of wages. The Directors had fully considered the question and had met the men again and again. They had felt bound to consider the state of the labor market, and also public opinion at the present time. They found that the London companies after a long contest had decided to limit the mens' working hours and to increase their wages, and the Directors had agreed to 12 hours a day instead of 13½ hours, and had increased their wages, although they felt the condition of their finances did not justify it, as it had made a difference of £500 a year loss to the company. The Directors looked to be somewhat compensated by the men valuing their situations more. A memorial assenting had been signed by all but 20 out of the 200 men employed, the rest prefering unrest and agitation, which meant insubordination that could not be tolerated and, if continued, those men would have to be dismissed.

Mr. Wood, a director, in seconding the motion agreed substantially with the Chairman, but confined his remarks entirely to the question between the company and the men, and since they were a good body of men, taken as a whole, on a previous occasion the Directors had, unsolicited, advanced the wages and reduced the mens' working hours from 15 to 13½; and they had contemplated reducing the hours still more when the company had earned a 5 per cent. dividend to their shareholders. Further the Directors were not hostile to the men belonging to any union so long as that body did not interfere with the management of the company's business and dictate who they were and were not to employ.

The report and balance sheet were then adopted. Also a resolution that a dividend of 4 per cent. be declared.

Mr. Wright in moving a vote of thanks to the Chairman and the Directors, remarked the figures in the report showed the financial condition of the company was sound, and he was sure the meeting would approve the way the Directors had met the mens' appeal. The shareholders would feel they had now a valuable property of an enduring character.

The resolution was carried and the Chairman, in returning thanks, said the company had given the men the utmost they could give, and they were now prepared to stand by the result.

SAFETY VALVE PROBLEMS.

BY J. STANFORD BROWN.

(*Continued from page 63.*)

(3) That instead of a lot of rules, each to be reasoned out separately, we have a single equation which, by solution, gives us the value of any quantity involved, and that by a few simple rules, all of them free from possible slips of logic.

Starting again with our safety valve, Fig. 7, we know that there are two sets of forces at work acting in opposite directions, whose moments when equal give us the valve in equilibrium. The first of these is the steam pressure acting upward at the rate of let us say, 100 lbs. per square inch of surface of valve seat. So that calling the valve seat area A, and the pressure per square inch P, then, the resulting effort produced by them in combination with each other (for they are mutual functions), and which is the true "force" whose moment we want, will be represented by A P. Its lever arm is the distance S, from point of attachment of valve stem to the fulcrum. The moment of this force will then be A P × S. For use in a practical example, A is got by measuring the valve seat diameter with an ordinary rule and multiplying the result by the decimal 0.7854, which is the ratio of any circle to the square of its diameter.

Opposed to the steam force because acting opposite to it or in a downward direction, we find three forces, each with its own lever arm.

(1) The weight of the "pee," P, with its lever ≡ L.*

(2) The weight of the valve and stem ≡ W, with its lever ≡ S.

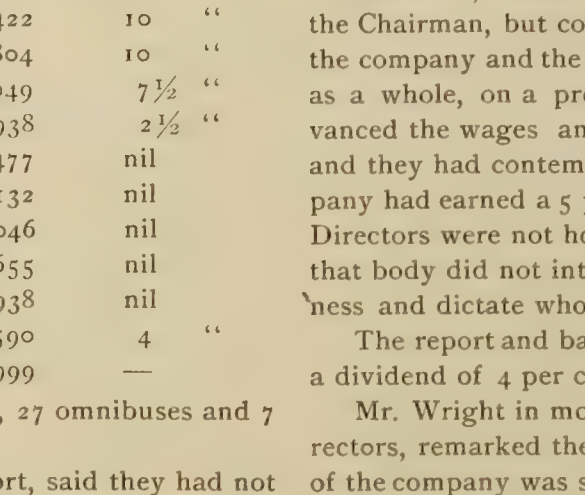


FIG. 1—STRAIGHT LEVER, CLASS 3, OR SAFETY VALVE.

(3) The weight of the valve rod, ≡ *p*, with its lever ≡ *l*.

l will be the distance from our fulcrum *f*, to a point of the valve rod *p*, which is called its "centre of gravity."

If a mass of matter be balanced in any position across a knife edge, we can, when equilibrium is established, imagine a perpendicular line drawn through the mass and the knife edge. Balancing the same again in a second position—preferably as near right angles as may be possible—a second such line may be imagined. Could our mass be suspended from the point of intersection of these two lines, it would be found in perfect balance, and the point of suspension would be called the *centre of gravity* of the mass.

If we take a bar fixed at one end from lifting but free to revolve about that part, like the arm of our safety valve, we shall find that its weight will act as a force whose lever arm is the distance from the fixed point or fulcrum to its centre of gravity. We therefore take our bar and balance it on a file or knife edge, or in a loop of string, and so get its "arm" by actual measurement. The gravity centre can also be got by calculating or by the ingenious method given in Prof. Meyer's paper.

We now have our formula complete,

$$(B\,L + W\,S + p\,l) = [(A\,P) \times S]$$

and the formula *is true in this form not only mathematically*, (*i. e.*, whatever numerical values be assigned to the quantities) *but also physically—i. e.*, it shows the physical relation of the quantities involved, the moments of the forces and the two sets opposed for the purpose of producing a balance about the fulcrum.

In short our formula is merely shorthand, for not one rule only, but for all our rules relating to

* The sign ≡ is a mathematical shorthand for "which let us call."

the safety valve, for we have but to weigh and measure and substitute our values for the letters they represent, and by performing the indicated operations and transferring all the terms, except the one we want, to the opposite side of the equation, we get our result at once in numerical form.

In solving such problems, if one is acqainted with algebra, he proceeds as we have shown, and gets a general equation and then translates it into written rules, if necessary, for the comprehension of others.

If the rule be written out from that form of the general equation, which also exhibits the simplest relations of the quantities involved, it will certainly be the one most easily understood. Applying algebraic rules, we can successively transform our general equation to

$$B\,L + pl = (A\,P)\,S - W\,S \qquad \text{whence}$$
$$B\,L + pl = (A\,P - W)\,S.$$

This form of the equation exhibits the physical truths in a new light, for here we have brought into the same member those two forces which have identical lever arms; namely, the force of the steam and the combined weight of the valve seat and stem.

We see readily from Fig. 7 that our equation represents the facts, for these two forces act oppositely at the same point of application, and so manifestly the resultant is their difference (A P—W) and expresses the amount of upward pressure that the lever and the "pee" have to hold down.

(*To be continued*).

GEARLESS MOTOR.*

That so desirable a machine as an absolutely gearless street car motor should be brought out at this time, instead of in the earlier days of electric railway practice, will probably be a matter of surprise to both railway men and practical electricians. We presume that there was more or less suspicion concerning the actual success of such a machine, until experience had demonstrated its permanent value, and until the methods by which the results have been obtained were fully understood.

It is impossible to design an electric motor of given power (say 15 H.P.) upon two general plans. In the first, there is an armature revolving at high speed in a weak "magnetic field." In the second, there is an armature revolving at a low speed in a more powerful "magnetic field."

The double reduction motor, long the standard in street railway practice, is a machine of the first type, one in which the armature revolves at high speed in a weak "magnetic field." Its characteristics are the following:

It has two poles separated by a wide cylindrical "magnetic gap" in which a long drum armature revolves.

There is the least possible amount of iron and copper in the machine for its output in power, the armature speed being a maximum with safe regard to the effect of centrifugal force, and very much higher than it is possible to obtain with any form of steam or oil engine of equal power, possessing reciprocating parts, and dead centres.

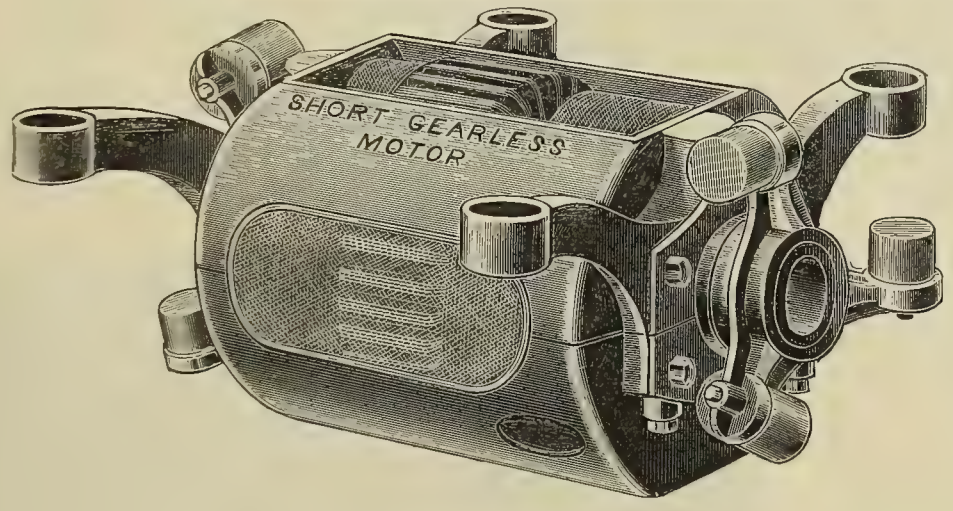
In order to bring this high armature speed to a point where it can be utilized on the car axles, two reductions are necessary, involving an armature, an intermediate pinion and an axle and intermediate gear, so that for a complete 30 H.P. car equipment, we find eight gears and pinions, twelve double bearings requiring special self-oiling arrangements, together with a large number of bolts, nuts, and other undesirable mechanical devices.

The high speed of armature pinion and intermediate gear, and the constant wear on the other gears, make frequent replacements necessary, and at consequent large expense.

The noise of the high speed gears, unless reduced by special and costly devices, becomes almost unbearable to the public.

The entire space beneath the car is taken up by the motors, making it difficult to introduce proper brake rigging, while other objections almost as serious are brought into play.

The single reduction motor is an advance on the double reduction motor, and is a step in the right direction, but it is only a step. In this form of machine, as it is now built by the various companies, we have either a ring, or a drum-armature revolving between massive pole pieces at a speed of about one-half of the double reduction armature. The weight of the machine is considerably increased because of the fact that the "magnetic gap" between the two pole pieces is increased rather than diminished, making it necessary to increase their strength by adding to the weight of iron and copper in the fields and armature. There are still two (in one type recently brought out, four) heavy gears in each motor equipment, together with eight bearings, bolts, nuts, etc. The amount of space taken up by the motor beneath the car is somewhat reduced, but there is still a very material complication. It is not easy to properly protect the motor from dust and moisture. The noise of the gearing is somewhat reduced, together with the "squealing" of the brushes on the commutator, which is the accompaniment of all high speed commutators.



GEARLESS MOTOR.

In the gearless motor, it is believed that the final form has been reached. Referring to the machine in a general way, it is seen that all gearing is absolutely eliminated, the number of bearings is reduced to two on each motor and four in the equipment. The armature speed comes down to the minimum, namely, that of the car axles in practical operation. The noise of the gearing and "squealing" of the brushes is entirely obviated, and there are but three wearing parts on each motor.

The intensity of the magnetic field is now at its maximum, this effect being due not to a material increase in the weight of armature and pole pieces but to the wholly different method of construction. Instead of two magnets, we find eight, instead of a wide magnetic gap, we find one extremely narrow, with consequent enormous intensity of the "field of force." Instead of a drum armature of small diameter, we find a ring armature of comparatively large diameter and increased "leverage"; the sum total being that we have here in full measure a motor of the second type, namely, one with an armature revolving at low speed in an intense "magnetic field," exerting a power fully equal to the motor with gearing, and at considerable less expenditure of current (*i. e.* coal) since all the friction of gearing is eliminated.

It is now proposed to describe in detail the construction of this remarkable machine, which has almost as many mechanical as it has electrical points of superiority.

The motor is complete in itself. It is not keyed to the car axle nor does it touch it at any point. The motor as a whole can be taken off the car axle after removing a wheel, but in practice it will rarely or never be found necessary to do this. The weight of the two motors forming a 30 H.P. equipment is distributed over the entire truck, but it follows from what is said above, that no part of the motor is borne directly upon car axles. Both motors are flexibly suspended at both ends, so that pounding on the rails, jolting and jarring of the truck, crystallization of motor frames, wheels and axle of truck are entirely avoided. The armature is always, and necessarily, central.

There are eight field magnets, four on each side of the armature. They face each other at a distance of only ten inches, and thus form a most intense magnetic field. The magnets are bolted to the frame work of the motor, in the centre of which are the bearings which carry the hollow armature shaft, presently to be described. The double arms running out from the framework to the cross girders on the truck make provision for the support of the entire motor. The insulation between these brackets and girders, is provided by means of heavy rubber bushings through which pass the bolts. By removing the bolts attaching the fields to the supporting framework, the coils may be quickly taken out, either for repair, or to more easily get at the armature.

The armature is keyed to a hollow steel shaft, which is concentric with the axle of the truck, an inside clearance of one inch all around being provided for. The armature proper consists of a laminated iron core upon which are mounted separate and entirely independent coils, following the well-known methods of the Short double reduction type of motor. These coils are perfectly ventilated, and in past practice almost no trouble has been experienced from burn-outs. It is the one street-car armature at present constructed of which it can be truly said that the coils are absolutely independent, and can be separately rewound in case of accident, at almost nominal expense. Mounted upon the hollow shaft, close to the armature, is the commutator, which is protected from injury by the surrounding pole pieces. The commutator is massive in construction and of large diameter, the idea being that because of its massiveness and slow speed the wear will be reduced to a minimum, and the replacing of the commutator will occur only at long intervals.

Upon either end of the hollow shaft is keyed a three-armed spider, each arm at its extremity being provided with a socket, which receives a rubber cushion, or spring. These cushions bear upon lugs cast on the car wheels, and as the armature shaft and spider revolve the action is imparted to the car wheels and the car.

The cushions being made of rubber serve the double purpose of insulation and easy starting. The bearing of these spiders are so arranged upon the car that the forward right hand and rear left hand wheels are driven in one direction, the other two wheels being driven in the opposite direction, so that the pressure is constantly maintained between the spider cushions and the car wheels.

From the above description it is at once apparent that the entire motor is absolutely insulated from the truck at every point. This is a feature which we believe to be of the utmost importance, and which in a large measure accounts for the small item of repairs which has been found in the use of these motors. By this means leakage or accidental connection between field or armature circuits and the iron frame work (which may be caused by moisture, dust, dirt, etc.,) does not produce a "ground circuit" and consequent burn-out of field or armature coil, as is the case with other types of machines.

*Short Electric Railway Company, Cleveland, O.

The method of mounting the motor and attaching it to the truck provides for absolute flexibility of the motor as previously stated. The use of the gearless motor makes possible an almost perfect method of protecting it from dust, moisture, etc., which have been a potent source of trouble in other forms of equipment.

The casing is so arranged with openings on the sides covered with wire gauze that perfect ventilation is provided for.

From the centre of the axle to the bottom of the casing is 12¾ inches. On a 36-inch wheel, which we strongly advise, not only in the gearless but in other types of motor, there is thus made a clearance of 5¼ inches, which is ample for all purposes.

At a speed of ten miles an hour the armature revolves at 94 revolutions per minute, with a 36 inch wheel. The equivalent speed of the single reduction motor would be at least 400, and of a double reduction motor about 1,200. The enormous advantage of the gearless form over all others is thus clearly evident.

The absence of gears and bearings and diminution of friction therein, joined with the general correct design and construction of the machine, reduce the power necessary to propel a loaded car to a minimum, and there results a very material saving in the coal heap.

One of the most valuable features of the machine is the facility with which it can be repaired in case of necessity. By loosening four bolts in the motor frame work, and by taking off the iron strips below the wheel boxes, one end of the car may be jacked up and the axle wheels and armature complete run out from under into the light of day. The armature coils may be rewound without removing the armature from the car axle. Field coils can be repaired as easily. The commutator may be reached and dressed while the machine is running. If steel-tired wheels are used, by a special arrangement the motor may be jacked up, raising the wheels from the ground, the current brought on the motor and the wheels turned just as would be the case on the truck, so that by a special "tool-jig" the wheels may be turned down as required, thus removing any flat spots or other imperfections, or the wheels and axles may be turned from outside through the hollow shaft of armature without the least effect on motor, it being, of course, necessary, however, to remove the spring attachment between the hollow shaft and the wheels. In case it is found necessary to replace a commutator, a wheel must be pressed off and the commutator removed bodily. This could be done only with great difficulty if the armature were keyed directly to the axle instead of being on the hollow shaft. The commutator will have a life three or four times that of wheels in common use on electric railways, and it will not usually be necessary to press off a wheel for the express purpose of replacing a commutator.

In presenting the gearless motor to the world, the manufacturer confidently believes that it is the ultimate form of street railway motor. The machines in use have convinced us absolutely that the motor is efficient, reliable, and entirely successful. The result of a full year of investigation and experiment upon this motor in nearly every possible combination has convinced us that a gearless motor cannot be produced except by following the general characteristics of this machine, including first, the multipolar field; second, a small "magnetic gap," and third, a ring armature of comparatively large diameter.

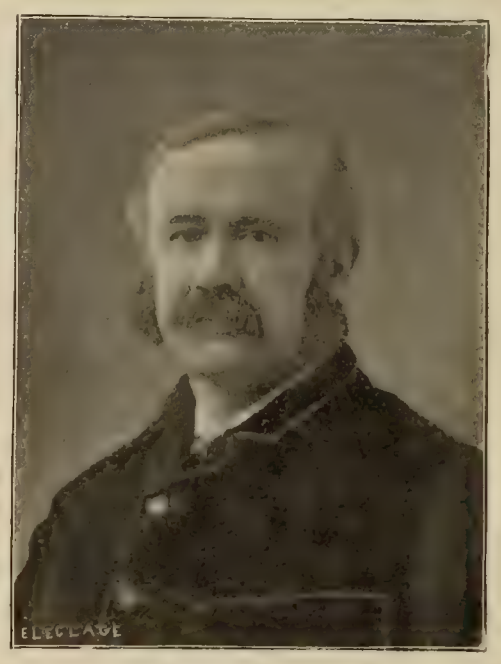
MINNEAPOLIS NOTES.

The efficiency of the electric train service between St. Paul and Minneapolis has been completely and satisfactorily demonstrated. The drop letter system is also becoming popular. This system provides a letter box on the cars, into which letters may be dropped and taken to one or the other city. The boxes are attached to the sides of the cars within convenient reach.

The East Side car house is now completed. There is room provided in it for 100 motors and 200 trailers.

The Northern Car Company will furnish a number of cars for the Minneapolis lines, in addition to those previously ordered.

An addition of nine elegant Pullman trailers has been made to the Fourth avenue line. They are very much liked by the passengers on that line, who, in the past, have been accustomed to riding in dingy old vehicles.



PROF. H. T. BOVEY, PRESIDENT CITIZENS' EXECUTIVE COMMITTEE, MONTREAL.

MONTREAL TELEPHONE EXCHANGE.

On this page we give a view of the operating room of the Telephone Exchange in Montreal. It is equipped with all the modern apparatus, and is light and airy. The exchange throughout is constructed and equipped in the most thorough manner.



TELEPHONE EXCHANGE, MONTREAL.

BOOKS, CATALOGUES, ETC.

A PRACTICAL HAND-BOOK OF ELECTRO-PLATING, by Edward Trevert. 75 pages, fully illustrated. Bubier Publishing Company, Lynn, Mass. Price 50 cents.

This little book, which is of a size that can be carried in the pocket, contains the elementary principles of the subject of electro-plating. It was written especially for the use of beginners and amateurs. The author endeavored to make the subject as complete as possible in so small a compass. A number of valuable tables are added and possibly an expert may find a number of new ideas. Every amateur should have a copy of the work.

The third edition of "THE ELECTRIC MOTOR AND ITS APPLICATIONS" by T. C. Martin and Joseph Wetzler, has just been issued by the W. J. Johnston Company, limited, New York. This work, which was the first treating exhaustively on the subject, probably remains the standard at the present time. We think that no other book on the electric motor published equals this one, and the third edition, which contains an appendix of 31 pages, bringing the development of the motor to date, makes the book more valuable than ever. Every electrician and student who does not possess a copy of this valuable work should procure one at once.

These and all other books on electrical subjects can be obtained at the office of the ELECTRIC AGE PUBLISHING COMPANY, first floor, *World* Building, New York.

The Electric Merchandise Company, 11 Adams street, Chicago, Ill., has recently placed on the market so much new line material, that it has found it necessary to issue a supplement to its catalogue covering these additions. Its large catalogue published but a short time ago, is very complete; and it was supposed to cover the entire field, but the additions have been so many that it has required a supplement of 184 pages to illustrate and describe the new material. This is the third supplement the company has published, and it is as complete as some catalogues.

The Moore Electrical Manufacturing Company, 652 to 660 Hudson street, New York, has just issued a 96-page catalogue, illustrating and describing the general electrical supplies of which it is a manufacturer and dealer. The list of electrical specialties described is very complete, comprising everything connected with the construction and use of electric gas lighting, house call annunciator, electric bell, switch, speaking tube and telegraphic apparatus.

NEW CUT-OUT.

We illustrate herewith an interesting cut-out, which has just been invented and placed on the market by the McCreary Electric Specialty Company, 136 Liberty street, New York. Electrical experts who have seen the model, claim it to be a novel invention and warmly approve of it.



FIG. 1.

It can be attached to a flexible cord at a convenient distance from the lamp, bringing the safety fuses where they can be renewed in a moment; it avoids the necessity and trouble of getting up to the ceiling and disconnecting the cut-out to renew the fuse.

Fig. 1 shows the McCreary Pendent Thermal Cut-out complete, Fig. 2, the top part of the cut-out showing connections and Fig. 3 the bottom of cut-out.

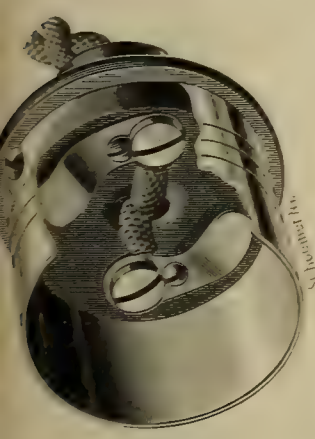


FIG. 2.

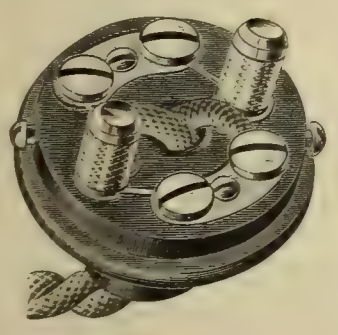
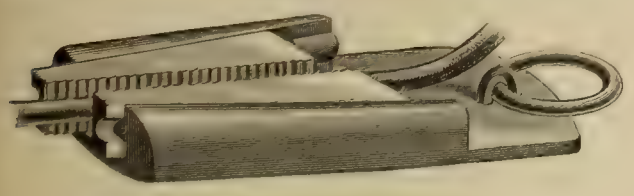


FIG. 3.

It will be seen that the internal arrangements and connections of this device are very simple. It is designed for a connecting plug where quick and safe connection is necessary and will prove useful wherever there is danger of the flexible cord being short-circuited. It is the intention of the firm to make it with a wall-base to be used as a wall receptacle for any system.

AUTOMATIC WIRE-PULLER.

We give herewith an illustration of a simple device, or "come-along," for gripping electric and other wires or cables, invented by T. J. Cope, 8 North 6th street, Philadelphia. The device consists of two inclines which are stationary and two

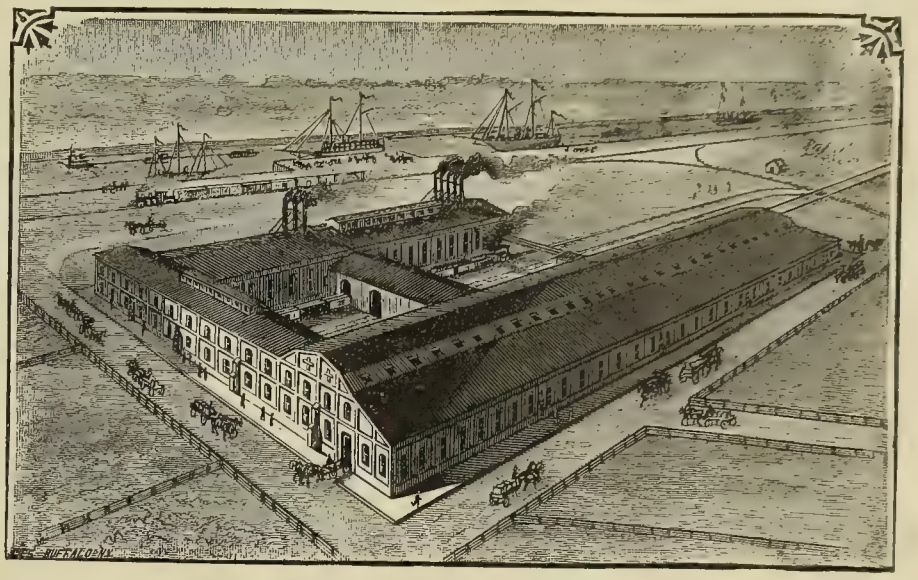


AUTOMATIC WIRE PULLER.

corresponding inclines or jaws that act as grips that are loosely attached to and bearing against the stationary ones. The wire or cable to be drawn is placed between the inner jaws, and on being drawn closes with sufficient grip to hold the wire. The pull is direct. The jaws have long bearings, thus preventing the breaking of the insulation. The releasing, as well as the gripping, is automatic. It can be used for naked and insulated wires, as the jaws engage from 1-32″ to 3-4″ in diameter.

THE DOMINION BARB WIRE COMPANY.

The accompanying cut shows a view of the works of the Dominion Barb Wire Company, limited, of Montreal and Toronto. The works are situated at Lachine, near Montreal, and the site is an admirable one for so large an industry, being, as it is, on the bank of the river. Railroad tracks run into the works, which greatly facilitate shipment of goods by rail, and as the river is near by, shipment by water is a matter of equal facility.

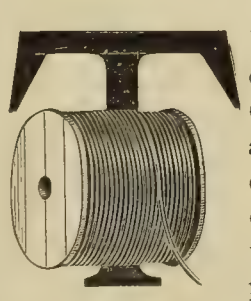


WORKS OF THE DOMINION BARB WIRE CO.

The company manufactures wire of all sorts, including telephone, telegraph and copper wire.

The head of this large concern is Mr. F. Fairman, who is a member of the Executive Committee of the Citizens' Committee.

THE ACME LEAD CABLE—ITS MANUFACTURE.



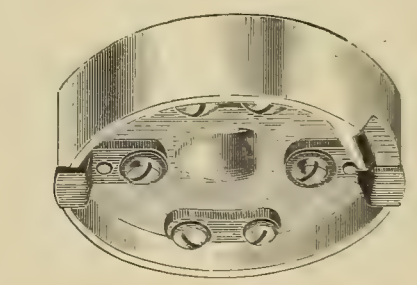
THIS is one of the latest products of the International Okonite Company (Limited), New York and London. It is a lead-covered cable and designed for extra heavy work and high voltage under extremes of temperature, being, therefore, especially adapted for underground work. A special feature of the new cable is its thorough insulation which consists of a combination of two or more distinct insulating materials, possessing different valuable qualities, one, of the high electrical resistance of Okonite, the other, an improved rubber compound especially adapted to resist the effects of high temperature. The high insulating properties of Okonite are well known to the trade. The special rubber compound, which also possesses high insulating and water-proofing qualities, has the additional quality of not being sensitive to heat. Its application serves as a protection to the high grade Okonite insulating material beneath, and insures centralization of the conductor at high temperature. In other words, it does not soften, neither does it allow the conductor by its weight to sag down through the insulating materials. After this second layer is applied, the cable thus far made is run through a bath under high heat until the insulation becomes impregnated with a material which protects it thoroughly from the effects of gas and moisture.

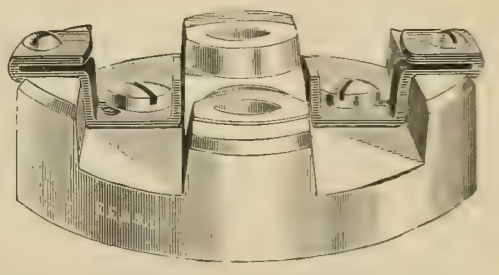
Over these two layers of special insulating material is superimposed a braid which in its turn is saturated with the same material to prevent capillary attraction on the exposed ends of the cable and protect it from the rotting effects of gas, and to increase lasting qualities, making it the most durable braid known. Though more expensive, the manufacturers use a braid in preference to a tape, on account of its superiority. Being elastic it does not break on bending as the tape is sure to do, but gives readily.

The now practically finished cable is then lead-covered by the most improved hydraulic processes that have yet been introduced, insuring freedom from blow-holes and air-bubbles and an even thickness and quality of lead. The lead is alloyed with tin, to secure sufficient hardness and to resist abrasion in drawing through ducts, yet assuring sufficient ductility to enable the cable to be easily handled without rupture. The Acme Lead Cable will, we predict, share the general popularity accorded to all the Okonite specialties put upon the market by the International Okonite Company, and like them will prove well deserving of it.

CEILING ROSETTE.

The Electric Engineering and Supply Company, of Syracuse, N. Y., has just placed a combination ceiling rosette on the market which has several new features not found in any other rosette. As will be seen from the illustration it is similar to the Standard E. E. & S. rosette, with the exception of the base, which is so arranged that the branch wires to which it is connected can either pass directly through the slots in the base, and





COMBINATION ROSETTE.

make contact with the rosette through the screws and brass parts when used with moulding or cleat work; or the branch wires may come through the holes in the centre of the base of the rosette, and be attached to the screws of the contact pieces located in the slotted base. From the manner of making connections it will be seen that the rosette can be used under a variety of conditions, making it a convenient design for supply companies to carry in stock.

THE WEEK'S RECORD OF STREET RAILWAY NOTES

ALABAMA.

DECATUR.—The construction of the street railway is being rapidly pushed.

CALIFORNIA.

SACRAMENTO.—Six new cars have recently been put into service on the Central Electric Railway, and are giving good satisfaction. They are practically noiseless in their operation.

STOCKTON.—A San Francisco syndicate headed by James G. Fair, the well-known millionaire, has bought the horse car system of this place, and will adopt electric power thereon. It is stated that $460,000 will be spent on these improvements.

CONNECTICUT.

HARTFORD.—Horse cars wlll be running to Glastonbury within a week or ten days.

ILLINOIS.

CHICAGO.—It is reported that a syndicate of Texas capitalists is after a franchise for an electric elevated railroad from Lake street to Jackson Park. (World's Fair enterprise.—Ed.)

INDIANA.

IRVINGTON.—Electric streetcars running Aug. 24.

KOKOMO.—Architects are at work on plans for the generating station of the electric street railway. Natural gas will probably be the fuel used.

IOWA.

CLINTON.—Electric cars running Sept. 9.

LYONS.—It is reported that the Clinton & Lyons Horse Railway Company has sold its line to the State Electric Company, Clinton. It is also said the Thomson-Houston has control of the latter.

MASSACHUSETTS.

BOSTON.—The new power house of the West End Street Railway at Fields Corner is progressing rapidly.

On Dorchester avenue and Dudley street, rails are being laid for the use of electric cars and the West End Road will shortly double track East Fourth and L streets and East Broadway, South Boston.

The plant of the New England Glass Works, at East Cambridge, is being transformed into a power plant by the West End Street Railway Company. The changes will not be completed for several months yet, and will represent an investment of $1,000,000. Three engines with an aggregate capacity of 450 horse power and 30 boilers will be put in.

It is reported that the West End Railway Company has enough money deposited in the bank to pay all of its outstanding notes when due.

GLOUCESTER.—The stockholders of the Gloucester Street Railway tendered an elaborate dinner to members of the city government, Aug. 27, to celebrate the opening of the electrical system.

The Gloucester Street Railway opened Aug. 27. The new road is equipped with the Rae system of electrical propulsion. The power plant consists of two 80,000 watt dynamos driven by a 250 horse power engine.

HAVERHILL.—The Street Railway Company is relaying its rails.

LAWRENCE.—Everything is now in readiness for the beginning of operations of the electric cars. The citizens are enthusiastic over the prospects of the improved transportation facilities.

LYNN.—It is said that the Thomson-Houston Electric Company equipped 42 street railways during the first six months of 1891, against 33 for the corresponding period of 1890. The company now has contracts for complete equipment of 41 roads, and orders for 1,400 motors for future delivery.

SPRINGFIELD.—Electricity is to be used on the steep grade of Maple street.

WORCESTER.—A horse becoming frightened at a passing electric car, threw its driver and a sick child from the carriage to which it was attached, seriously injuring both.

MICHIGAN.

DETROIT.—It is said that the City Railway Company is to adopt the Rae system of electric power for its street railway.

MINNESOTA.

ST. PAUL.—The Minnesota Transfer Company is to build a one story brick engine house to cost $5,000.

NEW HAMPSHIRE.

NASHUA.—The car house of the street railway is to be extended 60 feet.

NEW JERSEY.

ORANGE.—We understand that the Newark Passenger Railway Company will charge the South Orange Company one cent for each passenger carried by the South Orange Company over the tracks of the first named company.

NEW YORK.

BROOKLYN.—On Aug. 28, the driver of a brewery wagon was sentenced to jail for three days for purposely obstructing a street car.

SYRACUSE.—The new street car line being built by the Syracuse Consolidated Street Railway Company from the Fair Grounds to the lake, will be 2,200 feet long. It is to be called the Lakeside Railway.

The net work of tracks being laid by the same company in Salina street at the bridge, will cost $15,000. It will cost at least $2,000 to place them in position.

OHIO.

CANTON.—The construction work on the Canton & Massilon Electric Railway is to be commenced at once.

CINCINNATI.—A successful test of the new Thomson-Houston Single Reduction motor was made by the street railway company here August 23.

COLUMBUS.—The Consolidated Street Railway Company, which, it is claimed, has been impeding traffic by using horse cars on its electric line between the ends of the tunnel, has been ordered to vacate the tunnel.

HAMILTON.—It is said that the street railway companies here have consolidated.

TOLEDO.—The Toledo Consolidated Street Railway Company is extending its road one mile on the Ironville line.

YOUNGSTOWN.—The Youngstown Street Railway Company was recently reorganized and incorporated under the same name, with a capital stock of $500,000. The entire property of the original company has been conveyed to the new organization.

PENNSYLVANIA.

ALTOONA.—The Altoona City and Park Electric Railway Company has commenced construction work on its street railway to Hollidaysburg.

DUBOIS.—An injunction has been served upon the Buffalo, Rochester & Pittsburg Railway Company restraining it from interfering with the construction of the crossing for the street railway company, which is now building its lines. The crossing question has aroused considerable feeling and lively times have taken place.

MCKEESPORT.—The McKeesport Passenger Railway Company has been refused the right to erect wooden poles by the City Council.

PITTSBURG.—The Duquesne electric street railway stopped running August 27, on account of the track being entirely submerged by water for two blocks, caused by the breaking of a water main. A large force of men were at once engaged to repair the break.

POTTSVILLE.—The electric railway company is erecting a depot at the Palo Alto bridge terminus.

READING.—An electric railway between this place and Mohrsville will be opened for traffic shortly.

RHODE ISLAND.

PROVIDENCE.—The officers of the Interstate Street Railway Company, which was incorporated with a capital stock of $500,000, to construct and operate street railways connecting a number of towns of Rhode Island and Massachusetts, are as follows: Directors, W. F. Walton, W. H. Barney, H. M. Daggett, P. Nerney, W. N. Otis, George Demarest, C. T. Guild; President, H. M. Daggett; Treasurer, W. N. Otis.

VIRGINIA.

LYNCHBURG.—The Rivermont electric railway plant installed by the Edison General Electric Company has been formally accepted after a 30 days' trial. The results during the trial were satisfactory.

RICHMOND.—A resolution has been recommended to the City Council granting permission to the Brook Turnpike Company to construct and operate a street railway upon the Mechanicsville turnpike, outside of the city.

WISCONSIN.

APPLETON.—The electric street railway was opened September 10.

MILWAUKEE.—The Milwaukee and Wauwatosa Rapid Transit Company commenced construction work September 1.

NEW ROADS.

BALTIMORE, Md.—It is stated that the Traction Company of this city will begin the laying of another cable line at once, at a cost of $2,000,000. The new road will run through the western section of the city.

It is also reported that the City Passenger Railway Company will soon cable its line.

BERKELEY, Cal.—It is said that B. Morgan and others have asked for a franchise for an electric street railway between this place and Oakland.

CHICAGO, Ill.—It is said that a cable road is to be constructed on Fifth avenue.

COLUMBUS, O.—An electric street railway is to be built to Granville.

A project to construct an electric railway to Newark, O., is on foot. Address George B. Okey, Columbus, O.

CONCORD, N. H.—A Boston syndicate is to construct, equip and operate an electric street railway to Chester, a distance of six miles.

DEFIANCE, Ohio.—A street railway is to be constructed here by Illinois capitalists. S. L. Nelson is acting for the syndicate.

ELMIRA, N. Y.—It is reported that two more street railways are to be constructed here.

EL RENO, Oklahoma.—A street railway is to be constructed here.

FLORENCE, Ala.—Surveys are now being made here for a street railway. The line will run from the L. & N. Railroad station to Court street, and will likely be completed at an early date.

HANNIBAL, Mo.—The citizens of the south side desire a street railway.

KNOXVILLE, Tenn.—An electric road to Bearden is being strongly agitated.

SAGINAW, Mich.—It is said that A. T, Bliss is petitioning for a right-of-way for a street railway to Carrollton.

ST. LOUIS Mo.—An electric street railway is to be constructed from Belleville to this place.

VANCOUVER, B. C.—It is said that an electric street railway is to connect this place with New Westminster.

ELECTION OF OFFICERS.

TACOMA, Wash.—Mr. W. H. Lewis succeeded Frank B. Gamble to the position of assistant superintendent of the Tacoma Railway and Motor Company, Tacoma, Wash. Mr. Lewis has had large experience in railroading, and is thoroughly qualified to fill his new position.

The Hall Signal Company, 50 Broadway, N. Y., is hard at work on its new highway crossing alarm signal which every steam railroad is anxiously waiting to adopt. It will soon be ready. Wherever the Hall signals have been installed on railroads they have become adopted without a disenting voice, because they never fail to operate at the proper time.

PERSONAL.

SUPERIOR, Wis.—M. H. Gerry, an expert of the Thomson-Houston Company, was here recently superintending the installation of the electrical equipment of the new power house of the street railway company.

TOLEDO, O.—General Manager Lang of the Street Railway Company, recently made a pleasure trip to Catawba Island.

LEGAL.

BROOKLYN, N. Y.—The Coney Island and Brooklyn Railroad Company, which was unsuccessful in its application to the State Railroad Commission for permission to use electricity in place of horse-power, has given notice that it intends to apply for the appointment of three commissioners to consider the advisability of the change.

BUTTE, Mont.—The Metropolitan Electric Railway Company and the Butte Consolidated Railway Company are being sued for $25,000 damages by J. A. Murray, who claims to have been ejected from property he owned, by the companies when constructing their roads, without legal action being taken and without compensating him for his loss.

TRACK EXTENSIONS.

AUSTIN, Tex.—The Austin Rapid Transit Railway Company is to extend its track three miles at once.

BRADFORD, Pa.—The Bradford & Kendall Street Railway Company will extend its track three miles in the near future.

CONCORD, N. H.—The Concord Street Railway Company is to extend its track about two miles.

LOS ANGELES, Cal.—The Pacific Railway Company will extend its lines in the near future.

OAKLAND, Cal.—The Consolidated Piedmont Cable Company is to extend its tracks some fourteen miles in the near future.

OLEAN, N. Y.—The Olean Street Railway Company will extend its horse railway track about two miles.

PUEBLO, Cal.—The Pueblo City Railway Company is to construct a four-mile extension to its tracks.

ROCKFORD, Ill.—The West End Street Railway Company is about to extend its track. Address J. S. Ticknor, President.

ROME, Ga.—Extensions are to be added to the street railway here.

SAGINAW, Mich.—The Saginaw Union Street Railway Company will build an extension of six miles to its track.

SALEM, Ore.—The Capitol City Electric Railway Company will extend its tracks one mile,

SANTA BARBARA, Cal.—The Santa Barbara Street Railway Company is to construct an extension of six miles.

SAN DIEGO, Cal.—The San Diego Cable Railway Company may possibly extend its lines shortly.

SEATTLE, Wash.—The Rainer Power and Railway Company intends extending its tracks about four miles.

SPOKANE, Wash.—The City, Park and Transit Company is to extend its lines four miles in the near future.

ST. PAUL, Minn.—General Manager Scott of the City Railway Company, is making extensive additions to the company's tracks.

HOW TO PURCHASE AN ELECTRIC PLANT.

In a circular letter just issued by H. Ward Leonard & Co., of this city, some excellent advice is given in reference to the purchase of electric plants. Any person desiring to buy a plant of any kind can do so better, cheaper, quicker, and with a more satisfactory result in every way by having this firm act for him, and he will be saved the time and annoyance otherwise necessitated by interviews with the numerous agents of the various companies.

Concerns expecting to equip electric railways electrically or to transmit power or to make any important installation of electrical apparatus, will be able to secure from H. Ward Leonard & Co. complete information, statistics, prices, etc., of various systems, and can also obtain estimates, plans, determinations, etc., etc., at the most reasonable figures. The firm's services will be found to be of unequalled value in the capacity of supervising engineers on large electrical and steam plants, such as are met with in large electric railway and central station installations.

It is said that when but ten years of age Mr. J. E. McIntosh, of McIntosh, Seymour & Co., Auburn, N. Y., built and equipped a steam yacht with a triple expansion engine, every part of which was made with his own hands in a little shop which he had. Later he invented a high speed engine for electric purposes, involving a new idea, and to-day the company employs about 600 men to keep the large number of orders for them filled.

JOHN DUNN, JR., Pres't. T. L. POOLE, Sec'y.
H. S. WHITE Vice-Pres't. F. C. EDDY, Treas.

OFFICE OF

The Syracuse Consolidated Street Railway Company,

NO. 3 SYRACUSE SAVINGS BANK BUILDING.

SYRACUSE, N. Y., July 24, 1891.

E. PECKHAM, Esq., Pres't,
Peckham Motor Truck & Wheel Co., Kingston, N. Y.

Dear Sir:—Replying to yours of the 24th inst., will say, that we have 15 of the 31 improved Cantilever Trucks ordered of you March 18th, fitted with motors and in service, and that they are giving us entire satisfaction. Our cars ride very easy, and are free from oscillation. Your Trucks are all that you represent them to be, and it will afford us pleasure to so state to any one you desire to refer to us.

Please hurry forward the balance of our order.

Very truly yours,
(Signed) T. L. POOLE, Sec'y.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued September 1, 1891.

458,619. Conduit for Electric Railways. Frederick E. Degenhardt, Chicago, Ill. Filed Nov. 21, 1890.

The combination of successive sections of drainage-conduits independently secured together at their ends with successive sections of covered conductor-carrying boxes or conduits closed on their upper sides and supported within such drainage-conduit.

458,620. Electric Trolley or Contact Wheel. Frederick E. Degenhardt, Chicago, Ill. Filed Nov. 21, 1890.

In a trolley for electric railways, the combination of a central conducting-disc with insulation external thereto applied to both sides.

458,621. Sand-Box for Cars. George T. Drew, Omaha, Neb. Filed Feb. 20, 1891.

In a sand-box, the combination of the following instrumentalities: a slotted guide-tube having a cut-off within it circularly adjustable, agitators attached to the cut-off, and an adjustable feed-tube.

458,630. Conduit for Electric Railways. Emil E. Keller, Chicago, Ill. Filed Nov. 21, 1890.

The combination of successive insulated conducting-strips not in electrical connection with each other and capable of motion with suitable supports provided with engaging adjacent ends, so that adjacent ends of the conductor-strips will move together.

458,657. Construction of Railway Tracks. Thos. H. Gibbon, New York, N. Y., assignor to the Duplex Street Railway Track Company, of West Virginia. Filed Nov. 28, 1890.

The combination of the rails, a grooved and mortised switch-piece, tie-rods and automatic wedge-keys so arranged as to form a lap-joint or continuous rail.

458,665. Electric Railway. Henry A. Seymour, Washington, D. C., assignor to the Short Electric Railway Company, Cleveland, Ohio. Filed May 5, 1891.

A double trackway with a conductor common to the two tracks, and cars provided with trolleys which travel on the conductor with their respective cars on either track.

458,671. Car Axle. Hiram P. Willard, Tustin, Cal. Filed Apr. 21, 1891.

The combination of an axle provided with a wheel-bearing arbor at one end, a portion of the axle adjacent to the inner end of such arbor being provided with screw-threads, a circular nut of greater diameter than the axle screwed upon such threaded portion of the axle, means for locking such nut upon the axle, a cylindrical cap encircling the axle and provided with an annular recess fitted to the projecting portion of the cylindrical nut, a car-wheel mounted upon the wheel-arbor, and means for securing the cylindrical cap and the car-wheel together.

458,707. Car Truck. Carl F. Buschner, New York, N. Y. Filed Apr. 10, 1891.

The combination of slotted timbers with equalizing-bars having slotted ends and anti-friction discs embraced by and turning in the ends, and axle-journals engaging the discs.

458,729. Electric Locomotor. Henry F. Shaw, Boston, and George F. Shaw, Dedham, Mass., assignors to Franklin L. Pope, New York, N. Y. Filed Oct. 27, 1888.

An electric motor, two rollers driven thereby revolving in frictional contact with each other, and two friction-wheels having flanged peripheries, between which the contact-rollers are interposed and against which they respectively press, whereby power is communicated to the axle of the wheels.

458,747. Electric Railway Conduit and Contact Device. Walter H. Knight, New York, N. Y. Filed May 10, 1888.

A slot-rail, a series of transverse supporting-yokes, and an insulated conductor within the conduit supported by upward metallic projections from the yokes.

458,748. Railroad Rail. Elisha G. Patterson, Titusville, Pa. Filed Feb. 17, 1890.

A railroad-rail having T-head and flanged base and having corrugations or depressions in the surface of the flanges at right angles to the length of the rail for the reception of the under sides of the heads of the spikes or other device by which the rail is secured to the ties or railroad-bed.

458,749. Car Truck. Edgar Peckham, Kingston, N. Y., assignor by mesne assignments, to the Peckham Motor Truck and Wheel Company, same place. Filed Oct. 30, 1890.

The combination, with the car-body, of the truck-frame formed with longitudinal bars extending under the ends of the car-body, posts secured to the car-body and passing with their lower ends movably vertically between the aforesaid bars, and guides attached to the bars in front and rear of each post.

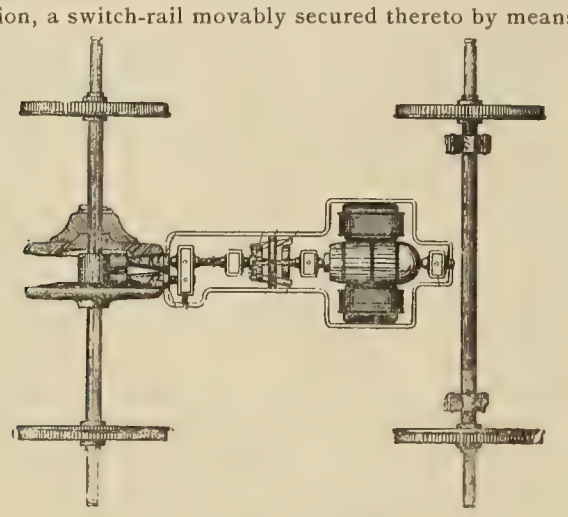
STREET RAILWAY PATENTS—Continued.

one-half to George L. Hunt, same place. Filed Dec. 12, 1890.

The combination of a hollow shaft supported in suitable bearings with a trolley or pulley adapted to rotate freely thereon, openings extending transversely through the shaft and into the chamber within the shaft, a wick provided in the chamber, and a short bolt closing the end of the chamber.

458,790. Street Railway Switch. Adolph Machalup, Leipsic, Germany, assignor, by direct and mesne assignments, of one half to Leopold Machalup and Christopher S. Geiner, both of Toledo, Ohio. Filed Feb. 13, 1891.

In combination with diverging rails, a connecting frog section, a switch-rail movably secured thereto by means of



458,729—ELECTRIC LOCOMOTOR.

a spring plate, a car mounted upon the track, provided with a lever having oppositely inclined switch-arms adapted when rocked in either direction to operate the switch-rail and mechanism upon the car for operating the lever.

458,800. Electric Car Mechanism. William E. Badger, West Quincy, Mass. Filed Oct. 17, 1890.

The combination of a motor driven shaft, a sleeve loosely mounted on the shaft and geared to an axle, two clutches each composed of a member attached to the sleeve and another member which is adapted to slide on the shaft and rotatively engaged therewith, and means for moving the movable members simultaneously in opposite directions toward and from the members on the sleeves, whereby the connection of the sleeve with the motor driven shaft may be effected without end thrust on the supports of the clutches.

458,844. Electric Railway. Leon O. Dion, Natick, Mass. Filed Nov. 24, 1890.

In an electric railway system, an underground main conductor combined with a series of rigid supports, extending upwardly from points outside of the track and laterally over the track and branch conductors extending from the main conductor along the supports and provided with vertically movable electrodes or terminals projecting below the supports above the track.

458,846. Elevated Railway. James P. Harper, Kansas City, Mo. Filed Nov. 24, 1890.

The combination, with an elevated track structure in elevated railways and with a movable platform thereon, of transverse car supporting truss beams at or near the points of support of the platform upon the track, and a car supporting frame consisting of parallel suspension rods on both sides of the elevated structure attached rigidly at their upper ends to each of the truss frames, and a transverse bar rigidly connected with the lower ends of the parallel suspension rods, and a car body within each of the suspended frames.

458,859. Method of and Apparatus for Operating Electric Railways by Dynamic Induction. Elias E. Ries, Baltimore, Md., assignor to Ries & Henderson, same place. Filed May 17, 1887.

The method of propelling vehicles by the agency of electricity by causing alternating or intermittent currents on a line or lines of conductors extending along a railway to induce alternating currents in a circuit or circuits feeding one or more propelling electric motors.

457,866. Closed Conduit for Electric Railways. Charles J. Van Depoele, Chicago, Ill. Filed Feb. 8, 1887.

In electric railways, the combination of a conduit, an electric conductor within the conduit and a conductor exterior thereto, magnetically-controlled circuit-closing devices between the conductors, and a magnet for actuating the circuit closing devices.

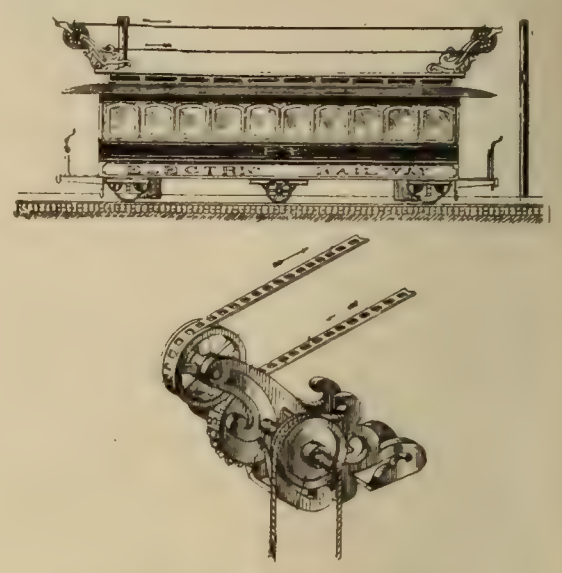
458,867. System of Electric Railway Conductors. Charles J. Van Depoele, Lynn, Mass. Filed July 19, 1889.

In a system of conductors for electric railways, the combination, with an exposed working conductor or conductors, of a conductor insulated from the primary or working conductor, the secondary conductor or conductors forming closed circuits in inductive relation to the working conductors, and grounded connections extending from the secondary circuit or circuits.

458,913. Throw on Sheave for Cable Railways. Evor P. Morgan and Richard McCarthy, St. Paul, Minn. Filed May 21, 1891.

In a cable railway, the combination, with the elevating-sheave, of a cam-sheave, its shortest radius being less and its longest radius greater than the radius of the elevating sheave mounted loosely on its shaft close to the sheave and standing normally with its shortest radius vertical above the shaft, a wedge-shaped peripheral groove in the cam- and a beveled plate terminating the groove at the point of greatest radius and inclined inward toward the elevating-sheave.

458,931. Electric Railway. Walter C. Wright, Philadelphia, Pa. Filed Nov. 25, 1889.



458,844—ELECTRIC RAILWAY.

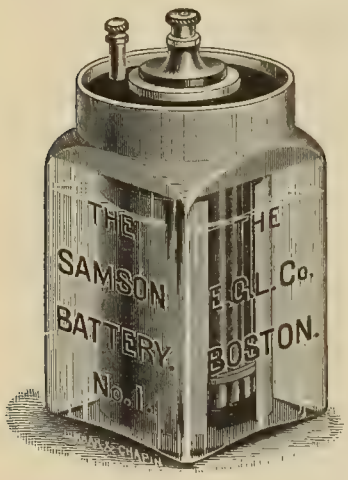
In an electric railway conduit, the combination, with the successive conducting trackway sections separated from each other at the conduit joints, of trackway sections of insulating material bridging the space between the conducting sections.

458,982. Apparatus for Warming and Ventilating Street Cars. Jacob B. Platt, Augusta, Ga. Filed Mar. 21, 1890.

A combustion chamber beneath the floor of a car body, a smoke flue extending in opposite directions from the rear of the chamber, a heated air pipe surrounding the smoke flue and having registers opening into the car, a well under the platform and partitioned from the heated air pipe, and a heating drum therein.

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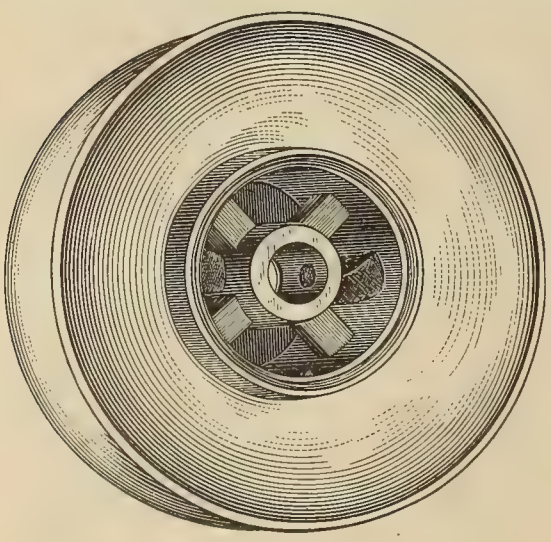
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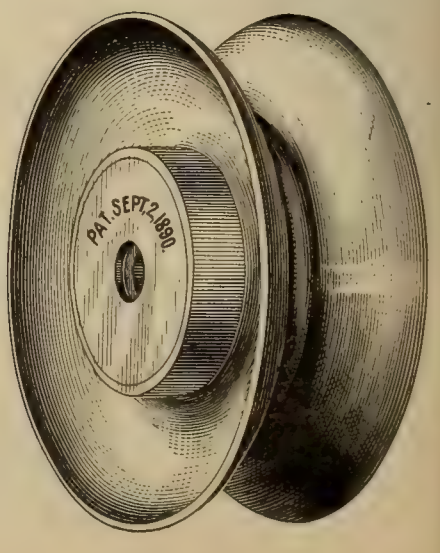
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The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.



BADGER BROTHERS,

WEST QUINCY, MASS.



Vol. I. NEW YORK, SEPTEMBER 19, 1891. No. 11.

STREET RAILWAY NEWS

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

J. B. TALTAVALL, *President*, T. R. TALTAVALL, *Sec. and Treas.*
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WE WERE THERE.

Oh, yes, we were there; we knew the convention could not and would not hold itself, nor allow any one else to hold it if we failed to inflict our names on the roster, so we buttoned up our coats, put on our dignity and linen dusters and, though, from a constant struggle with a relentless fate, some of us were illy provided with a coupon-cutting, bond-bloated diaphragm, yet we assumed a dignity we scarcely felt, and were there.

Badly, indeed, would we have felt had our names been lost in the shuffle; it would have made us realize that we are not as large and powerful as we once were, and that the experience of the past, when duns sought for us amid the swishes and swirls of the sand-hills, had passed us beyond all redemption.

But, no, we were greeted upon arrival at the hotel by a small army of gentlemen with diamond breast-works and 2x4 smiles, who quickly relieved us of our carpet-bags and dusters—and, a few days later of all that remained of the proceeds of a 20 per cent. porous plaster sticking close to what was once our stock in trade. And this because we promised not to disappoint his most gracious excellency Lord Stanley of Preston, Governor General of the Dominion of Canada—yet he started right in by disappointing us, and simply sent his regrets that he could not open the electrical exposition in person. This seemed hardly a square deal, as he was advertised as one of the chief attractions of the show. We offered our services in the premises and made tender of ourselves, but the authorities refused us, with a polite reference to our not being "Legal Tender." We went to the show, however.

TWO PICTURES.

Electric railways in actual operation January 1, 1888.	13
Miles of track.	48¼
Number of cars.	95
IN JULY, 1891,	
Three and one-half years later, in operation.	354
Miles equipped electrically.	2,893
Number of motor cars.	4,513

Comment is unnecessary!

THREE YEARS' DEVELOPMENT.

The paper prepared by Captain Eugene Griffin, and read before the annual convention of the N. E. L. A. in Montreal last week, and which we publish in full elsewhere, is full of information and replete with interesting statistics.

Commencing with an admirably selected quotation from the book of Nahum, the writer traced the history of the electric railway from the inception of a practical street railway system, through its chequered career, down to the present day, without crediting Mr. Davenport with being, so far as history tells us, the actual inventor of a system of propelling street cars by electricity. Captain Griffin refers to the work done by Charles J. Van Depoele, the old Bentley–Knight Co., and especially to the nerve and pluck displayed by Mr. Frank J. Sprague in his important Richmond deal, showing that within less than one year from the closing of the contract for the electrical equipment of that important system, Mr. Sprague had overcome all obstacles to success, that it had considerable influence in inducing President Whitney, of Boston, to adopt electricity as a motive power for his cars in lieu of cable, negotiations for a complete system of which were then about completed.

The reference to the effect of electric railways upon the residence area of a district is aptly put and well timed; that to the relative number of accidents—horses *vs.* electric—shows that in the city of Boston the deaths attributable to the adoption of the electric system were but 5 as against 10 to horse cars—significant figures, surely.

The paper concludes with some very valuable statistics, taken from figures furnished from actual experience by the West End Street Railway Company, of Boston, and a comparative statement of earnings from systems operating different motive powers.

RATES OF FARE TO PITTSBURG CONVENTION.

An official circular from Secretary Richardson has been received to the effect that the railway companies have granted rates of one and one third fares to delegates. That this action will ensure a large attendance there can be but little doubt, and Secretary Richardson is to be com plimented upon the concessions thus obtained

VESTIBULED CARS.

In his very able paper on "Electric Railroad Construction and Operation," etc., Mr. C. J. Field condemns the use of the vestibuled car, and expresses his belief that the vestibule is a failure and a misnomer.

Whether such a design of car is or is not a failure is still an open question, but the fact stares us in the face that electric and cable street railway companies still persist in placing orders with the leading car builders for this particular pattern.

It has always been somewhat of a puzzle to us, has this vestibule car craze, and the only solution to the problem we have yet heard is the improved appearance of the vestibuled car on the old style, but the question suggests itself to the thoughtful mind as to whether or not the handsome appearance of the former is sufficent compensation for the additional weight of the car, and consequent power required to move it.

THREE YEARS' DEVELOPMENT OF ELECTRIC RAILWAYS.*

The first recorded description of the electric car is found in the fourth verse of the second chapter of Nahum: "The chariots shall rage in the streets; they shall jostle one against another in the broadways; they shall seem like torches, they shall run like the lightnings."

Notwithstanding this early mention, it was not until 1888 that the electric railway became a practical commercial success. I fix the date at 1888 as it was in that year that Bentley and Knight opened the Allegheny City road to regular traffic; that the Sprague Company equipped the Richmond road, and the Thomson-Houston Co. installed the Eckington and Soldiers' Home road in Washington. It was in 1888 that railway officials began to realize the possibilities of this new tractive force; that the great West End system of Boston adopted electricity to the exclusion of cable, and that orders began to flow in upon the electric companies for street car motors to such an extent as to soon make the manufacture of such motors one of the leading branches of the electric industry.

Previous to 1888 electric motors had been used on several roads. Some of these roads were doing well and have been prosperous since; but to the public these were experiments on a comparatively small scale, and did little to inspire general confidence. The early inventors found it difficult to secure adequate financial backing; orders were few and business unprofitable. The stronger companies which took up the work in 1888, had the organizations and capital necessary to achieve success.

The pioneers who devoted their brains and frequently their purses to this work previous to 1888 are deserving all credit. It was their misfortune, not their fault, that their ideas were not developed and worked commercially. It is difficult for one man to combine the qualities of inventor, manager, superintendent, seller, expert and financier, and yet this is what Van Depoele, Daft, Bentley and Knight and others had to attempt. The record of their efforts is an interesting one, but the chronological record of electric traction has been so frequently given that it would be a waste of your time to repeat it again.

There are, however, one or two of the early trials that are specially worthy of consideration, not only because of what was actually accomplished, but principally on account of their bearing on later developments. On the 27th of July, 1884, an electric car was running scheduled trips over a mile of track of the East Cleveland Street Railway Co., in Cleveland, Ohio. This was the first electric car in regular operation on a street railway track in the United States. The motor was placed between the wheels and supported from the car body, and geared to the axles by belts of spring wire cables. The current was conveyed to the car by conductors supported on insulators in a small, wooden conduit, and connection made with the conductors by means of a plow extending through the slot to the conduit. This was the initial installation of the Bentley and Knight system. Mr. Bentley has a photograph of the car in his office in Boston.

The road was given up in 1885, and the Bentley-Knight works transferred to Providence, R. I. After various experiments the road in Allegheny City was begun in the summer of 1887. The cars were started during the winter of 1887-8, although the road was not formally opened to traffic until February 1888. Four cars were furnished to this road which, I believe, are still running. On the lower end of the road was a mile of double track conduit which was continued by an overhead system of about five miles. The conduit was on a long grade of about 12 per cent. Over-running trolleys were used with the overhead system. The conduit was in operation for two years or more, but has now been taken up and replaced by the overhead system.

As early as 1874, while C. J. Van Depoele was engaged in Detroit, experimenting with electric motors, generators, etc., it occurred to him that trains of cars, and even ordinary street cars, could be run by electricity. This was demonstrated to the satisfaction of his associates in various ways, but no public exhibition was made until 1883. When the Chicago elevated railway was under consideration, it was proposed to demonstrate the feasibility of utilizing electricity as a motive power. A track 400 feet in length was built with a 5 per cent. grade in the centre. One car was equipped with a 3 H. P. motor and ran for several weeks with considerable success, carrying crowds of people. This was in February, 1883. In the same year an elevated railway car was operated electrically at the Chicago Inter-State Fair. The car was suspended from the truck instead of being mounted upon it, and was in operation during the entire exposition—some fifty days.

During the Toronto Annual Exhibition in 1884, an electric railway some 3,000 feet long was operated from the entrance to the grounds to the main building. This was a conduit road and the wires carried a potential of over 1,000 volts without accident. A thirty-horse power electric locomotive was used hauling trains of cars.

The Van Depoele Company subsequently equipped roads at Minneapolis, Minn., Montgomery, Ala., Detroit, Mich., Windsor, Ont., Appleton, Wis., Port Huron, Mich., Scranton, Pa., Lima, O., Binghamton, N. Y., Ansonia, Conn., Dayton, O., Jamaica, N. Y., St. Catherines, Ont., and elsewhere, many of which are still in operation.

In the fall of 1887, Frank J. Sprague contracted for the electrical equipment of the Union Passenger Railway at Richmond, Virginia. This was an important road in a large city and Mr. Sprague's undertaking was the most ambitious effort in this direction up to that date. It is worthy of note that Sprague's original intention was to use motors with but one reduction, but he was forced to abandon this idea as none of the electrical companies at that date were able to produce single reduction motors. The motors used at first were too light for the work, the copper brushes scored the commutators badly and were rapidly consumed. Nevertheless, Mr Sprague persevered despite all obstacles, and in 1888 the road was running with so much success that it was one of the object lessons which induced Henry M. Whitney and his brother directors of the West End Street Railway, of Boston, to adopt electricity as a motive power when they were already far advanced in the plans for cabling their system.

As nearly as can now be ascertained, the following electric roads were actually in operation on January 1st, 1888.

ROADS.		LOCATION.	Miles.	No. of Mtr. cars.
Union Pass. Ry. Co..	(Daft).....	Baltimore, Md.....	2.00	3
Windsor Electric Ry.	(Van Depoele) opp..	Detroit, Mich.....	1.25	2
Appleton "	" "	Appleton, Wis.....	5.50	5
Port Huron "	" "	Port Huron, Mich...	2.75	4
Highland Park.....	(Fisher).....	Detroit, Mich.....	3.25	4
Scranton Suburban road.....	(Van Depoele).....	Scranton, Pa.....	5.00	12
Los Angeles Electric Ry. Co.....	(Daft).....	Los Angeles, Cal....	5.00	6
Lima Street Ry. and Motor Power Co...	(Van Depoele).....	Lima, Ohio.....	4.00	8
Columbus Consolidated Street Ry....	(Short).....	Columbus, Ohio....	1.00	2
St. Catherines Street Ry. Co.....	(Van Depoele).....	St. Catherines, Ont..	7.00	12
Seashore Electric Ry. Co.....	(Daft).....	Asbury Park, N. J..	4.00	18
San Diego Street Ry. Co.....	(Henry).....	San Diego, Cal.....	3.00	9
East Harrisburg Pass. Ry. Co.....	(Sprague).....	Harrisburg, Pa.....	4.50	10

A total of 13 roads, 48.25 miles of track and 95 cars.

On July 1st, 1891, there were 354 roads in actual operation, with 2,893 miles of track equipped electrically, and 4,513 motor cars. Such has been the growth of three and a half years.

This development has been marvelous and unprecedented. Referring to it, General Francis A. Walker said to me, not long since, that it seemed as though at least thirty years normal development had been crowded into three years.

It has indeed been a fruitful period, and the progress has been so rapid that the public are just beginning to appreciate the benefits which science has conferred upon them by the adaptation of the electric motor to street car propulsion.

During the past spring the legislature of the state of Massachusetts was considering a proposition which practically amounted to the imposition of new taxes upon the West End Street Railway Co., and the abrogation or virtual annulment of certain vested rights which the Company might claim. In his able and vigorous defence of his corporation, President Whitney was forced to investigate and determine the true relations which exist between his company and the public, and he was surprised himself to see how closely the welfare of the city of Boston and its surrounding suburbs was identified with the welfare of its street transportation system.

He at once entered upon a "campaign of education," and his speeches in Somerville, Roxbury, Dorchester and elsewhere (several of which have been published in pamphlet form) are masterly, impressive, straightforward and convincing presentations of the close relations which exist between the rapid transit systems and the health, wealth, morality and prosperity of our large cities.

I commend these speeches to the consideration of you all. I have not hesitated to draw from them largely myself.

I consider this growing realization of the true position which transportation companies occupy in respect to the public, as one of the most important of recent developments, and it may be well to give it some consideration.

The officers and directors of a street railway company are quasi-public officers with most important and serious duties devolving upon them. Their duty to their stockholders is to see that the company is economically and efficiently administered so as to produce a fair return upon the capital invested. Their duty towards the public is to see that the best possible transportation facilities are afforded, having in view "the greatest good of the greatest number." This broad statement of their public duty is unquestionably true, and yet the failure to appreciate this axiom is the most fertile source of adverse criticism of railway management. The critic almost invariably argues from a personal standpoint. If he would only remember that the road is run for the benefit of the masses and not for his personal individual benefit, the lives of general managers would be made less burdensome.

The last census has clearly shown a strongly-marked tendency of our population to gravitate towards the large cities. In every state the percentage of growth in cities is far greater than in towns and villages. Such condensation of population means an increase of the tenement house system in contradistinction to the cottage system, a crowding of people beneath each roof, an increase in vice, immorality, misery, crime and the death rate. How is it to be avoided? The laborer must live near his work, near in time and near in money. He can spare but a fraction of his time, but a fraction of his day's wages in going to and from his work. If the zone fare system exists as in Europe, the area within which he can live is limited to this consideration. Two cents per mile might restrict him to a radius of 2½ miles (5 cents). If the single-fare system prevails as in this country, time is practically the only restriction. Let us assume that he can allow thirty minutes morning and evening for his car ride, paying five cents for each ride. At the rate of six miles per hour, fast for horses, he has a radius of three miles and an area of 28¼ square miles within which to select a home. At the rate of nine miles per hour, slow for electricity, he has a radius of four and a half miles and an area of 63½ square miles within which to select a home. This example suffices to illustrate the point. An increase of only three miles per hour in rapidity of transit doubles the available residence area without increasing the time or expense of the laborer in going to and from his work.

The steam road, the elevated road, the underground road and the cable, each and all afford rapid transit; but their application is restricted within very narrow limits because of their great cost, while the electric roads can be profitably extended in all directions.

The great advantage of increasing the available residence area, of encouraging the cottage system and discouraging the tenement system, will be readily conceded by all. The health and morality of a great city are universally proportional to the number of people beneath each roof. The electric railway is one of the great moral agents of the nineteenth century.

The experience of the past three years has settled many disputed questions, resolved many doubts, systematized methods and improved construction.

A variety of styles, systems and methods were used prior to 1888. We had storage batteries, conduits and overhead wires; single trolley and double trolley wires, over-running trolleys and under-running trolleys.

Storage batteries have made little progress. They have nowhere scored a pronounced success and have been abandoned on nearly every road. They are but little considered in the field of electric traction, except in reference to future possibilities.

The very few conduits built have disappeared

*Paper read by Capt. Eugene Griffin at the Convention of the National Electric Light Association, Montreal, Que., Sept. 9, 1891.

and have been replaced with overhead wires. The overhead wire is now generally recognized as the only practicable method of conveying electricity from the generator to the car motor.

The objections to overhead wires have been, and in many places still are, very strong; but actual experience has shown that the objections are not well founded. Wires are not an ornament to the street, and objections on this ground will always exist; but lamp-posts, signs, railway tracks, and many other similarly useful objects are not ornaments. Overhead wires will never be condemned on this ground alone. Objections on the score of unsightliness become of less and less importance each year as the methods of construction are improved and the public appreciate more freely the benefits of electric motive power.

One of the early apprehensions in reference to the use of overhead wires was the possible danger to life from the current used. On this point I think the public are now well satisfied. While there are few employés on any of the roads now in operation who have not had the full shock of 500 volts repeatedly, there is not a single instance of any of the patrons of these roads who have been killed or even seriously injured by the 500 volt current from the overhead wire. Electric cars will run over and kill the careless pedestrian or the drunken passenger who falls from the platform in front of the wheels as will the horse car, but no passenger or pedestrian has ever been killed by the trolley wire, and statistics do not show that the electric car is in any respect more dangerous to life than the horse car or cable car. Last year (1890) the West End street railway system of Boston carried 114,853,081 passengers and all the steam railroads of the whole state of Massachusetts only carried 98,843,712. The West End system killed 15 passengers and employés and the steam roads killed 325. Of the 15 fatal accidents on the West End system, 5 were attributable to electric cars and 10 to horse cars. It is only fair to say that the narrow and crooked streets of Boston and the enormous traffic of the West End system are conditions peculiarly conducive to accidents.

The fear of the electric current is one born of ignorance and time alone can overcome it.

In the year 1889, nine human beings were killed by the arc light wires in New York City (2,500 volts) and the authorities were roused to such a pitch of frenzy that the poles were chopped down and a large part of the city left in darkness. Yet with perhaps one exception all of the victims were employés of the lighting companies and suffered because of failure to observe proper and well-known precautions. In the same year, twelve persons were asphyxiated by gas and over thirty were killed by signs and other objects falling on their heads as they walked peacefully along the streets.

In time we are able to estimate every danger relatively, but in the beginning unknown dangers, those to which we are not accustomed, are greatly exaggerated,

Ralph W. Pope, in a very interesting paper read before the Franklin Institute last year gives some curious illustrations of this tendency to magnify unknown dangers and arrest the progress of improvement. I quote:

"In an article, entitled 'How our Ancestors Traveled,' we find the following pertinent observations on the subject:

"Carriages met with great opposition at their first introduction, and laws were made to suppress their use. As early as the year 1294, Philip the Fair, of France, issued an ordinance for suppressing luxury, in which the wives of citizens were forbidden the use of carriages. Beckmann tells us that there is preserved in the archives of the County of Mark, an edict in which the feudal nobility and vassals are prohibited from using coaches under pain of incurring the punishment of felony. Duke John, of Brunswick, published an order in 1588, roundly rating his vassals for neglect of horsemanship, and forbidding them to appear or travel in coaches. A few years after this, the English Parliament took up the discussion of the subject, but on the 7th of November, 1601, the bill to restrain the excessive use of coaches within the realm of England was rejected. But the bitterness of antagonism to them did not cease with this legislative decision. In a pamphlet called the 'Great Concern of England Explained,' published 1673 the writer very gravely attempts to make out that the introduction of coaches was ruining the trade of the realm. Following is an example of his method of reasoning: 'Before coaches were set up, travelers rode on horseback, and men had boots, spurs, saddles bridles, saddle-cloths and good riding suits, coats and cloaks, stockings and hats, whereby the wood and leather of the kingdom were consumed. Besides, most gentlemen, when they traveled on horseback, used to ride with swords, belts, pistols, holsters, portmanteaus and hat cases, for which in these coaches they have little or no occasion. For when they rode on horseback, they rode in one suit and carried another to wear when they came to their journey's end; but in coaches they ride in a silk suit, silk stockings, beaver hats, etc., and carry no other with them. This is because they escape the wet and dirt, which upon horseback they cannot avoid; whereas in two or three journeys on horseback these clothes and hats were wont to be spoiled; which done they were forced to have new very often, and that increased the consumption of manufacture.' In another part of his pamphlet, the same writer puts the following query, evidently with the notion that it was a clencher: 'Is it for a man's health or business to be laid fast in four ways; to ride all day with strangers, often times sick, diseased, ancient persons, or young children crying; all whose humors he is obliged to put up with, and crippled with their boxes and bundles!' As an additional objection against the introduction of coaches, the writer urges that they would discourage the breeding and lessen the value of horses.

"The following passage occurs in a protest against the construction of railways, which is preserved in the archives of the Nurnberg Railway, at Furth, which was the first line constructed in Germany. It was drawn up by the Royal College of Bavarian Doctors:

"Travel in carriages drawn by a locomotive ought to be forbidden in the interest of public health. The rapid movement cannot fail to produce among the passengers the mental affection known as Delirium Furiotum. Even if travelers are willing to incur this risk, the Government should at least protect the public. A single glance at a locomotive passing rapidly is sufficient to cause the same cerebral derangement, consequently it is absolutely necessary to build a fence ten feet in height on each side of the railway."

These were all European, however, so in order to assure you that these peculiar views were held in our country, the following protest from the good citizens of Philadelphia, in 1833, against the introduction of gas, will be of interest to you:

"PHILADELPHIA, November 28, 1833.

"REMONSTRANCE AGAINST LIGHTING WITH GAS.

"To the Honorable, the Select and Common Council of the City of Philadelphia:

"GENTLEMEN:—

"The subscribers beg leave to respectfully remonstrate against the plan now in action for *lighting the city with gas*, as they consider it a most offensive, inexpedient and dangerous mode of lighting. In saying this they are fully sustained by the accounts of explosions, loss of life and destruction of property where this mode of lighting has been adopted.

"We consider gas to be as combustible as gunpowder and nearly as fatal in its acts; as regards the immense destruction of property, we believe that the vast number of fires in New York and other cities may be in a great measure ascribed to this mode of lighting. The leakage of pipes and carelessness of stopping off the gas, furnish almost daily instances of its destructive effects. And when we consider that this *powerful and destructi e agent* must necessarily be left often to the care of youth and domestics and careless people, we only wonder that the consequences are not more *appalling*. It is also an uncertain light, sometimes suddenly disappearing and leaving streets and houses in total darkness.

"The waters of the Delaware and Schuykill, now considered the most pure and salubrious in the world, as many long voyages have fully tested, must soon, we fear, experience the deterioration which has reduced the water of the Thames to the present impure state, for no reservoir will be able to contain such fetid drains from such an establishment, and very soon the rivers must be their receptacle, to the destruction of the immense shoals of shad, herring and other fish, with which they abound; the same cause must produce the same effect. Salmon, smelts, and other fish formerly caught in vast quantities in the Thames have nearly all disappeared. The constant digging up of the streets, the circumstances of the gas pipes, which, at the intersection of each square must come in contact with the water pipes, are difficulties and evils which we would anxiously avoid.

"In conclusion, we earnestly solicit that the *lighting of our city with oil may be continued*.

"And your petitioners, etc.

"Signed by 1,200 of the leading citizens of Philadelphia, whose names are attached hereto, such as Horace Binney, Hartman Kuhn, Jacob Ridgway, Paul Beck, Henry Pratt, Benjamin Chew (on whose farm the battle of Germantown was fought), John Sargeant, Charles Wharton, Richard Willing, Edward Pennington, Robert Baux, Joshua Longstreath, Matthew Newkirk, and 1,200 others.

"N. B.—The above are only part of the names, as many of the remonstrances have not yet come in."

The double and single trolley systems have each had ardent advocates, but three years experience has decided the question in favor of the single trolley and the ground return.

In July, 1888, several roads were using the over-running trolley and it was a question whether the over-running or under-running system was preferable. Three years have decided this question also, and practically all of the electric roads of to-day operate with under-running trolleys. The "fish pole" of 1888 has been supplanted by the neat steel rod of 1891, and the "broomstick train" can no longer be spoken of with disrespect as regards outward appearances.

Three years have not passed without much litigation and already we have historical cases finally determined, which tend to fix the legal boundaries of the rights of electric railways. Some of these decisions are of great importance.

The telephone companies have quite naturally been ardent advocates of the double trolley, and to avoid suffering from the induced currents of the single trolley, they have sought to induce the courts to compel railway companies to use metallic circuits. A recent decision of the Supreme Court of the State of Ohio, is a fair statement of the present legal aspect of this question.

Single Trolley System vs. *Double Trolley.*

(Supreme Court of Ohio.)

SYLLABUS.

1. The dominant purpose for which streets in a municipality are dedicated and opened, is to facilitate public travel and transportation, and in that view, new and improved modes of conveyance by street railways are by law authorized to be constructed, and a franchise granted to a telephone company of constructing and operating its lines along and upon such streets, is subordinate to the right of the public in the streets for the purpose of travel and transportation.

2. The fact that a telephone company acquired and entered upon the exercise of a franchise to erect and maintain its telephone poles and wires upon the streets of a city, prior to the operation of an electric railway thereon, will not give the telephone company, in the use of the streets, a right paramount to the easement of the public, to adopt and use the best and most improved mode of travel thereon; and if the operation of the street railway by electricity as the motive power, tends to disturb the working of the telephone system, the remedy of the telephone company will be to readjust its methods to meet the condition created by the introduction of *electro motive* power upon the street railway.

3. Where a telephone company, under authority, derived from statute, places its poles and wires in the streets of a municipality, and in order to make a complete electric circuit for the transmission of telephonic messages, uses the earth, or what is known as the "ground circuit," for a return current of electricity; and where an electric street railway afterwards constructed upon the same streets, is operated with the "Single Trolley Overhead System," so called, of which the ground circuit is a constituent part, if the use of the ground circuit in the operation of the street railway interferes with telephone communication, the telephone company, as against the street railway, will not have a vested interest and exclusive right in and to the use of the ground circuit, as a part of the telephone system.

The telephone companies have been beaten in every case, and the fact has been definitely settled that railway companies may use a single overhead trolley wire and a ground return without infringing any rights of the telephone companies.

Many interesting legal questions have arisen in reference to line construction.

Objection was made by the summer residents of Newport to the construction of an overhead electric railway, and eminent counsel was employed to place every possible legal obstacle in the way. The case was carried to the Supreme Court of the State of Rhode Island for determination of some of

the novel points involved, and one of these points was:

Are Poles and Wires an Additional Servitude upon the Streets?

The Court held:

"The fourth ground alleged is that, if the act of incorporation authorizes the use of electricity for the operation of said street railway, and the erection of the poles as ancillary thereto, it is unconstitutional and void, because it authorizes the imposition of additional servitude upon the streets without providing for any additional compensation to the owners of the fee of said streets. We think it is settled by the greater weight of decision that a railroad constructed in a street or highway and operated by steam in the usual manner, imposes a new servitude and entitles the owner of the fee to an additional compensation; but that a street railway operated by horse-power, as such street railways are ordinarily operated, does not impose any new servitude, and does not entitle the owner of the fee to any additional compensation.

"The distinction is not often stated as a distinction between steam and horse railroads; but the distinction properly rests, not on any difference in motive power, but on the different effects produced by them respectively on the highways or streets which they occupy. A steam railway is held to impose a new servitude, not because it is operated by steam, but because it is so operated as to be incompatible with the use of the street in the other usual modes, or, in other words, so as practically to exclude the usual modes of use.

"A steam railroad on a street, so operated as to be consistent with the use of the street in the usual modes, has been held not to impose a new servitude.

"It is not the motor but the kind of occupation, whether practically exclusive or not, which is the criterion.

"The only considerable privilege which the horse car has over other vehicles, is that, being confined to its tracks, it cannot turn aside for other vehicles, while they are forced to turn aside for it; but this is an incidental matter, insufficient to make the horse railroad a new servitude.

"The street railway here complained of is operated neither by steam nor horse power, but by electricity. It does not appear, however, that it occupies the streets or highways any more exclusively than if it were operated by horse power.

"Reference has been made to cases which hold that telegraph or telephone poles and wires erected on streets or highways constitute an additional servitude, entitling the owners of the fee to additional compensation; and from these cases it is argued that the railway here complained of is an additional servitude, by reason of the poles and wires which communicate its motive power. There are cases which hold as stated, and there are cases which hold otherwise, but, assuming that telegraph and telephone poles and wires do create a new servitude, we do not think it follows that the poles and wires erected and used for the service of said street railway likewise create a new servitude. Telegraph and telephone poles and wires are not used to facilitate the use of the streets where they are erected for travel and ransportation, or, if so, very indirectly so; whereas the poles and wires here in question are directly ancillary to the uses of the street as such, in that they communicate the power by which the street cars are propelled."

In the purely technical field all obstacles have been overcome. Like Perry, "We have met the enemy and they are ours." The severe strain imposed by railway work on the generating plant has necessitated the development of new types of engines and the fluctuations of the dynamos have been prevented by compound winding and series coils. Self-regulating dynamos are now considered necessary in any well-planned power plant.

I attended the exposition at Bremen, North Germany, last summer, and had the pleasure of riding on an electric railway operated by two 80 H. P. Thomson-Houston dynamos. One dynamo was driven by a 70 H. P. Armington & Sims engine, and one by a 125 H. P. German engine. So closely did the small American engine regulate that no variation in potential could be observed under the most violent and sudden variations in load. Notwithstanding its greater power, the German engine was slow to respond and the variations in speed were marked. I was subsequently informed that a medal was awarded to the American engine, although it had not been entered as an exhibit.

This is indicative of the enterprising way in which the inventors and manufacturers of the United States have met the new conditions imposed by the adoption of electricity as a motive power.

The difficulties Mr. Sprague encountered in Richmond in using copper brushes have now been avoided by the introduction of the carbon brush, for which we are indebted to Mr. C. J. Van Depoele.

As early as 1883–4 Van Depoele used carbon brushes with his motors. When the Van Depoele Electric Manufacturing Company was purchased by the Thomson-Houston Company in 1888, Van Depoele went to the Lynn factory of the latter company. Many did not then consider the carbon brush as practicable, and it was some time before Mr. Van Depoele had an opportunity to demonstrate its possibilities. When the time did come its great value was so apparent that it was at once adopted for motor work and subsequently has been used exclusively with generators.

Since the general adoption of the present method of mounting the motors directly on the axles, double reduction motors have been used. The supposed necessity of high speed of revolution in the armature made this obligatory. In 1890 it was found practicable to make motors in which the armature revolved at a slower rate and a single gear sufficed for the now greatly reduced reduction. From 10 and 12 to 1 with the old motor we come to 4½ to 1 with the new motor. The gears are enclosed in boxes and run in oil so that the noise has been reduced to a minimum, the offensive noise of the gears being practically eliminated. We have also gearless motors with no reduction and no gears.

Generator construction has kept pace with the improvements.

As large stations have been built generators have increased in size, and electrical companies are now producing 500 H.P. dynamos as readily as the steam engine builders respond to similar demands.

We have learned what it costs to operate electric railways and the result is gratifying. In 1885 it was prophesied that while electric roads might make good showings so long as the apparatus was new and curiosity riding lasted, in a short time the machinery would begin to wear out and the roads would be swamped by the great repair bills. In reality we find the almost universal testimony is that the longer the road runs, the less is the cost of repairs. This is, of course, not due to the fact the apparatus improves in quality with age, but the explanation is to be found in the very simple fact that as small defects are eliminated and the employés become more experienced and the organization is perfected, the apparatus is better cared for and injuries are prevented.

A very conspicuous example of this is the West End Street Railway, which has been under my own immediate observation.

In the contract between the Thomson-Houston Electric Company and the Railway Company it was provided that we should keep the overhead line and electrical apparatus on the cars in repair at a given price per car mile. There were many reasons which influenced us to enter such a contract, but the chief reason was that this was the uncertain element in the operation of an electrical railway, and unless this uncertainty could be eliminated, the West End would not make any contract. The cost of these repairs has steadily decreased, and on the 1st of October the West End Company avail themselves of their option and relieve us of this part of our contract, knowing there is now no uncertainty, and that they can do the work themselves for less money than they pay us.

Some months since President Whitney gave to the public the detailed figures showing the receipts and operating expenses of the West End road. These are of very great interest to all, and I give them in full for the purpose of drawing some conclusions from them:

THE ELECTRIC SYSTEM.

	April.	May.	June.	July.
Gross receipts	$134,...	$144,...	$...	$144,...
General expenses	...	...	...	...
Track and car exp.	...	...	...	...
Motive power	47,447	49,444	...	4...
Total op. exp.	...	...	...	...
Net earnings	...	...	...	...
Miles run	...	...	...	...
Ratio of Mileage	...	...	...	...
Per cent op. exp.	...	...	...	...
Earnings per mile run	...	...	...	...
Expenses per mile run:				
Motive power	...	...	...	...
Car repairs	...	...	...	...
Damages	...	...	...	...
Conductors and drivers	...	...	...	...
Other expenses	...	...	...	...
Total exp. per mile run	...	...	...	...
Net earned per mile run	...	...	...	...

HORSE CAR SYSTEM.

	April.	May.	June.	July.
Gross receipts	$...	$...	$...	$...
General expenses	...	...	...	...
Track and car expenses	...	...	...	...
Motive power	...	...	...	...
Total op. exp.	...	...	...	...
Net earnings	...	...	...	...
Miles run	...	...	...	...
Ratio of Mileage	...	...	...	...
Per cent op. exp.	...	...	...	...
Earnings per mile run	...	...	...	...
Expenses per mile run:				
Motive power	...	...	...	...
Car repairs	...	...	...	...
Damages	...	...	...	...
Conductors and drivers	...	...	...	...
Other expenses	...	...	...	...
Total exp. per mile run	...	...	...	...
Net earned per mile run	...	...	...	...

THE ENTIRE SYSTEM.

	April.	May.	June.	July.
Gross receipts	$...	$...	$...	$...
General expenses	...	...	...	...
Track and car exp.	...	...	...	...
Motive power	...	...	...	...
Total op. exp.	...	...	...	...
Net earnings	...	...	...	...
Miles run	...	...	...	...
Ratio of Mileage	...	...	...	...
Per cent op. exp.	...	...	...	...
Earnings per mile run	...	...	...	...
Expenses per mile run:				
Motive power	...	...	...	...
Car repairs	...	...	...	...
Damages	...	...	...	...
Conductors and drivers	...	...	...	...
Other expenses	...	...	...	...
Total exp. per mile run	...	...	...	...
Net earned per mile run	...	...	...	...

Taking the June figures, it will be noticed that the net earnings per electric car mile exceed the net earnings per horse car mile by 11.07 cents, while the operating expenses of the horse car lines exceed those of the electric car lines by 4.28 cents per car mile. The difference is 5.56 cents per car mile, which is the gain to the company due solely to the public satisfaction with the electric service. Mr. Arthur Jones, of the T.-H. International Co., first produced this figure, which he calls the "satisfaction figure."

The net earnings per electric car mile exceeded the net earnings per horse car mile by the following amounts:

In April 6.68 cents per car mile.
" May 6.47 " " "
" June 11.07 " " "

Mean 7.54 " " "

The net earnings of the horse cars for the three months averaged 9.56 cents per car mile, hence the electric cars showed a gain of 80 per cent. in the net earnings per car mile over the horse cars.

For the three months, we have the following figures for the electric cars:

Total receipts	$432,947
" expenses	243,456
Percentage of expenses to receipts	56 p. c.

In St. Paul and Minneapolis, with a combined population of 350,000, there is to-day not one single horse car. Minneapolis has 120 miles of electric railways, all equipped with the overhead system, and St. Paul has 75 miles of electric railways and 15 miles of cable. Most of the cable mileage is to be abandoned and supplanted by electricity. The last car horse disappeared from the streets of Minneapolis in June of this year. The July report of the Minneapolis system shows:

Gross earnings	$107,571
" expenses	52,585
Net earnings	54,985
Percentage of expenses to receipts	49 p.c.

Cleveland, Buffalo, Rochester, Toledo, Omaha, Cincinnati and many other large cities are now operating their street cars almost exclusively with electric motors, and the universal testimony is favorable to the increased facilities afforded the public and the increased profits to the stockholders.

Not the least important of the developments of the last three years has been the financial development. The fine showings as to earnings, the gradual decrease in operating expenses where increases were expected, the oft-demonstrated ability to run electric cars in all kinds of weather, in ice, snow, sleet, hail or rain has greatly improved the standing of electrical securities. An electric road is no longer an experiment, it is a paying investment and there are not a few instances where the introduction of electricity has been the salvation of a horse road that otherwise would have soon been in the hands of a receiver. The rapidly increasing demand for electrical securities is an evidence of a healthy growth of public sentiment in this direction. To equip electrically means the expenditure of money which must come from an increase of the bond of stock issued. The ability of the public to rapidly absorb these new bonds of stocks must be the ultimate limit of the ability of the railway companies to move in this direction.

In August the West End Street Railway Company put out four millions of common stock for additional electrical equipment under a plan of subscription which provided for two deferred payments. When the subscription books were closed on the 5th of

August, 33,000 shares had been paid in and only a paltry 245 shares had taken advantage of the option for deferred payments. I know of no more striking object lesson than this, except, perhaps, the rapid rise of the West End common stock from 63 to 77, which immediately followed.

Electric securities have heretofore been offered at tempting figures, but the day for this is passing. The public are realizing that a good street railway security is better than a Western railroad bond or stock, and the electric roads are better than the horse roads. Electric railways will pay where no one would dream of building a horse road, and when the public taste is whetted for electrical securities, we shall see a marvellous increase in the number of roads and the equipment of existing roads that will mean transportation facilities for thousands who are now unprovided, and many years' work for our electrical factories.

ELECTRIC RAILROAD CONSTRUCTION AND OPERATION AND A CONSIDERATION OF THEIR CONNECTION WITH CENTRAL STATION INTERESTS.*

INTRODUCTION.

The advantages of the electric railway have passed beyond the age of experiment or question. They are proved by their development in the past four years, and any argument as to their advantage in the general development of street railway practice or suburban rapid transit is antedated. It took several years to convince old staid financiers and directors of the larger street railway properties that it was to their financial advantage to throw in the scrap heap several million dollars, more or less, in equipment and spend that amount in addition and still make it pay; but they have seen this advantage in the development and increase of traffic and returns to their company. These returns have been brought about principally by the development of rapid transit, in the introduction of electricity and the flexibility of the system in adapting itself to all and any conditions of commercial practice.

In looking over the past four years of practice in electric railway work we have much to commend and considerable to condemn. Thd boldness of the achievements, the problems that have been solved, the rapidity of development and the perfection of the apparatus, seem almost beyond comprehension. That this apparatus in less than four years should reach the high state of perfection, economy and efficiency that it has, as compared to the long years of development of other mechanical appliances, is remarkable. The natural consequence of this large amount of work and development in this short time is that there has been much work done that had better been left undone; in the way of poor engineering, cheap work, and not a proper appreciation of the problem to be solved These, in some few instances, have retarded the development and progress of electric railway work in their vicinity, but street railway companies have now come to a proper appreciation of the necessity of good work well done, and that the wisest and best method is to consider carefully what will bring the best return for the money invested—not necessarily on the blind basis of the highest cost being the cheapest, for money can be wasted in this way as well as others. We have examples now in several directions of large equipments being installed on a sound engineering basis and with careful consideration of the best interests of the electrical interests, street railway owners and public combined, and we can safely add that there is no problem in this line which cannot to-day be taken up with a full assurance of practical solution and successful development in electric traction.

The future outlook of electricity in the development of rapid transit, inter-suburban, and even express service, is assured. We are coming now to the solving of the larger problems in this work and bringing the public to a proper appreciation of the resources and possible achievements in this line and its superiority over the old fogy systems of the past. We even see a considerable number of our friends from cable engineering lines of street railroad work coming over into the electrical fold, fully appreciating that the cable system has a very limited field for successful development and that electric traction is very broad gauge in the field of engineering work. Therefore, with this outlook, better construction work, better engineering, better mechanics, the solving of these larger problems are assured, and we see even to-day, in a number of cases, electric suburban traffic supplanting steam on a cheaper, better and more successful basis. The favorable report of the New York Rapid Transit Commissioners has done much to add to public confidence in this direction. Electric manufacturing companies are assisting the development of the work by making their apparatus more substantial, better in construction and more satisfactory in its mechanical design and operation. The reduction in the speed of the motors, the development of single reduction and even of direct connected motors, is doing much to add to the confidence in this line.

We hear asked sometimes by laymen the question: "What speed can electricity obtain in railway work?" The able consideration of this subject in several papers, and practical experiments as well, enables us to reply very briefly but confidently to this inquiry, that speed and power in electric railway traction are only limited by roadbed construction; in other words, any speed is obtainable within the range of possibility with the maintenance of proper track. We do not intend, however, to generally review electric railway work, but more particularly to give some details of the practical problems in their construction and operation, and, therefore, we will leave the consideration of other parts of the subject to papers which will, no doubt, treat it more fully.

*Paper read by C. J. Field, of the Field Engineering Company, New York, at the Convention of the National Electric Light Association, Montreal, September 16, 1891.

STEAM PLANT.

The consideration of the best development in the power generation of electric railway work has been one that has received considerable attention in past years from the best engineers in this line. We reach here a part of the problem which requires much more careful consideration than has been given steam power in electric lighting generally in the past. The work to be successfully done by the steam engine in the generation of electricity for the operation of railroads is the severest kind, and can be compared only to that of the engine operating rolling mill trains. It is owing to not fully appreciating this fact that we hear in some parts of the country of failures of steam plant on this kind of work, Electrical manufacturers are assisting the solution of this problem by the building of larger generators in units of 200 to 400 or 500 horse-power. What we want in the generating station for electricity is the smallest division of units consistent with the safe and economical operation of the station. Following the problem out on this line, we can build a successful station; and we would add to this that each unit should be entirely independent and separate from all other units, thereby increasing the reliability. This cannot be obtained in a safe and economical way by the use of our old friend, the countershaft. Undoubtedly, the countershaft has been of much use in electric lighting service, and particularly in arc lighting, but in railway work, with large generators, we can see no excuse at the present time for its use. Generators should be belted direct to the engines, whether Corliss or high speed, or else coupled direct to the engine shaft. With a Corliss engine of 500 horse-power, operating at 80 or 90 turns, with a fly-wheel 18 to 20 feet in diameter, we can belt with belt centres of, say, 40 feet, 2 inches, generators of several different commercial types; this gives us advantages which we have heretofore had only in high speed engines with direct connection. The engines should, in any event, as heretofore stated, be extra heavily built for the work to be done, with ample fly-wheel capacity. On engines of this size and speed a fly-wheel capacity of approximately 60,000 lbs. is about right. On engines operating about 150 turns, say 30,000 to 40,000 lbs.

While laying particular stress on the rapid and sudden changes of load, we do not know how to illustrate it more forcibly than in Figs. 1 and 2. Fig. 1 will show a practical case of changes in the indicator diagram within one minute, placed on the cylinder of an engine running on railway work, which shows a variation within that time of from full load to no load and back again several times, Fig. 2 illustrates a load diagram from an ordinary case which has not been particularly selected for its maximum and severe conditions. These impress on the mind more forcibly than words can the requirements of this work. High speed engines in the development of railway work have received in some cases a set-back, owing to the engine manufacturers not appreciating fully the conditions and necessity of the work undertaken. So-called high speed or automatic engines can be as successfully operated on this class of work as any other, if they are specially built for it. This means larger parts, bearings of more ample size and length and ample fly-wheel capacity. On a cross-compound engine of, say 300 horse-power, there should be about six to eight tons in the fly-wheels, the bearings seven or eight inches in diameter and 15 or 18 inches in length. (Such a type of engine is being furnished by the manufacturers of the Ball Engine.) In the case of engines built in this manner, there can be no fault found with their operation. A type of engine, which we believe is going to be largely used on this class of work, as well as lighting work, is one that will come in between the high speed engine and the Corliss and which will combine many of the advantages of both. Such an engine has been sought for by many engineers and has been attempted by a number of builders. To-day, however, we cannot find it on the commercial market. This engine, in units of 500 horse-power, would run at a rotative speed of about 140 or 150 revolutions and with a piston speed of about 650 to 700.

The question which has troubled most engine men in regard to the high speed engine with a single valve covering this kind of practice, has been a question of valves and clearances. Beyond any question, when it comes to this size, we have got to come to the Corliss practice of double valve, thereby reducing the clearances and bringing it down to the extent of the Corliss practice. The writer's company is having built, for the electric railroad at Buffalo, two engines of this class, by the Lake Erie Engineering Works, which we believe do much to develop this line of work, and also, will be particularly adapted for coupling direct to the engine shaft. In Figs. 3 and 4 one of these engines is shown coupled to the generator. The trouble in this line has been to get electric manufacturing companies to take up the building of large multipolar general tors adapted for direct coupling at a speed of from 100 to 200 revolutions. This problem was developed on a much smaller scale in this country, for marine plants, several years ago. We find that in Europe, where their work has been more special, that they have successfully developed this type of engine and generator, and beyond any question, it is going to be both for lighting work and for railway work the type of unit for central station practice in the future. It means, where the vertical engine is used, the installation of the steam and electric plant in the space formerly used for engines alone. This means reduction in the cost of building, operation and maintenance.

In concluding this part of our subject on steam generation, we trust that our experience in the past in lighting will show us the fallacy of poor steam engineering, and that we will build our stations for the future, and not have the problems before us that nine-tenths of the electric lighting stations have to-day, which mean, that in order to get down to commercial economy and competition, they have got to rebuild their whole outfit. We will merely append to the consideration of the steam plant part of our problem a few interesting figures and data which the writer collected for presenting to street railway companies, in order to give them some useful information in this respect. We believe that they may be well introduced here. The figures given on the tables, etc., are not ones that the manufacturer of an engine would tell you were those of the best economy for his engine or plant, but they are figures which will be appreciated by station owners and railway companies as those which are obtained in every-day commercial tests.

The relative commercial economy of engines and cost are as follows:

TYPE.	Lbs. or Cost per H.P. per H. P. Hour.	Cost per H.P. per Hour.
High speed single	4 to 5	$.11 to $.14
" " compound	3 to 3½	.14 to .16
" " " cond	2¾ to 3½	.14 to .18
" " " triple	1¾ to 2	.12 to .22
Corliss single	2½ to 4	.16 to .18
" compound Condensing	1¾ to 2	.22 to .25
Corliss triple	1½ to 1¾	.27 to .30

This is based on an evaporation of 1 lbs. of water per lb. of coal.

There are four classes of boilers:

1. Horizontal return tubular, which is the most general in use, and costs $9 to $10 per horse-power.

2. Vertical tubular (Corliss or Manning) which is a vertical tubular boiler with water leg, largely used throughout New England. Cost $10 to $12 per horse-power.

3. Sectional or water tube boiler, of which Babcock & Wilcox is the best known, especially adapted for higher pressures and safety. Cost $17 to $19 per horse-power.

4. Scotch type of marine boiler—one that has not been used to any extent as yet in station work—but we believe it will be as an offset to the sectional type, and fulfilling the requirements for higher pressure and economy of space.

Capacity of engine requisite for different generators:

GENERATOR.	ENGINE.						
		HIGH SPEED.			CORLISS.		
WATTS.	Horse Power	Size.	Speed.	Wt. of Fly-Wheels.	Size.	Speed	Wt. of Fly-wheels.
50,000	75	12 x 12	280	7,000 lbs.			
80,000	125	15 x 16	225	9,000 "			
150,000	225	18½ x 18	200	15,000 "	20 x 36	150	25,000 lbs
2,150,000	450				24 x 42	80	35,000 "

Steam pressure, 100 lbs.

The cost of steam plant complete is about $50 to $60 per horse-power for high speed, and $65 to $75 per horse-power for Corliss.

ELECTRIC PLANT.

The question of the best electrical generating plant for railway work is one which is allied closely to that of steam plant, particularly in relation of the generators to that of the engines. In some respects, in treating of the steam plant we have intimated what our idea was in connection with the generators. All large generators of from 200 to 500 horse-power connected as directly as possible, either by direct belting or shaft coupling, with the engines operating the same. It is only by this development that the safest and best solution of electric railway station practice—in fact, station practice in general—can be reached. Manufacturers of railway generators have had an experience extending back many years; that experience in the development of direct current incandescent machinery, although not of quite the same voltage, has led the way up to the safe, economical and commercial development of railway generators, and we find the railway generator of to-day one of the most perfect and reliable factors in the electric railway system. The only problem remaining to be solved in this connection is to build them in larger types and have slower speed for direct shaft coupling. Generators on this work are subjected to the severest and most excessive strain, particularly where of small type, but the building of them in larger units is going to remove to a great extent the question of the overloading of the machine. Railway machines are often subjected to an overload of from 25 to 50 per cent. In general these are only momentary, and we find most of them able to stand up to the work to be done.

The question which puzzles many of the railway companies as well as the electric companies is what amount of generating capacity is necessary for the operation of a given number of cars. This question, of course, has got to be carefully considered in connection with each case, but there can in a general way be laid down an approximate basis for this work. Some railway companies, in order to show a higher economy than their competitors, are unwisely claiming the requirement of a smaller amount of power than others; but the wisest manufacturer is the one who urges his client to install a larger amount of power than is barely required for the successful operation of the road under any and all conditions. For if any one thing will lead the public to condemn the electric railway traction it is a lack of power, thereby causing the cars to move slowly, and in case of any accident disabling part of the power. A fair basis on general conditions for 16 to 18-foot car bodies is 20 to 25 horse-power per car, which, with a properly designed and constructed plant, will give the desired power. The cost of generating this power for railway work for 16 and 18-foot cars is three to five cents per car mile for all expenses of the generating station. In some roads we find that cars of a larger size than these do not necessarily take a proportionately larger amount of power. We find from practical experience that a car 32 or 33 feet long, double the size of the 16-foot car, takes, under general conditions, about 50 per cent. more power, and we find by the same experience that a trail car adds about 50 per cent. to the amount of work to be done on the motor car for the same size. As to the minimum and maximum amount of power taken on an electric car, we find that a general average for a 16-foot car, under ordinary commercial conditions, without excessive grades, is one horse-power per car mile per hour; or, a car operating at an aveaage 10 miles per hour means an average of 10 horse-power per car. This same car will give, however, on a load diagram, taking all its conditions, from maximum to minimum, a variation of from nothing to 50, 60 or even 80 horse-power. This gives us an idea of the severe strains and conditions to which an electric motor is subjected.

ELECTRIC CARS AND THEIR EQUIPMENT.

One of the questions on which we find more variety of opinion than any other is what is the best size, type and style of car for given case and conditions. The old standard 16-foot car body we find is now being widely departed from, and the problem is, How large a car can we get on a single truck with four wheels without excessive destructive effect on the roadbed? and, What is the largest car we can operate on street car service economically on an eight wheel base? We believe the limit is reached with a

single truck in a 20-foot car body; we know that the truck manufacturers claim in some cases to operate a longer body but we do not believe it wise. An 18 or 20-foot car running under close headway we believe to fulfill best the conditions of city traffic in the larger cities. Sueh a car, with a wheel base of seven feet, and in some cases seven feet six inches, where curves are not too sharp, will give satisfaction, and not be too severe on the road-bed where the same is properly constructed. As to the difference in effect on the road-bed between the electric car and the horse car, it is briefly that the horse car is pulled by horses, from which it receives a balancing power and a steady pull, whereas an electric car is operating itself by a power moving the wheels against the track, having no steadying or balancing power from the pull of the horses, and transmitting all its power and moving itself through the wheels. We find, therefore, that it subjects the track to a very severe pounding, necessitating a much better construction of road-bed, practically equaling that of a steam railroad.

Some companies have favored the use of a vestibule on street cars. We believe, though, that any vestibule is a failure and a misnomer. It accomplishes no good and causes much trouble; a shield over the dashboard for the motor man in winter weather would give all that would be required. What is wanted on a street car is that which will allow the freest ingress and egress from the car for the passengers, and anything that retards this—and a vestibule most certainly does—is a detriment and an obstacle to rapid transit. On some roads we have tried the introduction of even larger cars, say, 28-foot body, or 36 feet over all. Such a car, of course, has to be put on a double truck. These cars have found favor with some companies when first considering the problem; the difficulty with them is in getting the passengers in and out of the cars as quickly as possible, and making too many stops, due to the larger number of passengers carried. For inter-suburban heavy traffic, with few stops, we believe such a car would fulfill the requirements, but only in such a case.

Thus, having gone over the question of the cars, we come to the consideration of the electric equipment for the same. To-day we find the double reduction motor discarded, as far as any new equipments are concerned. All the large electric manufacturing companies are placing single reduction motors on the market, and they are in successful commercial operation, One company is placing on the field a motor directly connected to the shaft and without any gearing—in other words, there is no reduction in speed, the speed of the armature being the same as that of the wheels—the same is accomplished by a very ingenious arrangement. We have heard asked in the past the question, Why was it necessary to place 30 horse-power to operate an electric car to do the work that two horses had done formerly? The answer is: The two horses did not do the work in a proper manner and give rapid transit. The life of a street car horse is very short, and we find under general conditions that 30 horse-power with two 15 horse-power motors has been found about right; in fact, we even find the companies tending towards a larger installation of power, particularly when using larger than a 16-foot car body, and we find to-day, being installed for rapid transit in inter-suburban work, 40 and 50 horse-power electric equipments per car, many of them operating at a speed of 30, and even 40 miles per hour. As the amount of power is directly proportionate to the speed, we can readily see the requirement for such an amount of power. The cost of a single car equipped, including the car body, truck and motors, is from $3,000 to $3,500, and the cost of the electric part of the power generating plant is from $35 to $45 per horse-power.

LINE CONSTRUCTION.

We find the past about as great a development in overhead and line construction for electric work as in any other part of the subject. While formerly this was one of the greatest sources of unreliability in the operation of the plant, to-day it has reached a very practical development. Formerly the trolley wires were too light, the feed wires were insufficient to furnish power, and the line was giving trouble, grounding and breaking continually. In the insulation of a single trolley system, with one side of the system grounded, we have the most severe requirements that it is possible to obtain in any electric insulation, in that any grounding on the other side of the system means trouble in the operation of the road. This has led to the introduction of double and even triple insulation into our line material to properly protect the trolley wire from grounding. Where streets are wide enough to spread the tracks to six feet and six feet six inches within the near rails we see introduced in many places centre iron poles, which makes a considerably stronger style of construction than cross-suspension. There are not many streets, however, where street cars are in operation that are wide enough, or where the city will allow the spreading of the tracks to this distance, and in closer proximity it is not safe to operate with centre poles. On the work installed by the Field Engineering Co., in Buffalo, we find the most extensive system of overhead and underground construction in operation anywhere. Here all the feed wires, with a few exceptions, are placed in underground conduits, thus removing all cause for objection to the unsightliness of a large number of feed wires overhead. These underground feed wires are connected to the overhead wires from junction boxes up the poles. Thus, in Fig. 3 is shown one of the lines on the Buffalo Railway system, which gives an idea of this style of construction, as well as the use of the large cars, which are 36 feet over all.

The cost of overhead construction may be about summarized as follows:

Line construction per mile, complete, including track bonding, plain pole work, cross suspension or bracket with feed wire	$2,000 to $2,500
With sawed and painted poles	2,500 to 3,000
Iron poles, cross suspension, concrete setting, double track, feed and guard wires	6,500 to 7,500
Same with centre poles	4,500 to 5,500

We also append a table which will give a general summary of the cost of electric equipment of street railway systems, omitting the track construction, which, of course, varies with the number of miles to be equipped.

COST OF ELECTRIC EQUIPMENTS FOR STREET RAILROADS.

No. of Cars.	Steam Plant H. P.	Capacity of Generators. K. W.	Steam Plant. †	Station Electrical Equipment.	Car Equipments. Car Trucks and Motors.	Line Construction ½ mile of Double Track per car.	Total Equipment (omitting track.)
6	120	80	$7,000	$6,400	$19,500	$7,500	$40,400
10	225	150	11,000	10,500	32,500	12,500	66,500
15	375	240	17,500	15,000	48,750	30,000	111,250
20	450	300	22,000	17,500	65,000	40,000	144,500
30	675	450	28,000	22,000	97,500	90,000	237,500
50	1,125	750	50,000	33,000	162,500	187,500	433,000
100	2,025	1,350	90,000	60,000	325,000	375,000	850,000

†Add 25 per cent. to these figures for Corliss.

The above figures are approximate only and based on the best City R. R. practice.

TRACK.

The track of street railway companies before the introduction of electricity was more behind the times than any other part of their equipment. The old flat rail is antiquated and antedated, and in a few years its use will be obsolete. The necessities of electric railway traction—in fact, of any traction—have impressed upon the street railway companies in their equipments the requirement of a good road-bed for the successful operation of a road, and we find this part of the problem receiving as much attention as any with companies who appreciate fully the work before them. The general construction to-day is girder rails of from 60 to 80 lbs. per yard, placed on chairs where block paving is in use, with ties 2½ to 3 feet between centres. We find in some cases even 90 and 100 lb. rails used, but we believe in more moderate weight for the rails and the ties placed closer on centres. We believe this has been the general experience in railway work. Such a style of construction costs from $9,000 to $10,000 per mile. In suburban roads, on streets were there is no paving, we find the T rail being used; the road-bed can be properly constructed on this basis with 45 to 50 lb. rail, for $6,000 to $6,500 per mile, the rail being spiked directly to the ties.

In order to make a summary of the data and figures, I will summarize them in a practical example.

AN ILLUSTRATIVE EXAMPLE.

I propose to take, as the best means of illustrating practically, the purchase, equipment and operation of a street railway system with electricity, a city with a population of say 100,000—with a dilapidated street railway system, earning a gross income of $125,000, to purchase same for $500,000—property rights, franchises, etc., and equip it with 40 miles of single track and 65 electric cars.

COST OF EQUIPMENT.

Steam Plant (1,500 horse-power steam plant):		
Five engines, 250 horse-power each, compound condensing, size 16 inches x 32 inches x 42 inches, with wheels weighing 30,000 lbs		$32,500
Eight R. T. boilers, 72 inches x 16 feet		9,600
Jet condensers		3,000
Two boiler feed pumps	$900	
Steam and exhaust piping	12,000	
Five engine foundations	3,500	
Eight boiler settings	3,200	
Five 30-inch belts	2,000	
Erecting and starting	3,500	
Freight and miscellaneous	2,500	
		$72,700
Electrical plant:		
Five generators, 200 kilowatts, 7,500	$37,500	
Switchboard installation, foundations, etc.	4,000	
		41,500
Building:		
Power station including stack, traveling crane, etc	$25,000	
Car house and repair shop, including tools, etc	15,000	
		40,000
Track construction:		
40 miles girder rail construction, ties 2½ ft. centres, 63 lbs. rails, etc., $1.15 per ft.	$244,880	
Relaying, including paving, etc., at 60 cents per foot	126,720	
Trucking, hauling, etc	24,000	
Ties, including 10 per cent. of joint ties, 130,000 at 40 cents	52,000	
Ties, including 10 per cent. of joint ties, 15,000 at 70 cents	10,500	
		456,100
Line construction:		
Ten miles iron poles, etc	$75,000	
Ten miles wooden poles, etc	40,000	
		115,000
Car equipment:		
65 electrical equipments at $2,000	$130,000	
65 car bodies, 18-foot bodies, with open ends.	65,000	
65 trucks at $250	16,250	
		211,250
Summary:		
Steam plant	$72,700	
Electrical plant	41,500	
Building	40,000	
Track	456,100	
Line construction	115,000	
Car equipment	211,250	
	$936,550	
Superintendent's and Engineer's work	$50,000	
General and miscellaneous	50,000	
	100,000	
	$1,035,550	
Original purchase	500,000	
Total cost re-equipped		$1,535,550

Gross income, say, $350,000.

Net income, say 35 per cent., equal to 8 per cent. on cost, on the basis of an investment of about one million and a half of dollars, and from a property which in many instances was hardly earning its fixed charges formerly.

We have here illustrated a practical example of what is being done every day in this country at the present time in the purchase and equipment of street railway systems. In fact, we find a large number of bankers and capitalists giving it their earnest attention as one of the best fields for investment at the present time.

CENTRAL STATION IN CONNECTION WITH ELECTRIC RAILWAY WORK.

We desire to call the attention of central station owners to the profit to be made from the furnishing of power in street railway operation, and also by the combining in smaller towns of the street railway companies and elcctric light companies. The trouble in most cases in central stations obtaining contracts for power, outside of small roads has been to convince the railway companies that the electric light station can economically and reliably furnish this power, and we must say that in many cases their fears are well founded. Therefore, it behooves the central station companies to place their generating plants and station, not only for their own business, but for this added business, in such a shape as to remove this objection. There is no reason why electric light stations should not do a large and profitable business in this line as well as in stationary motor work, for the same factor is introduced here and the same reasons why they can safely and profitably furnish this power; if they have a station properly built, and large enough to add this power, that factor is established. If they have a proper station operating force, in many cases this force need not be added to at all. As to what basis this work can be profitably done on, we hesitate to state figures, except in specific cases, but will try to give a general idea of some of them. For many small roads power contracts have been taken at so much per day, assuming a basis of 100 to 125 miles operated. Such contracts have been at from $3 to $5 per car. The regular basis, in accordance with which most street railway companies make their contracts and desire to base their cost of operation, is the unit of car mile operated; therefore, most contracts are on this basis. This comes down, therefore, to a basis of from three to five cents per car mile; the latter figure we consider excessive, and one which would be only made by any company for temporary necessities. We know of cases where the matter has been carefully considered and the plant properly installed for it, where contracts have been made for between 2½ to 2¾ cents per car mile for 16-foot cars, on roads with grades not exceeding 1½ to 2 per cent. In this case and, in fact, in most cases where the closer figures prevail, the railway company furnishes the generators and the station owner furnishes the steam power and all expenses of both steam and electric power due to ordinary wear and tear. A profitable source of investment has been found in the more moderate sized towns of, say, up to 30,000 or 40,000 inhabitants, in the installation of combined electric railway and lighting stations; the companies either equipping new ones or purchasing old street railway systems and delapidated lighting plants running on an unproductive basis, but which have a good franchise and field for business. Such companies have proved very profitable, as the combining of the operating expenses for railway and lighting station has done much to reduce expenses, and in many cases one manager or superintendent has proved sufficient for the entire system.

What we have tried to prepare here has been, not a paper which will be so attractive to merely read, but in which will be combined a certain amount of data information which will be of use in the further consideration of the problems herein outlined, and trusting that, if we have accomplished nothing else, we have led you to a profitable line of thought, it is respectfully submitted.

CORRESPONDENCE.

Malaga, Spain, Aug. 20, 1891.

Street Railway News, New York:

Gentlemen:—The tramway here was built by English capital and has not been in operation one year as yet. The rails are laid in stone, so the wheels run in grooves, instead of up on the rail, and they run well. The roadbed is solid and good. The company or syndicate is making money, and will extend its rails out into the suburbs. Indeed, I have ridden on the street cars in New York, Philadelphia, Boston, Chicago, St. Paul and elsewhere, but find the Malaga cars excellent. T. M. N.

The following copy of a letter received by the New Process Raw Hide Co., of Syracuse, N. Y., speaks for itself:

The Wightman Electric Manufacturing Company,
Scranton, Pa., August 17, 1891.

The New Process Raw Hide Co., Syracuse, N. Y.

Gentlemen: We have yours of the 13th inst., asking our experience with your raw hide pinions.

Our large orders for your pinions in the fifteeen months past, amounting to thousands of dollars, must speak pretty well for your goods and the satisfaction they are giving. A number of our best customers use your make of pinions exclusively, and they have pronounced themselves as being satisfied that the Patent Raw Hide Pinion is by far the most economical and satisfactory. On the Wightman single reduction motor we have adopted your pinions as being the most satisfactory way of transmitting the power from the armature to car axle.

Respectfully yours,
(Signed.) H. Bergholtz,
Gen. Mgr. & Con. Engr.

The popularity of the Ward arc lamp is constantly increasing. The simple fact that it burns perfectly on incandescent circuits is attracting the attention of all users of lamps, and the demand for it is rapidly a growing one. The lamp gives a remarkably steady and noiseless light. At the exhibition in Montreal last week, three of the Ward arc lamps were in operation, and the light produced was all that could be desired. The Electric Construction and Supply Company, 18 Cortlandt street, New York, is the manufacturers of this lamp, and Mr. R. B. Corey, the manager, is one of the most active men in the business.

THE WEEK'S RECORD OF STREET RAILWAY NOTES

ILLINOIS.

EAST ST. LOUIS.—The construction of the street railway to Venice will be under the supervision of C. C. Robinson, of Detroit, who has been appointed manager of the road.

INDIANA.

GREENCASTLE.—It is stated that the Greencastle City Street Railway Company has been reorganized with the following Board of Directors: A. W. Weik, K. S. Dowling, F. G. Gilmore, Henry Meltzer, Thomas Hanna and E. McLean. J. W. Weik is president, K. S. Dowling, vice-president, F. G. Gilmore, secretary, and E. McLean, superintendent.

INDIANAPOLIS.—The tracks on the English avenue line are to be relaid.

MASSACHUSETTS.

BEVERLEY.—The Union Electric Car Company, which has been experimenting with storage battery cars on the Beverley and Danvers Street Railway, has shipped the engine and boilers from the power house and abandoned the road.

BOSTON.—The slight difficulty between the West End Company and its employés has been settled satisfactorily to both parties.

LAWRENCE.—Electric cars in operation September 1.

NORTH ANDOVER.—A successful trial trip was made on the North Andover and Methune electrical line September 1.

WORCESTER.—It is reported that the Worcester Consolidated Street Railway Company has established a treasury in a saloon, where all conductors are obliged to deposit the receipts every day.

MISSOURI.

ST. LOUIS.—It is said that the St. Louis and Suburban Electric Railway Company is having two belts made for its power house, which will be, it is believed, the largest ever made in the United States. They are three-ply leather belts, each 150 feet long and 72 inches wide, weighing about 1,800 pounds.

ST. LOUIS.—The St. Louis and Jefferson Barracks Electric Railway Company proposes to build and operate an electric railway from Broadway to Jefferson Barracks. The right of way for nearly the entire distance has been secured. The balance will be secured as soon as condemnation proceedings can be completed for widening the road, which is now only 20 feet wide. It is thought the road will be completed and the cars running to Jefferson Barracks before May 1, 1892.

NEBRASKA.

BEATRICE.—The Beatrice Rapid Transit and Power Company has increased its power plant by a 190 H. P. engine, made by the Ball Engine Company, Erie, Pa.

NEW YORK.

FREDONIA.—A new engine has just been placed in the power house of the electric street railway company.

WATERTOWN.—The electric street railroad company has just received two motor cars from the John Stephenson Company, of New York. This makes 7 motor cars and 4 trailers now in operation on the road.

NORTH CAROLINA.

ASHEVILLE.—The electric street line to Sulphur Springs began operation Monday, September 7.

OHIO.

NEW LISBON.—The citizens here are asking the East Liverpool Electric Street Railway Company to extend its track to this place.

TOLEDO.—At a meeting of the Railroad Committee of the City Council on August 28, an ordinance empowering the Robison Electric Railway Company to extend its tracks was approved.

PENNSYLVANIA.

DUBOIS.—The Dubois Traction Passenger Railway Company has just installed a 100 H. P. engine, manufactured by the Ball Engine Company, Erie, Pa., sold to it by Dravo & Black, of Pittsburg, representatives of the Ball Engine Company.

READING.—The Reading & Southwestern electric line was opened for traffic August 29.

SCRANTON.—The Peoples' Street Railway Company has received a number of new cars.

TEXAS.

HOUSTON.—The Houston City Street Railway Company has received several new cars.

UTAH.

OGDEN.—The Ogden City Street Railway Company has just added a number of large boilers to its power plant.

WASHINGTON.

SEATTLE.—The power plant of the Seattle Electric Railway has been removed to Freemont.

NEW ROADS.

CAMDEN, N. J.—A movement is on foot to construct an electric railway to Woodbury.

GREEN BAY, Wis.—It is said that an electric street railway is to be constructed to Fort Howard.

MONTICELLO, Ia.—A street car line from the business centre to the park is being agitated.

NORMAN, Oklahoma.—The construction of a street railway is being agitated here.

ORANGE, N. J.—A company has been formed to push the construction of a cable road up the heights.

PERRYSBURG, Ohio.—An electric street railway to Toledo is being agitated.

ROCHESTER, N. Y.—An electric street railway is to be constructed between this place and Fairport.

SOMERVILLE, N. J.—The construction of a street railway is being agitated here.

WAYNESBORO, Pa.—C. L. Keedy is after a franchise for an electric railway here.

WESTBORO, Mass.—The construction of an electric street railway between this place and Marlboro is being agitated.

WINNIPEG, Man.—It is reported that a syndicate of eastern capitalists is to build a system of electric railways on the storage battery system here.

FINANCIAL.

BIDDEFORD, Me.—It is reported that the trustees of the Biddeford and Saco Street Railway Company have been authorized to cancel the original issue of $40,000 in bonds, and make a new issue of $90,000.

MADISON, Wis.—It is stated that the street car lines here have been purchased by the Thomson-Houston Electric Company, of Chicago.

RACINE, Wis.—It is reported that a St. Louis syndicate has bought the street car lines here.

POSSIBLE PURCHASES.

CAIRO, Ill.—The Cairo Street Railway Company will need additional equipment soon. Address Thomas Lewis, superintendent and treasurer.

DETROIT, Mich.—The Fort Wayne & Elmwood Railway Company may require additional equipment soon. Address James H. Vhay, president.

GREENCASTLE, Ind.—The Greencastle City Street Railway may require electrical equipment soon. Address J. W. Weik, president, Greencastle, Ind.

LAREDO, Tex.—The Laredo Improvement Company contemplates additional construction material for an extension of one mile, and additional equipment of two motor cars and two trailers. Address William Boyd, superintendent.

ROCHESTER, N. Y.—L. J. Delano, of Fairport, N. Y., may desire electrical equipment for a street railway between this place and Fairport.

SUNBURY, Pa.—The Sunbury & Northumberland Street Railway Company requires one or two more cars. Address H. E. Davis, president.

VANCOUVER, B. C.—The Vancouver Electric Railway and Light Company may require additional material for a two mile track extension. Address F. L. Dame, superintendent.

WASHINGTON, Ind.—It is said that a street railway is to be constructed here. For information as to equipment needed, address Theophilus Kates, Cincinnati, Ohio; William A. Cullop, Vincennes, Ind.; J. H. O'Neall or Hugh Barr, Washington, Ind.

TRACK EXTENSIONS.

CONCORD, N. H.—The Concord Street Railway Company is making large extensions to its tracks.

DETROIT, Mich.—The Detroit Street Railway Company is about to extend its tracks.

The Fort Wayne and Elmwood Railway Company is to make extensive additions to its tracks.

LAREDO, Tex.—The Laredo Improvement Company will make a one-mile extension to its track soon.

PITTSBURG, Pa.—The Pittsburg, Allegheny & Manchester Street Railway Company has been asked to extend its road to the Ninth and Eleventh wards, Allegheny City.

VANCOUVER, B. C.—The Vancouver Electric Railway and Light Company contemplates an extension of two miles to its tracks.

LEGAL.

BROOKLYN, N.Y.—It is said that A. H. Mathesius, formerly a member of the staff of engineers on the Brooklyn bridge, is about to bring suit against the trustees of the bridge for $24,960, which he says he is entitled to for the use of his patents on the structure.

HOUSTON, Tex.—On August 29 the Houston City Street Railway Company filed a petition in the District Court of Harris County, against the Rapid Transit Company and the City of Houston, to enjoin the Rapid Transit Company from building or operating a street railway on any of the streets on the City of Houston, and the city from building a tunnel under the Central Railroad tracks for the exclusive use of the Rapid Transit Company. The plaintiff claims a vested raight for a street railway on the streets in question, and that the ordinance granting the right-of-way to the Rapid Transit Company is null and void, never having been legally adopted.

MINNEAPOLIS, Minn.—The Minneapolis Street Railway Company is being sued for $1,160 by the father of a boy who was severely wounded by stepping on a nail, exposed on the company's tracks.

The Minneapolis Street Railway Company is being sued for $20,000 by Mrs. Kate B. Jones, for injuries received last July, by being struck by timbers pulled from the Milwaukee viaduct by the trolley pole of a car. Her husband also wants $5,000 for the loss of her services.

Benjamin J. Crosley, who entered suit against the same company for $10,500 for injuries received from the sudden jerking of an electric car, died Aug. 30. It is reported that his widow will continue the suit.

NEWARK, N. J.—The Rapid Transit Railway Company is being sued for $5,000 damages, by Samuel R. B. Walsh for injuries caused last March, by an electric car which struck his vehicle, demolishing it and throwing him to the ground.

SAN FRANCISCO, Cal.—The Market Street Cable Railway Company is being sued by Mary L. Nolan for $10,000 damages, for injuries caused by being thrown from one of the company's cable cars last April.

ST. PAUL, Minn.—On Aug. 31 Judge Brill dissolved the injunction restraining the St. Paul City Railway Company from constructing an electric line on Marshall ave.

FOREIGN.

The north end extension of the street railway, Halifax, N. S., was opened Sept. 1.

The Vancouver Electric Railway and Light Company, of Vancouver, B. C., has just added a generator, an engine and a boiler to its plant.

An offer has been made by G. H. Campbell, representing a syndicate of eastern capitalists, to build a storage battery system of electric street railways in Winnipeg, Man., if a franchise for 25 years can be secured. Eight miles are to be built before next September.

The street railways of Toronto, Ont., were turned over to the Kiely-Everett syndicate Sept. 1. The contract gives the syndicate possession of the roads for twenty years. The first payment was deposited in the form of four certified checks making a total of $475,000. It is said that the entire plant will be equipped with electricity within a year.

ELECTION OF OFFICERS.

BROOKLINE, Mass.—William E. Long has been appointed superintendent at the central office of the West End Street Railway here.

DULUTH, Minn.—At a meeting of the stockholders of the Duluth Street Railway Company, Aug. 29, the following board of directors was elected: Charles H. Hinchman, Philadelphia; Thomas Lowry, Minneapolis, Minn.; L. Mendehall, G. G. Hartley, A. R. McFarlane, of Duluth. L. Mendehall was elected president; G. G. Hartley, vice-president; T. W. Hoops, secretary and treasurer, and F. S. Wardwell, general manager. The court has been asked to dissolve the receivership.

ROCK ISLAND, Ia.—D. H. Louderback has been appointed trustee for the Rock Island & Milan Railway.

SAGINAW, Mich.—At the annual meeting of the stockholders of the Saginaw Union Street Railway Company, Sept. 1, the following Board of Directors was elected: F. E. Snow, W. A. Jackson, W. H. Stevens, Jacob Seligman, David Wallace, J. M. Nichol and L. T. Durand. Subsequently the Board elected F. E. Snow president; L. T. Durand, vice-president; J. M. Nichol, secretary and treasurer, W. J. Hart, general manager.

CHANGE OF POWER.

BIDDEFORD, Me.—The Biddeford & Saco Street Railway Company is to adopt electricity as its motive power in the near future.

CLEVELAND, O.—The Woodland Avenue & West Side Street Railway Company is to adopt electricity as a motive power.

GRAND RAPIDS, Mich.—The Street Railway Company is changing from cable to electric power.

GREENCASTLE, Ind.—It is reported that the Greencastle City Street Railway Company, will change to electric power in the near future.

FRANCHISES

COLUMBUS, O.—The Syndicate operating the Buffalo Street Car Line, Buffalo, N. Y., has made application for a franchise to construct and operate an electric street railway here.

DETROIT, Mich.—The Ft. Wayne & Elmwood Railway Company has been granted a franchise to lay a double track to the westerly city limits.

OAKLAND, Cal.—The Oakland Consolidated Street Railway Company has filed a petition with the Supervisors of Alameda County for a franchise for an electric road on a number of streets in the county, to form a branch line of the Oakland & Berkeley Rapid Transit road.

ROCHESTER, N. Y.—It is reported that a company has secured right-of-way to construct an electric street railway between this place and Fairport.

SAN FRANCISCO, Cal.—The Mayor has vetoed the order granting a franchise for the extension of the Omnibus Cable Company's lines.

ST. AUGUSTINE, Fla.—The City Council has granted a street railway franchise.

VINCENNES, Ind.—The Vincennes Citizens' Street Railway Company has asked for permission to use the streets of this city for the purpose of furnishing electric light and power.

WARREN, O.—The Trumbull Electric Railway Company has been granted a franchise to construct, operate and maintain a street railway between this place and Niles.

WASHINGTON, Ind.—The Washington Street Railway Company has petitioned the City Council for a franchise to construct and operate a street railway here.

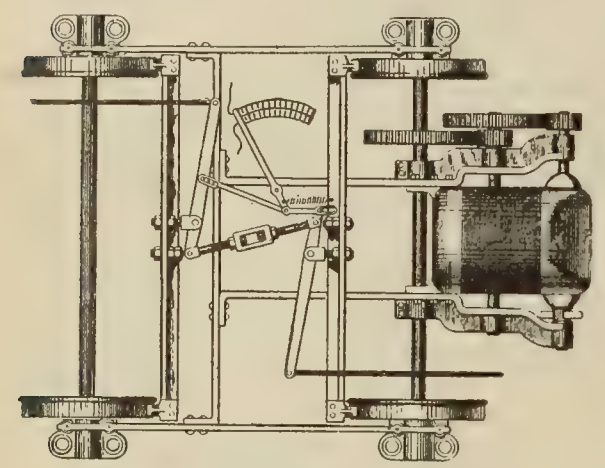
STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued September 1 and 8, 1891.

458,574. Grip for Cable Cars. George B. Hansell and Middleton S. Gill, San Francisco, Cal. Filed April 23, 1891.

The combination, with a depending fixed support, a series of axles journaled therein, and a gripping-roller on each axle, of a movable bar carrying a frame having axles journaled in it, a gripping-roller and a brake-roller rigidly secured on each axle, and a brake adapted to engage the brake-rollers for preventing the rotation of the axles.

458,582. Electric Railway System. Walter H. Knight, New York, N. Y. Original application filed May 11, 1885. Divided and this application filed July 3, 1888.



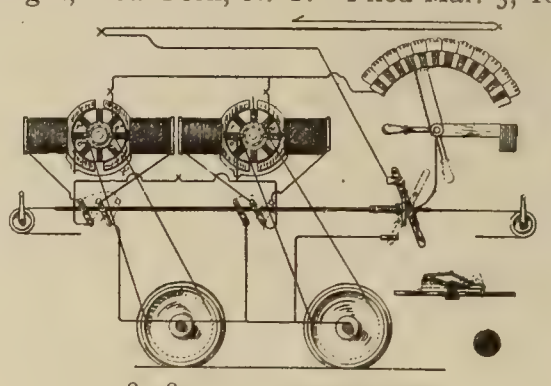
458,584—ELECTRIC MOTOR TRUCK.

The combination of a number of generators connected, respectively, to succeeding sections of an electric railway, with a number of electric locomotives on it, and means for reducing the current of any generator at the instant when a locomotive is leaving the corresponding section of road.

458,583. Electric Railway. Walter H. Knight, New York, N. Y. Original application filed Mar. 13, 1886. Divided and this application filed Dec. 5, 1888.

A slotted conduit inclosing the supply-conductor and normally parallel with the railway-track, but concentric thereto at a curve, with a contact device connected to a vehicle on the railway at a point at one side of the axle of the truck and having a movement relative to the vehicle about a vertical axis.

458,584. Electric Motor Truck. Walter H. Knight, New York, N. Y. Filed Mar. 5, 1889.

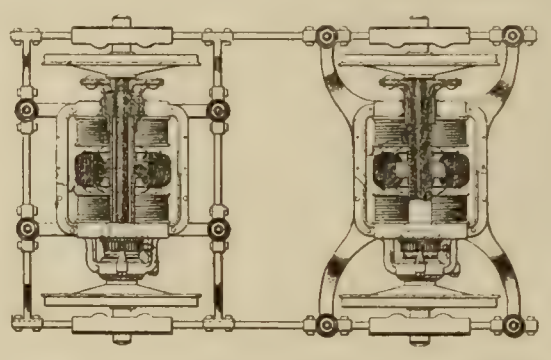


458,587—ELECTRIC BRAKE.

A motor fulcrumed upon the axle and extending down between the wheels on the outside of the axle with frame-bars counterbalancing the motor upon the opposite side of the axle and a compression-brake sliding on the frame-bars.

458,587. Electric Brake. John C. Lincoln, Rochester, N. Y. Filed Feb. 24, 1891.

The combination, with the electromotor and running-gear of an electric car, of a rheostat of variable resistance, means for opening the line-circuit, and suitable means for maintaining the direction of the current through the field-



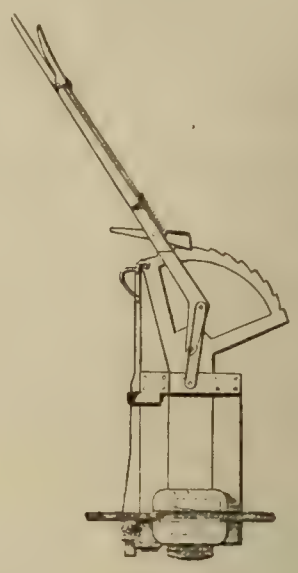
459,024—MOUNTING FOR MOTORS FOR ELECTRIC CARS.

magnets constant when the motor is used as a generator and for directing the current so generated through the rheostat.

458,759. Car Truck. William H. Siebecker, San Francisco, Cal. Filed May 20, 1891.

In a car-truck, the side timbers or wheel-pieces, the channel-iron timbers extending transversely between the side timbers, having their ends bolted thereto, the grip-timbers extending longitudinally between the channel-iron timbers, to which they are bolted, the wheel-axles extending parallel with and outside of the channel-iron beams, and journal-boxes within which the wheel-axles turn, the boxes being fitted against the channel-iron beams, which serve as the inner portions of the pedestals therefor.

459,024. Mounting for Motors of Electric Cars. Sydney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Dec. 24, 1890.



469,073—CABLE GRIP ATTACHMENT.

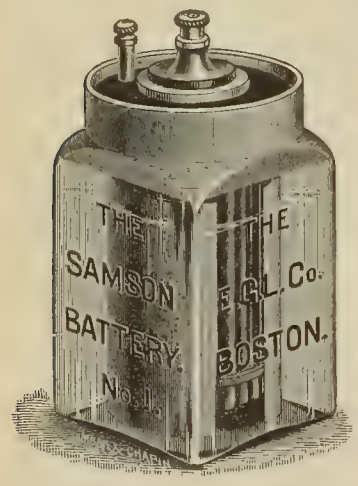
A propelling-motor comprising an axially-placed and directly-connected armature and field-magnets provided with bearings on the car-axle, and supports for sustaining the weight of the field-magnets at points in two vertical planes parallel with the axle,

459,073. Cable-Grip Attachment. Albert O. Warner, Kansas City, Mo. Filed March 30, 1891.

An improved attachment for cable-grips, comprising a bar having an inclined contact-surface at its lower portion to engage the cable and provided at its upper end with a hook to engage the segment of the grip.

A WONDERFULLY EFFICIENT BATTERY.

PEOPLE HAVE ONLY TO TRY THE "SAMSON" BATTERY to become convinced of **Its Superior Qualities.** It justifies all statements as to **Its Great Strength** and Durabilty for open circuit work, such as Call-Bell, Annunciator, Burglar Alarm, Gas Lighting, Telephone, Watchman's and Time Clock Service. It is not only the **Best** but the **Cheapest Battery in the World** to-day! Every day the Contractor defers using the **"SAMSON" will result in a loss to him** equal to the percentage of its superiority over the cells he now uses, which will aggregate 60 to 75 per centum.



OVER 100,000 NOW IN USE IN THIS COUNTRY. Address for further particulars,

THE ELECTRIC GAS LIGHTING CO., 195 Devonshire St., Boston.

Sole Manufacturing Agents for the United States.

FINE ELECTRICAL BELLS AND ANNUNCIATORS.

Numerous First-class Electrical Contractors and Fitters throughout the country use the VICTOR, VICTOR Iron Back and STANDARD Frame bells, because they are the best working and most satisfactory goods to be found. The improved SUCCESS Wooden Box, The CLIMAX Iron Box, and the new small STANDARD Iron Frame Bells, with 2½, 3 and 3½ inch gongs, are very fine instruments, and are being sold at low prices. Let us send you samples and prices.

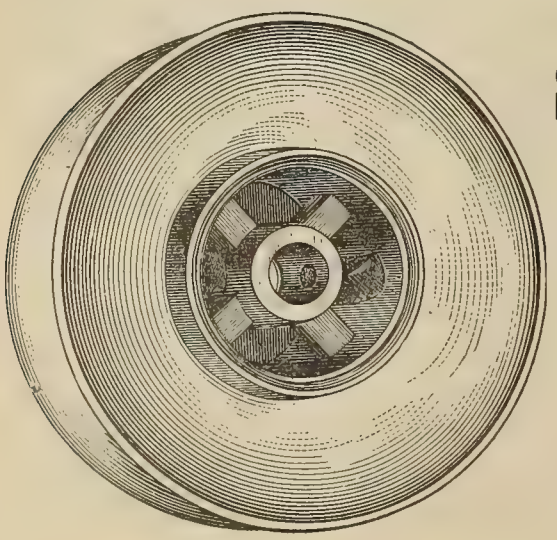
The "TIRRELL" GRAVITY DROP and the NEW "HUB" NEEDLE ANNUNCIATORS completely fill a want for instruments that require less battery power, hold their adjustments, and give the least trouble to the fitter and user. In fact these special goods when put up and worked by the celebrated SAMSON (French) Battery, will yield the greatest possible degree of satisfaction and comfort to the user. For Catalogues, Circulars, etc., Please address

Boston, Sept. 1891 THE ELECTRIC GAS LIGHTING CO., 195 DEVONSHIRE ST., BOSTON, MASS.

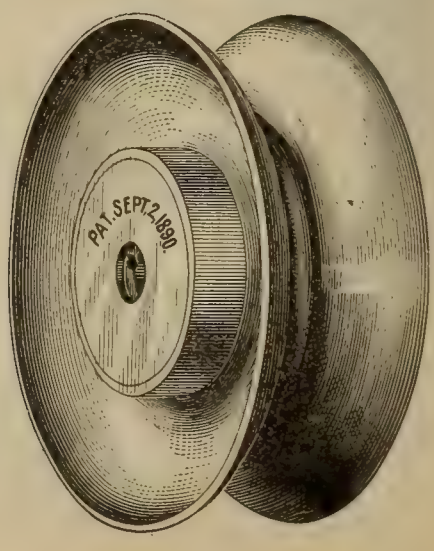
BADGER'S PATENT

SELF-OILING TROLLEY WHEEL,

For Electric Railways.



Smooth running; ways well oiled, prolongs the life of the wheel.
It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.



BADGER BROTHERS,

WEST QUINCY, MASS.

CONVENTION OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

The Ninth Annual Meeting of the Street Railway Association of the State of New York was held at the Hotel Metropole, New York City, on Tuesday, September 15, 1891.

President Daniel F. Lewis called the meeting to order.

The following delegates were present: George Law, President Eighth Avenue Railroad Co., New York City; Edwin Beers, President Broadway Railroad Company, Brooklyn; George W. Linch, Vice-President Christopher and Tenth St. R. R. Co., N. Y. City; Milton I. Masson, Secretary Central Crosstown Railroad Co., N. Y. City; D. B. Hasbrouck, Secretary Houston, West St. & Pavonia Ferry R. R. Co., N. Y. City; G. Hilton Scribner, President Central Park, N. & E. R. R. R. Co., N. Y. City; Henry Thompson, President Broadway & Seventh Avenue R.R.Co., N. Y. City; H. M. Watson, President Buffalo Railway Co., Buffalo; H. H. Littell, President Crosstown Railroad Co., Buffalo; W. H. Delancy, Supt. North and East River R. R., N. Y. City; Frank Curtiss, President Sixth Avenue R. R. Co., N. Y. City; John Kruesi, President Schenectady Street Railway Co., Schenectady; John W. McNamara, President Albany Railway, Albany; Daniel F. Lewis, President Brooklyn City R. R. Co., Brooklyn; John N. Partridge, President Brooklyn City and Newtown R. R. Co., Brooklyn; Duncan B. Cannon, Secretary Brooklyn City and Newtown R. R. Co., Brooklyn; C. J. Field, Elec. Engineer Buffalo Railway Co., Buffalo; C. Densmore Wyman, Vice-President Central Park, N. & E. R. R. R. Co., N. Y. City; J. L. Valentine, Secretary Central Park, N. & E. R. R. R. Co., N. Y. City; E. T. Landon, Auditor Dry Dock, East Broadway & B. R. R. Co., N. Y. City; John M. Calhoun, President Forty-second St. & Grand St. Ferry R. R. Co., N. Y. City; John S. Foster, President Forty-second St., M. & St. N. Ave. Ry. Co., N. Y. City; L. H. McIntyre, Engineer, Harlem Bridge, M. &. F. Railway Co., N. Y. City; John N. Beckley, President Rochester Railway Co., Rochester; Benjamin Graham, Vice-President Rochester Railway Co., Rochester; C. K. Minary, General Manager Rochester Railway, Rochester; Thomas H. McLean, Secretary Twenty-third Street Railway Co., N. Y. City.

There were also present: Thomas C. Barr, President People's Passenger Railway Co., Philadelphia; Lewis Perrine, President Trenton Horse Railroad Co., Trenton, N. J.; Edward J. Lawless, Superintendent Paterson Railway, Paterson, N. J.

The street-railway and electric press were represented as follows: STREET RAILWAY NEWS, J. B. Taltavall, E. V. Cavell, W. T. Hunt, T. R. Taltavall, M. W. Russell. *Street Railway Journal*, J. H. McGraw, C. E. Stump, C. B. Fairchild. *Electrical Engineer*, T. C. Martin. *Street Railway Review*, F. L. Kenfield. *Street Railway Gazette*, P. G. Monroe. *Electrical Review*, C. W. Price.

After the calling of the roll the first order of business was the address of the President, which is as follows:

"*To the Street Railway Association of the State of New York:*

"GENTLEMEN: The convention about to be held is the ninth in the history of this Association. To it I have the great pleasure to welcome the delegates. I trust when we adjourn it will be with profit in greater knowledge of the details of the business which we daily study, and in which we are all so deeply interested.

"It has been decided that as much of the time of the present session as possible be devoted to the subject of improved motive power, and as cable power has been quite fully discussed by this and the 'American' Association in the past, and as greater progress comparatively has been made in electrical power, this subject has been referred to able hands, and will doubtlessly be treated in a manner to be of great value and service to you.

"The past year has been one of prosperity to the street railway companies of this State; it has been comparatively free from severe snow-storms; it has been free from epidemics among horses; the receipts from passengers show a good average increase; no adverse legislation of a general character was effected, and last, but not least, no labor disturbances have taken place. In referring to the latter I feel that the heated experiences of the past few years have been of great benefit. The outcome has established a basis for the conditions under which employés of street railways should labor, and especially so as to the number of hours which should constitute a day's work and also the proper compensation therefor.

"We have reason also to congratulate ourselves in the benefits which will accrue to street railways growing out of the Court of Appeals' decision in the case of The People vs. The Union Trust Company of New York, which provides the manner in which assessors shall treat the capital stock of corporations for purposes of assessment.

"It very plainly holds that all corporations deriving profit from its capital stock shall only be assessed on the par value thereof, and that surplus earnings shall be exempt from assessment to the extent of 10 per cent. of the capital of any such corporation. It has been the practice in many cities of the State to tax the capital at its market value, which basis is now held as erroneous and will relieve the railway companies of a part of the heavy burden they are compelled to bear in the 'many kinds and sizes' of taxes which they pay annually to the cities and State.

"I am sorry to say that the membership is no larger than it was in 1890, and in view of this the Executive Committee has considered a remedy and will offer an amendment to the by-laws which, if adopted, will, I trust, have the desired result.

"It is very well to meet as we do annually and discuss the various current topics which affect the operation of our railways, but there is other work which this Association is capable of doing if its membership embraced a large majority of the surface railway companies of this State, as it should.

"For many years (except the past two, when we were very kindly treated) bills have been introduced in the Legislature which have affected, or would affect, the interests of street railways in all parts of the State, and at times very seriously so; and I may ask, who looks after such legislation? In answer, I can say that when it is looked after at all, it is done by the companies in the large cities; but is this right? should not the smaller companies contribute their share of labor and attention? are not their interests quite as great in proportion as any other company's? are not their interests as dear to them? should a small company take refuge under the protection of a large company because it is large, and not render a service which is at its command? They should be glad, because they are small and comparatively weak, to render any assistance they can, in order that their share might be done in behalf of the protection they get and need.

"The late Mr. Forshay, at the meeting in New York in 1884, in addressing you said: 'We cannot overestimate the value of combined action,' and likened it to the first feeble wire stretched across the East River, which a child could break, but which made a part of a combination of wires afterward supporting the great Bridge and the great volume of traffic over it. So it is in our case if a small faction only of the companies of this State participate in the labors and responsibilities of this Association it will not meet the requirements in the support of its interests any more than the first feeble wire would in the support of the great East River Bridge; while a vigorous and hearty co-operation on the part of all the railway companies of the State would render the service and support we desire and should have.

"The street-railway interest, I fear, is not aware of the power behind it; if the gentlemen representing it would only stop for a moment and think that the solid vote of their employés and the vote they could command would often turn the majority of the State one way or the other at elections, it would then comprehend what it might be capable of doing in emergencies. I refer to this only to show that any very radical action which the Legislature might undertake and which might cripple companies to a point where the employés would be seriously affected, would result disastrously to any party in case a political issue should be made of it, and anything so radical might very likely be so engineered if the proper management were at hand.

"Every street railway in the State has its friend or friends in the Legislature, and if this Association will recruit and make itself strong in numbers, the officers could, by notifying its members of any danger at Albany, surround itself with the necessary help at all times to secure *proper protection*, which is all we desire in this direction.

"Trusting the ensuing year will be one of peace and continued prosperity to you all, and with my appreciation of the compliment you conferred upon the company I represent and me one year ago in electing me the President of this Association, I have the honor to be

"Yours very sincerely and obediently,

"D. F. LEWIS, *President*."

The Treasurer's report was presented, and showed the following financial transactions during the year:

Receipts	$1,097.64
Expenses	959.48
	$138.16

This was followed by the report of the special committee on "Electric Motive Power for Street Surface Railways." The report was read by Mr. John N. Beckley, President of the Rochester Railway Company.

It was moved that the report be printed forthwith and, with copies of the address of the President, be distributed to all street-railway companies in the State.

The President then declared the subject of electricity open for discussion, and invited representatives of electrical equipment companies to participate.

Mr. Charles A. Benton, representing the Rae system, addressed the delegates briefly. The system, he said, was unique in itself. They manufactured a single motor made in three sizes, 15, 30 and 40 H. P. The peculiar advantage claimed for the system is that it gives to both axles a traction on the rails which cannot be got by any other system. He said that the company was the smallest represented at the meeting and the most recent in the field; but he could state with justice to the system that it had made in some places a respectable record.

Mr. C. C. Curtis, of the Short electric system, followed. He said:

"When this convention met in Rochester last September, the Short Company came before you and made some very strong promises as to the showing that would be made when the road in Rochester was started. What that showing has been you have heard in the very able report that has just been read. The question in which you are all vitally interested is the question of repairs; repairs to your motors, repairs to your lines and repairs to your generators. In the city of Rochester there has been kept day by day an accurate record of the motor and generator repairs. That road started running last November, and giving it eight months of run through the winter months—the hardest months in the year—up to the first day of August, the average cost of repairs per car mile was four mills. This is a very fine showing, as I think every gentleman who has kept a similar record will admit. The report just made gives the total repair account. That repair account as given month by month by Mr. Beckley will, of course, include the repairs of the line, generators, motors, rail, etc. When I say four mills per car mile, I mean only the repairs on the generators and the repairs on the motors; that is, the electrical repairs. In Muskegon, Mich., where we have been running about a year and a half, our record shows two mills per car mile. We have two new motors to offer you. We are prepared to give you the double-reduction motor or the single-reduction motor and the low-reduction motor. You know how great and excessive the repairs of gears are. One of the gentlemen who was on the floor of this convention stated to me a month ago that, in his judgment, if our gearless motor was really what we claimed for it (and we are prepared to back our claims up with strong guarantees) it would save his company seventy-five per cent. of the repair account. If this is true, no road should be equipped without looking carefully into the merits of this Short gearless motor. The armature of this motor is hung on a sleeve. This sleeve surrounds the axle. The whole weight of the motor is thus distributed over the whole motor frame and not on the axles of the cars. There is an air-space of about three-quarters of an inch between the axles of the car and the inner surface of the sleeve on which the armature is hung. By removing four bolts you take off the two lower wheels and raise one end of the car and you roll out your armature and the car-axle. You are, no doubt, more or less familiar with its construction. Should a bobbin burn out, it can, because of its peculiar construction, be repaired for from two to three dollars. As you may know, these bobbins are only about three-quarters of an inch deep and surround the outer circle of the armature. They are not connected; and should one burn out it does not interfere with or necessitate the burning out of any of the others. The hue and cry has been raised that the gearless motor is a very nice thing theoretically, but in practical operation it is going to take an enormous amount of current. I have a report of a test made in Cleveland, Ohio, about two weeks ago, by Mr. Al Johnson, with whom, no doubt, many of you are acquainted. It was a trial between one of his motor cars and one of the Short gearless motor cars. These two cars ran over the Brooklyn Street Railroad line, running about twenty minutes apart, doing commercial work. The gearless car checked up some eighty passengers, and the single-reduction motor, which Johnson was running, checked up forty-seven. The car ran for about two hours and a half, and we have the half-minute readings. The report and the readings show that the single-reduction motor takes twenty-four per cent. more current than the gearless motor. We have this gearless car all equipped in Cleveland, and we give you all a cordial invitation to come and see it and examine it carefully. Mr. M. K. Bowen, of our company, would like to say a few words to you on the Short generators."

Mr. M. K. Bowen, of the Short Electric Railway Company: "As Mr. Curtis, my colleague, has spoken to you this morning about double-reduction and single-reduction motors, I want to say a few words to you in regard to our dynamos or generators. We make them in five sizes: 75, 100, 150, 300 and 500 H. P. The peculiarities in the construction of our dynamos are in keeping with the peculiarities in the construction of our car motors. The bobbins are separately wound and connected in series. They are exposed to the air around the side, being thoroughly ventilated. The field coils are both series and parallel wound. The shaft is provided with self-oiling bearings near the commutator, which is extraordinarily large, being about twenty inches in diameter. Near the commutator is provided a bar which regulates all thrusts, so that there is no danger from displacement."

Mr. George W. Mansfield next addressed the meeting, representing the Thomson-Houston Electric Company: "Being connected with an electrical company, possibly I am not supposed to know much about the railroading part of it outside of the purely electrical apparatus. But, unfortunately for some of our customers, they have had to come to us for assistance; and through our rendering assistance we have, perforce, had to come into the operation and management of a number of railroads throughout the country. Therefore, in a certain sense, we do understand something about the operation of the electrical cars, and what they are doing and what they are supposed to do, and what the public and the officials of the railroads want them to do. Mr. Beckley's paper was exceedingly interesting. He dealt with the subject in a broad and wholesome way. I think, on the whole, it was one of the broadest papers on the subject that I have listened to. Our company endeavors to do what it does do well. It went into the field early. It struggled hard to produce a motor to meet all of the conditions that were to be imposed upon it, and I tell you these conditions were severe. It is not only a lack of knowledge on the part of the railroad officials, but a deep-rooted prejudice on the part of the public against the electric system that we have to meet. Then, again, I am sorry to say, we do not get the support we should from the builders of the other portions or railroad equipment. They did not evince a spirit of accommodation to see if they could help us in the combination of their manufactures and ours. I am glad to say, however, that matters in this respect have very much improved. We have put our motors under almost every style of car that is built, they have been used with almost every truck that is built, and on almost every kind of road that is built. We have them in the hottest climes, away in Brazil, and in the coldest climes, up in Vancouver or down in Maine. I believe you are all acquainted with our products, and it does not need any extended remarks of mine to describe them in detail. We manufacture every part of an electric system. We are constantly endeavoring to so harmonize and arrange the whole of the overhead parts that we will have a complete system. We are doing the same with all of the apparatus on the car—lightning arrester, reversing switch, trolley poles and bars, motors, fuse boxes and the controlling mechanism. We are happy to have all suggestions from railroad men possible. I believe firmly in the single-reduction motor. We have in the neighborhood of twelve hundred of them in operation. We have been manufacturing them since the first of last February, having made them to put out upon some small roads for experimental purposes last summer. We are also making experiments with gearless motors, etc.; but I believe that we should pin our faith to that which we know is absolutely satisfactory. We are building our generators large, now furnishing generators of two hundred and fifty and three hundred H. P. We are also building some of four and five hundred H. P. The four-hundred H. P. motor will quickly be put in operation; we are at present making tests with it at the factory. In every respect, from the details of the overhead system down to all of the parts of the car, we produce them all. I want to impress this fact upon you that you have not to come to us for a motor, and then to go to some one else for the overhead part, and so on; but come to us for the whole of it. There is another thing which interests all of you gentlemen, and that is the question of snow. It is said that electric cars have not earned the reputation they should have in regard to handling snow, and that electric roads are still dependent, to a great extent, upon horses and the muscle of men; but that is not entirely so. Our company has endeavored to evolve a plough and a broom-sweeper which will demonstrate that electricity is absolutely self-contained in every respect. I would like the convention to hear Mr. Barr, of our company, who represents it in that respect."

Mr. Barr, of the Thomson-Houston Company: "Our company has gone thoroughly into this question of snow-cleaning devices. Some of you may know that last year we got out a machine, a snow-sweeper, which in a great many cases has done excellent work and given good satisfaction. There were some defects in that machine, however, which we have tried to remedy this year. With that in view I early last year made a trip through the country and personally inspected all of the devices of which I could learn which were used by street railroads, steam railroads and cities for sweeping streets. From the information obtained, four of us, all practical men, mapped out a general line to follow. I may say to those of you who are not familiar with the machine we had last year, that it was a brush of rattan, set at an angle of sixty degrees, revolving in front of

a frame driven by a motor by means of sprocket chains. In a light sugar snow that brush gave good satisfaction; but in a heavy wet snow the brush would clog and served rather to pack the snow on the rail and make it solid, and therefore rendered it impossible for the wheel to get traction. The sprocket chain is always a source of trouble and annoyance. The lines were laid down to follow: first, to do away with the rattan broom, and, second, to get a positive drive for the cylinder. We have built a broom with steel teeth. It is supported from thirty-six-inch four-hundred-pound wheels, on 22a Bemis box. The wheels are driven in the same way as with the cars, placing the motors on the axles. We are using single-reduction motors for them. The cylinder is set at forty-five degrees of the track, extending completely across, and is hung over a rocker shaft. The motor counterbalances the blade of the broom around that shaft and is geared directly through spur gearing to the flyer. The main feature of the flyer is that it has a series of blades. The best description of it is to refer you to a paddle-wheel of a steamer, only of smaller diameter, having the blades cut at the centre to allow the spur gearing for the driving. These blades are of steel plate, about a quarter of an inch thick, and there were eight of them on each flyer. To the back of the blades are bolted steel brushes; the brushes made of flat steel wire, cutting edgewise. These brushes are adjustable, and ordinarily their surfaces project from five-eighths to one and one-half inches beyond the blade. The blade does the major part of the work. It breaks the heavy snow and will actually cut ice. The steel brush does the rest of the work. It sweeps the road clean, and if allowed to remain long enough in one place will cut the ice as well. The motor driving the broom or brush is independent from the motors driving the car; so that the sweeper can be propelled in a light snow at a speed sufficient to keep it ahead of any of the cars on the line. If you should meet with heavy snow or ice on the track the car can be slowed down, the brush still keeping its normal speed. By doing this these brushes, being made of steel or wire, will actually cut the ice clear down to the track. The whole thing is very novel, but it has done good work. We have experimented some with a new machine, somewhat different from the old one. Where the latter had only four blades the new one has eight; the old one was set at a sixty-degree angle, the new one at forty-five; in the old we used the sprocket chain, in the present spur gearing; we had a ten H. P. motor, but now have a twenty-five; in the old one the blade made eighty turns a minute, in the new one it will run up to one hundred and fifty turns a minute. We are building several of these machines, one of which we shall have on exhibition at the convention at Pittsburg."

Mr. H. W. Grannis, representing the Westinghouse Electric and Manufacturing Company, said: "There is one point touched upon by Mr. Beckley in his very interesting paper, attention to which, I think, has given us success in the manufacture of street-railway motors. I refer to his reference to the point of mechanical construction in the motors. I will not occupy your time to any extent, but will go into history for a moment to tell you what the Westinghouse Company has done since it began manufacturing street-railway motors. Our first motor was constructed one year ago, and put in operation July 4, 1890, in Pittsburg. It was the old type double-reduction motor, all the parts inclosed in cast-iron frames. All shafting was run parallel at all times, and the gears kept in perfect alignment. In addition to that, I think we first adopted the old device of inclosing the gears in gear-boxes filled with grease. This eliminated the noise and a large part of the wear and tear. That motor is still in operation. I cannot tell the expenses for repairs, but they were infinitesimal. Within five or six months succeeding the introduction of our motor we equipped a number of roads with double-reduction motors, all in successful operation to-day. In January last we got out another motor, single reduction, having many of the general features of the old double-reduction motor. This motor had several improvements over the other. We used a different resistance box. The other worked fairly well, but there was a little trouble. With the new motor we use only galvanized-iron wire, and it has given us no trouble in a single instance. It is open and ventilated. We made a slight modification of our controlling device. Formerly it was a wooden shaft with brass contact strips screwed to the shaft. We found this was not quite as durable as we wished, and we are now making them of asbestos and brass. If they do wear at all it makes very little difference, for they are practically indestructible. We are manufacturing and selling many of these motors. In the first year of our business career we have put our machines on about seventy different roads, which, we think, is about as good a record as any company can show for the same length of time. In April we commenced to get out a gearless motor, and have been operating that motor since May in Pittsburg. It has exceeded our most sanguine expectations and we will be ready in a few days to ship it. We have not said much about it for the past three or four months, for the reason that the single-reduction motor did better than we expected. They are giving satisfaction wherever they are used. We determined to wait and test the gearless motor thoroughly. This we have done, and to-day we stand before you with two motors to offer, single-reduction and gearless. Personally, I express a preference for the gearless. It is simpler than any other. I do not see how it is possible to construct a motor with fewer parts than the gearless. I was interested the other day, in reading on the subject of the underground railway in London, where electric traction is used, that the motor for the purpose of moving the trains had its armature mounted directly on the axle, which is the plan used by us. In that way we need not have any devices communicating power to the wheels. We do not require any special wheels; any standard wheels will do with our system. The gearless motor has been running in Pittsburg for some months. I have no doubt many of you gentlemen will be there, and you will have an opportunity to see it in all its details. We are manufacturing, as other companies are, different sizes of motors, somewhat larger than have been manufactured in the past—two hundred and fifty and five hundred horse-power."

Mr. C. J. Field, of the Field Engineering Company, next addressed the meeting. He urged the railway officials to always insist on the best class of construction work. This class of work always brought the largest return in the long run. Always get the best. The result would be a reduction in the repair account and in operating expenses, and the wisdom of getting everything of the best would eventually become manifest.

Mr. C. D. Shayne, of the Edison Electric Company, followed: "I would like to call the attention of the convention to our double and single reduction motors. We make the single-reduction motor in sizes from 15 to 30 H. P. Many roads adopt different-sized motors. It will be remembered that some years ago, when we commenced the manufacture of electric motors, they were from 5 to 10 H. P. At the present time many of the roads are using very long and heavy cars, and many gentlemen do not think it necessary to put in more than fifteen H. P. equipment on such cars. The result is a general disappointment all around, as the motors are too light for that purpose; and then they are equipped with two fifteen H. P. motors. Where large cars are used sufficient power must be provided. We make a full line of electrical supplies of every description for street-railway work, and we shall also present to street-car men this winter a snow-plough and sweeper combined."

Mr. C. C. Bowen, of the Multiple Distributing Station Electric Railway Company, also addressed the meeting, when the electrical discussion came to a close.

The recommendation of the Executive Committee that the by-laws be amended so that companies whose annual gross receipts from passengers is less than $100,000 may be admitted to membership upon the payment of nominal annual dues, viz., five dollars, was adopted.

The President appointed Messrs. John N. Partridge, of Brooklyn, Henry M. Watson, of Buffalo, and John W. McNamara, of Albany, a committee to nominate officers and select a place for the next meeting.

The following officers were elected for the ensuing year: President, John N. Beckley, Rochester; First Vice-President, Thomas H. McLean, New York City; Second Vice-President, George Law, New York City; Secretary and Treasurer, W. J. Richardson, Brooklyn. Executive Committee: President and Secretary, and Daniel F. Lewis, Brooklyn; C. Densmore Wyman, New York City; Charles Cleminshaw, Troy.

Saratoga Springs was selected as the place for the next meeting of the Association, which will take place on the third Tuesday in September, 1892.

The meeting then adjourned.

After the adjournment of the meeting luncheon was served to the delegates and all others at the meeting.

Daniel F. Lewis, President of the Association for 1891, extended an invitation to all in attendance to participate in a drive. A dozen open carriages were in waiting at the door of the hotel, and the party entered them and proceeded up Broadway to Central Park, out through the Seventy-second Street entrance to the Riverside Drive, to One Hundred and Twenty-second Street, to One Hundred and Fifty-fifth Street, to Amsterdam Avenue, thence to Kingsbridge Road, with a view of High Bridge; on to One Hundred and Eighty-first Street, with a view of Washington Bridge and Fort George. In the return, through Sedgwick Avenue to Jerome Avenue, across McCoombs' Dam Bridge to Seventh Avenue, through the Park to Broadway, and thence to Forty-second Street.

Shortly after the return from the drive the party entered the banquet hall of the hotel as the guests of George Green, Esq., the proprietor. The room was profusely decorated, and there was a good display of flowers. Music was provided, and discoursed the most popular gems. Nothing was lacking to make the affair most enjoyable, as will be attested by the following

MENU.

Huîtres en Coquilles — *Niersteiner*

POTAGES

Crème St. Germain — Consommé, Deslignac

HORS-D'ŒUVRES — *Amontillado*

Variés — Variés

Petit Pâté à la Reine

POISSON

Saumon à la Hollandaise

Pommes Parisiennes — Salade de Concombres

RELEVE — *Sauternes, B. & G.*

Filet de Bœuf piqué. Richemont

Haricots Verts

ENTREE — *Chateau Langoa*

Ris de Veau en caisse à la Toulouse

Pois Nouveaux

SORBET EN SURPRISE

ROTI — *Moet & Chandon*

Ghicken Grouse, currant jelly

Salade de Laitue et Tomate

ENTREMET

Fruits glacés

Petits Fours — Fromages

Pièces Montées

CAFE — *Liqueurs*

When full justice had been done to what was provided as above, Mr. Daniel E. Hasbrouck, acting as toastmaster, proposed that the health of the host be drank, in which every one joined with hearty good-will.

Mr. Hasbrouck then rapped for order and said: "If my wife had told me this morning that I would be called upon to preside over so much intellect and beauty and virtue as I see before me this evening, I would have told her that she was dreaming. I see by the expression of your countenances that you have done full justice to the hospitality of our friend Green. We will now have a brief season of the feast of reason. I am between two fires (Messrs. Lewis and Beckley), and I hardly know how to get out of it, except to call on both of the gentlemen, who have both of them importuned me not to. They are both loaded with speeches I know, and I shall take occasion at first to ask my friend, the retiring President, to say a word of encouragement to you."

MR. LEWIS—"Mr. Chairman and Gentlemen: I cannot but feel that we are terminating the year of our existence which has just expired in a very pleasant manner. We certainly all feel very grateful to our host for the royal manner in which he has entertained us. The balance in the treasury is small, as you heard to-day. We thought we might have a little banquet, and arrange to pay for it in some incidental way. Mr. Green a year ago invited us to meet at this hotel, and offered as an additional inducement for us to come here and visit him at his home, to provide a lunch. In considering the question of how we should arrange for a banquet, Mr. Green made an amendment to his first offer, and wanted to give us a dinner. He has done so, and has entertained us to-day in a very pleasant way, I am sure. He has authorized me and requested me to say in his name that he extends a very cordial welcome to you all here. He feels it an honor to have the State Railway Association select the Hotel Metropole as its place of meeting, and he cannot say too much of the good feeling which he has towards this Association, and which he believes is reciprocated by the members." (Applause.)

MR. HASBROUCK—"As I said a moment ago, I have been sitting between two very modest men, and you all know Mr. Beckley. Not to know Mr. Beckley argues one's self unknown. I call upon Mr. Beckley to say a word."

MR. BECKLEY—"Mr. Toastmaster and Gentlemen: Some time ago, as we were partaking of the good things our friend Green has provided for us, I asked the toastmaster as a special and personal favor not to call upon me this evening, as I really desired to enjoy myself without having occasion to think of something to say in case he should call me out. Truth compels me to say that he did not promise that he would not call upon me, but he did say that he would simply get me on my feet and I could say about five words and sit down. I am in the position that men are very often in when they are called upon to say something they don't know. People very frequently find that they have drunk too much or eaten too much, and that their brain for some reason or other is muddled and they are unable to think clearly upon some subject, especially when they have no subject to think upon and nothing special to say. I can echo all Mr. Lewis has said as to the splendid manner in which we have been entertained, and I am sure his words will find a response in every heart. Mr. Green has acted the part of the Good Samaritan. He found us strangers in a strange land. Thinking, no doubt, that he had been in a somewhat similar situation when in other cities, out of the plenitude of the goodness of his heart he has provided this sumptuous banquet for us. It is a very handsome and generous thing to have done; and I am sure we all appreciate it. I know every one of us would like to catch Mr. Green in his own particular town for a day and a night, to see how much we could do to return the compliment. Ever since I have been in the railroad business it has been my ambition to have held in Rochester the national convention. I understand that the place of meeting is generally bespoken about two or three years in advance; for instance, this year it is to be Pittsburg, and next year Kansas City. I would like you, gentlemen, if you ever expect a single motor or do any other business in Rochester, pledge yourselves that when you go to Pittsburg you will work night and day and spend any amount of money, and charge it to your electric companies, to secure a promise from the delegates at that convention that the meeting of the American Street Railway Association, after the convention in Kansas City, shall be held at Rochester."

Mr. John S. Foster was next called upon, but stated that like the illustrious General (Grant), to view whose monument it was necessary to take the cars of his line, he was not a man of speech, and begged to be excused from making any extended remarks.

MR. HASBROUCK—"There is a gentleman present this evening who took me aside and said if I did not call upon him he would never forget me. He controls one of the backbone roads of the city, and I know you will all be pleased to have a word from him. I call upon Mr. Frank Curtiss, of the Sixth Avenue road."

MR. CURTISS—"I have known Mr. Hasbrouck for a number of years, and have always taken him to be a man of truth and veracity. He this evening destroys the trust that I had in him for years. He has violated his promise. I am not connected with the Association, and hardly know whether I ought to be here. I found Mr. Green anxious that I should come, and my friend Foster agreeing to come and take care of me in a measure, I came, and of course you can see very readily why it is a good thing to have him along. I am very much pleased to be present this evening, and the only thing that I regret is that for so long I have missed the pleasure which has attended your meetings."

Mr. Hasbrouck then called upon Mr. McGraw, who made a short speech.

After that Mr. John W. McNamara, of Albany, said: "I always feel that I am entirely out of place at a banquet. I never seem to enter into the true spirit of a banquet, and that is perhaps because all my glasses remain empty. I, in common with every speaker this evening, am very grateful to our landlord. I trust that he will live to be with us at Saratoga a year hence. I trust we will all be alive and have the blessings which we now enjoy, and some of us have blessings that we do not enjoy. In this connection I refer to Mr. Cavell, of the *Street Railway News*, from whom, owing to a sad ailment, we cannot have the pleasure of hearing to-night, but I trust if he is alive and at Saratoga we will have that pleasure." (Applause.)

MR. HASBROUCK—"I now call on Mr. Wyman, of the Belt road. Without a word from him we could not adjourn."

MR. WYMAN—"Everybody knows that I am not addicted to speech-making, and no one better than our reverend and honored chairman. I am very glad indeed that he has permitted me to inflict myself long enough upon you to thank you for the great pleasure that I have enjoyed in my attendance upon this convention, and to permit me to express my thanks to Mr. Green for his most hospitable entertainment, in which I have shared; and also to express my pleasure in hearing the ablest paper, as our late President very properly denominated it, that we have ever listened to regarding that motor or that force toward which we look with fevered anticipation as the only means by which we shall solve this problem of rapid transit. I remember some years ago I listened to some remarks at a post-prandial address in which an epitaph was recited which very properly represents my feeling in being called upon to speak after hearing so much of eloquence and wit and humor as has preceded me. An old gentleman wrote it when hewas suppossed to be on his death-bed, and it ran like this:

> "Beneath this stone my wife and I,
> Back to back, together lie,
> More blessed than when in life's short space
> We lied like others, face to face:
> Now free from trouble, free from fear,
> If she should scold, I could not hear.
> When the last trump the air shall fill,
> If she gets up, then I'll lie still.

"I think perhaps I had better keep still. I want, however, to say one thing more. It is not usual for a street railway man to be retrospective; we are looking forward to the electric motor, and to other things—increase of salaries, payment on income bonds, etc. But I want to look back for a moment. We had a meeting last year in Rochester. Those of you who were there may remember it. I shall always remember it. I came home in sections. The condition in which we returned reminds me of the small boy who was crying at the foot of the stairs leading to an editor's sanctum. Some one said, 'What are you crying about, Johnnie?' 'Well,' he said, 'my father just went up to lick the editor.' 'Well, hasn't he come down?' 'No; part of

him has, and I'm waiting for the rest!' That is about the way we came home from Rochester. I wish to congratulate the street railway men that we had our meeting in Rochester, and I wish to subscribe to the movement which has been suggested, that we have another one; the sooner the better. The new impulse, the new energy and life that were given to this Association in Rochester will be felt for a long time. There is no reason why our Association should not be a great success, and measures have been instituted today which I have no doubt will lead to that result."

Mr. Green was called for, and said: "I can only reiterate what our kind President has said. I thank you in behalf of the Metropole for your courtesy in selecting it as your meeting-place. We sincerely hope we have entertained you to your satisfaction, and at some future time, if you will decide to meet in New York and will not forget the Metropole, we will try to do it doubly so."

The company then dispersed.

REPORT OF THE EXECUTIVE COMMITTEE.

NEW YORK, September 15, 1891.

To the Street Railway Association of New York:

GENTLEMEN: Your Executive Committee respectfully submits the following report:

MEMBERSHIP.

During the year two members have withdrawn, viz., the Central City, of Syracuse, and the Lockport companies.

It was ascertained that while the management in both cases desired to retain the membership of their companies, it was considered that the annual dues of thirty-five dollars (which far exceeded a whole day's gross receipts of one company) was more than they could afford to pay.

The Executive Committee therefore considered it a duty resting upon it to devise a plan whereby, if possible, all the small compaies in the State might be induced to become members of the Association. As the result of its careful study of the question, the committee submits an amendment to the by-laws and offers for adoption the following resolution:

AMENDMENT TO BY-LAWS.

"*Resolved*, That Article XV. of the by-laws be amended so as to read as follows:

"'XV. Members whose annual gross receipts from passengers shall be more than $100,000 shall pay an admission fee of twenty-five dollars and annual dues of thirty-five dollars, payable in advance. Members whose annual gross receipts from passengers shall be less than $100,000 shall pay an admission fee of five dollars and annual dues of five dollars, payable in advance.'"

It is confidently expected that making the fees nominal, as proposed, will bring into active co-operation with us nearly if not quite all the companies concerned. The benefits which will result from such a consummation cannot be overestimated.

MOTIVE-POWER.

The horse is with us, and always will be in greater or less number. For his sake, however, we devoutly hope that, as a motive-power for street-cars, his days, not years, are numbered.

Cable power is having its full share of attention, as is evidenced by the transformation into cable roads of the lines on the two leading business thoroughfares of the metropolis.

This Association in its meeting this year, as in that of a year ago, has but one idea, however, and that is electricity as a motive-power.

While such companies as the Third Avenue and the Broadway & Seventh Avenue demonstrate the courage of their convictions by launching out upon an expenditure of millions, most of us must perforce make haste slowly; and we therefore turn our attention to electricity! The people want an improved motive-power, *i.e.*, an improvement over horses; and surely the most brilliant and magnetic, the loftiest and most promising motive-power, based upon what we see and hear, is electricity. Thus it comes to pass that your committee has arranged for the preparation of another report upon Electric Motive-Power for Street Surface Railways, by the President of a company whose lines are operated by this subtle and withal fascinating power. Participation in the discussion of this subject by men eminent on the surface as well as overhead has also been arranged for.

EMPLOYER AND EMPLOYEE.

The mutual benefit associations connected with several of the member companies, the organization of which we were pleased to notice a year ago, have continued to do their work altogether satisfactorily, and with most gratifying results to all connected therewith. These societies have been the means of bringing the officers and employees of the companies into closer and friendlier relations; and whatever will succeed in bringing about such a happy state of things is to be commended.

As we look out upon the future, judging by the recent past, we become optimists while we realize the fact that the world is growing better. Even as nations have come to settle their differences, not by the sword, as formerly, but by international councils of peace, so labor and capital have both learned wisdom by experience, at least so far as the street railway industry is concerned; and all matters of difference which may, and inevitably must, from time to time, arise between employer and employee, will be adjusted amicably by the parties interested. The motto about which we used to hear so much, "An injury to one is the concern of all," has given place to a higher and nobler sentiment, "An injury to either is the concern of both."

OUR HOST.

We take occasion to express our sincere appreciation of the courtesy and hospitality of George Green, Esq., who is really the host on this occasion and whose guests we are.

In bringing this brief report to a close, we would give expression to our profound gratitude to God, that while the year has been one of excessive mortality in the community, death has not marred our charmed circle.

Respectfully submitted,

D. F. LEWIS.
JOHN N. PARTRIDGE.
C. D. WYMAN.
W. J. RICHARDSON.

J. G. White & Company, the well-known electrical engineers of this city, were ably represented by Mr. White himself.

Bemis Car Box Company, of Springfield, sent its Mr. C. G. Stearns to attend to its business interests.

Charles A. Schieren & Company showed up with two representatives—Messrs. E. P. Atkinson and Charles A. Schieren, Jr.

Littell's "Track Scraper" (not exactly the same which were given away as chromos at the Washington Convention) was properly explained by its owner, Mr. H. H. Littell, General Manager of the Buffalo Railroad Company.

Mr. C. J. Field, of the Field Engineering Company, was around with both eyes keenly alive to the main chance.

The Interior Conduit and Insulation Company sent Mr. Cliff Wise to see that they did not lose anything by the convention.

W. B. Silver, of W. B. Silver & Company, "was there." He usually is.

The Eastern District of the Edison Company had the very popular Charles E. Shaw in attendance.

In Mr. Towrance, of the Guarantee and Accident Lloyds, those in attendance at the convention found a remarkably clever gentleman and a sound business man.

Mr. Abram M. Kirby, whom many delegates of last year's convention in Buffalo well remember, attended the convention, shook hands with lots of old friends, and made lots of new ones.

The New York Car Wheel Works had Mr. B. G. Hann, Jr., to look after its interests.

Richard Vose Car Spring Company, of 115 Broadway, was capitally represented by Mr. Gus. Suckow.

Peckham's Motor Trucks were ably represented by President Peckham and his first lieutenant, Mr. Hughes.

The Electric Engineering and Supply Company had its able Vice-President, Frank H. Leonard, and Mr. L. H. McIntyre on the ground looking after its interests.

President Chapin and Mr. F. T. Russell took care of the Rochester Car Wheel Company.

St. Louis—the "Mound" City—sent its representative in the person of Mr. Kline, of the St. Louis Car Company.

Entirely superfluous to record the fact that Major Harry C. Evans was on deck first, last and all the time.

Electrician George W. Mansfield, one of the brightest electric railway men of to-day, showed up bright and early and saw that the Thomson-Houston Company lost nothing by the convention.

Messrs. C. C. Curtis, Bowen and William Hazleton talked short gearless motors till they were driven away.

W. K. Mason, President of the Electric Merchandise Company, of Chicago, sent his right-hand bower, D. B. Dean, to represent his company.

The John Stephenson Company had two of its best men on the ground, Mr. J. A. Tackaberry and D. W. Pugh.

"Okonite" showed up with its Captain Candee and T. McCoubray.

The McIntosh Seymour Engine could not have had a better exponent than Mr. F. M. Pierce, of Pierce & Thomas, who was most ubiquitous both at the convention and at the banquet.

REPORT OF SPECIAL COMMITTEE ON "ELECTRIC MOTIVE-POWER FOR STREET SURFACE RAILWAYS."

"MR. PRESIDENT AND GENTLEMEN: Last May I received a letter from the President of this Association asking me to prepare a report, to be read at this meeting, 'on any subject covered by the range of electric motive power for street-surface railways.' In that letter the President, seeking to lure me to my destruction, stated that many months would yet elapse before the next meeting of the Association, and closed by expressing the hope that I would oblige him personally by complying with his request. I have been in so many situations where I have found it necessary to call upon my friends to oblige me that I could not find it in my heart to deny the President this request, especially if my promise, if made, was to do something months hence. I attached a string to my promise in the concluding part of my letter of acceptance, in which I stated that I did not see how I should get time to prepare anything worth the hearing, but that I would do my best.

"I expected, when I agreed to write something for your consideration, that I would have an opportunity, before preparing what I had to say, of talking with the President of this Association, and of obtaining from him some suggestions upon which I might hang the slender thread of my thought. That pleasure, by reason of his and my business cares and engagements, has been denied me, and only the other day I was brought up with a round turn by a letter from the Secretary, reminding me that I had agreed to prepare a paper for this meeting upon the subject, 'Electric Motive Power for Street-Surface Railways.' The reminder that the time had come for the fulfilment of my promise was almost as disagreeable to me as an electric shock administered by a five-hundred-volt current, but the unpleasant features of that situation were considerably modified by the statement that the Secretary, or some one acting through him, had been kind enough to formulate and put into quotation marks for me a definite subject for my paper. The fact that the subject is deeper than any well and wider than any church door, is, to be sure, a little embarrassing. I am encouraged, however, to say what little I can upon this very comprehensive subject by the knowledge that, while I know really very little about it, yet there may be some others engaged in the street-railroad business who have had less experience in the operation of street-surface railroads by means of this unseen and wonderful force called electricity.

"The subject which has been given to me is many-sided. I shall endeavor to throw out a few suggestions, based upon some study of the problem of street-railroad transportation and upon a little experience. If in what I shall say I am able to furnish one or two texts for discussion, I am sure there are those present who, by their discussion of the texts, will furnish all of us valuable information and food for thought, and thereby my purpose will have been attained.

"Most of us are engaged throughout all of the working hours of each day in the performance of duties which leaves us little time for reflection upon and study of the broad questions suggested by the subject which has been given to me. We all know that the tendency of modern American life is towards the concentration of vast masses of people in our towns and cities, and that this urban increase is somewhat at the expense of the agricultural communities. We also know that the American workman, as well as the American business and professional man, is seeking to locate his home some distance away from the section of his town or city where his business is transacted or where his work is done. Every householder has, or desires to have, at least a little patch of lawn or garden about his home, to obtain which he must locate some distance from the business or manufacturing centre of the town or city where he lives. To the average man, however, this is not possible, except as he can have some means of communication with that business or manufacturing centre at low cost to him. But as towns and cities grow and distance becomes more and more an element to be considered, it becomes necessary that the citizen should have not only facilities for cheap transportation for himself and the members of his family, but that he should have means of rapid intercommunication. Out of the needs of modern city and town life grew the horse railroad. The development of cities and towns brought with it the necessity for quicker transportation. The American intellect, ready to meet every emergency, set itself at work to devise some method of quickly transporting the people of the great cities of the country, and so far as the great cities are concerned, practically solved the problem presented by inventing and building cable railways. It was soon found, however, that while cable railways answered the purpose for which they were designed in cities like Chicago and Philadelphia and New York, they would not do in smaller cities, except in isolated cases where vast numbers of people were required to be moved daily over a comparatively short mileage.

"Five years ago the only street-surface railways which were in successful operation anywhere in the United States were horse and cable railways. Within that five years more than four thousand street cars have been electrically equipped, and to-day more than three thousand miles of track in three hundred cities and towns of this country have been constructed, on which these electric cars are run with satisfaction to the people and in the main with profit to the companies operating them.

"The development of the street railway has had as much—perhaps more—to do with the growth and prosperity of the towns and cities of this country, than any other one thing. The transportation of people by street railroads is most intimately connected with the social and business life of the people. Nearly five hundred cities in the United States have street-railway systems in operation. More than eight hundred corporations are operating street railways in such towns and cities. As many as thirty thousand street cars, horse, cable and electric, are to-day running upon the eight thousand miles of street railroads in this country. In these cars and on these tracks are carried as many as three thousand millions of people yearly, or fifty times the entire population of the United States. When we consider that the number of people carried by all of the steam-railroad companies in all of the States of this Union last year is estimated at less than five hundred million, and that more people are carried on the street-surface railroads in the City of New York in a year than are carried by all the steam railroads of the State in the same period, we come to have some conception of the immense importance to the people of the rapid, efficient and safe service of street cars in the rapidly growing cities and towns of this wonderfully prosperous country. Think for a moment of the daily loss to the people of any city where horse cars are run at from four to six miles an hour as compared with the operation in the same city of electric or cable cars running from six to twelve miles an hour. Consider the immense increase in the value of property in any municipality caused by the introduction of rapid transit. Consider the wholesome influence upon the people of every community where the husband or other head of a household is able, by means of facilities of quick transportation, to take his midday meal with the members of his family. The best thought of this time may well be expended upon this great question of furnishing quick, safe, cheap and comfortable transportation to the people whose lot it is to dwell, as dwell they do in such vast numbers, in the towns and cities of this land.

"The problem which is presented to the street-railroad man of to-day must be considered, not simply with reference to the populations as they now exist, but with reference to the great increase of population which is certain to come. There are seventy-four cities in the United States which have a population in excess of forty thousand. The total population of these seventy-four cities, as shown by the last census, is nearly thirteen millions, and the average increase of population in these cities during the last decade is nearly forty-seven per cent. In this State there are twenty-eight cities having a population in excess of ten thousand and a total aggregate population of nearly three and one-half millions. The average increase in population in these cities in the past ten years has been more than thirty-three per cent. For all these growing towns and cities in our own State and throughout the country what can electricity do as motive power for the operation of their street railroads?

"We who have had to do somewhat with the change of the system of operation of street-surface railroads from horse to electric power know that we have now passed beyond the experimental stage and are beginning to tread upon ground which seems firm under foot. We hear now and then fears expressed by doubting Thomases as to whether the motors are going to last, as to whether the repair bill is not going to wipe out all profit, and as to whether the great expenditure which has been and is being made in our railroads may not be thrown away because some new and wonderful principle is to be discovered which will enable our railroad companies to operate their roads with commercial success by means of storage batteries. We find in some communities so great a prejudice against overhead wires that railroad companies are unable to obtain the necessary franchises

and privileges, the granting of which would result in giving to those communities the benefits of rapid transit with electricity as motive power. Hour by hour, however, experience is teaching all doubters that the problem of rapid transit for cities has been solved, and that the trolley has come and come to stay.

"As this convention is held in the City of New York, where as yet the people have not had a practical demonstration of the merits of the trolley system, it may not be inappropriate to look at this question from the point of view of the New York citizen, and to meet, if we may, some objections which are here urged to the trolley system, so called. I have read with some interest much that has appeared in the great New York dailies with reference to the horrible condition of things which exists in towns and cities where the trolley system is used for street-car propulsion.

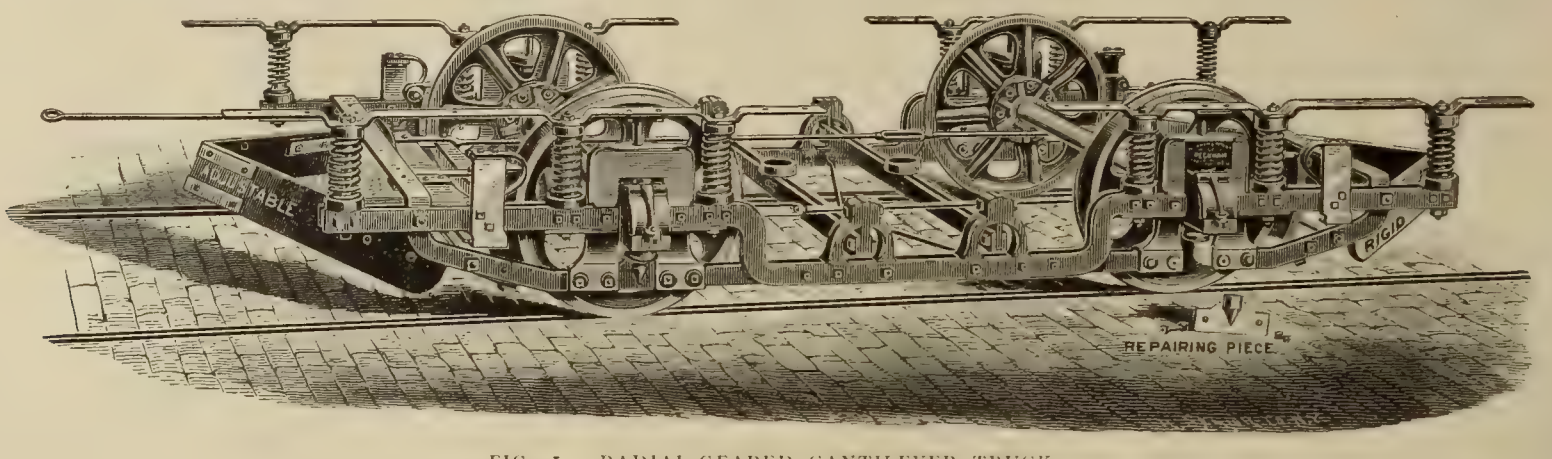


FIG. 1.—RADIAL-GEARED CANTILEVER TRUCK.

Our friends over in Brooklyn have been endeavoring since the last meeting of this Association to educate their townsmen upon this matter, and with at least a reasonable measure of success. To them, and indeed to all of us, the facts, which are perfectly well known, have become trite from iteration. Everybody knows that a rapidly moving car, whether the propelling force is furnished by horses, by steam power exerted upon a steel rope, or by electricity, will hurt, and perhaps kill, the person with whom it comes in contact, but the rapidly moving car is essential to rapid transit. An electric car can be stopped as quickly as, indeed



FIG. 2.—CANTILEVER EXTENSION SIDE-FRAME.

more quickly than, can a cable or horse car running at the same rate of speed. Collisions occur with one system of operation as much as with another, but we contend, so far as the danger question is concerned, that the only danger to life or limb from the operation of electric cars comes from the possibility of collision with persons or vehicles, and that there is no danger from the electric current itself propelling the car.

(*To be continued.*)

IMPROVEMENTS IN CAR TRUCKS.

This truck (see Fig. 1), while embodying some of the general features of the original cantilever truck introduced by the Peckham Wheel and Axle Co. some eighteen months ago, has many radical and important improvements invented by Mr. Peckham to overcome the objections developed by service, and to better adapt it to the requirements of the electric motor.

The first improvement consists in the improved construction of its *cantilever extension side-frames* (see Fig. 2), which consists of several wrought steel and iron bars, firmly riveted to malleable iron yokes in such a manner that the side-frame is practically one piece.

The malleable iron yokes of the side-frames are constructed as hereafter described in the construction of the gear, and are provided with removable repairing pieces, to allow for an easy removal of wheels and axles. The centre portions of the side-frames are bent so as to allow for ready access to the motors and the removal of the armatures. It is claimed that this improved construction provides for an easy removal of the wheels and axles without taking the side-frame apart, as was necessary in the construction of the truck as originally constructed, and also provides for a more easy access to and removal of the armatures.

The second improvement in this truck consists in the construction of the radial gear, which is radically new in construction. It consists of a malleable iron or steel yoke, provided at its upper cross-section with a pocket, into which is inserted, first, a "rubber cushion," which sustains the entire weight of the side-frame to which the yoke is riveted; the lower section of the "rubber cushion" rests upon the hollow bearing which comes in contact with the journal-box. This bearing is constructed of "ball" shape, and fits into a ball-shaped socket in the top of the journal-box, thereby making the connection with the journal-box a flexible one.

The lower sections of the yokes are riveted at one side to the end truss extension and at the other to a centre steel bar connecting the two yokes together. The centre cross-section of the yoke underneath the journal-boxes (known as the repairing piece) is provided with a projection that fits into a socket in the under side, and is secured in the jaws of the yokes by bolts which can be easily removed when desired to remove the wheels and axles. The socket in the under side of the journal-box is constructed of oblong shape, so as to allow for the lateral or end play of the axle. The sections of the yokes that embrace the sides of the journal-boxes are constructed with apertures that allow for a removal of the journal-boxes without jacking up the car body.

The claims for this gear are: First. It provides a positive "rubber cushion" for the side-frames of the truck, which relieves them, and also the motor-frames connected thereto, from shocks, and prevents loose bolts and breakages.

Second. That its "flexible ball-shaped journal-box bearing" readily adjusts itself to any unevenness in the track, and relieves the car from shocks when suddenly stopping and starting.

Third. That it allows the journal-boxes to be removed without jacking up the car.

Fourth. That it holds the car-body firmly in place and does away with the use of stay-bolts and rods.

Fifth. That it provides for the easy removal of wheels and axles.

The third improvement embodied in this truck consists in the construction of the *flexible motor support* or hanger (see Fig. 3), which consists of two parallel steel bars provided with one or more spring-pockets (as required for different styles of motors) to sustain the rubber or steel springs used to support and cushion the rear end of the motor-frame. The two parallel crossbars are suspended at each end by flexible connecting-bars from brackets riveted to the side-frames. This flexible suspension allows the suspended bars to move freely sidewise in any direction, so that the heel of the motor-frame being flexibly secured, can adjust itself easily to the variable motions of the axle, and thereby relieve the motor-frames from side-strains, and insure a true mesh to the motor-gears.

In addition to the foregoing recent improvements, this truck, when so specified, is equipped with Peckham's patent interchangeable wheels, to which improvements have also been made during the past eighteen months. These wheels are doing satisfactory service upon roads with heavy grades, and are claimed to be much more economical than the ordinary rigid wheels, as they can be renewed at any car-barn by any ordinary laborer without the aid of special machinery, and without removing the motors from the axles. It is also claimed for them that the "rubber cushions" contained in the eyes of these wheels afford a positive cushion for the axles and thereby relieve them and the motor-frames (attached to the axles) from shocks and vibrations and consequent crystallization caused thereby, and in that way prolong their life.

The self-lubricating journal-boxes and brakes used upon this truck also contain improvements of Mr. Peckham, claimed to be unsurpassed by any in use.

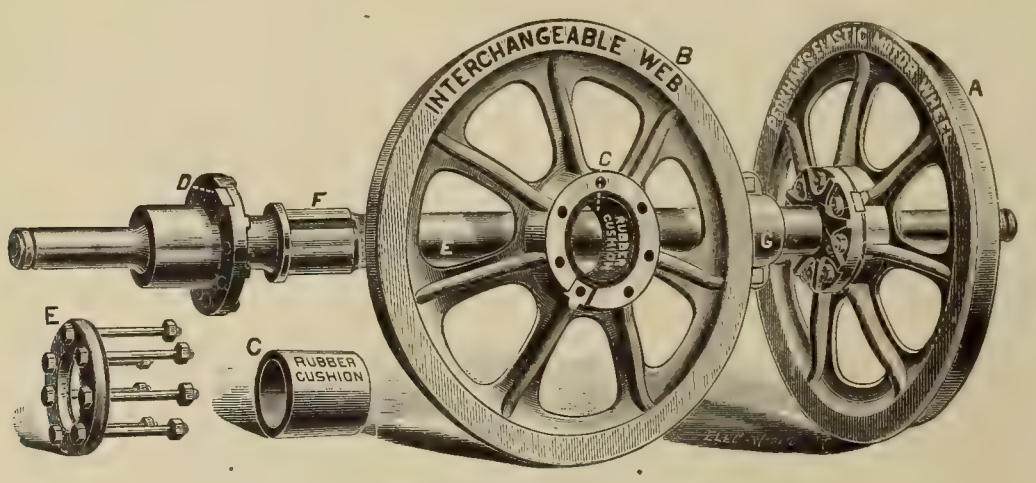


FIG. 3.—INTERCHANGEABLE CUSHIONED WHEELS.

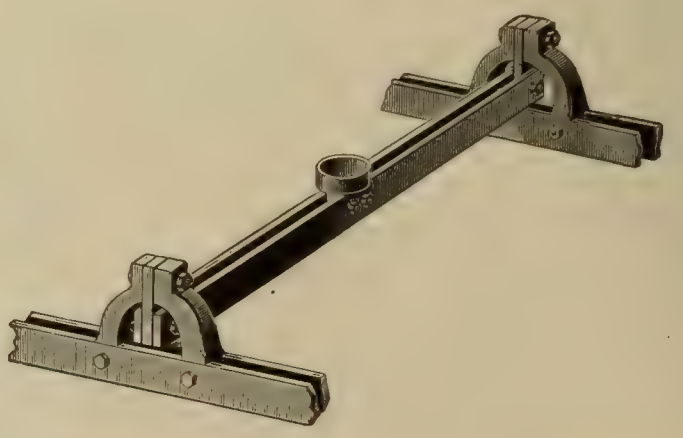


FIG. 4.—PENDULUM MOTOR HANGER.

From the above description of this truck, together with the reports of the result of several months' service now in our possession upon roads whose service (owing to heavy grades and sharp curves) is very severe, and we think that the claims of the inventor, Mr. Peckham, that he has fully perfected his truck and wheels, and that it will positively prevent both end and side oscillation of electric cars running at a high rate of speed, giving flexibility to journal-box, motor-support connections, and that he has reduced the cost of repairs to a minimum, besides insuring an easy-riding car, are fully sustained.



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THE PITTSBURG CONVENTION.

Active preparations are being made among street-railway and supply men in connection with the convention at Pittsburg, which is to be held there on the 21st of next month, of the American Street Railway Association. This will be one of the most important and probably one of the most largely attended conventions of street-railway officials ever held, and judging from the programme, it will also be one of exceeding interest.

As far as can be estimated at the present time, there will probably be over three hundred leading street-railway officials in attendance, and the exhibition of street-railway machinery and appliances is likely to exceed anything of the kind ever held in this or in any other country.

Electricity will, of course, be the dominating feature of the meeting, both as regards the subjects of the papers to be read and discussed and the exhibits. The exhibits, in the main, will be displayed on a large double-decked excursion boat, which will be moored to the wharf alongside the Monongahela House, the headquarters of the Association. The heavy goods will be shown on the lower deck, while the lighter ones will be placed on the upper deck. The boat will be suitably decorated for the occasion, and at night will be lighted so that the exhibition may be visited at night as well as in the day-time.

There is every indication that the convention will be an unqualified success in every respect, and nothing will be left undone by those who are actively interested in it to make it so.

SAFETY-VALVE PROBLEMS.

We conclude in this issue the valuable series of articles written by Mr. J. Stanford Brown on safety-valve problems.

After reading Mr. Brown's articles, no one who understands the subject can question his ability to handle it properly. That he is a master in this direction is self-evident, and it is hoped that his able articles will prove of much benefit to all interested. Mr. Brown handled the subject in an extremely interesting manner. Usually such matter is dry reading, but Mr. Brown's style is quite as interesting as it is instructive, and the reader is carried on quite unconscious of the hard facts he is considering.

This latest addition to the literature on safety-valves will prove of great value to the practicing as well as the professional mechanical engineer.

OBSTRUCTIVE MEASURES.

In the very face of the fact that over three hundred and fifty electric railways are in actual operation, that no less than 2,893 miles (almost equal to the distance from New York to San Francisco) of track are electrically equipped, and that between four and five thousand electric-motor cars are in use to-day—in the very teeth of the acknowledged fact that no human life has ever yet been sacrificed to the potential of the trolley wire, we find attorneys to-day who, to make out a case for their clients, actually fly directly in the teeth of all this and file objections to an application for change from horse to electric traction on the grounds

First—That the change of motive power as proposed would be a constant source of danger to the increasing population of Brooklyn using said thoroughfares and a menace to life and limb.

Second—That the erection of poles and the maintenance of overhead wires as proposed would be an unsightly and disfiguring obstruction to the avenues along which they would extend, and an injury to your objector's property abutting thereon.

Third—That said change of motive-power would be a constant source of danger to those using and approaching objector's property.

Fourth—That a change of motive-power would cause your objector's property to depreciate in value thereby.

To the "first" we cannot but say that the premises are incorrect and the presumption is against the facts of the case in point.

To the second we might agree but for the very ornamental styles now pretty generally adopted by electric-railway companies. As to electric railways being an "injury to" property, the records determine this to be precisely the reverse.

To the third applies the same arguments as to the first.

To the last (the fourth) we can only say that the statement made has never yet been borne out by actual experience.

If some of these gentlemen—these attorneys—were to honestly study the contents of the street-railway papers, issue by issue, we feel sure that they would learn much of great value to them and save their having, sooner than lose a case, to resort to such simply obstructive measures as the case in point.

CORRESPONDENCE.

ST. THOMAS, WEST INDIES, August, 1891.

GENTLEMEN: I am very much obliged to you for the copies of your valuable paper which you so kindly sent me, and in reply to your letter of the 27th ult. will say that with the exception of a telegraph and cable line, there are no electrical appliances of any kind in the Danish West Indies, neither are there any street railways or tramways.

It has often occurred to me that the establishment of an electric-motor line would pay well in the Island of St. Croix. The distance from Fredericksted to Christiansted is but fifteen miles, with many valuable sugar estates along the route, and there is a population (mostly black) of about 18,000.

Such a line could, I am sure, secure the hauling of produce to either city for shipment, and also deliver supplies, etc., at the different estates through which it might pass; and sufficient power might also be contracted for by the operating company to light both cities with electricity.

If any of your readers feel disposed to make such a venture, I will gladly render them all assistance in my power. Meanwhile believe me, gentlemen,

Yours, very truly,
S. B. HORNE.

TANGIER, AFRICA, August, 1891.

GENTLEMEN: Replying to your recent favor with regard to the existence of street railways, tramways or electric motors in Morocco, I will state that this country has not yet reached that advanced state of civilization which embraces street railways, tramways or electric motors, the only means of transportation being those which have been in use from time immemorial, viz.: camels, horses, mules and donkeys; therefore it is impossible for me to give you any kind of an interesting letter regarding something which does not exist in this land of the torrid zone.

Very truly yours,
F. A. M.

RAILWAY POWER PLANT.*

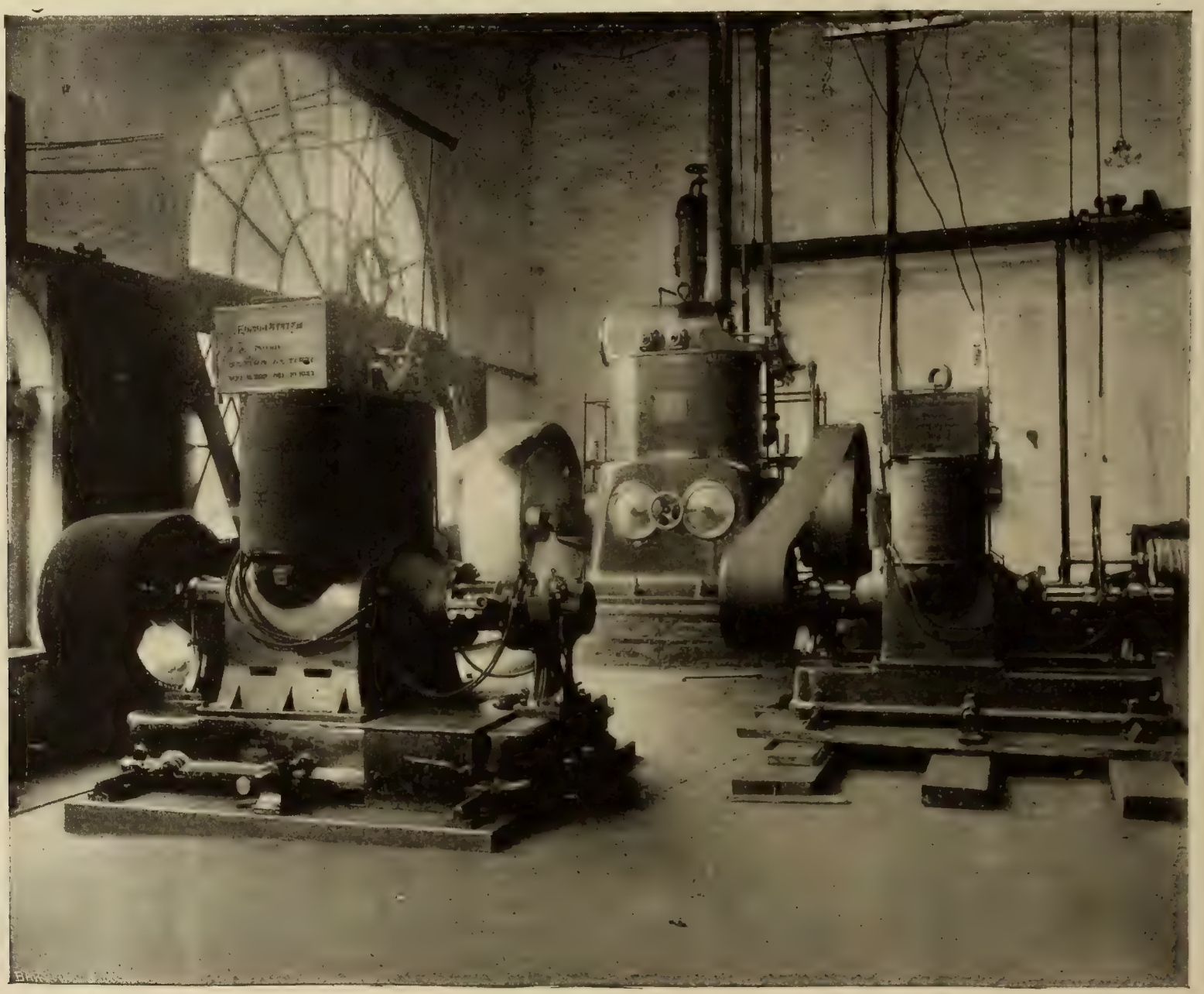
The accompanying illustration shows a complete power plant, the first of a series in the station of the Federal Street and Pleasant Valley Electric Street Railway Company, Allegheny, Pa., which are being put in to replace the old complex system of centralized power, with its attendant evils of countershafting, clutches and belting.

It having become recognized by users of electrical power machinery that the direct belted dynamo system of subdivided and independent power offers greater immunity from delays or accidents, the railway company, with its customary enterprise, decided to adopt this system and thus keep on the safe side as far as possible.

The engine shown in the cut, which is an excellent one, is of the Westinghouse compound type with cylinders 18 and 30 x 16 inches.

The governor of this engine was recently the subject of some interesting experiments with a view to determining the rapidity of adjustment with instantaneous changes of load.

As originally intended, the combination consisted of a single Edison dynamo belted direct to the engine; but the imposition of a second dynamo on the engine, with increased steam-pressure on account of the continued trouble with the other system, indicates the success of the change.



POWER PLANT OF THE FEDERAL STREET AND PLEASANT VALLEY ELECTRIC STREET RAILWAY CO., ALLEGHENY, PA.

BUFFALO NOTES.

The overhead work being completed and the connections with the underground system finished on lower Main street, the Niagara street cars commenced running down to Seneca street on the 6th inst. A number of new cars have been added to this line to meet the increased traffic and to provide for the additional length of the run. The travel grows faster than cars can be secured to accommodate it, and they continue to run overcrowded.

The new Seneca street electric line was opened on the 9th inst., the cars running at present from Main street to the crossing of the Erie railway. Some difficulty with the latter company prevents the street-car company from effecting a crossing of its tracks, and until this is settled the cars cannot be run to the end of the line. The Seneca street line is equipped with cars of the ordinary size, sixteen feet long, without vestibules. They are propelled by Thomson-Houston single-reduction motors, as in fact are all of the new cars, this system having been adopted by the street-car company after the experience of a few months.

The big carson the Niagara street lines are found to be somewhat cumbersome, and it is doubtful if any of the other lines will be supplied with such heavy cars.

ELECTRIC ROADS IN ATLANTA, GA.

Work on the various electric street railway lines in Atlanta, Ga., is progressing very rapidly, and in a few months that city will have one of the best-equipped and most complete systems of transportation to be found anywhere in the South.

There will be in all six main lines when the improvements are completed, and it is expected that the electric line running in that direction will reach the exposition grounds by the time of the opening.

The six roads referred to will run on routes as follows: On Edgewood avenue out Whitehall street to West End; from the Boulevard to West End by either Broad or Whitehall street line; another connecting the end of the Decatur line with the long Marietta line; from West Peachtree street across the city out Pryor street or Capitol avenue; from Courtland avenue out Pryor street or Capitol avenue. When these roads are completed passengers can ride from one section of the city to another with great facility. Some of the lines will be double-tracked.

The dummy line now running to Grand Park via Georgia avenue will be operated by electricity very shortly, and it is said that the Fair street dummy line will also be transformed into the overhead trolley system before long.

These lines are controlled by the Atlantic Consolidated Street Railway Company, and are equipped with Thomson-Houston double and single reduction motors. When the improvements and extensions are completed Atlanta will have some 35 or 40 miles of electric road within its corporate limits.

The McPherson Barracks line, which is not included in the consolidated system, is owned by Messrs. Woodward and Mountain, associated with Mr. H. M. Atkinson. This line is operated by electricity on the Edison system; there are now five cars, and the number will soon be increased to ten or fifteen. The new extension to this line, known as the Grand Park extension, was lately opened for business. Seargent & Lumby, of Chicago, installed the complete overhead work, and are now getting ready to place new motors and double-decked cars on that line.

The power for the road will be taken from the McPherson Barracks station.

Referring to the consolidated system, it may be of interest to state that eventually an electric power plant of 6,000 horse-power will supply the current for the operation of the roads. At the present time only 400 horse-power supplies the electric lines in operation.

ELECTRIC ROAD AT ESCANABA.

Escanaba, Michigan, is a thoroughly progressive town with a population of eight thousand. Its streets are wide and well paved, and from its immense ore docks, perhaps the largest in the world, large shipments are made which makes the tonnage greater than from any other part of the country, except New York.

Under such conditions, Escanaba, of course, could not permit its sister towns to surpass it in facilities for rapid transit, and nothing less than the latest electrical equipment would satisfy the present desires of the community. The road which was recently completed and formally opened for traffic on September 13 certainly reflects credit on its owners and others concerned in its construction. It extends from the railway station on Stephenson avenue about three-quarters of a mile, thence through Ludington street for a distance of one and a half miles. The latter street is the main business thoroughfare and is lined throughout its entire length with the principal stores of the city.

At the opening of the road the scenes which have become so familiar were repeated. Crowds of passengers, enthusiastic citizens and delighted owners all testified their satisfaction with what is fast being recognized as the only method of rapid transit, suitable alike for cities and villages. On examination of the road and its construction, it was seen to be one of the most carefully constructed in the West. The track is laid with 45-pound Johnson girder rails and the rolling-stock consists at present of two Pullman cars mounted upon Hubbard trucks, manufactured by the McGuire Manufacturing Company. The electrical equipment of each car consists of one twenty horse-power single-reduction Westinghouse motor. All

* Westinghouse Machine Co., Edison General Electric Co.

the line material was furnished by the Electric Merchandise Company, Chicago, and the overhead work presents a neat and handsome appearance. The cars will be heated during the coming winter with the Burton electric heaters, thus making the system purely electrical. The track was laid under the care of James B. Moran, who is to be the manager of the road, and the installation at the power-house, together with the construction of the overhead work, was in charge of Mr. J. F. McBeth.

The President of the Company is Mr. James Lillie, of Kankakee, and at his invitation Mr. J. L. Barclay, of the Westinghouse Electric & Manufacturing Company, Mr. Edward Halliday, President of the Cairo Electric Railroad, Mr. W. R. Mason, General Manager of the Electric Merchandise Company, a representative of STREET RAILWAY NEWS and others interested in electric traction attended the formal opening of the road and witnessed the successful inauguration of a rapid-transit service which will doubtless result in hastening the growth of the prosperous little city.

RECENT PROGRESS IN THE USE OF ELECTRIC MOTORS.*

BY PROF. G. FORBES.

In the application of electric motors I have noticed three directions in which this country needs the testimony of independent and impartial people to assert the value of applications which in some other countries are generally adopted. These are: (1) Electric railways. (2) Replacing shafting in shops by electric conductors and motors. (3) Transmitting power to a distance from waterfalls and rivers by electricity.

Electric Railways.—These are thoroughly established in America on the cheapest system—*i.e.*, electricity supplied from a central station by overhead wires. The extensive adoption of electric tram lines in America and the small number in England is certainly due to the fact that they allow these overhead conductors and we do not generally do so. The most trustworthy estimates seem to vary between 4.18 and 6.00 cents per car mile, including coal, attendance, land and buildings, machinery, line, oil, water and waste. The question of repairs is serious and must be reduced. Most of the lines adopt spur gearing to reduce the speed from the electric motors to the car-axles. They generally use two pinions and two spur-wheels. This introduces great friction. It is very generally accepted that 8 H. P. is lost in gear friction, though this seems somewhat incredible, being about 30 per cent. These cars are large and the motors are of 30 H. P. This enormous power is absolutely demanded to enable them to start on a gradiant with facility, and they do this. There is no crawling about these cars. You feel that there is plenty of power for the work. The noise in these cars used to be very considerable, and the injury to watches through magnetization was at one time an objection. The noise from the gearing, especially when worn, has been deadened by inclosing the motor and gearing in cast-iron boxes. The magnetization of watches is prevented by adopting a suitable type of motor. Another source of trouble in motors used to be the brushes, for sparking is liable to be very violent with the variable load of a tram motor, and the commutators wore away rapidly. Since carbon brushes have been introduced this difficulty has disappeared.

The loss in double-reducing gear and the wear and tear led to all the important companies turning to single-reducing gear with rather heavier motors. It would at first appear impossible to go farther and adopt armatures on the wheel-axles without sacrificing the great advantage of gearing, which allows the motors to be independently supported without being subjected to the same shocks as the wheel-axles. In spite of this, the Westinghouse Company has introduced a gearless motor which has strength enough to stand the shocks. But other inventors had the idea of fixing the armature alone on the axle and supporting the field magnet wholly on springs; to support it partially on springs is of little value. In this direction the most important and promising plan seems to be that adopted by Eickemeyer and Field. They support the whole motor in guides on springs, and connect the motor-axle and the wheel-axle by cranks and a coupling bar, the cranks on the right and left sides being at right angles to each other. This seems to reduce gearing friction to the minimum, while completely obviating shocks.

In America spur gearing is almost universal, but in Switzerland the Oerlikon Company are introducing worm gearing, which has been so much approved by Mr. Reckenzaun. Storage batteries have not generally been successful in America, but in some trials have worked very well.

Replacing Shafting by Electricity.—The benefit of replacing shafting by electric conductors and motors has been thoroughly appreciated in America. Every one knows of the hundreds of motors for small work which are supplied with electricity by central stations in Boston and New York, besides other places, and of the large number of electric lifts supplied by the Otis Company with electric motors designed by Eickemeyer. I will only place before English manufacturers two of the establishments where a statement of what has been done is enough to bring conviction to the mind of every shrewd and sensible employer of power. In the great works of William Sellers & Co. shafting has been abolished as far as possible. The second establishment is Baldwin's locomotive factory, whence from 16 to 20 locomotives are sent off every week, and where space is so far valuable that there is no room for shunt lines, and where a 100-ton travelling crane picks up one out of the 20 and puts it down where wanted. This fine travelling crane and every other crane in this huge part of the works are driven by electric motors.

Transmission of Power to a Distance from Waterfalls.—With regard to transmission of power to a distance from waterfalls, I have seen little to chronicle in America, and what there is seems rather antiquated; but in Switzerland important work has been done both by continuous and alternating currents. The high-tension electrical work in connection with continuous currents that most impressed me was what was done by Cuenod, Sautter et Cie. Their six-pole machines, with Gramme commutators up to 2,000 volts, designed by M. Thury, seem to work admirably and sparklessly, and I must here state my conviction, which I did not previously hold, that the insulation of such a machine can be made perfect, as there done, by supporting the dynamo or motor on a number of alternate slabs of vulcanized rubber and porcelain and by connecting the shafts by Raffard couplings.

I will not take up time with describing different works of this kind, but I will now say something about the use of multiphase alternate or rotary currents, about the prospective use of which so much has been published. I have seen the machines and transformers in course of construction at Oerlikon, and the insulators which have been used; the mechanical design is excellent. I can quite appreciate the difficulties of regulation of three currents referred to by M. Dobrowolski, but I think that there are further points upon which information is much wanted. I want to know, for hitherto I have utterly failed to see, the advantage of this three-phase synchronizing alternator over the simple alternators which do such excellent work. I have been told that calculation shows that Mr. Brown's machine has 96 per cent. efficiency as a dynamo. Well, I reply that an ordinary alternator without iron, not having the hysteresis of Mr. Brown's machine, ought to have a higher efficiency. In the next place, I am told by Mr. Brown that while you cannot switch one of these three-phase synchronizing motors, with its load, on to an electric circuit, and expect it to get up to the synchronizing speed, yet it will do so along with the electric generator of electricity if the latter be also started from rest. In this it certainly has the advantage over the synchronizing alternator with iron, but none whatever over those without iron, which will act in precisely the same way unless the motor happens to be in dead-centres—*i.e.*, with the centres of coils (in a Mordey alternator, for example) half-way between the poles of the field magnets. If this is the only gain over single-phase alternators with self-induction, and if there be no advantage gained over alternators without large self-induction, I fail to see the merit of the complication of three phases. I would not have drawn attention to the absence of advantage, but would have preferred to await the experiments before expressing an opinion, were it not for the great attention directed to the scheme by the press, altogether out of proportion to the results which Mr. Brown and the Oerlikon managers hope to obtain. The great experiment about to be tried at Frankfort, which interests electricians all over the world, is not to prove that transformation is efficient, but to prove that 30,000 volts can be carried along 112 miles of overhead conductor.

M. Dobrowolski says that whatever load may be put on his motors, there is no serious difference in phase between the potential difference applied to the motor and the current, and there is no appreciable lag. If this be so, it would be a decided improvement; but I shall require strong proof before I accept the multiphase motor as a great advance over the Tesla machine. The only advantage which it possesses over synchronizing alternators without iron in the armatures and with large momentum lies in its power to start with the load on. But I do not see that in large applications this advantage is to be compared with what it loses by its want of synchronism. M. Dobrowolski claims that these machines have the further advantage over the synchronizers that they will not stop when overloaded. After having tested Mr. Mordey's synchronizing alternators, I have a strong conviction, almost amounting to a feeling of certainty, that it is impossible to put them out of step in ordinary conditions by merely increasing the load. The more you increase the load the more current goes through them to keep them in step. They would rather get red-hot than get out of step. They behave just as a continuous-current motor or Tesla motor or a Dobrowolski motor behaves under the same conditions; it gets hot but it does not stop.

People seem to be greatly at a loss to explain why it is that some alternators work well as motors, while others do not. The explanation is simply that the former have a large momentum and the latter have not. I announced this explanation of the difficulty at a meeting of electricians in Paris last February, and found that M. Hospitalier had arrived at exactly the same conclusion and quite independently. I feel confident in predicting that the Ferranti dynamo, if supplied with a heavy-enough fly-wheel, will be found to work as well as the Mordey machine as a motor.

*Abstract of a paper read before the British Associat on, in Section G, Cardiff, August, 1891.

FINANCIAL DEPARTMENT.

We are pleased to record the listing of the Thomson-Houston Company in the regular list of the Boston Stock Exchange on the 16th inst. There can be no doubt of the committee acting favorably on it at the regular meeting, which takes place on the first Wednesday in October. The financial statement is that of February last, being $10,000,000 common and $5,000,000 preferred, with only $6,000,000 and $4,000,000 issued. Par in both cases is $25, non-assessable. We are of the opinion that the new business of this company for several years will be largely connected with street railways. Whipple truly says: "The Thomson-Houston 'System' comprises everything about a street railway that is electrical and mechanical." The field is a grand one, practically unlimited and fresh. The public is fairly educated on the subject and accepts either of the methods with open arms as soon as the opportunity is given it. The few exceptions are the large cities, and Messrs. "We-are-the-people" will not be able to defer the accommodation much longer.

The liquidation of the Baring account is of interest to investors all over the civilized world. Their failure affected financial intercourse everywhere that commercial correspondence existed. The Governor of the Bank of England at the semi-annual meeting states that "the liabilities on the Baring account are run off except £280,000. The bank is now practically only a creditor for the £7,000,000 covered by South American and other funded assets. The syndicate will probably assume the securities later and repay the bank."

We are informed that the municipal bonds of Spokane Falls, of which mention was made lately in these columns, have been placed on the market, but it is reported that Auditor Peel refused to sign the bonds on the bid of $183,000, on the ground that less than par could not be accepted. The bonds are 6 per cent. funding, and at the above price would only yield 93 per cent. Spokane city and county bonds are soon to be issued for some $1,300,000. Electric construction is progressing rapidly in the whole Northwest. A new town does not monkey about oil or even gas any more, but as soon as they can induce a few women to settle among them, in goes a resolution for electric light, heat and power, and it is always carried unanimously. There is no safer investment than the local electric securities; they stand substantially on a par with school bonds and should never sell for less than par and interest. To be sure, Wall Street usually turns up its gilded nose at any new bond offered at par, but that is simply because they fail to see their commission, not that the bond is thought to be really worth less than par to an investor. It would not be a bad scheme for Congress to pass a bill this winter forming a bureau in

some record department in which all electric incorporations could be found with their capital, number of shares and gross bonds, the same as the location and area of a mine patented can be found and traced. We should then be able to see where the industry stood as compared with others. Now is the time before the volume gets too large. Quite a number of new electric street railway bonds in blocks from $20,000 up to $200,000 and bearing interest from 5 per cent. to 7 per cent., being the whole issue, are to be had, and several of them represent central station lighting in their assets. Before spring we look for municipal bonds issued by towns generally, but including a few cities, who will own their electric plants and operate them. We are curious to see what the result of this new departure will be as it becomes more general.

Street railways are being constructed in all directions, and with electric power reasonable distance is overcome inexpensively. Towns are being joined, or, as in the case of large cities, absorbed by this modern improvement.

The total number of organizations incorporated during the month of August was 1,356, with a capital of $462,756,155, of which 88 were light, heat, power and transportation companies, capitalized at $64,419,000, and 439 miscellaneous, having a gross capital amounting to $70,339,497. We are of the opinion that the lowest point has been passed and the time has arrived to exploit every meritorious enterprise you have been withholding. New York is being visited this month by many financial envoys of electric corporations from all parts of the Union; even Oklahoma is represented by its Guthrie Electric Light bond, the stock already paying 18 per cent. There is a chance for a few thousand invested today growing into hundreds of thousands in a very few years. Alaska, with her gold mines, seals and glaciers, will be tapping at our door before another year for money at seven to eight per cent., instead of the high rate demanded out there. One of the most important advances is the concentration of the electric light and public water supply under one management, the saving of expense admits of so much more efficient service and increased income; many are also including the electric street railway, and it must be remembered these bonds are for long time. The franchise is usually for not less than thirty years in a rapidly-growing city or town, and, as will be seen by referring to our list, paying five and six per cent., purchasable at or very near par.

REPORT OF SPECIAL COMMITTEE ON "ELECTRIC MOTIVE-POWER FOR STREET SURFACE RAILWAYS."*

(*Continued from page* 86.)

"As I have stated, electric cars have been operated during the past year on more than twenty-five hundred miles of track, and although millions of people have been carried upon these cars, no instance can be given of serious injury to any person by reason of shock caused by the electric current. We contend that the electric pressure used in the propulsion of street cars is below the danger limit. We know that in every locality where the electric railroad has been properly built and is properly operated the people are enthusiastic in its praise, and that a proposition to go back to the system formerly used would meet with universal condemnation. We know that a railroad operated by electricity is a pleasant railroad to ride upon. The cars are started and stopped on such a railroad easily, and without jerking. On such a railroad we do not see horses frequently struggling beyond their strength to start a loaded car or to haul it up a grade. As we ride on such a railroad, we experience a sense of exhilaration as the car swiftly and safely speeds along, and unless our attention is specially called to the trolley wire overhead, we do not even realize that it is there. Only last week many people who reside in the City of New York had an opportunity of observing some of the advantages of propelling cars by electric power under hard conditions. Those in attendance upon the Republican State Convention, at Rochester, indulged, in the evening after the nominations had been made, in an impromptu celebration in front of the leading hotel of that city. The street in front of the hotel was completely blocked with people listening to the speeches and admiring the fireworks. The electric cars were, however, kept moving throughout the entire evening, and as several of the lines in operation in the city passed in front of the hotel, it was necessary for the cars to feel their way through this vast crowd. During the time of the celebration between forty and fifty cars passed through the concourse of people, moving, if need be, at a snail's pace, backing when necessary by the reversal of the current, and without in the slightest degree injuring a single person. Cars drawn by horses could not have gone through the crowd in safety. I believe that every person who witnessed that sight, no matter how prejudiced he may have been before, was convinced that the operation of street cars by electric power is safe.

"There is, however, one objection, which is urged with great insistance, especially in the City of New York, to the trolley system, and that is to the trolley wire itself. There is not the slightest danger in putting up or maintaining the trolley and necessary feed wires, if the work is done in a proper manner and if reasonable care is exercised in their maintenance, except as these wires are made dangerous by the telephone, electric light or telegraph wires placed above them. If the telephone, telegraph and electric light companies would take as much pains in putting up and maintaining their wires as do the electric-railroad companies, there would never be any occasion for complaint so far as danger is concerned, and then the only objection which would be urged to the maintenance of the necessary wires to operate electric cars would be their so-called unsightliness.

"It must be conceded that poles, however shapely, and wires, however well put up, do not improve the appearance of city streets, but quite the contrary. But experience has shown that except poles be set and wires strung electric roads cannot be made a commercial success, and therefore without poles and wires electric railroads will not be operated. Hence the question presented to the people of a city where the population is not large enough to sustain a cable railroad on a given line is this: Shall we have rapid transit by electric motive power, and waive a sentimental objection to the maintenance of a few light wires eighteen or twenty feet above the surface of the street, or shall we have slow transit by horse power, with its many disadvantages and disagreeable accompaniments, and be rid of the wires? The question is being answered almost every day in the towns and cities of our country in favor of electric rapid transit.

"The question is often asked by officials of street-railroad companies who are contemplating making a change from horse to electric power, what is the cost of operation of an electric railroad as compared with the cost of operating a horse railroad? I propose to state some experience which electric-railroad companies have had upon this subject, and to answer the question as well as I can.

"You have undoubtedly all seen the census bulletin prepared by Mr. Cooley upon the relative economy of electric, cable and animal motive power for street railways. Those of you who have seen this bulletin and studied the tables which Mr. Cooley has prepared must have felt that, so far as electric roads are concerned, the information upon which they are based is very inadequate and unsatisfactory.

"Four of the electric railroads, the reports of which furnished information for his table, had been in operation less than one year at the time these statistics were furnished, and the electric railroad which commenced operation earliest extended no farther back than May 1, 1888. The average cost of operating the ten electric railways taken for purposes of comparison by Mr. Cooley is in round numbers thirteen cents per car mile, while the average cost of operating the ten railways operated by animal power is in round numbers eighteen cents per car mile, and the average cost of operating the ten cable railways is in round numbers fourteen cents per car mile. Mr. Cooley gives as the total average cost of road and equipment per mile of line with cable power in round numbers, three hundred and fifty thousand dollars; with electric power in round numbers, forty-six thousand dollars, and with animal power in round numbers, seventy-one thousand dollars. There is little value, however, to be attached to comparisons of this character. Everybody knows that it costs less to construct and equip a horse railroad on a given line than an electric railroad, and that it costs very much more to construct and equip a cable railroad than an electric railroad. Of course, in determining the question of economy in operation, the first cost of construction and equipment is a very important element for consideration, as well as the actual cost of maintaining and operating the railroad, whatever the motive power, when once completed. It seems more profitable to avail ourselves of comparisons which have been made by surface-railroad companies operating a part of its system by electricity and a part by horse power. Fortunately, we have gone far enough in electric railroading to be able to obtain sufficient facts to enable us to make an intelligent and trustworthy comparison.

"The company which has had the greatest experience as to these matters is the West End Street Railway Company of Boston. That company has published a statement showing its earnings and expenses both with the electric and the horse car system for the months of April, May and June of this year. I ought perhaps to state that, as it seems to me, the conditions involved in the consideration of these questions are so diverse in different cities that the only proper basis of comparison of cost of operation is the cost per car mile. It is quite common for the street-railroad officials to consider this question of the relative cost of operation upon a basis of a percentage of gross receipts. It will be readily seen, however, that this basis of comparison is necessarily misleading and inaccurate. The other basis is not exact, but approaches at least approximately to exactness. The total expense, as shown by the West End Company for motive-power, car repairs, damages, wages of conductors and drivers, and all other expenses per mile run with electric power during the three months mentioned was as follows:

April	21.75 cents.
May	22.36 "
June	20.37 "

"The total expense per mile run with horse-power for the time mentioned was as follows:

April	24.56 cents.
May	24.04 "
June	23.52 "

"Earnings upon the two lines during the period under consideration with the two systems were as follows:

April	Electric,	34.05 cents;	horse,	31.77 cents.
May	"	38.43 "	"	34.22 "
June	"	42.71 "	"	36.85 "

"It will be observed that the earning power of the electric cars is considerably in excess of that of the horse-cars, and that the expense per car mile is considerably below. The West End Company states that the electric cars of this company are run on the longer and less remunerative lines. If this be true, the showing made is very greatly in favor of the electric car from a commercial standpoint.

"Permit me to refer to the experience of the company at Rochester with which I am connected. In the month of May last the Rochester Railway Company operated forty-four 18-foot vestibule electric cars. The gross receipts from passengers riding on these cars during the month was $37,053, or 23.15 cents per car mile for a mileage of 159,567 miles. The total expense of operation of these cars for that month was $18,332, thus leaving a net profit of $18,721. The total cost of operation per car mile was 11.4 cents, and the profit per car mile was therefore 12.11 cents. It may be observed in passing that the operating expense was a trifle under fifty per cent. of the gross receipts.

"The cost of operation was divided as follows:

Motive-power	2.8 cents.
Car repairs	0.7 "
Conductors and motormen	4.9 "
Other expenses	3.0 "

"During the same period the company operated sixty-two horse-cars, all of them without conductors. Most of the horse-cars were one-horse or bob-tail cars. The total cost of operating the horse-cars without conductors, during this period, was about ten cents per car mile, but the total receipts per car mile were but little above twelve cents.

"In the month of June, the Rochester Railway Company operated fifty-four electric cars and sixty horse-cars. The electric cars earned each per day $23.60, or 22.77 cents per car mile, and the total expense of operating them per day was $10.50, or 11.07 cents per car mile. The cost of operation per car mile was divided as follows:

Motive-power	2.40 cents.
Car repairs	1.00 "
Conductors and motormen	5.66 "
Other expenses	2.01 "
Making a total per car mile of	11.07 "

"The cost of operating the horse-cars during the same month, per car mile, was 11.06 cents, and they earned 14.87 cents per car mile. These illustrations are fairly indicative of our experience in Rochester month by month. My experience in the operation of street railroads has convinced me that the most economical system of operation is the electric system. I have not, in the statements which I have now made, taken into consideration the greater fixed charge in the operation of an electric railroad as compared with a horse railroad, due to the much greater cost of the former; but in arriving at the conclusion which I have above expressed due consideration has been given to this element of increased cost. We know that when a horse railroad is changed over and operated by electricity the receipts are very largely increased. It is safe in any case to say that the increase in gross receipts will be at least fifteen per cent., and the average increase is probably as high as thirty per cent. Some of this increase is undoubtedly due to the greater mileage which the cars make, and still more is due to the cleaner, more rapid and more comfortable transportation of the people.

"We have reached the conclusion also that the bugaboo, which formerly somewhat frightened us, of the cost of maintenance and renewals of electric motors need frighten us no longer. We have had motors in constant service on one of the first electric lines equipped in this country, namely, the line extending from Rochester to Charlotte, and these motors seem as efficient and in every way as satisfactory as they did the first month they were operated. We have of course renewed various parts of the motors, and we have replaced gears which have worn out, the expense of which has gone into the cost of maintenance. But the motors are still there doing their work, and likely, with proper care and renewal of parts, to be doing their work ten, and even twenty years from to-day. The cost of maintenance and renewals of parts has not been so large as to carry operating expenses up to anywhere near the expense of operating the same number of cars, at the same mileage, by animal or cable power.

"Those who propose to substitute electric for horse power will make a great blunder if they attempt to put in cheap construction or material. We who have gone into this matter have learned that the track upon which it is proposed to operate electric cars should be of girder or Tee rail, of not less weight than fifty pounds to the yard of Tee, and sixty-two pounds to the yard of girder rail. The weakest place in the track is of course at the joint, and no cheap contrivance at that point should on any account be permitted. With girder or Tee rail construction it is, it seems to me, a useless expense to lay a continuous supplementary wire. The rails should of course be well and heavily bonded at the joints with iron, not copper, wire and cross connection of rails be frequently made. Where tram rail track is used, I think a continuous wire should be laid and connected with the bond wires.

"The overhead wire cannot be too well put up. Cheap devices should never be used because they are cheap. The best and strongest are none too good. In putting up the feed-wire and in putting in the ground-wire return to the generators, do not spare copper. I am convinced that much that we have heard about the inefficiency of generators and motors is due to trying to get too great a quantity of current through too small a quantity of copper. In the power station do not make the units too large. Accidents will happen as long as machinery is run, and an accident to a five-hundred horse-power plant is serious, while you can keep your cars or most of them moving, if one of two or three small engines breaks down. The same rule of course holds as to the generators.

"Always put in a condensing steam plant. One large item of expense of operation is the coal bill. Cut that down at least forty per cent. by erecting condensing engines. The first cost is of course a little more, but your stockholders, as they examine your statements of operation in the years to come, will say you were wise in your day and generation.

"Locate your power station as near as may be in the centre of your system, but above all, if possible, on a stream large enough to furnish all the water you require for the boilers and condensers. City water, where your consumption runs into the millions of gallons fast, is expensive.

"It seems to me a mistake to equip a car body of greater length than eighteen feet, and I think a sixteen-foot car is better still. During the hours of the day when travel is heavy it is easier to pull a trailer, and when traffic is light you are not then using up your power in hauling around a great lumbering double-truck structure practically empty.

"A great many companies have had trouble with their motors. The chief reason for this trouble has been that their motors have been too light mechanically and too economically built electrically to stand the strain. All the manufacturing companies have learned their lesson, and to-day most of the motors put upon the market are strong enough mechanically and electrically to perform, under proper conditions, the work expected of them.

"The managers of electric railroads, if they are to be made successful, must learn that the greater earning power is no excuse for extravagant management, and that the difference between success and failure is often a narrow one.

* Read at the Convention of the Street Railway Association of the State of New York, New York, Sept. 15, 1891.

Everything depends upon taking the stitch in time. A loose bolt, an imperfect connection, any one of forty little things, may result in serious damage and consequent financial loss. I do not know of an electric railroad anywhere, where the overhead single trolley system is used, which ought not to be successful. I know of some which have not been. In some cases cheap construction accounts for failure, and in some others careless management or reckless extravagance is the cause of the failure. The scrap-heap about an electric car-barn or machine-shop often tells a significant story. In intelligent supervision and painstaking watchfulness is found one great secret of commercial success, in this business as well as in most others.

"Every manager should keep a record of the items which go to make up operating expenses, and those responsible for management should carefully study these statements month by month with a view of lessening the expense of each item. An intelligent and careful examination of the cause of accidents to parts of a motor will often be the means of preventing the recurrence of troubles in the future.

"So far as possible motormen, as well as conductors, should be made to understand the mechanism of the machines which propel their cars and the function of each part. Thereby they are made ready to act promptly and intelligently in case of trouble with a motor.

"The directors of some companies, because of their desire to make handsome returns to their stockholders, have paid out in dividends money which ought to have gone back into the road. The proper policy to pursue in all cases is the building up and bettering of the plant out of earnings, so far as necessary, even at the expense of cutting down dividends.

"The field in which we are working is a great one. There is in this field abundant opportunity for the intelligent, progressive and sagacious business man. The primary object which the management of a street railroad seeks to attain is business success, but success in that direction cannot be had without great resulting benefits to the people of the community served by the railroad operated. We should not lose sight of the fact that we are engaged in a work the successful performance of which builds up communities, aids business enterprises and makes the life of the people in those communities better worth living.

"Respectfully submitted,

"JOHN N. BECKLEY, *Committee.*"

SAFETY-VALVE PROBLEMS.

BY J. STANFORD BROWN.

(*Concluded from page* 69.)

If, however, the rule be written out from the form of the equation when the value of B is wanted, it is almost impossible for the mind to find any meaning in the words without putting the facts into algebraic form. This is the criticism upon the rule, as given in *Power and Transmission*, VI., 76.

In *Power-Steam*, X. (No. 5), 6 May, '90, appears a figure which we reproduce as our Fig. 8. This illustrates the method then given for determining practically the combined effective weight of the valve (including stem) and of the lever arm from which the pee is hung. This involves the assumption that the "lever arm" of the force (represented by the weight) of the lever p is not l (the distance from the fulcrum, f, to the gravity centre of the said lever p), but S (the distance from the fulcrum, f, to the point of the lever p, at which the valve is attached).

Assuming the following values and solving for L, we get L = 31.1″, while if we make l = S = 3¼″, we get L = 32.64, a difference of 1.5″ or 4.9 = 5 % in the lever arm to be given the pee.

B = 22.3 p = 17 lbs.
L = 31″ or 50″ at max. l=23
W = 6¾ lbs. D = 6″, A = 28.3 sq. in.
S = 3¼″ P = 80 lbs.

Dimensions are taken from 6″ valve made by E. C. & B. Co., for which B. is made 223 lbs.

If we are trying to set the valve to blow off at 80 lbs. steam (*i.e.* = 100 lbs. over atmospheric pressure), making L = 31, we get P = 79.6 = 80; but if in our calculation we make l = S = 3¼″, we shall find that our valve will lift at 75.9 lbs., which is 5.1% fortunately on the safe side of our limit

"T. S. C.," in the *Colliery Engineer*, XI., 200, assumes the following values:

B = 50 lbs.
L = x = ? A = 7 in. W = 10 lbs.
p = 10 lbs. P = 100 lbs. S = 4″
l = 55.2″ (N.B.—This is really a value of L instead of being about ½ L)

and writes his formula:

$$7 \diagup 100 \diagup 4 - \left[10 \times 4 + \left(\frac{10}{2} \times 55.2 \right) \right] \div 50 = 49.68 = L$$

He evidently gets his equation into the form in the following way, starting with the general formula:

B L + W S + p l = A P S; transposing W S, we get
B L = A P S − W S; transposing p l, we get
B L = A P S − W S − p l; dividing by B, we get

$$L = \frac{A\,P\,S - W\,S - p\,l}{B}, \text{ which may be written:}$$

$$L = \frac{A\,P\,S - (W\,S + p\,l)}{B},$$

which is evidently the form "T. S. C." was trying to write.

The only explanation of why he should twist the formula into this shape, which effectually conceals all the true physical relations of the quantities, is that he has been misled by the error pointed out in the article in *Power-Steam* WS and pl are coupled in brackets, because it has been erroneously supposed that we could assume l = S, and write (W + p) S for WS + pl. The effect of so doing has already been pointed out.

Our friend has, however, been led astray in another respect as regards the physical relations of the quantities involved in his formula.

To show this more clearly, we will write his expression with the letters replacing the figures, thus:

$$A\,P\,S - \left[\frac{p}{W\,S + (2 \times L)} \right] \div B = 49.68 = L$$

Passing over the fact that a value of L has inadvertently been used for l, and that the division by B

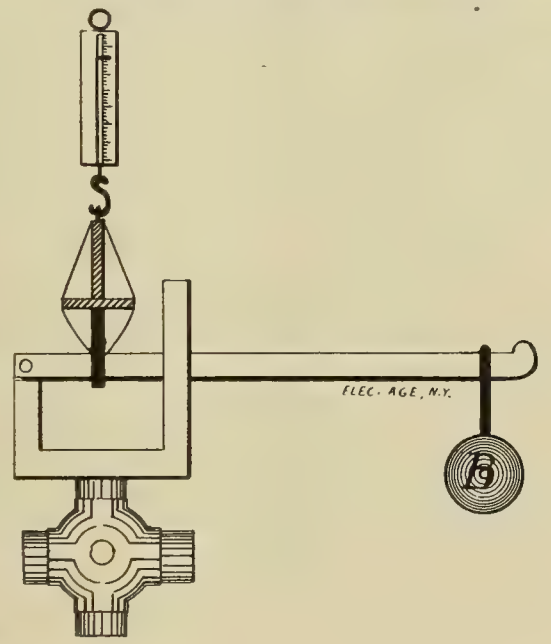


FIG. 8.

should apply to the term A P S quite as much as to the term in [ ], which would give L = 60.72 instead of 49.68, we will take up the question of the value of $\frac{p}{2}$.

The value of the weight (force) exerted by the safety-valve lever is seen to have been taken as one-half of itself (." ."), and furthermore that this weight is supposed to be exerted not with a lever arm equal to the distance from the fulcrum to its gravity centre or l, but at a distance from the fulcrum to a point of the lever arm chosen really by accident, he having taken it from his previous example.

Our friend is evidently at sea so far as the physical concepts of the subject are concerned. In taking $p = \frac{10}{2}$ he was evidently trying to get at the centre of gravity of the lever p, but he has taken one-half of its weight, p, instead of one-half of its length, l. He should have written $(p \times \frac{l}{2})$ instead of $(\frac{p}{2} \times l)$. Arithmetically and algebraically, the expressions are equivalent, for both may be written $\frac{(p \times l)}{2}$, but physically the half-weight is nonsense, for it can have nothing to do with the matter, and no one, from "T. S. C.'s" note alone, could get a correct understanding of the problem. To get the gravity centre of the lever by division by 2, we must assume that it is of uniform cross-section, end to end, which may not always be found a correct assumption in commercial practice.

Mr. Levan (*Canadian Electrical News*, I. (No. 8), p. 106, August, '91) falls into the same error as *Power-Steam* and "T. S. C." when he says: "In finding the centre of gravity, the valve, v, and stem, s, must be in their natural position when the lever arm, a, is balanced over a sharp edge, in order to find the centre of gravity of the system."

His v + s = our W.
" a = " p.

Again, under "the graduation of safety-valve levers" (*loc. cit.*, p. 107), when he writes: "For greater accuracy in finding the centre of gravity g, the weight of valve v and stem s should be weighed with the lever arm a; and they also should be placed on the lever at their proper distance from fulcrum f when the lever arm a is balanced over a sharp edge. As before stated, the momentum (*sic*) w x of the lever is found by multiplying the weight of lever arm a, valve v and stem s by the distance x from the fulcrum f to the centre of gravity g, which is a constant quantity in the graduation of the lever for different pressures of steam."

Nor is this the only trouble. Through this error the writer quoted has been led to give the general equation of the safety-valve with only two terms to the member whose moment balances that of the steam-pressure. This would have been pardonable had the two terms represented respectively the moments B L (his W L) and p l, the moment W S being thrown over, as we showed above, because its lever arm S is identical with that of the steam; for then the expression would still mean something physically. Instead of this, however, in his equation:

(1) W L + w x = A p l.

W L and A p l corresponding to our B L and A P S are correct, but w x not being equivalent to (p l + W S) for reasons we have above given, makes the equation wrong, both mechanically and physically, thus masking again its real meaning.

In his first paper, Prof. Meyer treats the problem neglecting the effect of the weight of the valve and stem, but includes them in the formula deduced in his second paper. It is to be regretted that it did not occur to him to express any opinion as to the respective merits of the two sets of formulæ, in short, failed to show how large an error might be introduced by omitting the weight of valve and stem.

On page 47 of the 1889 edition of "Guide Posts on the Engineer's Journey," edited by Geo. B. N. Tower for the Am. Steam Boiler Insurance Co. of N. Y., will be found a chapter on Boiler Apparatus, which begins with the safety-valve, the problems being treated on p. 52. We quote: "As the valve is 4″ in diameter its area is 12.5 sq. in., and *multiplying this area by* 50 *lbs.* (sic), the pressure, we have a total pressure or power of 628.32 lbs. on the valve, which we must keep in place by the weights of the valve and of the lever and by the weight on the lever. The valve acts as a dead weight, so by subtracting its weight, 5 lbs., from 628.32, we find we have only 623.32 lbs. resistance to be overcome, but this resistance is applied at 5 inches from the fulcrum, so we multiply by 5, and we have 3,116.6 lbs. The lever *weighs* 10 *lbs. and acts with a leverage of* 20 *inches, thus making* 200 *lbs. of weight* tending to keep the valve closed, and this subtracted from 3,116.6 lbs. leaves 2,916.6 lbs. to be neutralized by the weight. Now, if we *divide* 2,916.6 *lbs. by* 80 *lbs.* (sic), *we shall have* 36.47, *which is the distance in inches* at which the weight must be placed from the fulcrum."

The form of our general equation suited to the above is manifestly

$$L = \frac{(A\,P - W)\,S - p\,l}{B}$$

The physical facts are all correctly entered in the above equation, and it would be quite possible for one previously acquainted with the subject and with elementary algebra to put the above statements, and so get his equation solvable for the other quantities.

The statements as given, however, are open to criticism in regard to a different kind of inaccuracy.

For instance, it is not possible to multiply an "area" (in sq. inches or any other unit) by "lbs.," any more than to multiply 3 calves by 5 acres of land, and if we did why should the result be lbs. rather than sq. inches?

If our valve area be 12.56—^{2} and our steam pressure per sq. inch 50 lbs., we can multiply the number 12.56 by the number 50 and get the number 628.32 as a result, but this number 628.32 will not represent either sq. inches or lbs. It does represent a tendency to produce motion; it is an abstract number whose only quality is "bigness." It is proportional in that "bigness" to both the number of square inches and to the number of lbs., but the product has no specific nit. It is comparable only with unity itself. Such quantities appear frequently in mathematics. They are called "numerics." In the Calculus of Quaternion's, when the distinction is of vital importance they are termed "scalars," or "scalar quantities," or measuring quantities, for they answer by scale or measure only to the question "how much." So we cannot divide lbs. by lbs.

Many of those into whose hands this book last quoted will go have not had the best possible educational advantages, and it is therefore to be regretted that any work containing so much valuable information should be marred by a form of inaccuracy of statement which would call for correction in a public school. This will without doubt be corrected in a future edition.

Using the formula A P S = B L instead of A P S = B L + W S + pl for getting L—*i. e.*, neglecting "the weight of the safety-valve lever, valve and spindle"—introduces an error of 3 % on the danger side. Criticism has been freely made, but only in the hope of assisting in the attempt to aid the beginner, and so the writer will be glad to have any lips he may have made corrected; for quoting Prof. Josiah Royce: "The ideal of the truly academic person is of one who can criticise and be criticised as to scholarly work done, wholly without mercy as to the scholarship that is in question, wholly without malice toward the person of his opponent."

IN FAVOR OF THE GEARLESS MOTOR.

A very careful comparative test in actual service between the Short "Gearless" motor and a leading type of single-reduction motor was made on the Brooklyn Street Railway, of Cleveland, Ohio, August 19, 1891, the same speed being maintained and the same distance being run by both motors, with the following results: The single-reduction motor picked up forty-seven passengers, the Short "Gearless" eighty. Voltmeter and Ammeter readings taken every half-minute showed that the "Gearless" took 24 per cent. less E. H. P. than the single-reduction motor.

One of the ablest papers that has ever been read before a street-railway convention was that of John N. Beckley, President of the Rochester Railway Company, read at the convention of the Street Railway Association of the State of New York, held in New York, September 15. Between the lines of Mr. Beckley's paper we read the strongest possible indorsement of the Short Electric Railway Company's apparatus, with which the Rochester Railway Company is equipped.

THE WEEK'S RECORD OF STREET RAILWAY NOTES.

COLORADO

DENVER.—It is reported that the Traction Company is to complete an extensive system of street railways here.

GEORGIA.

ATHENS.—It is reported that the street railway company is having trouble with negroes, who attack the cars with stones.

ILLINOIS.

CHICAGO.—E. Proutty, president of the South West Chicago Rapid Transit Company, has patented a high-pressure steam motor for tramway purposes, said to be noiseless and smokeless. The exhaust is to be used for heating cars and to furnish power for automatic brakes.

MARYLAND.

BALTIMORE.—Surveys and plans for cabling the Fayette and Gilmore Street lines of the Baltimore Traction Company have been completed. Construction work will be commenced immediately.

MASSACHUSETTS.

LAWRENCE.—The electric street railway to Andover will be completed in a few days.

NORTH ADAMS.—Levels have been run to ascertain if the grade will permit the running of electric cars to the park on the hill.

SOUTH NATICK.—Construction work on the South Natick and Natick Centre Street Railway has been begun.

SPRINGFIELD.—On September 12 a passenger who tendered the conductor on a street car a larger bill than the company's rules permitted its employés to change was ejected from the car. The company is now threatened with a lawsuit.

NEW YORK.

BUFFALO.—Electric cars commenced running on Seneca street September 9.

LOCKPORT.—The street railway of the Lockport Electric Railway, Light and Power Company is being rapidly constructed.

OSWEGO.—Street railway started September 4.

ROCHESTER.—Electric cars running on North St. Paul Street and Plymouth avenue September 8.

ROME.—The gross earnings of the Rome City Street Railroad Company for the past year were $11,973; operating expenses, $13,278.56; fixed charges, $7,973.04; deficit for the year, $9,278.60.

SARATOGA.—It is reported that an Albany syndicate has purchased the property of the Saratoga Electric Railway Company.

OHIO.

COLUMBUS.—Construction work on the electric street railroad on Broad and Columbus Streets has been commenced.

OTTUMWA.—The Ottumwa Railway, Electric and Steam Company has just added one 135 H. P. railway generator to its plant.

PENNSYLVANIA.

HARRISBURG.—The City Passenger Railway Company is double-tracking its road on Race, Vine, Second, Chestnut and Fourth Streets.

PITTSTON.—It is stated that a Wilkesbarre syndicate has purchased the property of the street-railway company here for $40,000.

SCRANTON.—The People's Street Railway Company has just received five additional cars.

WESTCHESTER.—Street railway running September 1.

RHODE ISLAND.

PROVIDENCE.—The contract for the engines for the Broadway Cable, New York City, has been awarded to the Greene Engine Works here.

TENNESSEE.

KNOXVILLE.—The Knoxville Electric Railroad Company has given a deed of trust upon all its property to the American Loan and Trust Company, of Boston, Mass., to secure bonds to the amount of $700,000.

TEXAS.

BONHAM, FANNIN COUNTY.—Track-laying commenced on the Rapid Transit Railway September 11.

Track Extensions.

ATLANTA, GA.—The Metropolitan Street Railway Company will probably extend its tracks in the near future.

GREAT FALLS, MONT.—The Electric Street Railway Company will extend its tracks to the Boston and Montana addition. (See Possible Purchases.)

SALEM, ORE.—The Capital City Electric Company is to extend its system to the railway depots. (See Possible Purchases.)

SPOKANE, WASH.—It is reported that the Spokane Street Railway Company will extend its lines to Liberty Park, in the eastern part of the city.

Change of Power.

FORT WAYNE, IND.—It is probable that every horse railroad in this city will be converted to electric roads shortly.

OSWEGO, N. Y.—The Oswego Street Railway Company is to change from animal to electric power.

Franchises.

PORTLAND, ME.—The Westbrook Manufacturing Company has been granted a franchise to construct and operate an electric street railway on a number of streets here.

REVERE, MASS.—The Lynn and Boston Railroad Company has petitioned for a franchise to construct and maintain an electric street railway on a number of streets here.

SALT LAKE CITY, UTAH.—The Rapid Transit Company has been granted a franchise to construct a single or double track street railway on Fifth West Street to connect its existing lines.

WILKESBARRE, PA.—The Wilkesbarre and Suburban Street Railway Company has been granted a franchise to lay tracks and operate an electric street railway on a number of streets here.

WOOSTER, OHIO.—A syndicate of Eastern capitalists are after a franchise for an electric street railway here.

Increase of Capital.

OSWEGO, N. Y.—The Oswego Street Railway Company is to increase its capital stock from $20,000 to $125,000.

SCHENECTADY, N. Y.—The capital stock of the Schenectady Street Railway Company is to be increased to $300,000.

Casualties.

AMESBURY, Mass.—On September 10 a horse, becoming frightened at a passing electric car, ran away, badly injuring himself and the driver and smashing the carriage.

COLUMBUS, Ohio.—On September 13 a passenger stepped off of an electric car going at a very high rate of speed and was killed.

GLOUCESTER, Mass.—On September 10 two electric cars collided with terrific force, crushing both legs of one motorneer in a shocking manner. Several passengers were slightly injured.

MILWAUKEE, Wis.—A few days ago a horse received a shock by touching the track of the electric street railway and was thrown to the ground, the vehicle to which he was attached being completely wrecked and the driver, who threatens the company with a lawsuit, slightly injured.

NEW HAVEN, Conn.—A lady who jumped from a rapidly moving street car recenty fell under the car, receiving such injuries as to necessitate the amputation of both feet at the instep.

NEW YORK, N. Y.—On the evening of September 17 two little girls were run over by a car on the Central Cross Town lines, and one of them was killed.

SIOUX CITY, IA.—On September 10 a buggy was broken at Fourth and Pearl Streets by an electric car suddenly turning the curve without the motorneer ringing the bell. On September 11 another carriage was overturned by an electric car and its occupants seriously injured.

TOLEDO, Ohio.—On September 10 the 14-foot main belt of the Toledo Street Railway Company broke.

On September 6 two electric cars collided with great force badly damaging the cars and slightly injuring the motorneers.

A collision occurred on the Inter-Urban Electric Railway in St. Paul, Minn., on Saturday night last. The cars were crowded with people returning from the Minneapolis Exposition, ten of whom were injured. One dispatch concerning the same affair states that a car jumped the track.

New Roads.

AKRON, Ohio.—It is said that a company is after a franchise to connect Akron, Cuyahoga Falls, Silver Lake, Ravenna and Kent by an electric street railway. Address T. Johnson, Columbus, Ohio.

ANNISTON, Ga.—A street railway is to be constructed here.

CLEVELAND, Ohio.—A street railway is to be constructed between this place and Berea.

CLINTON, Mass.—It is reported that a company is after a franchise for an electric street railway here which will extend as far as Lancaster.

COLUMBUS, Ohio.—An electric street railway is to be constructed between this place and Westerville.

COTTAGE CITY, Mass.—An electric street railway is to join this place to Gay Head.

PARSONS, Pa.—A street railway is to be constructed here.

PITTSBURG, Pa.—An electric street railway is to be constructed from the West End to Mansfield.

WINNIPEG, Man.—An electric street railway is to be constructed from this place to Selkirk.

Incorporations.

KENSINGTON, PA.—The Kensington Electric Street Railway Company was incorporated September 11, with a capital stock of $12,000, to operate a street railway in the Borough of Kensington, Allegheny Co., Pa. Incorporators: John S. Alles, S. Stafford, A. E. Alles, Henry Alles, Sr., and Jacob Alles, all of Pittsburg, Pa.

ROANOKE, VA.—The Electric Construction Company has been incorporated, with a capital stock of $300,000, to carry on an electric railway construction and supply business. Incorporators: H. W. Sellers, S. E. Hase, C. A. Pearson, A. C. Deniston and R. J. Byron, of Philadelphia, Pa.

WESTBOROUGH, MASS.—The Westborough and Marlborough Street Railway Company has been organized, with a capital stock of $100,000, to construct and operate a street railway between Westborough and Marlborough, Mass. Incorporators: B. C. Hathaway, Geo. O. Brigham, Geo. L. Smith, R. D. Smith, A. B. Maynard, J. A. Fayerweather, W. A. Reed, Chas. H. Reed, Joseph B. Adams, F. V. Bartlett, C. H. Thurston, H. P. Longley, C. B. Frost, W. B. Frost, E. C. Lowe, E. C. Bates, Westborough; P. A. Underwood, Cambridge; Albert C. Pond, Boston; E. P. Shaw, Newburyport; W. B. Ferguson, Malden, and Thos. T. Robinson, Dedham. The first Board of Directors is as follows: J. A. Fayerweather, C. B. Frost, B. C. Hathaway, Geo. L. Smith, Albert C. Pond, W. B. Ferguson and Thos. T. Robinson.

COLUMBUS, Ohio.—The Columbus and Johnstown Electric Railway Company was incorporated September 3, with a capital stock of $200,000, to construct, operate and maintain a street railway from Columbus to Johnstown. Incorporators: W. Shepard, Felix A. Jacobs, Rufus S. Clark, S. H. Ewing, W. B. Rusler and J. W. Lake.

DEFIANCE, Ohio.—The Defiance Light and Power Company was incorporated September 4, with a capital stock of $100,000, to construct an electric street railway and operate electric light and power plants. Incorporators: E. N. Lewis, C. P. Harley, H. P. Miller, Henry J. Smith, Henry Fosz, Orlando Dyarman and R. H. Gleason.

WASHINGTON, Ind.—The Washington Street Railway Company has been incorporated, to construct and operate a street railway here. Incorporators: W. A. Cullop, Vincennes, Ind.; Theophilus Kates, Cincinnati, Ohio; John H. O'Neall and Hugh Barr, Washington, Ind.

Possible Purchases.

GREAT FALLS, MONT.—The Electric Street Car Company will require additional construction material shortly. Address Supt. Dickinson, Great Falls, Mont.

LAFAYETTE, IND.—It is stated that the Street Car Company will expend $18,000 in improvements in the near future.

SALEM, ORE.—The Capital City Electric Company may require additional equipment shortly. Address Supt. Barnes, Salem, Ore.

WASHINGTON, D. C.—The Anacostia and Potomac River Railway Company will require eight cars, two scrapers and one sweeper shortly.

Elections of Officers.

DENVER, COL.—At a meeting of the stockholders of the Denver, Lakewood and Golden Street Railway Company, September 10, the following Board of Directors was elected for the ensuing year: William A. H. Loveland, A. C. Hodges, Jr., Charles C. Welch, W. F. R. Mills, F. P. King, C. Yeaman and S. Newhouse. At a subsequent meeting of the Board the following officers were elected: Charles C. Welch, President; Samuel Newhouse, Vice-President; Frank P. King, General Manager; J. C. Hodges, Jr., Treasurer; H. J. Hersey, Secretary.

RIVERSIDE, CAL.—On September 1 the stockholders of the Riverside and Arlington Street Railway Company elected the following Board of Directors: S. C. Evans, J. S. Castleman, W. E. Keith, Perrin E. White, F. A. Miller and G. O. Newman. At a subsequent meeting the Board elected the following officers: S. C. Evans, President; Orrin Backus, Vice-President; W. E. Keith, Secretary; Riverside Banking Company, Treasurer; G. O. Newman, Superintendent, and J. C. Little, Assistant Superintendent.

SCHENECTADY, N. Y.—At a meeting of the stockholders of the Schenectady Street Railroad, September 6, John Kruesi was elected President and William E. Gilmore Treasurer for the ensuing year.

TOLEDO, OHIO.—Conrad Sherman has been appointed Assistant Superintendent of the Toledo Electric Street Railway Company in place of Edgar W. Bates, resigned.

WORCESTER, MASS.—At the annual meeting of the Massachusetts Street Railway Association, September 9, the following officers were elected for the ensuing year: President, Hon. C. B. Pratt, of Worcester; First Vice-President, Amos Breed, of Lynn; Second Vice-President, Frank S. Stevens, of Fall River; Secretary and Treasurer, James H. Eaton, of Lawrence; Executive Committee: Percy Barker, of Lowell; Henry A. Willis, of Fitchburg, A. E. Smith, of Springfield; Joseph Tucker, of Pittsfield; W. W. Cross, of Brockton; S. C. Hart, of New Bedford; F. H. Monks, of Brockton; John Quincy Adams, of Quincy, and E. P. Shaw, of Newburyport.

Legal.

GALVESTON, TEX.—It is reported that the city is to institute proceedings with a view of placing the Galveston City Street Railway Company, in which it is largely interested, in the hands of a receiver.

GRAND RAPIDS, MICH.—A passenger who was ejected from one of the Consolidated Street Railway Company's cars has just recovered damages from the corporation.

HARRISBURG, PA.—On September 9 Judge Sadler continued the injunction restraining the East Harrisburg Passenger Street Railway Company from constructing the South Harrisburg extension.

LOWELL, MASS.—In a suit for damages for injuries sustained by being struck by a car of the Lowell & Dracot Street Railway Company, G. K. Van Volkingburg was awarded $10,000.

PAWTUCKET, R. I.—The Pawtucket Street Railway Company is being sued for $5,000 damages by a passenger who sustained severe injuries by being knocked from a car by another car passing.

ST. LOUIS, MO.—The Citizens' Railway Company is being sued for $5,000 damages by Peter Weiss, whose son was killed while attempting to board a car last June.

On September 12 a suit for foreclosure was brought against the Citizens' Horse Railway Company of Belleville, Ill. It is said the suit was to prevent the city from revoking the company's franchise.

TERRE HAUTE, IND.—The street-railway company is being sued by a passenger for $2,000 damages for injuries received by being thrown from a car by its sudden starting.

WASHINGTON, Pa.—The electric railway company has asked for an injunction restraining the borough or the contractor from interfering with the company's tracks on South Main street.

Foreign.

The first Russian electric railway with overhead conductors is now being constructed at Kiew by the Allgemeine Elektricitäts Gesellschaft of Berlin. This is expected to lead to a number of similar contracts in the Russian Empire, where electrical enterprise has hitherto been kept in the background.

Captain Cattori, who represents the electric tramway from the Piazza del Popolo to the Ponte Molle in Rome, has asked for a concession for the installation and working of four new electric tramways in that city.

The Lyons Tramway Company, after making experiments with nearly all systems of locomotion, has now entered upon a series of trials with an accumulator car. The car carries 112 cells weighing two and a half tons, and its total weight when fully loaded is eleven tons. The results obtained with this car have been satisfactory, and the directors of the company seem disposed to introduce other electric tramcars.

It is reported that an electric street railway is to be constructed between Winnipeg and Selkirk, Man.

Personal.

Mr. P. M. Kline, Vice-President and General Manager of the St. Louis Car Company, paid us a visit during the week.

TO UTILIZE SOME OF NIAGARA'S POWER.

Mr. A. P. Brayton, President of the Pelton Water Wheel Company, 225 Central Building, corner of Liberty and West streets, New York, has just returned from a trip to Great Britain and Paris. Mr. Brayton brings back with him a sample of the Ferranti cable used by the London Electric Supply Company in the operation of its Deptford Station, from which large powers are supplied. The section of cable measures $2\frac{1}{12}$ inches on the outside, with inside insulation of $\frac{3}{16}$ of an inch in thickness. Next to this comes a copper tube of $\frac{1}{16}$ of an inch in thickness, then insulating material $\frac{5}{8}$ of an inch thick and lastly another copper tube $\frac{1}{8}$ of an inch thick, with an outside diameter of $\frac{7}{8}$ of an inch, the bore being $\frac{5}{8}$ of an inch in diameter. The outside shell of the cable is made of steel. The cable is designed to carry 5,000 horse-power at a pressure of 10,000 volts.

Mr. Brayton met M. Ferranti and refers to the latter's boldness in his plans and designs as unequalled. M. Ferranti is only 28 years old, and his electrical system is considered marvellous. He now occupies the position of superintendent of the company using his system.

M. Ferranti has secured a concession from the Canadian government to utilize the Canadian side of Niagara Falls for the purpose of the production of electrical power. The concession grants his company the privilege of using all the water it may need. It purposes taking the water from above the Falls and discharging it below, thus obtaining 140 to 150 feet fall. For this purpose Mr. Brayton can furnish a wheel capable of developing 5,000 horse-power if necessary.

M. Ferranti expects to use dynamos of 2,500 H. P. capacity and the Pelton Water Wheel Company will furnish wheels of 5,000 horse-power—two of 2,500 H. P. each, connected directly to the shaft of each dynamo. The works will start with a capacity of 20,000 horse-power, necessitating the use of eight water-wheels.

The Treasury authorities at Washington have made a ruling on the question of bringing electric power developed in Canada into the United States. The decision is that electric power developed in Canada and transmitted to the States across the border is not dutiable.

The Ferranti Company proposes to build a very extensive power station at the Falls. The Ferranti cable above mentioned renders it practicable to transmit large powers at long distances at comparatively small expense.

AN ELECTRIC MOTOR FOR THE SAINTS.

A French patent was granted in 1881 for a "perpetual electro-magnetic motor." Just what the motor amounts to cannot be said, but the most interesting part of the affair is the dedication of the invention by the inventor, which reads as follows:

Dedication of My Work.

I dedicate the greater part of the glory of my invention to Him who in His wise providence thought fit to inspire me. I dedicate it to a God "all powerful" and the Holy Trinity; to God the Father, to God the Son Jesus, to God the Holy Spirit. I desire that the reign of God shall arrive with the Republic, and that His holy will shall be done on earth as it is in Heaven. I dedicate my work and I confide it to God, to the Holy Virgin Mary of Immaculate Conception and Mother of God, to St. Joseph, St. Peter, St. Platon, St. Albert, St. Prudence, St. Hegesippe, St. Gautier, St. Mary, St. Madeleine, St. Agnes, St. Genevieve, St. Etienne, and to my holy patrons, Victor, Auguste, Charles, Louis, St. Vivien, St. Palais, St. John, St. Joan of Arc, I dedicate my work to all the saints, angels and seraphims, and to the archangels, St. Gabriel, St. George, St. Michael, to the suns, the moons, the stars, the planets and to the firmament, to all the elements and to all the works of God.

I dedicate it to France and to the Republic, and I desire that it shall contribute to its triumph and greatest welfare.

I vow to share the benefits derived from my invention with the poor and the miserable, in honour of St. Martin, God, the Holy Virgin Mary, and the heavens.

CATALOGUES.

The D. Frisbie Company, of 112 Liberty street, New York, makers of passenger and freight elevators and hoisting machinery, has just issued a very attractively illustrated catalogue. This includes descriptions and illustrations of the well-known direct electric passenger elevators made by this company, and which we described and illustrated in our issue of August 22 last. The electric hoist, run by C. & C. electric motors, is also fully described. The company is doing a large business in electric elevators, and these machines are giving the best of satisfaction. The company's works are in New Haven, Conn.

The Electric Engineering and Supply Company, Syracuse, N. Y., in addition to the catalogue of street railway material just issued by them, has also issued a general catalogue. The latter includes lamp sockets of all kinds, rosettes, cut-outs, switches of all kinds, hoods for lamps, line equipments, etc., etc. The catalogue is very neatly gotten up, and is artistically illustrated.

Business Notes.

An order taken for electric-railway equipment by B. Blum, of the firm of Blum & Hess, general export agents, Whitehall, Stone and Bridge streets, New York, consisting of one 50,000-watt Wenstrom generator and station equipment, 1½ miles line and track material and a specially designed motor car for a narrow-gauge road, was shipped per S. S. *Seguranca*, August 24, to Bahia, Brazil. This will be the first installation for passenger traffic made in that country. An order for 65 more cars is to follow the successful trial of this equipment. The order for this sample plant was placed on July 23 last, and was ready for shipment by August 12. Considering that the conditions of the road and roadbed are such as present obstacles which have probably not yet been presented by any road in the United States, and which had to be overcome by special machinery, it is probable no other order for special apparatus of this kind has been filled so quickly.

J. A. McLure has disposed of all his interest in and has retired from the firm of the Thomas Murray Company, New York, of which he was secretary.

The City Electric Street Railroad, of Asbury Park, N. J., has been purchased by J. C. Schaffer, of Richmond, Ind.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued September 15, 1891.

459,418. Street Railway-Switching Device. Roswell T. Smith, Nashua, N. H. Filed Jan. 24, 1891.

A movable bracket carrying a guide-wheel and supported by the truck-frame upon which a lever is pivotally mounted, a link connecting the lever and bracket, a longitudinally-movable bar connected to the lever and supported by the frame, and means also supported by the frame to move the bar.

459,419. Street-Railway Switching Device. Roswell T. Smith, Nashua, N. H. Filed Jan. 24, 1891.

The combination of a guide-wheel, a movable support therefor carried by the truck-frame, a lever pivotally supported on the truck-frame, means to transmit the movement of the lever to the support, a retracting-spring for the lever and a connector attached to it, and a treadle and bell-crank for applying power at the end of the connector.

459,425. Motor-Car Fender. Edward Tiemann, Chicago, Ill. Filed Dec. 22, 1890.

The combination of a frame carrying a wire screen, pins fixed to two corners of the frame and sliding in apertures in the dash-board of the car, a bracket projecting forward and downwardly from the car platform, pins fixed at two corners of the frame and sliding in apertures in the bracket, a series of springs interposed between the frame and the

STREET RAILWAY NEWS' PATENTS—Continued.

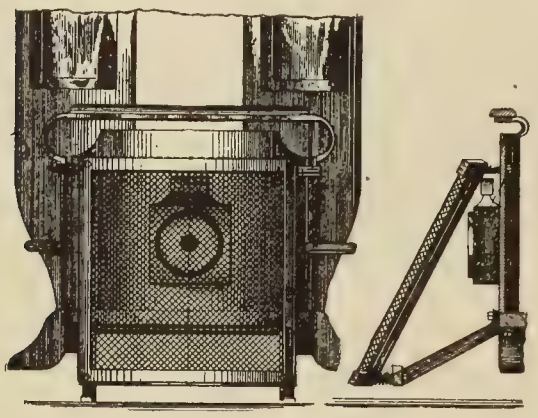
upper part of the dash-board, and a second series of springs interposed between the frame and the bracket.

459,485. Trolley-Wire Connection. Robert L. Caldwell, Rochester, N. Y. Filed June 10, 1891.

A support for the end of a trolley-wire, having a seat for the wire, a perforation for the passage of the end of the wire, and lugs on the side opposite the seat adapted to engage and retain the end of the wire when passed through the perforation and bent over.

459,588. Trolley-Wheel. George E. Lewis, Seneca Falls, N. Y. Filed Dec. 20, 1890.

A trolley-wheel consisting of a hub, spokes radiating



459,425. MOTOR-CAR FENDER.

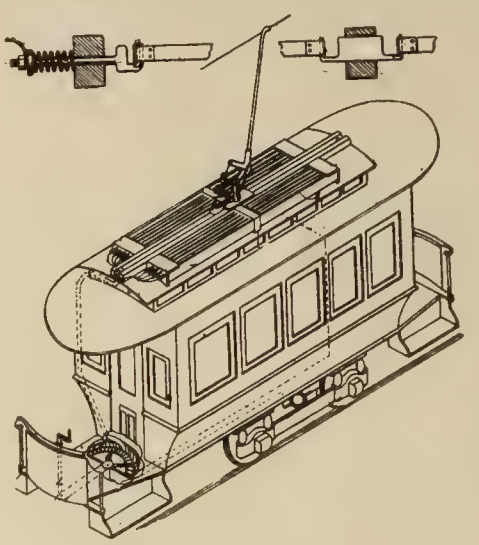
therefrom, and parallel rims upon the extremities of the spokes which have inner faces converging to the seat for the trolley-wire.

459,689. Slide-Shoe Trolley. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed April 15, 1890.

A trolley comprising a spring-pressed swivelled pole and a sliding grooved contact-shoe rigidly secured to the upper end of the pole and projecting rearwardly therefrom, the shoe being formed with a curved bearing-surface.

459,690. Rheostat for Electric-Motor Cars. Sidney H. Short, Cleveland, Ohio. Filed Mar. 18, 1891.

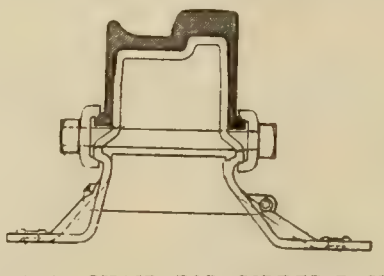
A rheostat composed of exposed strips of low conductivity mounted and extending upon the roof of the car, a switch-board, electrical connections between the same and the rheostat, and operating mechanism for the switch-board within convenient reach of the motor-man.



459,690. RHEOSTAT FOR ELECTRIC MOTOR.

459,717. Chair for Girder-Rails. William C. Wood, Brooklyn, N. Y., assignor to the Lewis & Fowler Girder-Rail Company, same place. Filed Dec. 18, 1890.

A wrought chair for girder-rails, comprising a hollow chair-iron having a suitable seat portion at top, hollow lateral projections bevelled at bottom on its respective sides, side holes above the bevels of the lateral projections, and hollow

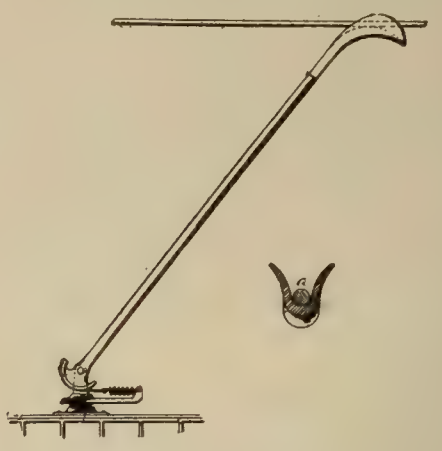


459,717. CHAIR FOR GIRDER-RAILS.

lateral braces below the bevels merging into the side and base portions of the chair-iron, the whole being so adapted to be formed of substantially uniform thickness from plate-iron or the like without upsetting the metal and at the same time to co-act with wedging-clamps and through-bolts for fastening down the rail or rails.

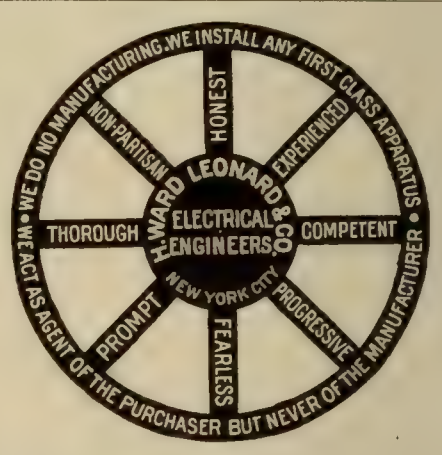
459,721. Safety Cut-Out for Overhead Wires. Nicholas Froloff and William Subbotin, Boston, Mass. Filed Feb. 7, 1891.

An overhead electrical conductor constructed in electrically-isolated sections, a wire for supplying an electric cur-



459,689. SLIDE-SHOE TROLLEY.

rent to each of the sections, a circuit-breaker interposed between the trolley and supply wires and consisting of two parts frictionally engaged and adapted to be disconnected from each other by the breaking and sagging of the conductor.

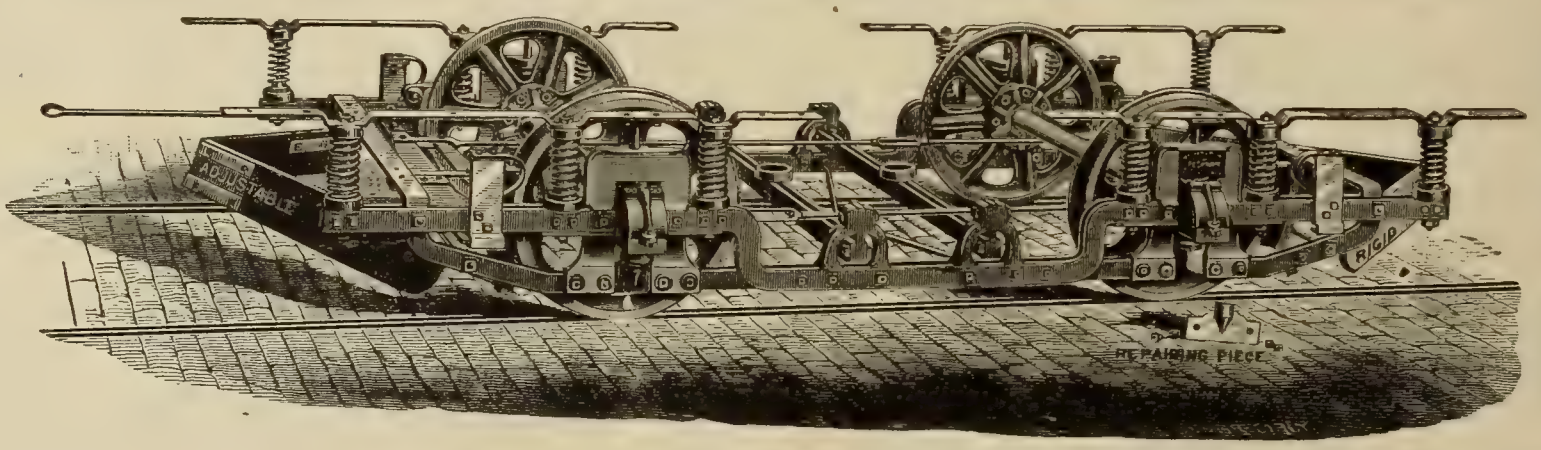


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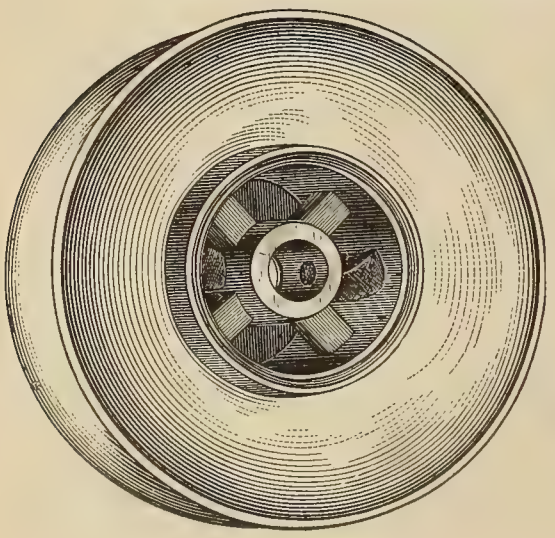
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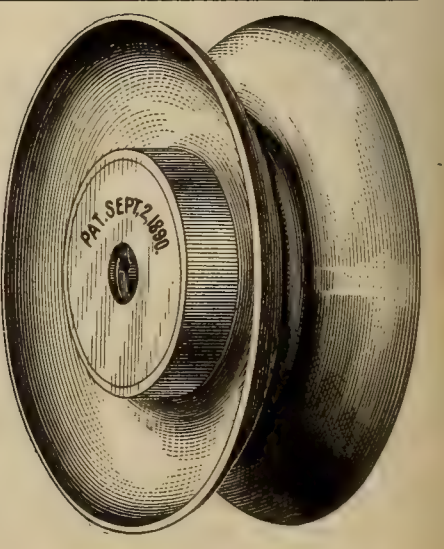
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For Electric Railway.

Smooth running; ways well oiled, prolongs the life of the wheel.
It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
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Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

BADGER BROTHERS, West Quincy, Mass.





VOL. I. NEW YORK, OCTOBER 3, 1891. No. 13.

STREET RAILWAY NEWS.

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

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J. B. TALTAVALL, *President.* T. R. TALTAVALL, *Sec. and Treas.*
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WM. H. KEMBLE, DECEASED.

The death of this remarkable man, which took place on Sunday, and a sketch of whose biography appears elsewhere in this issue, brings afresh to the mind the time when he wrote the following letter to T. J. Coffey in Washington, introducing Geo. O. Evans, who had been commissioned to collect certain claims against the government. The letter ran thus:

"MY DEAR TITIAN:

This will introduce to you Mr. George O. Evans, who has a claim of some magnitude against the government. Treat him as you would me. He understands addition, division and—silence."

Several years elapsed before the contents of the letter became generally known, but it made the author famous, nevertheless, and became a powerful element in the politics of the Commonwealth of Pennsylvania.

STREET-CAR CHECKS CONFISCATED.

On September 26 an official of the government secret service appeared in Rochester, N. Y., and confiscated all the street-car checks in use in that city. The cause of this action was that these checks were being circulated among saloons and drug stores, and accepted as money, being worth five cents—a street-car fare.

Such use of checks is prohibited by a Federal statute. The street-car company was taken by surprise at the sudden appearance and activity of the government official, but, of course, could do nothing. The company will at once issue paper tickets in ribbons, so that they may be torn off. This was contemplated by the company before the action of the government official.

The objectionable checks were a legacy from the days of the *effete* bob-tail cars, when passengers were required to deposit their fares in a box themselves. Now the cars have conductors, and the old checks were being gradually withdrawn.

VERBUM SAP.

Notice has been received at this office from responsible and very well-known supply men sounding a note of warning regarding one C. H. Lawrence, known as the general agent of the Lockport (N. Y.) Electric Railway Light and Power Company, but who, we understand, is in some way connected with the "U. S. Railway Equipment and Construction Co., of Chicago," a name, until now, unknown to us. It is said that one of his methods is to place an order for supplies, then to "touch" the party from whom he buys for a small loan, giving a draft in exchange therefor; in due course of time the draft is presented for payment and allowed to go to protest. A few days later the anxious supply man receives a letter from the party named, regretting his absence from the city, etc., and stating that through abominable carelessness upon the part of one of the clerks the draft was allowed to go by default—the statement being accompanied with a very plausible request to "send me the protested draft." In no case that has as yet come to our knowledge has the party of the second part (viz., the "loaner") ever heard anything further from the "loanee" regarding said draft.

[Developments in no less than three particular cases (known to us) similar to the above are awaited with no little interest.—EDITORS.]

ELECTRIC RAILWAY SECURITIES SOUND INVESTMENTS.

Bullish: that is exactly the present state of the New York stock market, and will continue to be so all this winter. The shrewdest, boldest manipulators of the farm product have failed to control the soil's bountiful output. The harvest is secure beyond all reasonable doubt, and we not only have it certain, but have also a foreign market for all our domestic surplus. Besides this, the gold which we loaned to Europe early in the year is now coming back to our shores with interest; the cotton crop is also a very large one, and, of course, with sale for all we care to dispose of. On the other hand, the movement of all this overplus taxes our common carriers to the utmost, both by land and sea; bulls and bears, in the tug of war, will pass and repass the centre line, but, like the ship with the head wind, the bull gains ground on every tack, and will hold it; each have their uses, their own mission to accomplish in the financial community; but, as brokers, many of them are allowing their Boston brother to reap more than his share in the commissions made from the street-car bonded interest by which the whole of our country's settlements are being gridironed. It is a fact that while no less than 133 different securities were dealt in at the New York Stock Exchange on the 21st of last month (equinox's stormy day), not a single bond or share of electrical car industry was even heard of on the floor. This should be discountenanced and industrial securities more actively dealt in. They are safer, because in more hands and harder to control. Dividends are positive and must grow every year after the roads are running smoothly. They are long-time bonds and more solid year by year, as the income of the stockholder increases. Their number will only be equalled by the number of towns with over one thousand inhabitants, each one constituting a good, safe investment. The bonds are generally $500, and nearly every one who invests at all can afford to take at least one of them, and it cannot be long before most of them earn their face value in dividends alone.

The electric railway represents to-day one of the most important of all electrical industries; it is still in its infancy, in its swaddling clothes, as it were, but a youthful giant nevertheless. In the natural order of things street-railway stocks will in a few years usurp the field now held by steam railways; it is inevitable, and nothing short of miracles can change it. The horse and steam railroad are on the wane together and both will soon find their resting places. Again we most firmly express the conviction that electric street-railway securities must prove highly remunerative.

SINGLE REDUCTION MOTOR.*

A single reduction motor has been recently brought out and placed upon the market, an illustration of which is given below.

This motor is of the multipolar type and is inclosed in a peculiarly well-designed casing.

The armature is of the Gramme ring type, with bobbins wound in series and in separate slots, each winding projecting out from the foundation core.

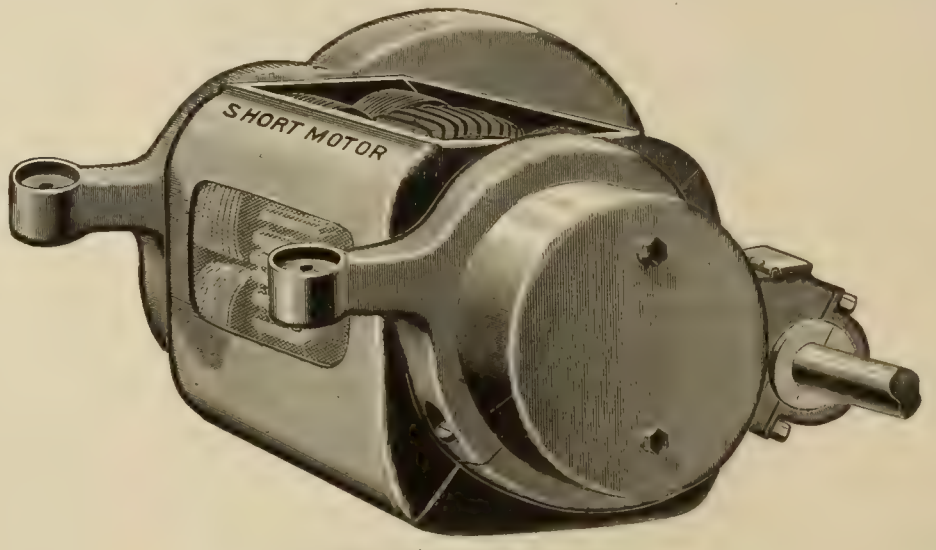
This method of winding and construction insures in this motor, as well as in the Standard or Double Reduction, and the "Gearless" and the generators manufactured by the company, perfect ventilation and non-heating of parts, and enables repairs to be made with greater facility and at lower cost than on any type of armature in the market.

The field magnets are presented to the sides of the ring armature, and the revolutions of the armature in a powerful field with a small magnetic gap insures maximum efficiency with as little weight of entire motor as is compatible with strength and durability.

These motors are made in the company's shops, in Cleveland, where 800 skilled workmen are constantly employed, turning out ten motors a day and the necessary number of generators to operate them. The details of construction are carefully watched, and all motors and generators are thoroughly tested before leaving the works. This attention to details and careful finish is one of the distinctive features of work turned out by this company.

The company is now in the field with three motors, viz.: The Standard, or Double Reduction; the Single Reduction, and the Gearless, which latter has become so well and favorably known through the columns of this paper that no further description is necessary.

The company has every reason to feel proud of its apparatus, the results of the operation of which were so ably shown by Mr. John N. Beckley, president of the Rochester Railway Co., in his admirable report to the New York Street Railway Convention, held in New York September 15 last, and it believes, and not without reason, that still more perfect results may be attained with the Single Reduction, and the best with the Gearless motors.



SINGLE REDUCTION MOTOR.

THE MAKING OF A MODEL NEW YORK CITY.

A good-sized crowd gathered at the Electric Club, New York, on the evening of September 24, to listen to the first address of the season—that of Mr. Allen R. Foote, the special agent for the collection of the statistics of the electrical industry for the eleventh census, entitled "The Making of a Model New York City."

Hon. Erastus Wiman presided and introduced the lecturer in a few appropriate words. He stated, among other things, that there were more people to the acre in New York City than in equal area in London, and some portions of New York City were more densely crowded than the most thickly settled portions of Pekin, China.

Mr. Foote began his lecture by laying down this proposition:

"The problem to be solved is, how to secure for New York the quickest and cheapest facilities for handling passengers and freight for its internal and external traffic; to provide the best and cheapest homes for wage-workers; also warehouse and manufacturing privileges."

The want of a home, so far as Mr. Foote had observed, "has been made the basis of, and has fixed the character of all plans for rapid transit. The people are incited to favor or give validity to this or that plan by glowing accounts of the *time to be saved, the distance to be travelled and the comfortable homes to be enjoyed* when the proposed better transit facilities are ready for use. As a further claim to favor, some urge the rapidity with which they can construct the system they advocate.

"In all the descriptions given the following facts are omitted—facts that will be very clear, however, before the facilities proposed can be used for a single year. They are:

"(*a*) That long before the proposed construction can be ready for use every foot of land within the zone of its influence will be advanced in price to a point that will prevent home-hungry humanity with small incomes from securing a home so located that any *time* whatever can be saved for the trip between the place of employment and the home.

"(*b*) That the supplementary conditions for supplying the necessities of a modern urban life will cost infinitely more in the suburban districts—and for some time many of them cannot be obtained—than in the closely-built districts of the city. When the suburban home acquires all facilities that render time and expense saving service, the rent to be paid, if rented, or the cost of investment, if owned, will be equal to that of a city home.

"(*c*) That if advantages are to be enjoyed for intellectual associations in church, industrial, political or social meetings, a second trip must be made to such centres. The two round trips in a day will involve more loss of time than can be saved by any possible speed.

"These factors of the problem are ignored. No statement is made comparing advantages with disadvantages in a clear, concise way to enable wage-workers to strike a balance and see clearly just where and to what extent their gain is to be made.

"*No system of rapid transit that does not offer a permanent and great gain for wage-earners is worthy of a moment's consideration.*

"No construction that can answer *all* requirements and do service for a hundred years can be rushed to completion in a single year. The city has a *temporary* construction and service now. Let that stand until a solution is found for the entire problem.

"It is because those who controlled New York City when the existing elevated roads were planned and built did not make it possible to carry out a form of construction that would be lasting and ample for all requirements that this problem is now pressing for a more satisfactory solution.

"The proposal to make New York a city of homes for honest, hard-working, thrifty wage-workers is certainly a project worthy of the best efforts of the most able men. The resources of intelligence and civilization ought to be adequate to secure such a consummation.

"All plans that have been proposed for doing this are inadequate. They are powerless to accomplish the desired object even though they bring every foot of land in Westchester County within thirty minutes travel of the City Hall.

"Employment by which a home can be obtained and sustained is the fundamental condition that renders a home possible.

"Employment of labor involves the problem of handling materials—*freight traffic.*

"Travel between the place of employment and the home involves the problem of handling persons—*passenger traffic.*

"Freight traffic is the fundamental condition that renders passenger traffic possible.

"*Quick and cheap means of communication and transportation are fundamental industrial conditions.* They include telegraphing, telephoning, the transportation of mails, persons and property. Those localities possess an economic advantage that have the quickest and cheapest facilities for such services. These services are each essential to the other. They can have no separate existence.

"A system of rapid transit that does not provide for all of them is incomplete and partial, totally inadequate to furnish facilities needed now, and absolutely incompetent to deal with the requirements of the future. It is but a half-way measure—bread without butter.

"To provide facilities for these services so that they may be rendered in New York City quicker and cheaper than in any other commercial centre is to cause New York to become the commercial centre of the world.

"When New York City *is* the commercial centre of the world the enormous volume of materials to be exchanged, the unparalleled opportunity for selection of material for manufacture, the world-wide correspondence for moving the products of all countries, cannot fail to furnish constant employment to wage-workers, manufacturers, merchants and financiers.

"Viewing this problem from a strictly economic standpoint, it is clearly seen that conditions most serviceable to wage-workers are the conditions that will best serve the true interests and highest welfare of the whole population.

"The time required and the cost of terminal charges in New York City is a tax on the industry of the nation. New York City cannot maintain its proud position of commercial and financial supremacy on the western hemisphere, much less can it gain supremacy over the world, by obstructing or overtaxing the traffic passing through its limits. It has no moral right to do this. It should have no legal right to do it. If the right of eminent domain is ever justly exercised, it is when used to open highways for the free passage of the people and the products of their industry. Public considerations of the highest importance to the city, the State and the nation demand that this right shall be exercised with fullest authority in clearing away obstacles to the remodelling of the terminal and traffic facilities now existing in New York City.

"Can a problem of this magnitude be dealt with now, or shall improvements that have been proposed be made, with full knowledge that a few years hence they will prove to the world how incapable the people of the present were to comprehend the conditions necessary for the business, comfort and prosperity of the New York that is and is to be?

"It seems strange that rapid transit for passengers should be the only thing talked about, when all the improvements of the century have been devoted to that object, while freight traffic is handled in wagons on wagon roads, as was done one hundred years ago. Is it not time that this slow moving, endless procession of freight wagons should be notified that the quicker, cheaper and tireless forces of steam and electricity have been tamed to the service of transportation?

"It is undeniably to the best interests of New York City that it be made the quickest and cheapest centre in the world for manufacturing and for the handling of freight and its storage. This can only be done by improving terminal facilities for all waterways and all railways. This requirement determines the location and form of construction.

"The route must be along the water front around the island, with cross-town connections at convenient intervals.

"The construction must include the docks on one side and the area between the first and second streets from the water front on the other side, with a surface and an elevated roadway occupying the whole space of the water front street.

"For this construction the entire area must be cleared of all existing incumbrances and the whole rebuilding be designed according to the best practice known, with special reference to secure the objects in view, it being clearly understood that durable structures cost the least for maintenance and afford the best protection from contingencies. This will secure the best docks, the best roadways, the best warehouse and manufacturing privileges and the best wage-workers' homes in the world.

"Is there any reason in the nature of things why New York should not have them? In which particular is New York deficient — intelligence, the command of proper material, or the necessary means?

"The surface roadway and the first stories of the docks and squares should be utilized entirely for freight or manufacturing, so constructed that a car from any railroad can be switched into any dock, warehouse or factory on the route, on either side of the city. The tracks should be so planned as to bring the floor of the car on a level with the floor of the docks, warehouses or factories.

"The elevated roadway and the second stories of the docks and squares should be utilized for passengers, warerooms, manufacturing and stores.

"The roadway structure should be substantial enough to be used for trains from any of the steam railroads and to admit of their being run at high speed.

"There should be four or more tracks below and above, to provide for express and way traffic. The power used should be electric locomotives, which will eliminate the smoke, dirt and fire that are inseparable from the use of steam locomotives. This construction will enable passengers to travel in open air and daylight, and will make possible sanitary conditions that will change what is now the most filthy part of the city into a state of cleanliness and freshness of air that will make it, in these respects, a continuation of Battery Park.

"Along the lower roadways, on either side, provi-

* Short Electric Railway Co., Cleveland, Ohio.

sion should be made for ample service for sewerage, water, gas and steam heating pipes.

"The roadways above should be flanked their entire length by broad, well-protected sidewalks, which should be always open to the public. These walks should also extend around each square. A similar, but narrower, walk should be built for each story, so that every floor will be provided with an outside open air passageway, not only around the square, but from square to square on the same level.

"All squares should be supplied with ample elevator capacity for freight and passengers,also with water, gas, steam heating, electric lighting, and power, telegraph, telephone and signal services, so that each will have within itself all the mechanical appliances that modern science and invention have made contributory to industry and comfort. The buildings being of uniform height will afford the best supports in the world for the wires needed to supply electric light and power, also the telegraph and telephone lines, not only for internal communication but for all external service. Stoppage of service or accidents to persons or property, with such construction, will be almost wholly unknown. Being over the tops of buildings and on a line with them, the wires will be almost entirely hidden from view, yet accessible, and offer no interference with other services, the natural place for which is underground as assuredly as the natural place for electrical service is in the air.

"Steam power and electric plants should be located at proper intervals to generate the power required for the roadways, and for all power-driven machinery used along the route, for docks, in warehouses, or manufacturing establishments, and for electric lighting of the whole area. These plants can also generate the steam and gas required for heating, cooking and other similar purposes.

"The upper stories of the square should be constructed in the form of a hollow square, so as to afford the greatest amount of light and air to the surface story, the whole of which should be used for warehouse or manufacturing purposes. A passageway should be built around the inside of each square for each story, similar to the one on the outside.

"The upper floors should be designed for homes and should be supplied with every convenience for that purpose, such as baths, hot and cold water, steam heat, gas for cooking, electric lights and call bells. It will be seen at once that more comfortable homes do not exist. For many persons they will be on the same square or within one square of the work to be done. They will be surrounded by fresh air and good light; will be out of the reach of street filth, dust and annoyances; can be easily policed, inspected for sanitary and health purposes; will have passenger and freight elevator service, and will be accessible to all lines of travel and methods of communication.

"These conditions, taken as a whole, will secure for the enjoyment and comfort of wage-workers all the conveniences of life that can be commanded by wealth. They include all there is. This development is on the line of correct economic progress.

"Two forces are always at work to improve the economic condition of wage-workers. One seeks to secure for them a greater amount of pay; the other seeks to enable them to secure greater benefits from the payments received. In the past the latter has been neglected, while the attention of wage-workers has been concentrated on the first.

"A careful study of this problem will show clearly that vastly more can be gained in the direction indicated, combining, as it does, interests of such far-reaching magnitude and influence, than has ever been thought of, much less attempted, by all the projects ever proposed for improving the environments of wage-workers.

"This proposal, carried into practical operation, will wipe out the tenement-house evil in New York City.

"If squares are carried up seven or eight stories the floor space created will far exceed the present floor space of the entire city. The capacity of the warehouse and manufacturing premises will exceed that of any city of the world. The terminal facilities for freight and passenger traffic will so nearly reach the economic limit it may safely be assumed that no city in the world will ever gain an overmastering economic advantage in these particulars. New York City will then lead the van of progress by its intelligent, comprehensive and far-seeing provision for necessary conditions to induce industrial prosperity."

Regarding the management of the enterprise, Mr. Foote said:

"This great work can be accomplished without overtaxing the resources of the city, and can be so planned that an increasing business will *cheapen* correspondingly the facilities for doing business. It requires simply sound business management uninfluenced by party politics.

"A competent commission should have charge of the work. For all property acquired and for all cost of construction, three per cent. one hundred years bonds should be issued.

"One-half the cost of the roadways constructed ready for the tracks should be capitalized by being added to the cost of the docks and buildings. The other half should be charged to the city at large.

"The sources of income will be payments for docks, warehouses, manufacturing privileges, stores and homes, all leased for one hundred years, with privilege of renewal and with proper provisions for the forfeiture of the lease for cause. The price should be calculated to yield an income sufficient to pay on the total bonded debt:

"(*a*) Interest on bonds.

"(*b*) Cost of maintenance and administration.

"(*c*) One per cent. per annum as principal.

"Such payments will be no more than present rents for vastly inferior accommodations. Under a proper form of lease and administration the occupant will enjoy all the privileges and security of private ownership.

"Leases should be made to existing corporations performing quasi-public services, securing to them *exclusive privileges and permanent tenure, without charge or tax of any kind.*

"In consideration of these valuable concessions, they should stipulate to render a faithful accounting to the commission, in the form prescribed by it, of all items of income and expenses, the commission to fix charges to the public for services from time to time, at rates calculated to yield a sufficient income to pay:

"(*a*) Interest on investment at three per cent.

"(*b*) An agreed per cent. on investment to create a reserve fund out of which all charges for depreciation, maintenance and contingencies are to be paid.

"(*c*) Operating expenses.

"(*d*) Ten per cent. profit on investment.

"It will be seen at once that, under such conditions, the greater the volume of business the smaller the charges will be.

"There being no investment in road-beds, rights of way, franchise or taxes, no suits for constructive damages from property owners along the route, no arbitrary interference with the form of construction by municipal council or state legislation, all quasi-public works can then be conducted by strict business management, relieved from all unnatural charges, *under economic conditions, arranged to reduce the price for services rendered to the lowest price at which they can be produced.*

"Under these conditions,concentration of business, giving increased value to these privileges, cannot cause increased capitalization for anything but necessary increase in the operating plants. Road-beds, rights of way and franchises, without capitalization and without charges or taxes, *will be as free for the service of the world as the channels of the ocean.*

"The construction should commence at the lower end of the city and the first cross-town belt. It should be extended as rapidly as will be consistent with judicious and substantial building. As fast as it can be done the service of the existing elevated roads should be transferred to the new routes. The present routes of these roads can then be remodelled on the general plans described for the water front routes, with such modifications as may be deemed desirable.

"The new property thus created, especially that part of it designed for homes, should be leased exclusively to citizens of the United States. Wage-workers should be protected in their social and industrial environments from the inroads of foreigners of low intelligence, who will degrade the standard of living and lower the rate of wages."

At the conclusion of the reading of the paper Mr. Wiman made a few interesting remarks. He thought Mr. Foote's plan was a feasible though extremely novel one.

CONSOLIDATION IN ATLANTA, GA.

All of the street railway lines in Atlanta, Ga., except the Atlanta and McPherson road, have been consolidated under one management, the new organization being known as the Atlanta Consolidated Railway Company. The various railroad companies passing into the control of the new concern have executed and delivered the deeds, and the consolidation is finally and completely accomplished.

Mr. Joel Hurt has been elected president of the Consolidated Company, and has already assumed active control of his important office, the duties of which will require great executive ability and careful management. But all who know him know that no better man could be found to fill the position than Mr. Hurt.

As regards the employés under him, Mr. Hurt says they are all efficient and they will be retained.

The consolidated company forms one of the most extensive street car systems in the South, and it is the company's purpose to improve the service on its lines in every way. The tracks are to be rebuilt in a most substantial manner, and according to the most approved methods for modern requirements.

Horses and mules are to be displaced by the more modern motive power—electricity—and the roads will be equipped with electricity as soon as it is possible to effect the change. It is thought that electric cars will be run on some of the lines in a very short time.

The street railways absorbed by the Consolidated Company are as follows: The Gate City Street Railway Company, the old Atlanta Company, the Atlanta and West End Street Railway Company, the Atlanta and Edgewood Company, the Fulton County Street Railway Company and the Metropolitan Street Railway Company.

The consolidation has been on the tapis for some time, but was formally closed by the delivery of the deeds to the new company a few days ago. President Hurt will manage the company's affairs in that liberal, progressive and exact manner that has made him recognized as a peerless manager of street railways. and Superintendent Larendon will under the new order of things discharge the duties of that office with his well-known ability and justice.

NEW SYSTEM OF ELECTRIC RAILWAYS.

In a new system of electric railways invented by Herr Heilmann, a steam engine and dynamo are carried in a vehicle which takes the place of the present locomotive. Current is conveyed by conductors, which pass under the carriages, to a series of electric motors, which drive some or all of the axles. A triple expansion engine is to be used, and in order to insure equal work being done by all the motors, their armature coils are all in series with one another, and current is supplied from one dynamo. The field magnets of the motors and of the generating dynamo are excited by current from a dynamo working at a constant potential. The boiler is capable of developing 600 horse power, and is of the type in general use on torpedo boats. The steam engine is coupled direct to the dynamo, which is a Rechniewski multipolar machine. A switchboard is placed in front of the vehicle, and openings are left through which the driver can look out. It is hoped that a speed of 50 miles on gradients of 1 in 200, and 75 to 80 miles on the level, will be reached. The motors, which are also of the Rechniewski type, are placed direct on the axles, and the cables are joined by couplings between the carriages. It is said that the directors of the French State Railways have placed rolling stock at the disposal of the inventor, and have given permission for experiments to be made upon their lines.—London *Electrical Review.*

ELECTRIC ROADS.

Short motors are now in use by the following roads:

Denver Tramway Co., Denver, Col.; Watervliet Turnpike & Ry. Co., Albany, N. Y.; Battle Creek Street Ry. Co., Battle Creek, Mich.; Braddock Electric Ry. Co., Braddock, Pa.; Bristol Belt Line Co., Bristol, Tenn.; Coney Island & Brooklyn R. R. Co., Brooklyn, N. Y.; Broadway & Newburg Street R. R. Co., Cleveland, O.; Brooklyn Street R. R. Co., Cleveland, O.; South Covington & Cincinnati Street Ry. Co., Covington, Ky.; Georgetown & Tenallytown Ry. Co., Georgetown, D. C.; Harvey Rapid Transit Company, Harvey, Ill.; Fred T. Evans, Hot Springs, So. Dak.; Huntington Electric Light & Street Ry. Co., Huntington, W. Va.; Citizens' Street R. R. Co., Indianapolis Ind.; Jamestown Street Ry. Co., Jamestown, N. Y.; Johnstown Passenger Ry. Co., Johnstown, Pa.; Lincoln Street Ry. Co., Lincoln Neb.; Central Passenger Ry. Co., Louisville, Ky.; Muskegon Ry. Co., Muskegon, Mich.; Pittsburg & Birmingham Traction Co., Pittsburg, Pa.; Schuylkill Electric Ry. Co., Pittsburg, Pa.; Rochester Electric Ry. Co., Rochester, N. Y.; West End Street Ry. Co., Rockford, Ill.; Lindell Ry. Co., St. Louis, Mo.; Wilkesbarre & Wyoming Valley Traction Co., Wilkesbarre, Pa.

The Windsor (N. S. W.) Local Land Board proposes to divert the water from Grose river into a race, securing thereby a fall of about 100 feet. This power will be used, by means of a turbine and dynamos, to generate electricity for the purpose of lighting Windsor, Penrith, Richmond and other towns, as well as providing motive power for factories which may be established in and around the neighborhood.

ENGINEERS' RECORDS.

If one desires to see the various workings of many mens' minds he need only take a trip through different engine rooms and enquire as to the engineer's method of keeping a record of engines working under different circumstances. No matter how similar the workings of engines may be the diaries will be found to differ largely in the items recorded and the manner of keeping them. No two engineers will be of the same mind in regard to the most important and useful working data to record, and yet every one who has run an engine of any kind knows the convenience and importance of having a daily record of the engine's performance at ones elbow to make comparisons of the work done and the cost of doing it. Every engineer endeavors, or should endeavor, to find out exactly how the engine or engines over which he is placed runs under different circumstances, and this can be done only by keeping a faithful daily record of everything coming under his observation, as well as such data as are inherent in the working of every engine. It is only by having on hand such a record, written either on memory's tablet or on tablets having no organic factor, that the engineer knows whether or not the engine is doing the work it should do, and that enables him to get out of his machine its full rated work at the minimum cost. Sometimes it is amusing to see the diversity of methods to reach the same end, and yet both time and labor can be saved by occasionally glancing through the advertising columns of the journals relating to engineering, where usually something will be found to exactly fill the requirement. This will be found true of all wants; necessity is the mother of invention, and no matter how time or labor is wasted some one will make a labor-saving device to curtail the waste, whether it be of engine or engineer. One of these labor savers we illustrate herewith—a labor-saving record devised by Howard Challen, of 10 Spruce street, New York.

The illustrations, which show blank pages of Challen's Engineer's Log Book, and Challen's Engineer's Daily Report, need no explanation as any one can see at a glance the value of the work to the engineer. The headings appear to cover everything that is necessary, and as a diary seems to be a necessity to every careful engineer.

STATION. 18

Engine.	Start.	Stop.	Hours run.	Rev's.	Vacuum per gauge inches.	Receiver Pressure	Ind. H. P.	TEMP. OF ROOM. 6	9	12	3	TEMP. OF WATER. 6	9	12	3	Water per pr. H. P. lbs.	Fuel Burned lbs.	Ashes.	Eng. oil used.	Cyl. oil used.	Waste used.	Ice used.
No. 1.																						
No. 2.																						
No. 3.																						
No. 4.																						
No. 5.																						
No. 6.																						

ENGINEER'S LOG BOOK.

GEARLESS MOTOR TESTS.

During the past month the "Gearless" motor has been very thoroughly tested in Cleveland, being put to the hardest kind of work in regular commercial operation. Among some of the noteworthy tests may be mentioned the following:

In order to prove the power of the motor, it was attached to two other motor cars and drew them without difficulty along a rough and dirty track, attaining a very fair rate of speed. The car was stopped at the commencement of a 40-foot curve, at the other end of which was a 3 per cent. grade. It was then started up, and without difficulty drew the three cars around the curve and up the grade. This was one of the severest tests which could be put upon the motor under all the conditions. A prominent electric railway manager, who was present, stated that not a single motor on his line could do the same work.

The car was put into regular service on three of the Cleveland street railway lines, carrying trailers and drawing heavy loads without the slightest difficulty and at speeds far in advance of the ordinary schedule of the road. Current and volt meter readings were taken in each case, showing that the power consumed was even less than had been anticipated by the Short people themselves.

A comparative test was made on the line of the Brooklyn Street Railway Company between the "Gearless" motor drawing a trailer and a "Single Reduction" motor also drawing a trailer. These cars were run ten minutes apart over the same line for a distance of 22 miles, covering one round trip. This distance was made in two hours by both cars, stopping to take on and let off passengers. The fare register showed 50 passengers carried by the Short motor and 47 by the "Single Reduction." Ampere and volt readings were taken at intervals of one-half minute for a long distance, the general averages showing that the Short "Gearless" motor required about 25 per cent. less power than the S. R. Motor. This was a complete surprise to all concerned, as the Short Company had hardly hoped to show any material advantage over other motors in the matter of current, its chief claim for the "Gearless" being a large reduction in the repair account, owing to the extreme simplicity of the machine.

On one of the tests the trailer car ran off the track at a curve. Its brakes were set and it was drawn into and around the curve with the full load of passengers on both cars and without the slightest difficulty.

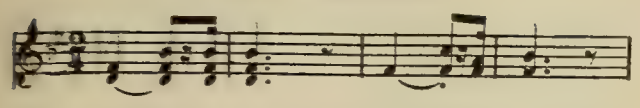
Month 188	Day of Week.	Av. B. Press. per gauge lbs.	Hours run.	Rev's.	Vacuum per gauge inches.	Piston Speed per min.	Ind. H. P.	Initial Press per Indicator	Term Pres.	Tem.	Temp. of Hot Well.	Temp. of Heater.	Water per pr. H. P. lbs.	Fuel Burned lbs.	Ashes.	Oil used.		Waste used.
	MON.																	
	TUES.																	
	WED.																	
	THU.																	
	FRI.																	
	SAT.																	
	SUN.																	

ENGINEER'S DAILY REPORT.

J. F. Porter, formerly general manager of the Electric Railway Specialty Company, 29 Broadway, has been elected secretary and director of the R. D. Nuttall Company, of Allegheny, Pa., and New York. Mr. Porter will in future have charge of the sales, purchasing and financial department of the R. D. Nuttall Company, with headquarters at Allegheny, where he will be pleased to see friends and customers.

WEDDED.

LOWRY—ROBINSON.



A very brilliant and equally charming wedding was that which was celebrated on Sept. 23 at St. Mark's Episcopal Church, Minneapolis, when Mr. P. Robinson led to the hymeneal altar Mary, daughter of Col. Thomas Lowry, President of the Minneapolis & St. Paul street car systems.

The altar of the church had been converted into a bed of white roses and was exquisitely decorated throughout. A choir of no less than twenty choristers passed down the centre aisle promptly at 7:30 o'clock, singing the bridal march from Lohengrin, and as the strains of "Faithful and True" rang out through the church, the nine ushers and equal number of bridemaids entered in sets of three. Following these came a lovely little girl, who carried a large pillow of white satin for the bride to kneel upon; then followed the maid of honor, Miss Nellie Lowry, sister of the bride, and then the bride herself, radiant in a white satin gown embroidered with pearls, the shoulders tipped with the proverbial orange-blossoms, while a wreath of the same sweet flower was worn with the customary white veil.

The gallant Colonel was at his best, and meeting his daughter at the altar, handed her over to the bridegroom and his best man.

A very brilliant reception at the paternal mansion on Hennepin avenue followed the nuptial ceremonies, and the banquet substituted for the usual "wedding breakfast."

The wedding gifts were very handsome, the Colonel's gift to his daughter being $200,000 in money.

To our brother editor, the happy bridegroom, we extend the right hand of hearty congratulation, and with it an earnest hope that this, his latest venture, may prove, if possible, even more successful than his already brilliant career.

OBITUARY.

W. H. KEMBLE.

Mr. W. H. Kemble, president of the Philadelphia Traction Company, died quite suddenly of heart disease about midnight on Sunday last at his residence, known as Marylawn.

Mr. Kemble was a native of New Jersey, having being born sixty-four years ago in Woodbury, Gloucester Co., in that State, and was educated at the local academy there.

His first business experience occurred when he was but fourteen years of age, when he entered the employ of some silk merchants in Philadelphia. He staid there, however, but a short time, when he was attracted to the metropolis, and secured employment with J. R. Jeffrey & Son. A few years later he hung out his own shingle in Shannonville, Pa., as a general-supply man, and there it was that he met the lady who is now his widow.

Upon the attainment of his majority he moved to Philadelphia and started the concern of Thompson & Kemble, which was afterwards known under the name of Thompson, Potter & Kemble. Six years later Mr. Kemble disposed of his interest in that partnership and assumed the management of departments in the house of L. Hollowell & Co., which berth, however, he retained but a short time, as he opened up business for himself in the same line within a few doors of his old employers not long afterwards.

In '57 came a serious financial panic, at which time Mr. Kemble retired from active business operations, but interested himself in the old brush manufacturing house of John Eckstein.

Not long after the war broke out Mr. Kemble received the appointment of Stamp Agent under President Lincoln, and it was during those stirring days that Mr. Kemble, with some other gentlemen, conceived the idea of the Union Passenger Railway Company of Philadelphia.

During his life-time Mr. Kemble was interested in quite a large nnmber of financial enterprises, and was for a long time president of the People's Bank; he was president of the Union Passenger Railway Company, as well as of the Philadelphia Traction Company when he died.

He left a widow and one daughter, and a fortune running up into the millions.

Messrs. Siemens and Halske have submitted a proposal to the Prussian Minister of the Interior and the Berlin Municipality for the construction of elevated electrical railways throughout Berlin and the suburbs. They propose to construct eight different lines, covering some 40 miles, at an estimated cost of 80,000,000 marks.

VENTILATION.

In the promotion of the interests of your journal and the public, I note that you invite communications from laymen as well as physicians. In this view I propose to say something about the ventilation of railroad cars. I will not occupy space by discussing the necessity of ventilation, but assume that it is admitted that a railroad car should at all times contain as perfect atmospheric conditions within itself as the air through which it is passing. That it does not is patent to every one at times.

It is said of a famous politician of the spoils type, when a taxpayer grumbled at his waste of public money, that he replied, "Well, what are you going to do about it?" That is the question the railroad official asks; so does the car-builder as well as the travelling public. It is easy to grumble, find fault and criticise and write volumes on the subject, but somehow I think the fault-finder should be prepared to propose something better. "'Tis better to endure the ills we have than to fly to others that we know not of." It is a fact that as a rule railroad cars are not as well ventilated as they were thirty years ago; especially is this true of sleeping-cars; while at the same time enormous sums are expended in upholstery, mahogany and brass-work, etc., not a dollar goes toward improving the atmospheric conditions. Millions for pleasing the eye, but not a cent for the nose, lungs or bodily conditions.

Well, what do you propose to do about it? This: I would first make provision for a constant inflow of fresh air, which in winter I would bring in contact with the heating appliances before its discharge into the car. In summer I would arrange the same heating appliances to cool the air. Before discharging it in the car I would have it as thoroughly screened as possible from cinders and smoke. I would take in the air at a point most free from smoke or gas, and that is on the side of the car on line with the windows. The roof of the car is the worst place possible, especially in tunnels, cuttings or side-hill embankments, or even on open levels, when there is no wind, and the smoke, gas and cinders cling to the roof. There is no such thing as ventilation without the admission of fresh air, and it is all-important to take it in at the best place. It is a vital point also that the air be admitted without violent drafts; no one will stand a cold draft at any time. Openings for the admission of air that are liable to this contingency are not to be thought of. It is vastly better to have numerous small openings throughout the car near the floor. So much for the admission of fresh air. For the outlet of vitiated air apertures provided with registers must be placed on the sides of the clearstory, about four feet apart, and connected with or opposite each register, and on the outside is placed a self-reversing exhaust ventilator. All the registers on the inside are connected to one rod and operated at the end of the car by a lever handle within easy reach. It is simply a nuisance to have an attendant constantly fussing with each register or sash over the heads of the passengers. The tipping sashes in the clearstory, so much used, are decidedly ineffective, but they are better than nothing.* The deflecting sashes are somewhat better, but they need to be changed at each end of the route, and are often neglected. They are liable to cold drafts when the train stops, as the tipping sashes are at all times. Speaking of deflecting sashes, is it not slightly absurd to use this method, with its necessary machinery, when simpler, cheaper and more effective devices can be had that require no attention?

It may be said that with the plans proposed the heating apparatus may not be sufficient for such a rapid change of the atmosphere. The answer to this then would be, increase them, as the air MUST be changed to insure any ventilation. This, however, is no real objection, as the inflow and outflow can be regulated without the least difficulty. The slightest reflection will suggest that in a climate like ours there are plenty of occasions when the most rapid change possible is desirable. Nothing within the reach of mechanism can be produced that will not require some adjustment to suit the outside temperature in this country. WM. G. CREAMER.

*The methods of ventilation applicable to dwellings or public buildings are not suitable to a railroad car. The cubical area of which and the number of people it contains requires a much more active change of air, hence the idea of using power which is present in the movement of the train. By a judicious use of the power, with proper appliances for its regulation, it is a simple problem to accomplish perfect ventilation without opening doors, windows or end sashes. Transom registers and perforated end plates, however, should not be discarded, as they are at times a desirable addition to the plans proposed, as there are frequent occasions when all the ventilation possible is not too much.—W. G. Creamer in *Annals of Hygiene.*

The Week's Record of Street Railway Notes.

CALIFORNIA.

Los Angeles.—A number of horse railways here are to adopt electric power in the near future.

San Francisco.—Work on the new power-house of the San Francisco and San Mateo Electric Railroad Company is being rapidly pushed.

COLORADO.

Denver.—Work is being rushed on the 17th street cable line.

CONNECTICUT.

Derby.—An addition has been built to the power station of the electric street railway.

FLORIDA.

Pensacola.—The Pensacola Terminal Company is making preparations for extensive improvements upon its street railway system. A motor using coke for fuel is to be used.

GEORGIA.

Athens.—The electric street railway company has just received a new generator.

INDIANA.

Greencastle.—It is reported that the street railway lines here have been purchased by a syndicate of local capitalists.

MARYLAND.

Cumberland.—Electric street cars running on Baltimore street September 16.

MASSACHUSETTS.

Boston.—It is said that the West End Street Railway Company is to use the largest leather belting ever manufactured in New England, in its immense power station on Albany street. There will be 36 belts in all, 12 of which will be 150 feet long and 54 inches wide, made from the centre of extra heavy hides of carefully selected pure oak belt leather and double throughout. Two of these belts will be used on each main fly-wheel, giving what is supposed to be the largest belt surface ever used on a single wheel. Twenty four of the belts will be used to run the generators. These are also double, of the same quality of leather and 30 inches in width. It is said to have taken 100,000 pounds of leather or 2,600 hides in the manufacture of the belts.

Brockton.—The Brockton Street Railway Company has voted to increase its capital stock.

The Brockton Street Railway Company has petitioned for permission to relocate its tracks, to enable it to construct a double track to Avon.

Lynn.—It is reported that the Naumkeag Street Railway Company will make a belt line from Lynn to Peabody via Salem.

Newburyport.—A 200 light dynamo is to be installed in the Newburyport Car Company's factory, to furnish light throughout the works.

Salem.—It is reported that the Naumkeag Street Railway Company purchased the property of the Essex Electric Railway Company September 19.

Springfield.—It is expected that the electrical street car line on Maple street will be running shortly.

MICHIGAN.

Jackson.—As the result of the placing of a stone on the rails by some malicious person September 16, an electric car running at very high speed jumped the track, crashed into and broke a telegraph pole and injured several persons.

Menominee.—A successful trial trip was made by the electric street railway company September 15.

MINNESOTA.

Mankato.—A syndicate of Eastern capitalists is negotiating for the purchase of the street car line here.

MISSOURI.

Kansas City.—On September 17 two masked men held up a street car and robbed the conductor of $50.

NEW HAMPSHIRE.

Concord.—The overhead construction of the West End road was commenced here September 21.

Manchester.—The street railway tracks are being relaid.

NEW YORK.

Buffalo.—The Buffalo Street Railway Company has just received eight more motor cars for its Niagara and Seneca street lines.

Kingston.—The Peckham Street Car Wheel and Axle Company, which was recently reorganized as the Peckham Motor Truck & Wheel Company, has been compelled to double the capacity of its plant to keep up with the orders for the Peckham truck.

OHIO.

Cleveland.—Efforts are being made to consolidate the street railway systems of this city.

Columbus.—The electric street railway company commenced using the newly constructed trestle over the steam railroad tracks September 16.

Toledo.—The Toledo Electric Street Railway Company will install four additional generators and one 500 horse-power engine in the power house this week.

The Consolidated Street Railway Company will run compressed air cars on its lines.

Westerville.—Committees have been formed to solicit stock subscriptions and draft articles of incorporation for a

company to construct and operate an electric railway to Columbus.

Youngstown.—It is said that portions of the franchise granted the Youngstown Street Railway Company are to be revoked.

PENNSYLVANIA.

Allegheny City.—Both branches of the City Council have passed a resolution that no more street railway privileges will be granted in Allegheny City until the corporations pay all the taxes due.

McKeesport.—The construction of the street railway power house is being rapidly pushed.

The White Electric Traction Company expects to have cars running in a few days.

The street railway company is constructing a frame car house 55 x 115 feet, to cost about $2,500; and a brick and stone power house 43 x 78 feet, to cost $25,000.

TENNESSEE.

Memphis.—The trouble between the City Council and the Citizens' Railway Company has been amicably settled, and the company will proceed with the construction of its tracks at once.

UTAH.

Salt Lake City.—It is stated that the Salt Lake City Street Railway Company now has 36 miles of track and 36 electric cars in operation, and the Rapid Transit Street Railway Company 30 miles of track and 30 electric cars.

WASHINGTON.

Spokane Falls.—The Edison Illuminating Company has just installed a new 400 horse power water-wheel and three new generators in its power house. The generators will be used to furnish power for the Spokane Street Railway, the Arlington Heights and the Lidgerwood lines.

WISCONSIN.

Hurley.—The first car over the electric line between this place and Ironwood ran September 16.

Track Extensions.

Harrisburg, Pa.—It is said that the street railway company contemplates several improvements in its Allison Hill line, among which will be the extension of its tracks out State street to connect with its lines on Thirteenth street.

Oakland, Cal.—The Rapid Transit Company desires to extend its track along College avenue and Audobon street.

Rochester, N. Y.—The Rochester Street Railway Company has been granted the right to extend its tracks through Ames and Maple streets.

Franchises.

Fresno, Cal.—A franchise has been granted F. G. Berry and J. R. White to construct and operate a street railway on Elm avenue.

Kokomo, Ind.—A franchise has been granted to the Saginaw Union Street Railway Company to construct and operate a street railway here.

New York, N. Y.—The 42d Street, Manhattanville and St. Nicholas Avenue Railroad Company is endeavoring to secure permission to construct a street railway on West 86th street from Amsterdam avenue to the river.

Syracuse, N. Y.—A number of street railway franchises are pending before the Board of Aldermen.

Vincennes, Ind.—The Vincennes Electric Light and Power Company, of this place, and the Thomson-Houston Company, of Boston, have been granted the right to construct and operate an electric street railway here.

Youngstown, Ohio.—The Youngstown Street Railway Company has been granted the right to extend its lines on a number of streets here not covered by its system.

Casualties.

Baltimore, Md.—On September 22 the driver of a horse car was severely injured by his car coming into collision with an electric car at the corner of North avenue and Carey street.

Bangor, Me.—On September 15 a painter, while painting the building of Hinckley & Egery, grasped the two electric wires running along the side of the building carrying the current for the Bangor Street Railway Company, receiving a shock that caused him to fall to the ground, killing him instantly.

Boston, Mass.—The West End Street Railroad Company lost upward of $15,000 September 15 by the burning of its Meridian street car stables, East Boston.

Columbus, Ohio.—On September 16 a man was knocked down by a motor car and severely injured.

Grand Rapids, Mich.—On September 20 a lady and child when alighting from an electric car were knocked down by a passing cable car, narrowly escaping death.

Holyoke, Mass.—On September 24 an electric street car ran into an express wagon, injuring the horse and driver.

Indianapolis, Ind.—On September 18 an employé of the Frankfort Street Railway Company accidentally fell off his car and was seriously injured.

Jamestown, N. Y.—On September 14 a laborer employed in the construction of the double track for the electric railway company stepped in front of an electric car, receiving injuries that caused his death shortly afterward.

Minneapolis, Minn.—On September 19 a tail-end collision on the interurban lines resulted in the serious injury of a large number of passengers.

A man in attempting to board a rapidly moving motor car September 18 missed his footing and fell under the trailer, receiving injuries from which he died shortly after.

Newburyport, Mass.—On September 19 a horse car and an electric car collided, severely injuring one passenger.

San Francisco, Cal.—On September 13 a man who endeavored to board a rapidly moving train on the Geary street line fell under the train and was killed.

Springfield, Mass.—On September 20 a lady passenger on an electric street car was seriously injured by the car running into another car which it was following.

Toledo, Ohio.—On September 16 a man was knocked down and seriously injured by an electric street car.

New Roads.

Barre, Vt.—An electric street railway is proposed between this place and Strafford.

Cannelton, Ind.—It is said that a street railway is to be constructed here.

San Francisco, Cal.—A company composed of I. C. Stump, A. Doble, W. R. Hearst, P. N. Lilienthal, W. S. Chapman, Monroe Greenwood and William Hollis has petitioned the Board of Supervisors for a franchise to construct and operate a street railway from Market and Sixth streets, this city, to South San Francisco.

Scottdale, Pa.—A street railway to connect this place with Everson, Keifertown, McClures and Bessemer is contemplated. Steps toward the formation of a company have been taken.

Incorporations.

Lansing, Mich.—The Owosso & Corunna Street Railway Company, of Owosso, Mich., has been incorporated, with a capital stock of $50,000.

New York, N. Y.—The North New York Junction Railroad Co. has been incorporated, with a capital stock of $250,000, to construct and operate a street railroad in the annexed district. Incorporators: Gunther H. Ackerman, Byron G. Hughes, William O'Toole, Adolph C. Hattenroth, Owen W. Flannagan, Bernard S. Levy, Henry A. Gumbleton, Benjamin A. Kirkland and John Cotter.

Pittsburg, Pa.—The Pittsburg Underground Electric Construction Company was incorporated (in W. Va.) September 21, with a capital stock of $300,000, to construct electric traction roads. Incorporators: Charles D. Robbins, D. J. Rex, J. J. Miller, all of Pittsburg, Pa.

Portsmouth, O.—The Portsmouth Electric & Power Company was incorporated September 16, with a capital stock of $10,000, to construct and operate a street railway and furnish electrical power. Incorporators: Anselm T. Holcomb, George Dabis, F. J. McGinnis, Floyd L. Smith and Samuel B. Timmonds.

Waukegan, Wis.—The Waukegan & North Shore Rapid Transit Company has been incorporated, with a capital stock of $180,000, to construct and operate a street railway here. Incorporators: George P. Washburn, A. E. Holt, W. O. Jones and F. B. Benton.

Personal.

Mr. Hugh Millan, one of the wealthiest and best known of Detroit's citizens, was in town last week.

Mr. David Robinson, Jr., of Toledo, was met in the city during the past week.

Mr. H. B. Prindle, who has been for some time connected with the advertising department of the Thomson-Houston company, has resigned, his resignation being in effect October 1. Mr. Samuel C. Peck, one of the brightest men in the employ of the Thomson-Hoston International Company, has been appointed Mr. Prindle's successor.

Mr. E. E. Higgins, General Manager of the Short Electric Railway Company, has been on a well-earned vacation. He was last heard of in Burlington, Vt.

Mr. W. J. Clark, General Agent of Railway Department of the Thomson-Houston Electric Company, paid us a very delightful visit last week while *en route* from Boston to Ohio. Few supply men are better known than Mr. Clark, and few make better acquaintances than they do when they make his.

Col. Louis Perrine, Jr., General Manager of the Trenton, N. J., street railways, was in town last week.

Mr. W. B. Ferguson, of Boston, was in New York last week.

Elmer A. Evans, of Johnson Company's New York office, was recently convicted of selling lots of Johnson rails up in the neighborhood of Syracuse, Rochester, Buffalo, etc.

Mr. John A. Brill, Vice-President of J. G. Brill Co., passed through New York last week *en route* home from the wild woolly West where he has been for several weeks.

Mr. Frank E. Pettingell, of the well known firm of Pettingell, Andrews Co., Boston, was in town last week shaking hands with his many friends.

Possible Purchases.

Abilene, Tex.—The Abilene Electric Light & Power Company contemplates the construction of an electric street railway in the near future.

Harrisburg, Pa.—The street railway company here may require equipment for an extension of track.

Huntington, W. Va.—The Huntington Electric Light and Street Railway Company contemplates extensive additions in the near future. Address J. L. Caldwell, President.

Oakland, Cal.—The Rapid Transit Company may need equipment for an extension of track which the company has in contemplation.

Rochester, N. Y.—The Rochester Street Railway Company will need construction material for an extension of track.

Scottdale, Pa.—Some construction company may contract with the citizens here for a street railway to connect this place with Everson, Kiefertown, McClures and Bessemer.

The New Glasgow Electric Company, New Glasgow, N. S., contemplates the construction of an electric street railway in the near future.

The Yarmouth Gas Light Company, of Yarmouth, N. S., is to install electrical power for a street railway now in course of construction.

Legal.

Bridgeport, Conn.—The East End Railway Company is being sued for $5,000 by Elizabeth Burns, whose husband was run over and killed by one of the company's cars on March 21 last.

Harrisburg, Pa.—Attorney-General Hensel has refused to use the name of the State in a suit to restrain the running of street cars here on Sunday.

Indianapolis, Ind.—The Broad Ripple Rapid Transit Company has commenced a suit against the Edison General Electric Company for $75,000 for failure to construct a street railway to Broad Ripple. It is alleged that the breach of contract caused a loss of the franchise, valued at $26,000, and profits of $10,000, and with other damages a total loss of $75,000. It is reported that the Edison Company owns the only practical route to Broad Ripple, and that it will neither construct a street railway, keep the road in repair or permit any other company to do so. Strenuous efforts are being made to force the fight and secure rapid transit to Broad Ripple either through the Edison or some other company.

Rochester, N. Y.—The Rochester Electric Railway Company is being sued by Mary J. Nickerson, as administratrix on the estate of Wakeman Nickerson, who was killed by one of the company's cars last February. George Van Schuyver sues the company for $10,000 damages for injuries received during an accident on the company's lines. Leroy Cady sues the company for $10,000 damages for injuries received by striking his arm against a pole which was too near the car in which he was riding. Theresa Guthrie fell into an excavation made by the company and received injuries for which she asks $5,000 damages. Ann Mitchell is also suing the company for $50,000 damages for injuries received.

Salt Lake City, Utah.—The Salt Lake City Rapid Transit Company is being sued for the sum of $26 000 by Joseph M. Thompson for the death of his son, who was run over by one of the company's cars.

BOOK REVIEWS.

Dynamo Construction, by John W. Urquhart. 352 pages, and numerous illustrations. D. Van Nostrand Company, New York.

This work is a practical hand-book for the use of engineer-constructors and electricians-in-charge. It gives full instructions regarding frame work building, field magnet and armature winding and grouping, compounding, etc., with examples of leading English, American and Continental dynamos and motors, and it will be found of great practical value to every electrical engineer. It deals with the subjects discussed in very plain language, and, as the author says in the preface, one of the objects of the work is to throw light upon the jealously guarded "mysteries" in the dynamo builder's art. He seems to have succeeded very well in his object, and has covered the field very thoroughly. It is a book that has long been looked for by electricians and it is fortunate for Mr. Urquhart that he has been able to take the time to write such a valuable and instructive work.

CATALOGUES, ETC.

—The Goldie & McCulloch Co., of Galt, Ont., has just issued a 56 page catalogue describing the Wheelock automatic engines. The single and compound engines are illustrated and described in sections, and the merits of each are fully set forth. It is claimed the Wheelock is specially adapted for electric lighting, electric street cars and power stations, and in all places requiring economy of fuel. The Montreal representative is Alfred Benn, 298 St. James street.

—The Norfolk & Western R. R. Co. is issuing in pamphlet form copies of prize essays on "The Industrial Future of the South." An electrician cannot read the pamphlet without reflecting upon the vast field the development of the South opens up for the application of electricity in every form. Those engaged in the management of electrical industries would do well to keep an eye and a hand on the South.

—The Salina Electric Railway Company, Salina, Kan., has issued a folder, giving information concerning that place, which is claimed to be the most prosperous and attractive trade centre in Kansas. A description of the place and its varied interests public and private is given in an interesting manner. The Electric Railroad Company will erect a military park and a tabernacle with seating capacity of 5,000 and the annual assemblies of the Chautauqua Society will be held there. The Salina Electric Railway Company owns and controls 1,600 of the choicest lots in the city of Salina, and offers inducements to purchasers and builders.

ELECTRICAL HEATING.

Among the many interesting and instructive exhibits at the recent Montreal Convention, and one which attracted particular attention, was that of the Burton Electric Heater Company. Many street railway managers have been quick to see the advantages of this method of heating; such as economy of space, time and money, and its merits are well understood by them. The exhibition of the heaters in actual operation on an incandescent light circuit was the means of awakening an interest among the central station men and showing them their varied usefulness, which may be so turned as to enhance their own business interests.

We are glad to learn that there will be a complete exhibit of the heaters at the Street Railway Convention at Pittsburg, and also that Dr. W. Leigh Burton, the inventor, will be present, which circumstance will certainly add largely to the interest of the exhibit. This will be an occasion for street railway men to examine the heaters personally and to determine the comparative value and economy of electric and other heaters. Electrical heating as electric lighting, is of universal interest, and having received its first successful employment on electric cars must necessarily be of deep interest to all street railway men.

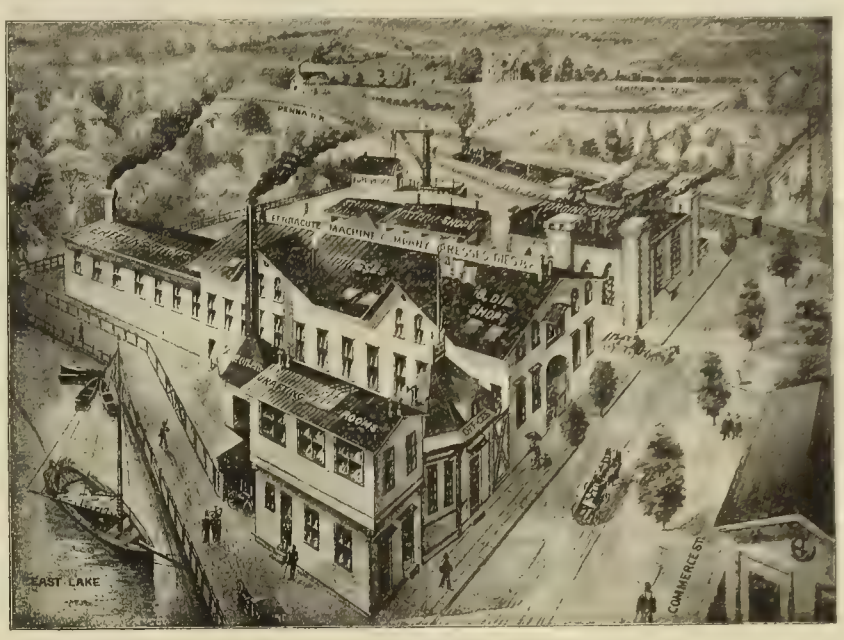
BUSINESS NOTES.

The Electric Merchandise Company, Chicago, reports for the last week the closing of contracts for the complete equipment of electric roads at Defiance, Ohio, and Negaunee and Ishpeming, Mich. The superiority of the equipment manufactured by this reliable company is recognized by both parent electric companies and construction companies as well as practical street railway managers. It also reports during the same period orders for the Burton Electric Heater from roads in Amsterdam, N. Y.; West Superior, Wis.; Milwaukee, Wis,; Escanaba, Mich.; Defiance, Ohio; Dallas, Tex.; Newton, Mass.; Champaign, Ill.; Helena, Mont., and Ann Arbor, Mich.

The "Ward" Arc Lamp, which is running so successfully on the incandescent or direct current electric light circuits, are meeting more than their usual demand from the numerous electric light companies. The orders received by the Electric Supply & Construction Company, 18 Cortlandt street, the manufacturer of the Ward arc lamp, are increasing daily. Thousands of the company's lamps are now running incandescent circuits in New York State, California, Montreal, Toronto, Canada, Jacksonville. Fla.; and that there are enough lamps in circuit in the intermediate States to make a circuit around the United States and the Dominion. The demand is increasing at such a rate that the company has found it necessary to increase its manufacturing facilities, as it has not with its immense factories an opportunity to fully develop its other specialties. The company has lamps, as will be seen in its several advertisements, for alternating current circuits, which have been tested and have not been found wanting in any particular. Its Ward arc lamps for railroad circuits will be found on the exhibition barge at the Convention of the American Street Railway Association of the United States, which will be found lying alongside of the Monongahela House, Pittsburgh, Pa., Oct. 21st to the 24th, where it will demonstrate the perfection of arc lamps on electric railroad circuits. Many questions are involved in the operation of arc lamps on railway circuits, as it seems to be understood by a great many electricians that it is impossible to run an even potential on a railway circuit, but upon investigation by the writer he finds there is only a variation of some six per cent. potential at the most on any railway circuit, and the Ward arc lamps are made to run perfectly with this variation. The company has also produced a photo-engraving lamp, electric, calcium lamp, arc lamps for theatres, etc.

THE FERRACUTE MACHINE WORKS.

We present to our readers herewith an exterior view of the Ferracute Machine Works, Bridgeton, N. J. This company manufactures upward of 100 different styles of presses, spinning lathes, dies and other tools for making articles in sheet metal and for general work in cutting, pressing and forming metal, leather and paper goods. The presses and dies made at these works are shipped to all parts of the world, and are used by some of the largest concerns in the country who manufacture iron and steel work and brass goods, clocks, watch-cases, tin and sheet-iron ware. The foreign trade of this firm extends to China and Australia, as well as Europe and South America. About 100 men are employed at the works. Special machinery for the manufacture of electrical goods is one of the specialties of this company, and in this line it is doing a large trade.



FERRACUTE MACHINE WORKS.

Permission has been given to prolong the electric railway connecting Clermont-Ferrand with Royat-les-Bains (4½ miles distant) to the summit of the Puy-de-Dôme, which is 5,000 feet above the level of the sea. The extension will be completed in about eighteen months, and will comprise examples of the ordinary adhesive system of traction, as well as of the rack and funicular methods. The line between Clermont-Ferrand and Royat has been in successful operation for some little time past. The current is supplied at a pressure of 300 volts, an overhead conductor and rail return being employed. The conductor is a slotted copper tube, inside which runs a sliding contact, consisting of a string of bronze balls connected together by a piece of wire. Each car carries 50 passengers, and is worked through Vaucanson chain gearing by a 40 H. P. motor.

NEW COMPANIES.

The Nicholson Electric Hoist Company, of Cleveland, Ohio, was incorporated September 17, with a capital stock of $30,000. Incorporators: D. A. Dangler, Martyn Bonnell, E. C. Pope, H. D. Coffinberry, H. P. Lillibridge and Ezra Nicholson.

The Washington Illuminating Company of Washington, Ia., was incorporated September 16, with a capital stock of $50,000. Incorporators: Norman Everson, L. L. Everson and D. W. Hunt, Washington, Ia.

The Fredonia Electric Light, Heat & Power Co., of Fredonia, N. Y., was incorporated September 14, with a capital stock of $30,000. Incorporators: George Barker, Frederick R. Green, John A. Warren, Benjamin F. Skinner and Louis McKinstry, all of Fredonia, N. Y.

The Holekamp, Grady & Moore Instrument Co., St. Louis, Mo., was incorporated September 15, with a capital stock of $10,000, to manufacture electrical instruments for physicians and surgeons. Incorporators: R. A. Holekamp, W. R. Grady and J. W. Moore, all of St. Louis, Mo.

The City of Oklahoma Light Manufacturing, Canal & Water Power Co., Jersey City, N. J., was incorporated September 16, with a capital stock of $150,000. Incorporators: William D. B. Janes and John H. Pell, of Brooklyn, N. Y.; E. B. Merrill, New York City, and Frank L. Clark, Jersey City, N. J.

The Elgin Electric Heating Co., Elgin, Ill., was incorporated September 17, with a capital stock of $10,000. Incorporators: Charles E. Jones, F. R. Allen and R. N. Botsford.

The Madisonville Electric Light and Power Co., Madisonville, Ohio, was incorporated September 16, with a capital stock of $30,000. Incorporators: John G. Luhn, Edwin S. Emerson, John S. Nowotny, F. R. Lindsley and J. G. Raum.

The Oswego Electrical Co., Oswego, Kas., was incorporated September 14, with a capital stock of $50,000, to supply light and heat by electricity. Incorporators: A. D. Carpenter, B. F. Henderson and F. G. Van Sant, all of Oswego, Kas., and M. V. Barnum, of Chicago, Ill.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued September 22, 1891.

459,737. Electric-Railway-Conductor Support. Edward M. Bentley, New York, N. Y. Filed Sept. 5, 1887.

In an electric railway the combination of a suspended wire, a fin and sleeve and a support separate from the fin, but to which it is attached.

459,741. Railway-Rail Clamp. William H. Brooks, West Point, N. Y. Filed Dec. 3, 1890.

A clamp for railway-rails, the lower section of which has an elongated slot or opening at one end and an elongated perforation at the other, the same being combined with a similarly-perforated binder and fasteners and made adjustable with the rail, the upper faces of the clamp being inclined.

459,748. Car Truck and Brake. Caleb E. Healy, New London, Ohio. Filed April 29, 1891.

A divided brace-bar connecting the journal-bearings for the axles, slots at the outer extremities of the brace portions, and oppositely screw-threaded inner extremities, in combination with an elongated nut with corresponding thread.

459,753. Trolley-Line Circuit-Breaker. Robert M. Jones, Salt Lake City, Utah. Filed April 16, 1891.

A circuit-breaker for separating the blocks or sections of electric railways, with a cap of a bell form provided with plates or projections of insulating material, to which are secured line-wire terminals.

459,780. Construction of Railroad-Tracks. Catharine L. Gibbon and Thomas H. Gibbon, New York, N. Y. Filed June 28, 1890.

The combination of a track-rail, a cross-tie having a series of T-shaped openings in its upper face, cheek-pieces or rail-braces fitted to engage in the openings and to bear against the opposite sides of the track-rail, the cheek-pieces being each provided with a lug or shoulder on the lower face thereof, the lug being fitted to enter the notches in the bottom flange of the track-rail and a key provided with notches in its opposite edges to engage in the openings of the cross-tie for securing the cheek-pieces in the openings.

459,781. Compound Rail for Railway-Tracks. Catharine L. Gibbon and Thomas H. Gibbon, New York, N. Y. Filed June 27, 1890. Renewed Aug. 24, 1891.

A track-rail composed of a principal rail and a complementary rail, the principal rail being composed of a head portion, a web portion, a bottom-flange portion and a longitudinal tongue at the lower part of its inner face, and the complementary rail having a head flange, a web portion, a bottom-flange portion and a longitudinal groove at the lower part of its inner face, the head of the principal rail being fitted to overlap and interlock with the head flange of the complementary rail and the lower tongue of the latter being fitted to interlock with the corresponding groove of the complementary rail.

459,794. Rheostat for Electric-Motor Cars. Sidney H. Short, Cleveland, Ohio. Filed March 17, 1891.

An exposed rheostat located outside of the car in an open flue or air-duct running lengthwise the car-body, a switch-board also located outside of the car and separated from the rheostat, electric connections between the rheostat and switch-board, and operating mechanism for the latter within convenient reach of the motor-man.

459,803. Car-Starter. Henry P. Wayman, Trenton, N. J. Filed April 21, 1891.

In combination with the axle and two-part hub provided with recesses, rollers or balls, a ring or collar provided with peripheral notches and circumferential recess and two-part guard-plates.

459,815. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Company, Boston, Mass. Filed March 16, 1888.

In an electric-railway system the combination of two railways, a suspended working conductor arranged above each railway, a supply-conductor extending along the line and common to both of them, branch conductors connecting the supply-conductor with the working conductors at intervals in their length, electric cars receiving current from the suspended conductors and having the motors of the several cars coupled in parallel, and means on the cars to control the current passing through the motor-circuits of the several cars independently of each other.

459,840. Automatic Disconnector for Overhead Conductors. Andrew L. Johnston, Richmond, Va. Filed Jan. 19, 1891.

A trolley-wire attached to a lever having its free end in electrical contact with a metal plate, a feed-conductor electrically connected with the plate, and an adjustable spring-contact connected to the free end of the lever.

STREET RAILWAY NEWS' PATENTS—Continued.

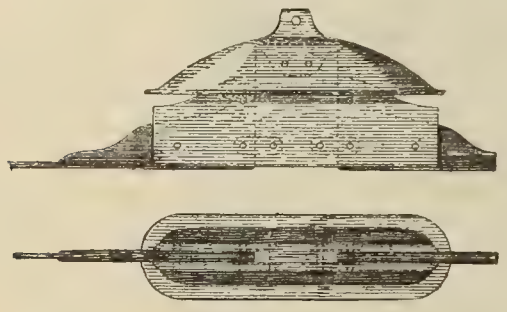
459,848. Trolley-Wheel for Electric Railways. Jean A. Wetmore, Brooklyn, N. Y. Filed Feb. 4, 1891.

An electrical contact wheel or tire formed of a spirally-wound conductor and having in its periphery an annular depression or recess adapted to receive the conductor or rail in contact with which the wheel is to rotate.

459,855. Terminal Station for Handling Rapid-Transit Passenger Traffic. Albert P. Massey, Watertown, N. Y. Filed Jan. 12, 1891.

A terminal station composed of a series of tracks and platforms arranged alternately, combined with incoming tracks passing either under or over the outgoing tracks before reaching the tracks between the loading-platforms, so that no outgoing train can cross the track of an incoming train.

459,860. Manufacture of Tie-Bars and Connecting-Rods for Railroads. Axel A. Strom, Austin, assignor to the Strom Manufacturing Company, Chicago, Ill. Filed June 16, 1891.



459,753. TROLLEY-LINE CIRCUIT-BREAKER.

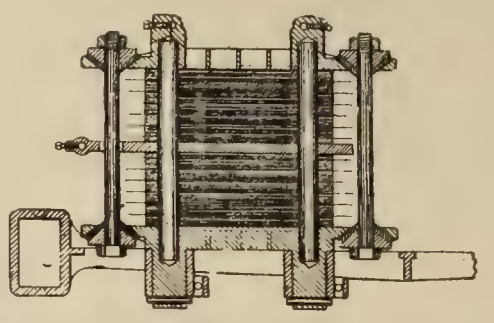
The method of manufacturing a rail-seat end of a tie-bar or connecting-rod, which consists in forging protuberances on a suitable blank and punching out a portion of the metal from the opposing sides of the protuberances, thereby forming jaws.

459,888. Bicycle Car-Truck. John Fish, Summit, N. J. Filed Jan. 20, 1891.

The combination of double-flanged centre-rail wheels with flangeless outside-rail bearing-wheels, each bearing-wheel having an axle independent of the other and running in bearing-boxes, each bearing-box having two bearings carrying a journal of each axle.

459,893. Chair for Girder-Rails. William C. Wood, Brooklyn, N. Y., assignor to the Lewis & Fowler Girder Rail Company, same place. Filed Dec. 26, 1890.

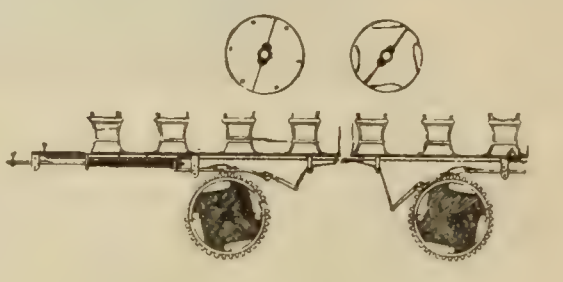
An improved wrought chair for girder-rails, comprising a hollow chair-iron adapted to be formed in one piece from plate-iron or the like and having a suitable seat portion at top, hollow lateral projections bevelled at bottom on its respective sides, side holes above the bevels of the lateral projections and vertical or substantially vertical portions extending continuously from below the projections to above the same and integral with the remainder of the chair-iron.



459,794. RHEOSTAT FOR ELECTRIC-MOTOR CARS.

460,040. Motor Mechanism for Electric Cars. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Nov. 1, 1890.

Field-magnets located between the armature mounted on and rotating with the car-axles and the car-wheels and provided with yokes which are mounted by means of journal-bearings on the axle, and an elastic connection between the car and the field-magnets for preventing the rotation of the latter and allowing them a yielding, rocking movement.



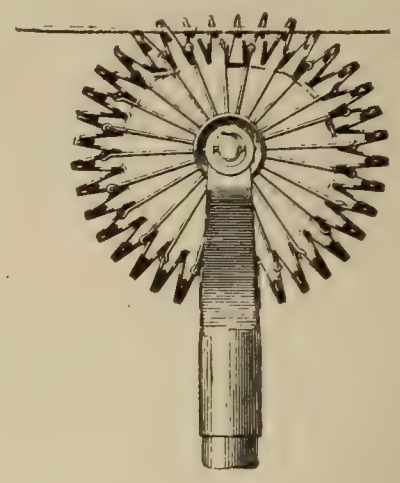
459,803. CAR-STARTER.

460,063. Railroad-Rail. Maximilian M. Suppes, Johnstown, Pa., assignor to The Johnson Company, same place. Filed June 20, 1891.

A railroad-rail and support welded together.

460,064. Railroad-Rail. Maximilian M. Suppes, Johnstown, Pa., assignor to The Johnson Company, same place. Filed June 20, 1891.

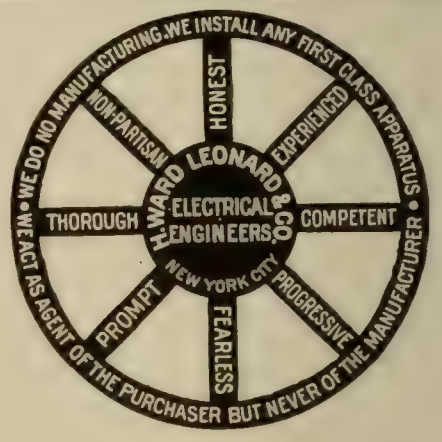
A rolled rail provided at intervals with a base or support integral with it.



459,848. TROLLEY-WHEEL.

460,096. Process of Making Railroad-Rails. Maximilian M. Suppes, Johnstown, Pa., assignor to The Johnson Company, same place. Filed Feb. 28, 1891.

A process of forming a rail and a base or support separately and welding the rail and base or support together.

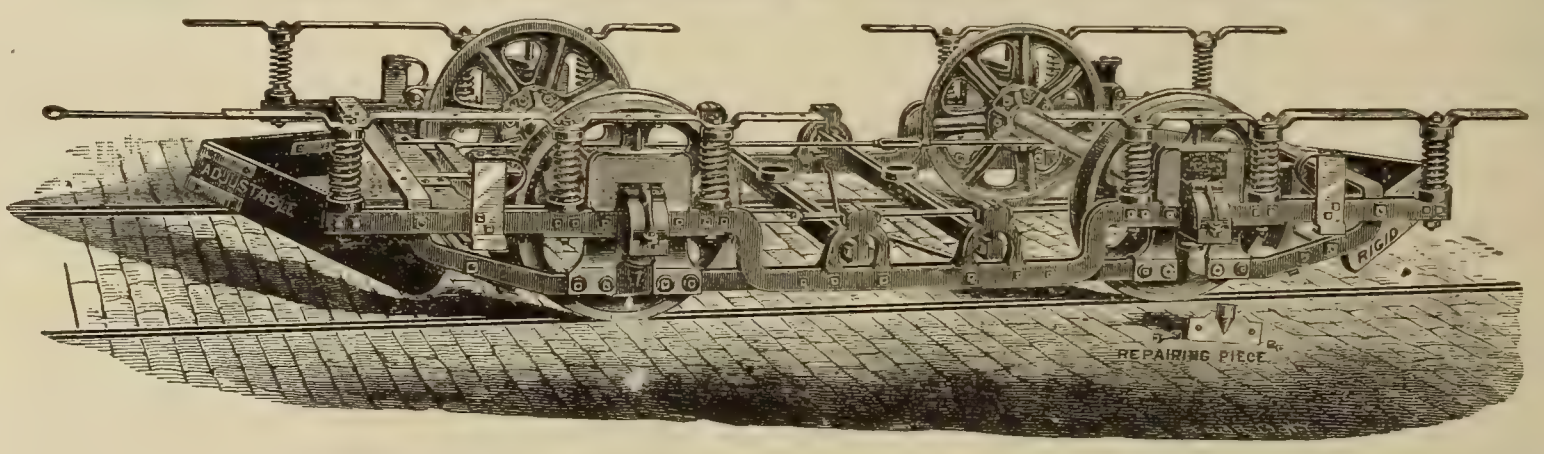


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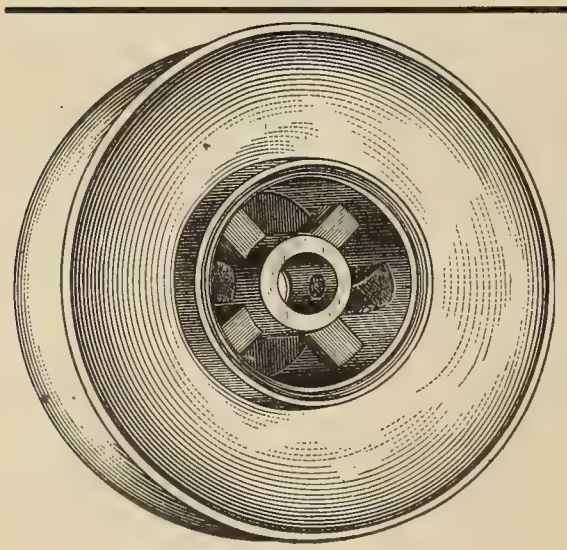
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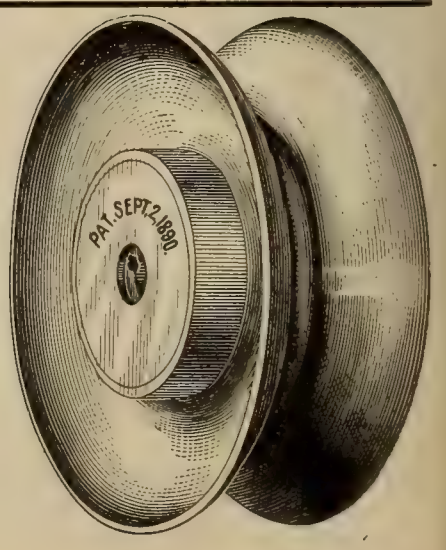
BADGER'S PATENT

SELF-OILING TROLLEY WHEEL,

For Electric Railway.

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It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

BADGER BROTHERS, West Quincy, Mass.





VOL. I. NEW YORK, OCTOBER 10, 1891. No. 14.

STREET RAILWAY NEWS.

(RAILWAY DEPARTMENT OF ELECTRICAL AGE.)

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Publisher.

J. B. TALTAVALL, *President.* T. R. TALTAVALL, *Sec. and Treas.*
W. T. HUNT, *Vice-President.* E. V. CAVELL, *General Manager.*

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FACILITATE DISCUSSION.

At the forthcoming convention of the American Street Railway Association the question will be brought up for discussion as to the advisability of having all reports of committees appointed to prepare papers printed prior to each convention and circulated among the members' delegates in order to permit of their having ample time in which to study up the questions involved and be thoroughly prepared to discuss the various subjects brought up with intelligence and a knowledge of the points at issue.

The present method is for a party to be notified that he has been appointed a committee of one to prepare a paper on a certain subject, then to either have him read it in person or by proxy before the convention, after which a discussion is invited, which is generally participated in by a few who chance to be present and who happen to be interested in the subject mooted at the time.

It is a well-established fact that not over five per cent. of men are prepared to discuss a subject intelligently off-hand, while fully fifty per cent. would add the weight of their experiences and opinions if they only had an opportunity to study up the subjects beforehand.

The objection has been urged that if the new idea obtains technical papers will at once inaugurate a war of jealous rivalry to secure priority of publication; but we hold to the opinion that there need be no apprehensions on that score, as no responsible journal would commit such an unpardonable breach of etiquette to the extent of publishing matter pertaining to an important organization when requested by a duly qualified officer of such a body to abstain from giving the matter publicity until it has become a part and parcel of the official proceedings of that organization.

By all means let the new idea become established usage; its adoption will facilitate the already lengthy business of the conventions, and not only that, it will make the proceedings infinitely more interesting than they have hitherto been. The change will be a welcome one.

ARC LAMPS ON RAILWAY CIRCUITS.

All of the blessings that the world enjoys to-day are the outcome of previous conditions, and our experience of to-day will suggest something new that will be carried into practice to-morrow. This has been the history of industrial development, and will always be until the end of time.

Every invention or improvement is sure to lead to other inventions and improvements, and the refined conditions in the industrial world to-day represent, to a large extent, a step-by-step movement from the first, just as a day represents the aggregate of 86,400 seconds of time.

This principle is not more fully exemplified than in the case of the development of the electrical industries.

From the accidental discovery of the wonderful power of amber to attract light bodies when it is subjected to friction, the electric light and the electric railway and all other electrical inventions have been evolved.

Coming down to a practical consideration of these ideas, we find that one thing leads to another in the development of the electric railway. It was a natural thought that the current used in propelling street cars might be also used to light the streets through which the trolley lines ran. This led to the invention of lamps for this particular use, and on another page in this issue we give a description and illustrations of an arc lamp of this character.

The great advantage of lighting by the trolley-wire current lies in the fact that extra poles and wires are not necessary. The railway poles answer the two-fold purpose, and it is not unreasonable to suppose that the day is nigh at hand when street-lighting will be accomplished in this manner very extensively. It is a great step toward the solution of the overhead-wire problem which is being agitated in the cities.

ELECTRIC RAILWAYS IN CANADA.

Gradually our Canadian friends are realizing the many and important advantages of electric railways as compared with horse roads. They, like the English people, are somewhat slow to exploit any new invention, especially when it is a radical departure from existing practice. It can be said to their credit, however, that they are constantly becoming more enterprising, and it will not be long before they will be peers of their American cousins in this regard.

Canadians have recently come to the conclusion that there is great merit in electric railways, and they are beginning to show their appreciation of its advantages by building electric lines in different parts of the Dominion. One of the most recent of these is that at Ottawa, a description and illustration of which we print elsewhere in this issue.

From the description it may be judged that the road is a first-class one in every respect. Canadians do things well when they undertake any enterprise, and this road in Ottawa is no exception.

It is quite a point, too, in favor of electric railroads to have one in the capital city of the Dominion, where the legislators and chief officials can study its advantages. With these gentlemen on the side of electricity for motive power on street railways a great advantage will be gained. Their voices will be heard in connection with other similar projects, and if they believe in the new power, as they undoubtedly will when they become thoroughly familiar with it, capitalists will find it much easier to carry foward their plans than they would if they were required to argue and fight for every point involved when trying to obtain necessary legislation. It is hard work at best to get an electric road established, and it requires good generalship; but when the authorities understand for themselves what electric roads are and what they are good for, we claim that it is a big advantage gained.

RECENT ENGINE DESIGNS.*

These engines are designed with a view of meeting the continually-increasing demand for economy in floor-space, in the use of steam, and thorough reliability. They are especially adapted for central-station electric lighting and railway work, and are really the first practical solution of the problem of direct connection or direct belting for the larger types of generators now being introduced in this country.

The rotative speed chosen is somewhat above the limitations imposed by the releasing valve gear of other engines, but is not what is called high speed. The engines occupy a middle ground in this particular. The pressures per square inch on the bearings and the rubbing velocities of the journals form the starting-point in establishing the rotative speed, the rate of rotation varying in the different sizes of engines inversely proportional to the diameters of their shafts, and the pressure per inch of bearing surface is kept below a certain limitation in all sizes. This insures uniform results.

The piston speed is universally 650 feet per minute, and the stroke is reckoned from the diameter of the shaft and its consequent rate of rotation.

Add to this the limited floor-space for these machines and the large saving of real estate in this particular, and the importance of this advanced step in engineering becomes conspicuous. One thousand horse-power triple-expansion, including electric generators and all, will occupy floor-space of 14 x 24 feet, at the same time allowing easy access to all working parts.

Figs. 1 and 2 are front and side views of the three-cylinder type. The crank-shaft is 9¾ diameter and carries at each end an armature, and has two intermediate wheels. In this manner the weight is distributed evenly along the shaft upon the bearings, keeping the shaft straight and free from undue strains.

Each cylinder has an independent frame and pedestal, the whole, including the generators, standing on a common bed-plate.

The columns are "divided," allowing sufficient space between the divided halves for the valve-stems and rock-arms of the high-pressure and intermediate-pressure cylinders, bringing the valve-chest at right angles to the crank-shaft, where they are perfectly easy of access. These valve-chests form the receivers between the cylinders. Four valves are used on each cylinder, the steam and exhaust being independent of each other, and the steam-lap and exhaust-lap adjustable, so the admission, lead, closing and opening of exhaust or point of cut-off may be easily altered by adjustment. In this manner the engine is easily adapted to any service, either condensing or non-condensing.

The clearances are small, averaging from 2½ to 6 %, according to sizes of cylinders, and the valves are adjusted to fill the clearance by compression, neutralizing the small loss that would occur in these limited clearance spaces, and at the same time preventing "knocking" on the rod-bearings and main journals.

The valves are four-ported, flat-faced and nearly balanced, pressing against their seats just sufficiently to keep tight, and are allowed to follow their wear. The engines are of the disconnective type.

By referring to Fig. 3 it is seen that the hand-wheels A, B, C, D, E and F are placed on the steam-chest opposite the pipes H, G, K, I, J and L respectively, the valves being placed upon seats at the ends of the pipes and operated by their respective hand-wheels. By the use of these valves the engine can be converted into either a small compound engine by disconnecting the low-pressure cylinder, or it may be made into a large compound by disconnecting the high-pressure cylinder, and the change can be made while the engine is running, the governor being connected to the intermediate steam-valves when using the intermediate and low-pressure cylinders as a compound.

The engines are equipped with complete system for grease lubrications. The cranks and shafts are forged and of the built-up pattern, with counter-weighted crank-arms.

These engines are built in sizes from 150 horse-power to 10,000 horse-power.

The principal dimensions are as follows:

Diameter of high-pressure cylinder	16 inches
" intermediate "	26 "
" low-pressure "	40 "
Stroke	34 "
Diameter of shaft	9¾ "
Height above cap-stone	21 ft. 9 "
Length over generators	23 ft. 6 "
Breadth	14 ft.
Revolutions per minute	115

In another design the engine is arranged as a four-cylinder triple. By putting it in this form some floor-space is saved over the three-cylinder type; the economy is about the same; the engine is disconnected and automatically regulated. Putting its bearings at equal service with the three-cylinder engine its speed is 94 revolutions per minute.

In either design belt-wheels may be substituted in place of generators at ends of shaft.

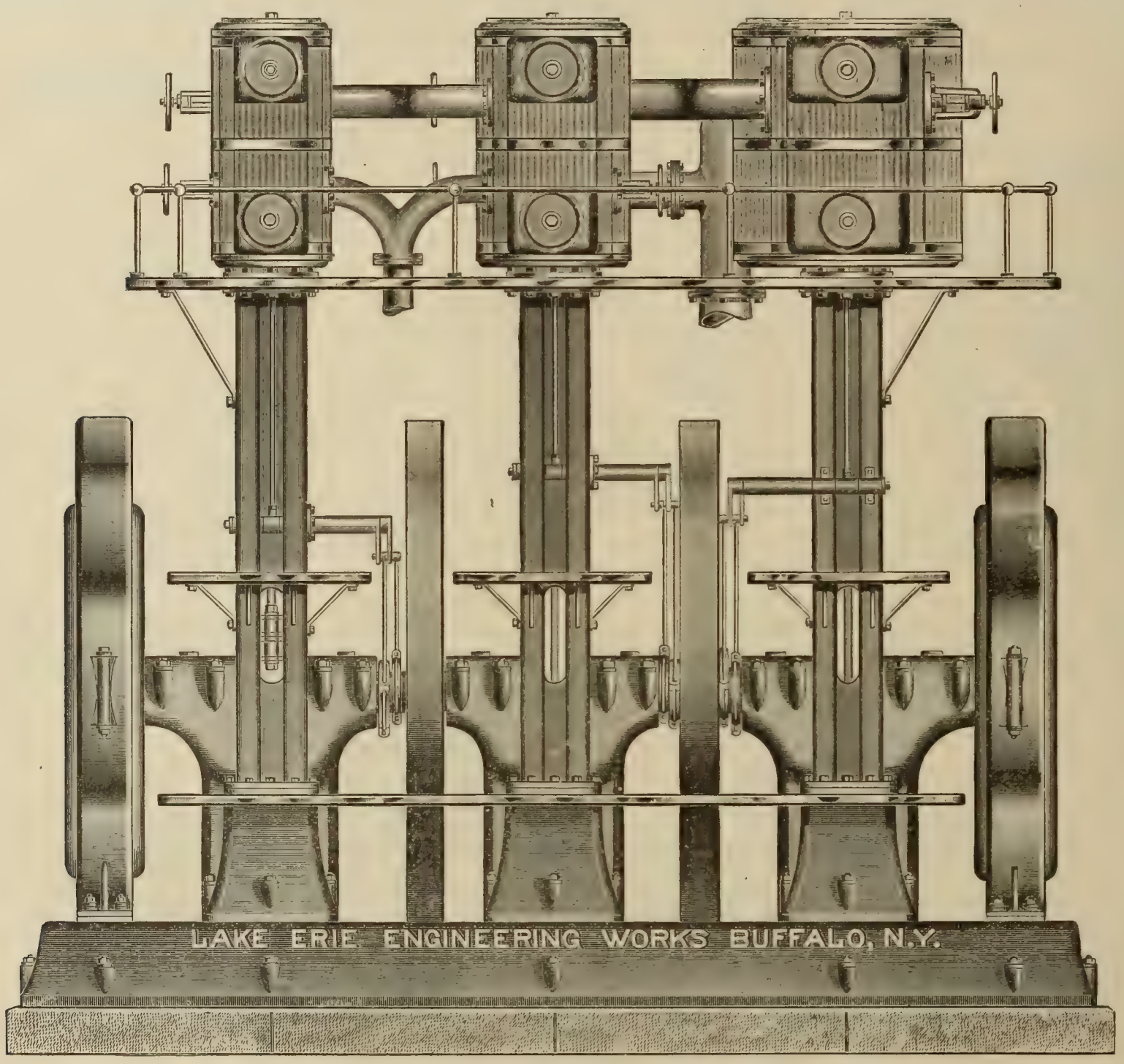


FIG. 1.—FRONT VIEW OF TRIPLE-EXPANSION ENGINE.

The accompanying illustrations are from scale drawings of triple-expansion engines, and are shown connected direct to two 500-horse-power generators. They are intended to work under from 140 pounds to 160 pounds steam pressure when connected with condensers, and from 180 pounds to 200 pounds steam when exhausting into the atmosphere.

Their rated power is 1,000 horse when most economically loaded, but are capable of performing 1,200 horse-power or more very easily should they be called on to do so. It is expected to obtain as good economy with these engines working under from 180 pounds to 200 pounds steam-pressure, without condensers, as with best compound condensing engines under from 80 to 100 pounds steam. Their adaptability, therefore, to situations where water cannot be obtained for condensation is apparent. It is safe to say that by using triple-expansion engines thoroughly adapted to the service under heavy steam-pressure without condensers, not more than one-half the fuel generally used will be required.

* Lake Erie Engineering Works, Buffalo, N. Y.

PITTSBURGH NOTES.

The Westinghouse Electric and Manufacturing Company will have a large exhibition at its works in Pittsburgh during the convention of the American Street Railway Association, which meets in that city on October 24 next.

The Pittsburgh, Allegheny & Manchester Traction Co. formally opened for business October 1. Electricity is the motive-power. Every line of street cars in Pittsburgh with but one exception is now operated by electricity.

"GEARLESS" MOTOR.*

More than six months ago the "Gearless" Motor was announced in these words: "The manufacturers confidently believe that it is the ultimate form of street-railway motor. The machines in use have convinced us absolutely that the motor is efficient, reliable and entirely successful. The result of a full year of investigation and experiment on this motor in nearly every possible combination has convinced us that a 'Gearless' motor cannot be produced, except by following the general characteristics of this machine, including, first, the multipolar field; second, a small 'magnetic gap;' and, third, a ring armature of comparatively large diameter."

The motor referred to was a radical departure from existing types, and has attracted so much attention from discussions in technical journals that it may be interesting to our readers to have a short description of it.

All gearing is eliminated from the machine. The number of bearings is reduced to two on each motor, making four in a car equipment. The armature speed has been reduced to the minimum, viz., that of the car-axles in practical operation. The noise of gearing and the "squealing" of commutator brushes are entirely obviated, and there are but three wearing parts on each motor. The armature is of the ring type, of comparatively large diameter and increased "leverage." It is keyed to the hollow steel shaft, which is concentric with the axle of the truck, and an inside clearance of one inch all around is provided for. The coils of the armature are entirely independent and perfectly ventilated.

The motor has eight field-magnets, four on each side of the armature. They face each other at a distance of only ten inches, and thus form a most intense magnetic field. They are bolted to the framework of the motor, in the centre of which are the bearings which carry the hollow armature shaft.

Mounted upon the hollow shaft close to the armature is the commutator, which is protected from injury by the surrounding pole-pieces. It is massive in construction and much larger than any commutator heretofore used, the idea being that because of its massiveness and slow speed the wear would be reduced to a minimum. Six months' operation of these motors has proved the correctness of this idea and disclosed other distinct advantages in the use of the enlarged commutator.

In mounting this simple machine, a three-armed spider is placed upon each end of the hollow shaft. Each arm is provided at the extremity with a socket to receive a rubber cushion or spring. These cushions bear upon lugs cast on the car-wheels, and as the armature shaft and spider revolve, the action is imparted to the car-wheels. This rubber cushion serves the double purpose of insulation and easy starting. The company has studied the matter of insulating its motors from the truck very carefully, and accidental leakage, short circuit between the fields or armature and the iron framework of the motor, or any other of the frequent causes for a "ground circuit" and the consequent burning out of field and armature coils, has been practically avoided. For those who are interested in the mechanical construction of the motor, we will say that from the centre of the axle to the bottom of the casing is 12¾ inches. At a speed of twelve miles an hour the armature revolves at 94 revolutions per minute with a 36-inch wheel. The equivalent speed of the Single-Reduction motor is about 400, and the Double-Reduction motor about 800 revolutions per minute.

The electrical output of the motor has been noted with great interest and all tests carefully tabulated. The following result has been obtained from thousands of readings taken on the three electric railway lines in Cleveland:

Average Volts.	Amperes.	E. H. P.	Passengers.
480	24	15.44	48

In the Double-Reduction motor the ring armature, multiple fields, large-size commutator, etc., are so arranged as to admit of their perfect ventilation. This and the "Water Tight" are the only motors on the market having wooden web gearing, by means of which the perfect insulation of the motor from its frame and truck has been secured. The pinions are of solid steel, of large diameter and with large teeth. The rim of the wooden web gear is of cast-steel. The motor frame in this, as in the other two forms of motor, is in one piece and is held by flexible supports.

In the "Single Reduction" or "Water Tight" motor one pinion and one gear have been dispensed with and arrangements made to run the remaining gear in oil. The machines are practically the same, and a series of efficiency tests show that in economy of current and in output of power there is little choice between them. The "W. T." motor, however, is smaller than the "Standard" or double-reduction motor, and it is claimed is the lightest and smallest street-car motor thus far constructed. It weighs something less than 1,800 pounds. It is incased in and entirely protected by its iron frame, and can be operated on 30," 33" and 36" wheels and on any gauge of track down to 3 feet. It is in great demand for narrow-gauge roads and for mining and other electrical haulage purposes. It is made in two standard sizes, 15 and 20 H. P.

Carefully-kept records of the operation of electric cars on the many roads equipped with these geared motors show that the cost per car mile ranges from two to four mills. The small direct cost for repairing these motors is, however, only one part of the problem. The length of time consumed in making repairs enters into every record kept by street-railway companies, and one of the most valuable features of all the machines under consideration is the facility with which they can be repaired in case of necessity. By loosening four bolts in the motor framework and taking off the iron strips below the wheel-box, a car equipped with "Gearless" motors may be jacked up and axle, wheels and armature complete run out from under the car. The armature coils may be re-wound without removing the armature from the car-axle. Field-coils can be repaired as easily. The commutator may be reached and dressed while the machine is running.

With the geared motors it is not necessary to remove the motor and car-wheels. A car can be run over a pit and every part of the motor reached without difficulty. The commutator, field-coils and armature are easy of access, and the armature can be removed in case of necessity by two men in eight minutes, its weight being only 198 pounds. In fact, every part of the motor can be removed without taking the machine to pieces. The bearings of the car-motors are twice oiled, and the comparatively slow revolution of the armature reduces natural wear to a minimum.

The Jamestown (N. Y.) Street Railway Co. operated ten cars from June 10 to August 29, a period of 11 weeks, with a total loss of but two car-days. On the Rochester (N. Y.) Railway, during eight months of operation, the total cost of repairs, including material and repairs to electrical machinery, was but four mills per car mile, and the average loss per car was but 4 % of the total mileage.

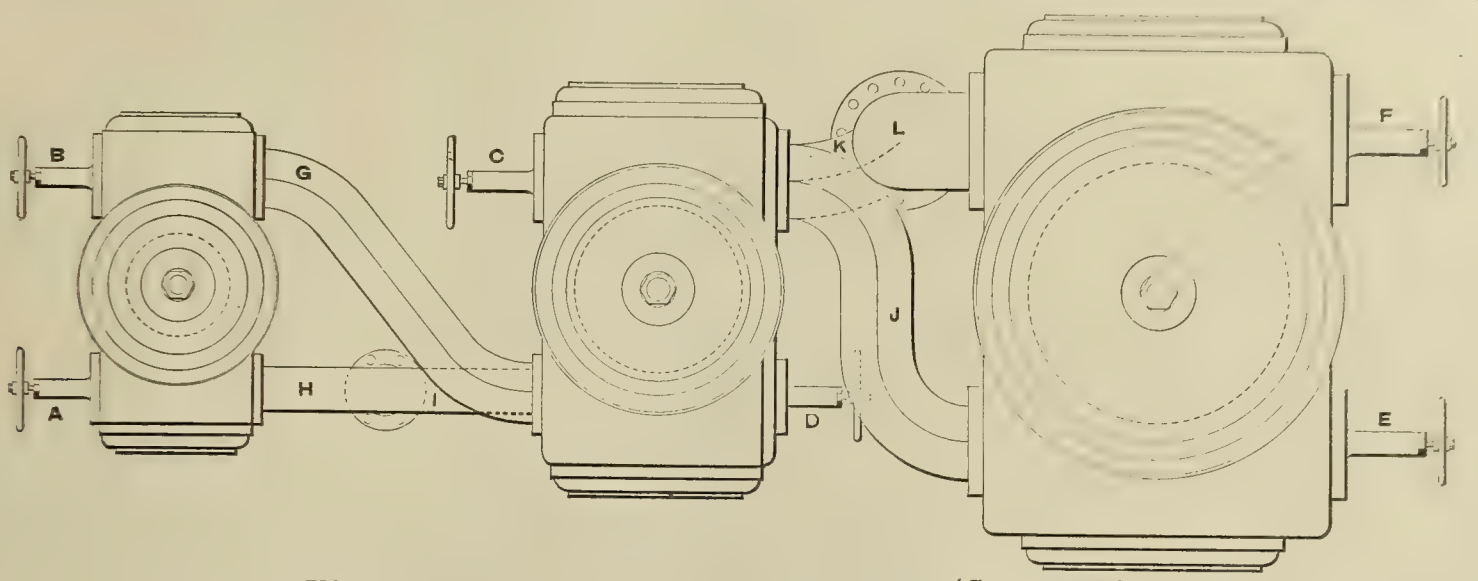


FIG. 3.—TOP VIEW OF TRIPLE-EXPANSION ENGINE. (*See page* 104.)

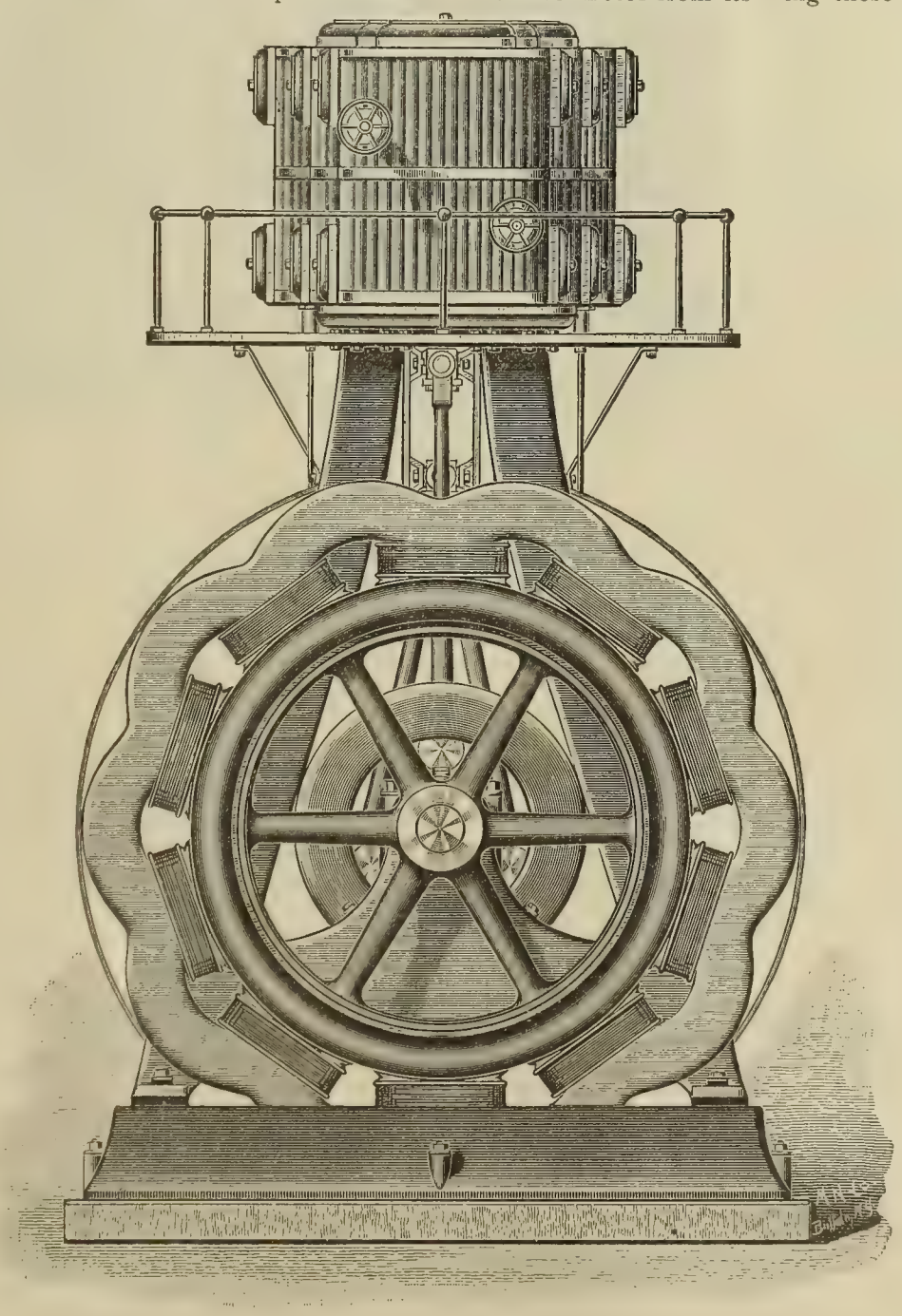


FIG. 2.—END VIEW TRIPLE-EXPANSION ENGINE. (*See page* 104.)

ENEMIES OF THE TROLLEY SYSTEM.

The much-abused "trolley system," after all of the fierce attacks upon it by its enemies, not only holds its own, but is constantly and rapidly gaining ground and conquering its foes in every direction. In view of the facts pertaining to the operation of the "trolley system" which are now so well known, it is rather amusing to witness such a scene as that which occurred in Brooklyn a

* Short Electric Railway Company, Cleveland, O.

few days ago, when the Commissioners took evidence on the application of General Slocum for permission to extend his trolley line within the city limits. Vincent R. Schenck, an officer of a company which insures railroads from loss by accidents, testified that he thought the trolley system to be very safe and had never heard of any one being killed by contact with a wire.

"Have you insured the Newark system?" asked Assistant Corporation Counsel Salmon, representing the protesting Park Commissioners.

"We have."

"Are you aware that that corporation has been presented to the Grand Jury, owing to the many accidents on its road?"

"No, I am not."

"Have you heard of the large fires in Boston caused by the trolley wires coming in contact with buildings?"

"I never heard of them."

"Do you know that four persons have been killed in Rochester by the trolley system?"

"I did not know it."

"Are you not doing a bigger business than before the trolley was introduced?"

"I think not."

Several other witnesses testified that the trolley system was safe and a necessity.

The same old arguments against the trolley system—the Boston fire and the "deadly wire!" Corporation Counsel Salmon evidently does not keep well informed on electric-railway matters. All opponents of trolley wires hug to the theory that the Boston fire was caused by an electric wire, simply because they have no direct proof that it was caused otherwise, and the Assistant Corporation Counsel could not let the opportunity pass without parading the skeletons of the Boston fire "chestnut" in the interest of his clients.

Not satisfied with the impression made upon the witness by his observation with reference to the Boston fires, Lawyer Salmon tests the killing power of the trolley wire by asking if he (the witness) had heard of the killing of four persons in Rochester by the "trolley system."

Whether Lawyer Salmon knows it or not, it may be of interest to state that there is no authentic record of a single instance where human life has been sacrificed by a trolley-line current.

These stories about trolley wires causing Boston fires and killing people are out of date, and if these are the only grounds for opposition in the case under consideration, the "trolley system" can well afford to stand by its record—its authentic record.

DIRECT-COUPLED MULTIPOLAR GENERATOR.*

It is somewhat remarkable that advanced as American engineers are in general mechanics, they should be so far behind European engineers in the matter of heavy construction in power stations. It is doubtful, however, if the responsibility really rests at the door of the engineering profession. The assignable cause is probably commercial. Large and relatively slow-speed generators coupled to vertical compound engines of several hundred H. P. is the general European practice. But European capital, contenting itself with smaller and slower returns, is willing to make the disproportionate investment required by the comparatively slow speeds which are alone possible to the forms of construction there adopted. In this country we must have faster-running machinery, more compact in form and of a greater earning capacity per dollar of cost. When we add to this the further imperative requirement of safety, economy of maintenance and operation, and economy of fuel under fluctuating loads, we have erected a problem which can be permanently and successfully solved only by compound or triple-expansion engines of special design, having in view a terminal pressure of exhaust which shall not fall below atmosphere, even under light loads. Such an engine would come under the high-speed class, while the dynamo would in its class be distinctly low-speed. The original idea attempted in various shapes of forcing an engine to an abnormal speed to meet the supposed necessities of the dynamo was unnatural and wrong. The present state of electric art now permits the reasonable practice of cutting down the speed of the dynamo to the normal requirements of the engine.

In this direction all modern engineering is strongly tending, and there is no longer room for doubt that the generating plant of the future, so immediate as to be even now the present, is to be the Direct-Coupled, Slow-Speed, Multipolar Generator for railway stations, and the same system in connection with a dynamo for electric-lighting.

The advantages are sufficiently apparent. The first cost of a plant on this principle, as compared with a system involving counter-shafting, clutch pulleys, belt tighteners, belts, etc., would be enormously in its favor. This is obvious when referring to the machinery alone, but is strongly emphasized when the further value of the reduced cost of real estate and buildings is considered.

Every transformation or transmission of energy is a loss of money, and it follows that when the crank-shaft of the engine is the armature-shaft of the dynamo, the loss is reduced to its lowest terms. Consider for a moment that the normal resistance of an armature is strictly torsional, and the difference will be quickly appreciated between the power required to drive it when spinning it by the end, against that required to drive it under the transverse strain of a heavy belt. Under ordinary conditions the belt strain to transmit 200 H. P. will be about 1,500 lbs., and the friction due to this strain is twice repeated, once on the shaft of the engine and once on the shaft of the dynamo. This is the simple case of an engine belting direct to the dynamo. Where counter-shafting is employed the frictional loss is again doubled by being repeated at the receiving and delivering bearings of the counter-shafting. The work required to overcome this friction is a net loss, and can never fall below the minimum above described when everything is in line. If the engine-shaft, or still worse, the counter-shaft, is out of line, the friction load may run up to any figure, limited only by the preservation of the bearings. With the direct-connected dynamo the frictional load due to these causes entirely disappears, leaving nothing but the internal friction of the engine to be accounted for.

Next to the direct saving in power comes the saving in space. As a general statement, fully twice as much generating capacity, with the same accessibility and convenience, can be got into a given floor-space with the coupled dynamo as with the direct-belted generator, and from four to eight times as much as with indirect belting through counter-shafting. This tells immediately upon the cost of real estate and buildings and the accompanying items of taxes, insurance and interest.

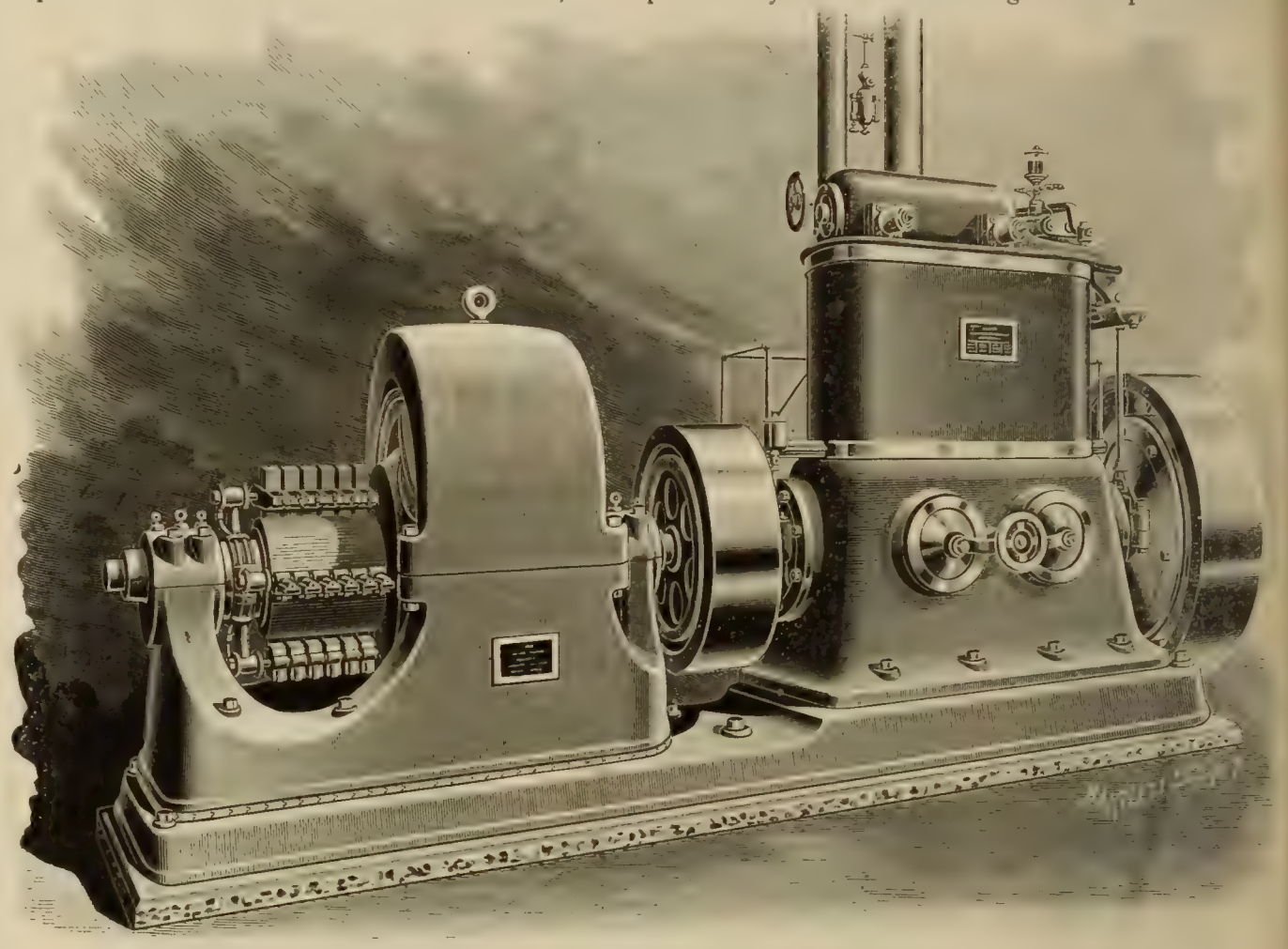
In the item of attendance and maintenance the coupled generator possesses manifest advantages in eliminating the belt account wholly, and the oil and babbitt account in large part.

Most operators will gladly welcome the absence of the noise which is inseparable from the use of belting. This becomes an important and oft-times a controlling condition in stations centrally located in business and residence districts. Not the least of the recommendations of the Coupled Generator is that it is strictly noiseless.

Such a generator has been developed in the form shown in the engraving, and is now being placed on the market as a thoroughly practical self-contained machine. The engraving represents a 250 H. P. Generator for railway work coupled to a compound engine capable of developing 250 H. P. on 100 lbs. of steam non-condensing—speed being 250 revolutions. The design is that of a single machine carried upon a massive bed-plate requiring only a moderate foundation. The generator is thoroughly insulated from the bed-plate by a sheeting of tarred plank, the bolts being insulated by bushings and washers of non-conducting material. The insulation is completed at the coupling, in which non-conducting material is interposed to prevent the possibility of metallic contact. The electrician will recognize the value of this protection. The coupling is further so designed that it will yield fully to any misalignment of the two shafts either as to angle or position of centres. The larger engines are provided with unhooking gear in the valve-motion so that they can be handled by a starting-bar, and are also fitted with a gallery sole-plate and stairway protected by hand rails, so that the throttle-valve and lubricator are conveniently accessible.

The same general design is carried out for direct coupling to heavy alternating dynamos. The sizes at present manufactured correspond to 125, 250 and 500 H. P., with 1,000 H. P. to follow. The sizes of engines required for the given power will vary according to the steam-pressure carried; 180 lbs. being contemplated as a maximum and 100 lbs. as a minimum.

The preliminary work of a design for a third high-pressure Cylinder for converting the Compound Engine into a Triple-Expansion has also been completed.



DIRECT-COUPLED, SLOW-SPEED MULTIPOLAR RAILWAY GENERATOR.

FINANCIAL DEPARTMENT.

Comparisons are odious; but to inculcate an idea into the minds of those who read to learn must sometimes be resorted to. The present occasion is the difference between the position occupied by the stockholder in the street railway receiving his regular dividends from an economically managed corporation of small dimensions, both in mileage and capital indebtedness, where he can ride daily from one end to the other without interfering with his business calls and judge very nearly the income and expense without calling on the president or secretary; and the stockholder of the large steam railway corporation whose accounts cannot be balanced in a half year and whose dividend is uncertain at all times. Even if earned, it may be found necessary to devote it to construction or some other account or place it in the reserve fund for the purpose of changing the power from steam to electric; but in any case pass the dividend, reduce the collateral value of the holding, the stockholder-investor being always at the mercy of the stockholder-speculator, as witness the published reports of nearly every deal or pool as carried out by the passing manipulators of Wall Street. Nor are there many, if any, investments as commercially certain. Well do I remember in 1848 the first train of the Eastern Railroad Company coming to our village. For many years without realizing it I looked upon that as being the most solid company in the world, and when in London some ten or twelve years ago I was told the road was bursted, I resented it (as I should if told a dear friend whom I knew to be pure and immaculate was a criminal defaulter or embezzler) until I learned the fact and was left without a champion railroad

*Westinghouse, Church, Kerr & Co., and Westinghouse Electric and Mfg. Co.

to indicate as an ideal. Shortly before this the New York Central placed its first bond on the London market, and I was asked by an intending investor for advice. I gave it and he bought. Soon the first dividend was about due and he appealed to me again. Glad of the chance to gain information I called at the office, but the only answer I could get was "ven ve get dat money ve pay dat dividend; ven ve don t get dat money ve don't pay dat dividend; ve haf not got dat money yet." Fairly staggered, I could only report back the reply I got and he sold at a loss. The dividend was paid, of course, and I was doubly blamed. I have no steam railroad now. All to me are a gamble. The financial articles in the leading daily newspapers of the country only a few days ago published to the world that two men with the question of two steam railroads controlled the business and prices on the Stock Exchange Can this be possible with the street-car securities? In a few years there will be thousands of them, and their value based on their dividends will be thousands of thousands of dollars, and there will never be a time prior to the government purchasing them that an executor or guardian cannot find with ordinary search a number in which he can invest his trust with the certainty of receiving back the principal and interest. Don't delay; get into street railroads and stay there; grow up with them. Comparisons are odious but sometimes useful.

The total amount of four and one-half per cents continued is said to be $25,864,500, which is a saving in interest beyond that of any other nation that has arrived at the dignity and ability of issuing a bond. It is so very small that every schoolboy in the country can be a government bondholder before he is twenty-one if he will deprive himself of his particular fad, whether it be the church fair or candy and the girls; but there are so many national banks which require the two per cents as a deposit against their notes that patriotism does not demand an investment in them, and really under the circumstances it is much more practical to salt down your spare change in electric securities, where the present income is all the way from five to ten per cent. They are so plenty in the market that it is rumored some private banks have purchased more than they can sell, and when the bills they gave for them fall due they must be met from other sources or returned to the Treasury, whence they emanated, and increase the assets represented by the whole issue; meanwhile the plant has been completed, and often earning dividends on the stock rendering the extra bonds unnecessary. Once back in the Treasury, they will never offer another opportunity for investment. The plants will continue both in number and value and the one-cent fare on a five-year-old electric tram is nearer our day than a two per cent. dividend.

Pittsburgh advices are to the effect that the Westinghouse reorganization really advances and that all parties in interest are working in harmony.

The amount of the 4½ per cents. continued at 2 per cent. $25,364,500, the balance of the $50,869,200 outstanding, has been redeemed with the exception of about $7,000,000. At the close of business September 30 there was found to be $248,900 of the 4½ per cents. held as security for the circulation of fourteen National Banks situated in ten different States. These must be replaced at once.

RAPID TRANSIT IN NEW YORK.

The Rapid Transit Commissioners a few days ago made public the reports of the expert engineers on the plans for an underground system of railways for New York City. The experts were John Bogart, State Engineer; Octave Chanute, president of the American Association of Civil Engineers; Joseph M. Wilson and Theodore Cooper. They fully considered the plans of Engineers Worthen and Parsons, and while they could not agree on all points involved, the plans of Mr. Worthen seem to be the more favored ones. The Commissioners have as yet not agreed upon a report.

The plans of Engineer Worthen call for four tracks on the same level to the City Hall. Below that point it requires only two, which will form a loop around State and Whitehall streets. The tunnel will not interfere with the subterranean pipes, as its top will be nine feet below the surface. The roof will be supported by iron, upheld by a single row of pillars set on a concrete foundation.

The floor of the tunnel will be nineteen feet below the street and access to it will be had from buildings erected for stations. The width of the tunnel will be 44 feet in all, and will run close to the curb-stone and in some places partially under it, but not so as to come in contact with the foundations of any buildings. Mr. Parson's plans provide for four tracks in pairs, one above the other. He would have all the subterranean pipes placed in one conduit, which would be directly under the line of the cable road and over the top of the tunnel. From the street to the first floor the distance is 10 feet 10 inches; to the second floor, 23 feet 5 inches.

THE OTTAWA (ONT.) ELECTRIC ROAD.

Probably the most perfectly equipped electric street railway in Canada is that at Ottawa, the capital of the Dominion, and certainly it is far above the average in the regularity of the service and in the satisfaction which it is giving to those who rely upon it for their means of rapid transit.

The track construction is of the most substantial character, girder and T rails being used. Much attention was given by the builders of the road to the overhead-line construction and before commencing the work they made a careful investigation of the different methods in use in the United States, consequently it embodies all the latest improvements in the way of insulators, switches, etc. Wooden poles are used and the trolley wire is hung from span wires in the usual way. The gauge of the track is 4′ 8½″.

The road, which is an entirely new one, having a total length of about ten miles, traverses the prominent business districts of the city and has branches extending into the suburbs. Steep grades are encountered in some portions of the line, and the ease with which the electric cars mounted these grades was a revelation of the power of electricity to those who had up to that time been accustomed only to cars drawn by horses.

The equipment of the road consists of sixteen closed cars, manufactured by the firm of Patterson & Corbin, of St. Catherines, Ont., which are mounted on Brill trucks, each car being equipped with two 20 H. P. Westinghouse single-reduction motors, together with the usual controlling switches, incandescent lamps, etc. The original equipment consisted of a less number of cars than stated above, but after a short experience with the Westinghouse motors the Ottawa Co. decided to make an increase in its equipment, and so placed an additional order with the Westinghouse Co.

An interesting feature of the plant is the use of water-power to drive the two 100 H. P. Westinghouse generators with which the power-station is equipped. The power is obtained from the Chaudière River, and the amount available with the present facilities at the power-house is estimated at from 800 to 1,000 H. P. The view which we present herewith shows several cars as they appeared when making an exhibition trip complimentary to members of the Senate and House of Parliament.

The frequent expressions of satisfaction which are heard from the patrons of the road, regarding the smooth and noiseless operation of the cars, warrants the officials of the company in their belief that they have a road which is second to none.

The full name of the company is The Ottawa Electric Street Railway Co., Ltd., and the officers are: J. W. McRae, Pres.; Geo. P. Brophy, V.-Pres.; Wm. Scott, Treas.; D. C. Dewar, Sec.

The construction and equipment of the road was done under the supervision of Messrs. Ahearn and Soper, electrical engineers, of Ottawa, and to them much credit is due for its successful operation.

BUFFALO, TONAWANDA AND NIAGARA FALLS ELECTRIC ROAD.

Work on the Buffalo, Tonawanda and Niagara Falls electric road is progressing rapidly, and it is expected that cars will be running regularly between Buffalo and Tonawanda by December 1 next. About three miles of track are already laid in Tonawanda, and all grading within the corporation limits is done. The cars will connect with the Niagara street line on Tonawanda street at the Buffalo city line. The distance thence to the corporation of Tonawanda is only two and one-eighth miles. In Tonawanda a belt-line covers the principal streets. Stations at which all cars will stop are to be erected every half-mile on the main line, and quick time is expected.

Fifty-two-pound girder rails are being laid, and the J.G. Brill Company, of Philadelphia, is manufacturing the cars, which are to embrace all the latest improvements. They will be twenty feet long and contain vestibules for the convenience of smokers.

The Woodbridge & Turner Engineering Co. of New York, has the contract for the building and equipment of the entire road, which is to be extended to Niagara Falls at an early date. W. A. Moncrop, of New York, has general supervision of the work for the contractors.



VIEW ON OTTAWA ELECTRIC ROAD.

RAILWAY LAMP.*

We give herewith two cuts, one showing a diagram of the Ward arc lamp, designed for use on railway circuits, and the other showing the connection of the lamps in the circuits and their relation to the railway line.

This lamp has been specially designed for burning on the same circuit with the trolley wires of the

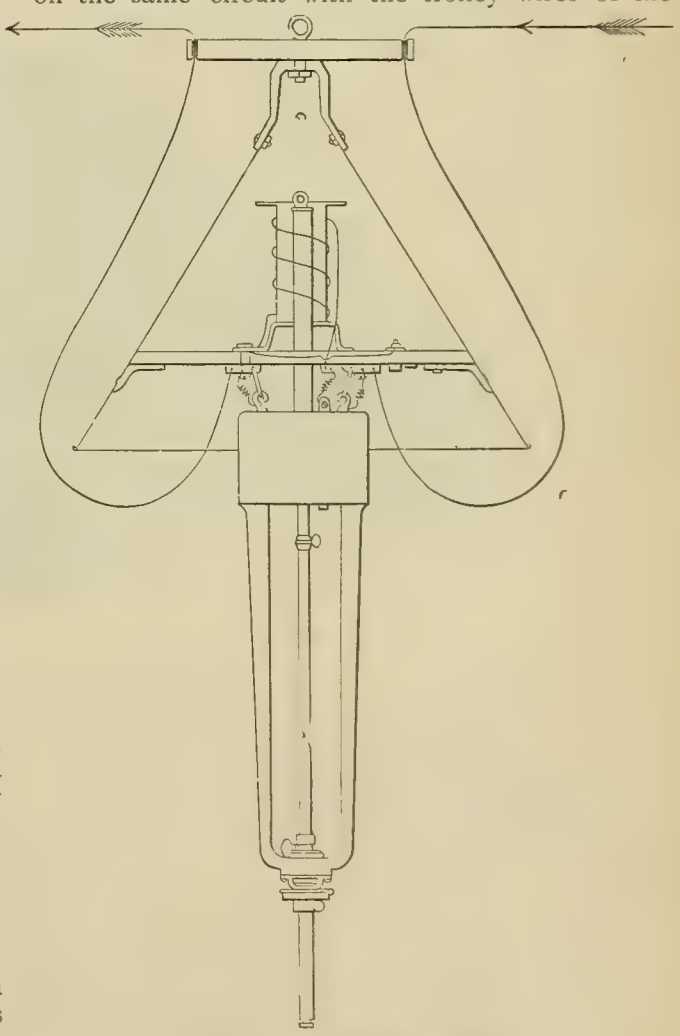


FIG. 1.—RAILWAY LAMP.

railway, enabling the street-car company to illuminate the streets along which its line runs, while it secures better service from the greater reliability which a well-regulated railway affords. The lamp is provided with an automatic cut-out to throw into

*The Electric Construction and Supply Co., New York.

circuit a resistance equal to that of the lamp. The object of this is to maintain a constant resistance in the entire circuit. The lamp has a resistance of about 4½ ohms, burning normally.

One of the valuable features of this system of lighting is that it reduces the number of poles and wires in the city streets and enables cheaper operation of lights and street cars, since the one pole line answers for both railway and street-lighting purposes.

DUPLEX STREET-RAILWAY TRACK.*

The New York & Harlem R. R. (city line) will relay its track on the Bowery and Fourth avenue, New York City, from Bond street northward, during October, with a new system for street railways. In consequence of the claims made in behalf of this new track, the event will be looked forward to and witnessed by almost every important interest connected with street railways.

If the new track is free from weakness at its joints it will succeed where most other tracks have failed; and unless the item of expense to obtain this all-important strength should prevent, it will have a large portion of the business of the whole country in street-railway construction. Its practical illustration of a continuous track, equally strong at every point in its length, will induce every street-railway man interested in a perfect and enduring construction to examine the work and method employed.

To those of our readers who are unfamiliar with the principles involved in the duplex construction we will briefly explain that the duplex rail is rolled in two complete parts, viz.: *a*, the head-rail, and *b*, the tram-rail. These two parts are put together so as to break joints; with the result that where there is a joint in the head-rail it is supported by the solid tram part of the rail. Where there is a joint between the tram parts of the rail the solid head-rail covers the connection. Each of these two parts of the rail has a vertical member resembling the neck of the ordinary girder rail, but neither of them has what is known as the flange or foot part of the rail, that part of the ordinary rail being utilized to make the second vertical member of the duplex rail, with the result that the complete rail has a box shape instead of the spindle of the ordinary girder form. The two parts of the rail, thus breaking joints, are mounted on metal chairs, which have a broad base (like an inverted saucer) twelve inches in diameter. These chairs are transversely connected by metal tie-bars, giving a greater bearing surface where bearing surface is required, and the track a much more secure gauge than can be obtained by wooden cross ties.

The rails, chairs and tie-bars are locked to each other by automatic spring-lock wedge-keys, making the whole track practically a trussed girder from end to end, without a point of weakness at any point of its length.

The special claims for the duplex track—in addition to its perfect joint and the permanence of an all-metal system—are a construction which enables the renewal of only the worn or damaged part of the rail; rapidity and economy of laying a track which has no bolts, nuts, or spikes (the parts of which fit each other like bridge material), and such continuity of metal as to render unnecessary the bonding of joints for electrical traction.

Of course the joint is the all-important point of interest in street-railway construction, and if the duplex system can make good its claim of a perfect joint for its track it will be hailed with delight by every railroad company which has suffered trouble and loss at this point.

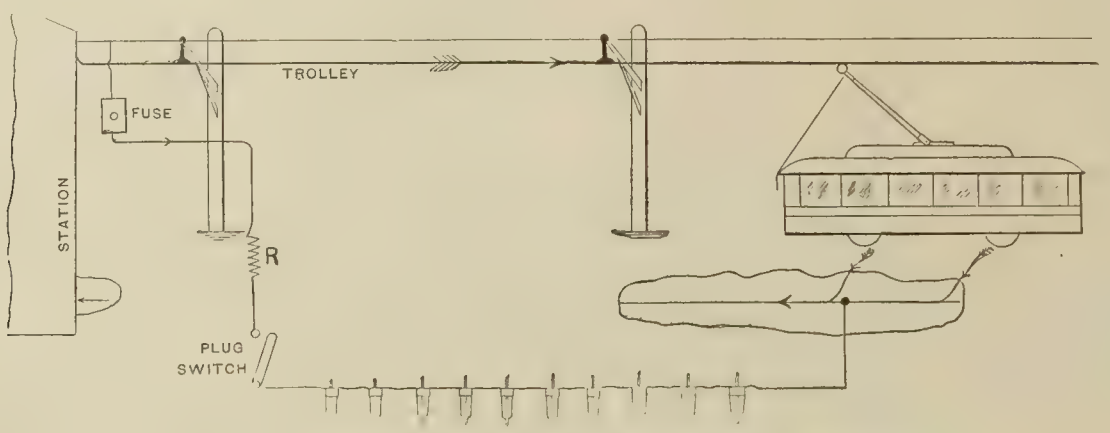
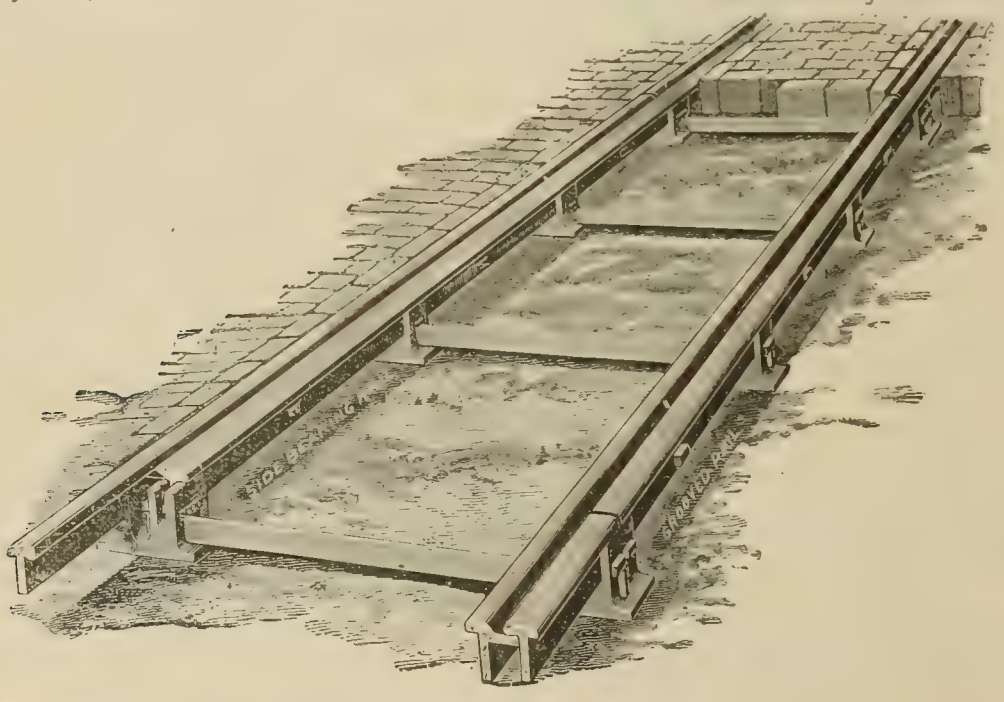
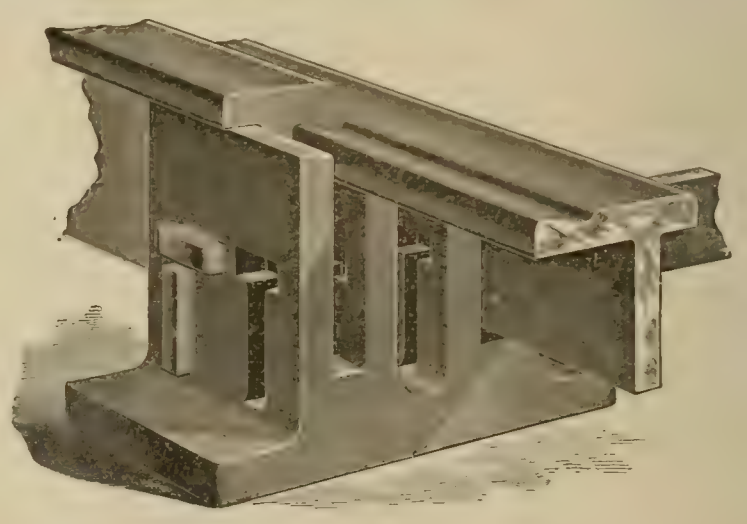


FIG. 2.—CONNECTIONS OF LAMPS ON RAILWAY CIRCUITS.



DUPLEX TRACK—GENERAL VIEW.



HEAD AND TRAM RAILS AND CHAIR.

* Duplex Street Railway Track Co., New York.

The Week's Record of Street-Railway Notes.

ALABAMA.

Anniston.—On September 28 the property of the Anniston Street Railway Company was sold to the First National Bank for $47,500. A new company is to be organized to operate the line, and it is thought that the motive-power will be changed to electricity in the near future.

Decatur.—It is reported that the Moulton Heights Improvement Company has expended nearly $100,000 in improving its street railway.

CALIFORNIA.

Berkeley.—The Rapid Transit Company is to put on ten or more extra cars.

Oakland.—A. G. Blasdel has assigned his East Oakland street-car franchise to H. J. Rose.

San Bernardino.—It is reported that the street railway companies forfeited their franchises rather than pave their tracks.

San Francisco.—The Geary Street Park and Ocean Railway Company has created a bonded indebtedness of $1,000,000 for the purpose of extending its cable line.

Santa Cruz.—It is reported that E. P. Hotaling has secured three-fourths of the stock of the Pacific Avenue Street Railway Company, and that he will rebuild and re-equip the entire system at once.

CONNECTICUT.

New Haven.—It is reported that the syndicate of Eastern capitalists, which recently purchased the Detroit street railways, has purchased two of the street railways here, through the law firm of Waller, Cook & Wagner, Wall Street, New York. The systems are supposed to be those of the West Haven Horse Railway Company and the Winchester Avenue Company. The amount paid is not stated.

ILLINOIS.

Chicago.—It is said that the Bradbury-Stone storage battery car just tested at Sioux City, Ia., is to be tested on the cable railway track here.

INDIANA.

Indianapolis.—The Northwestern Electric Motor Company will erect a plant at Hammond, Ind., for the manufacture of street-car motors and storage batteries.

IOWA.

Lyons.—Electric street cars running October 1

Sioux City.—The Bradbury-Stone storage battery car was given a successful test September 22.

MAINE.

Old Town.—The consolidation of the Old Town Street Railway Company and the Bangor Street Railway Company is being agitated.

MARYLAND.

Baltimore.—The steam dummy line from Waverley to Frederick opened September 29.

MASSACHUSETTS.

Boston.—On September 28 President H. M. Whitney, of the West End road, started a 2,000 horse power engine, the first of a number of the same power to be used by this company.

The gross receipts of the West End Street Railway Company for August were $528,720, total operating expenses $331,410 and net earnings $197,309. The number of miles run were 1,460,212.

Charlestown.—It is said that the West End Street Railway Company is to construct a one-story brick and frame car house 117 x 431 feet. The building will be very irregular in form, the above measurement being its greatest dimensions.

Milford.—The Grafton and Upton Street Railway Company has just completed a 45 x 76 feet car house.

Natick.—The street railway is expected to be in operation by October 10.

Salem.—It is reported that the Rae motors are to be used on the Essex road.

Springfield.—The street railway company is to put extra cars on its lines.

Weymouth.—The Weymouth and Hingham Railway Company will commence construction work at once.

Whitman.—The Whitman Street Railway Company began operating its lines September 28.

MINNESOTA.

Minneapolis.—The Como avenue extension of the University avenue line began operations September 28.

St. Paul.—The Selby avenue extension of the electric line will be in operation in a few days.

It is reported that the interurban line is to be kept free from cars belonging to other lines.

Winona.—George C. Duffy, of the Thomson-Houston Electric Company, St. Paul, has been here preparing for the construction of the street railway.

MONTANA.

Great Falls.—Construction work has been commenced on the street railway extension.

NEBRASKA.

South Omaha.—The Rood Street Railway Company is erecting a large street-car barn in Albright.

NEW JERSEY.

Elizabeth.—It is reported that the Elizabeth Passenger Railway Company and the Elizabeth and Newark Passenger Railway Company were consolidated October 1.

Paterson.—It is expected that electric cars will be running on Park avenue in three or four weeks.

NEW YORK.

Buffalo.—It is reported that the electric railway between this place and Tonawanda will be running within sixty days.

The Buffalo Railway Company has been granted permission to construct its tracks across those of the Erie Railroad Company.

Jamestown.—It is reported that trailer cars will be run on the electric street railway to carry freight.

Lockport.—The Lockport and Olcott Beach Railway Company will be given a franchise, provided it puts up a $10,000 bond to complete the road by August 1, 1892.

Olean.—The Olean Street Railway Company has contracted with Reed & McKibbin, 2 Wall street, New York, for the installation of its electrical equipment and the construction of its road.

Rochester.—The Exchange street electric line began operation September 28.

OREGON.

Portland.—It is reported that the Portland and Fair View electric line will be completed within thirty days.

PENNSYLVANIA.

Harrisburg.—The Council has passed an ordinance providing that the street railway companies must have shields and pilots on both the front and the rear of each car; that each car must be supplied with a head-light; that no car must exceed the speed of six miles per hour, and that all cars must distinctly ring an alarm gong three times upon approaching all crossings, and have the car under sufficient control to stop if necessary.

Pittsburgh.—The Pittsburgh, Allegheny and Manchester Street Railway opened October 1.

SOUTH CAROLINA.

Anderson.—The Anderson Electric Light and Power Company is to make an addition of a power generator for an electrical street railway.

UTAH.

Ogden.—A successful trial trip on the electric street railway system was made September 25. The road was thrown open to the public September 28.

VIRGINIA.

Manchester.—The extension of the horse-car line of West Manchester is nearly completed.

WEST VIRGINIA.

Huntington.—The street railway company is to exchange its double trolley wire for the single trolley wire system.

Possible Purchases.

Baltimore, Md.—The Baltimore City Passenger Railway Company is arranging details for the cabling of its lines. It has not closed contracts as yet. Oden Bowie is president.

Berkeley, Cal.—The Berkeley Rapid Transit Company may require construction material for an extension of track in the near future.

Beverley, Mass.—The Beverley and Danvers Street Railway Company will require electrical equipment in the near future.

Chicago, Ill.—The West Chicago Street Railway Company will require additional material for a large track extension which it has in contemplation.

Columbus, Ohio.—The Consolidated Street Railway Company will need construction material shortly.

Houston, Mo.—Some electric construction company may possibly close contracts for an electrical street railway between Rolla and Cabool, through this place, which the citizens here have in contemplation. (See New Roads.)

Louisville, Ky.—The Louisville Railway Company may possibly require material for an extension of its lines which it has in contemplation. (See New Roads.)

Marquette, Mich.—The Marquette Street Railway Company will need construction material shortly.

Change of Power.

Baltimore, Md.—On September 28 the board of directors of the Baltimore City Passenger Railway Company instructed a special committee to arrange all details and examine bids for contracts and for material for cabling the company's lines.

Beverley, Mass.—The Beverley and Danvers Street Railway Company will probably be operated by electrical power in the near future.

Denver, Col.—The work of changing the steam-motor line between this place and Rocky Mountain lake to an electric line is progressing rapidly. A branch line will be run to the entrance of Lake Park.

New Roads.

Cleveland, Ohio.—An electric railway from this place to Richfield, Summit county, is being agitated. It is said that Charles F. Brush is interested in the project.

Houston, Mo.—A project is on foot to construct an electric street-car line between Rolla and Cabool through this place. Citizens here have the matter in hand and steps are being taken to form a company. The length of the road will be seventy miles.

Louisville, Ky.—The Louisville Railway Company is to construct a street railway to Jacob Park, to be completed during December.

Pottsville, Pa.—An electric street railway to Boyerstown is a much-talked-of project.

Seattle, Wash.—A syndicate represented by J. C. Anderson has applied for a franchise to construct and operate an electrical street railway between this place and [illegible].

BUSINESS NOTES.

The Great Western Electric Supply Co., 205-207 [illegible] St., Chicago, is having splendid success with the [illegible] Lamp, which is manufactured by the [illegible] Lamp Co. of Chicago. It has installed a number of series [illegible] ous railroads throughout the West and reports that the lamps are giving most excellent satisfaction. The lamps operate either five, six or seven to a circuit on a 2,200 V railroad circuit, and give a beautiful white light without flickering, and are of from 1,200 to 2,000 candle power each. For lighting car-barns and power-houses at [illegible] crossings and areas through which railroads pass, they cannot be excelled.

The Field Engineering Co., 136 Liberty st., New York, who is making a specialty of large power-station construction and has built a number of representative stations for railway and lighting work, and who has been looking for an engine which would best fill the requirements of its practice, has concluded arrangements to especially represent the Lake Erie Engineering Works, of Buffalo. The Field Company is having two large engines of this type built in two-cylinder compound, to be installed in the power station of the Buffalo Railway Co.

Chas. A. Schieren & Co., manufacturers of Patent Perforated Electric Leather Belting, 45-51 Ferry street, New York, have received an order from the Diamond Electric Co., 17th and Clearfield streets, Philadelphia, Pa., for two 30 double, one 16" double, one 15 double, two 12 double and four 11" double belts for that company's new power plant. This is the entire lot of belts wanted by them. They also report that the demand for their Patent Perforated Electric Belting continues to increase, especially for use in electric street-railway work, where it is found very desirable because it can be run more slack than any unperforated belt without slipping. No charge is made for the perforations; they are given gratis.

A 100 H. P. Tandem Compound engine, manufactured by the Ball Engine Co., Erie, Pa., is to furnish the power for the new electric road being built by the Beatrice Rapid Transit Co., Beatrice, Neb. The same company shipped to the Buffalo Street Railway Co., a few days ago, a 300 H. P. Cross Compound engine, being the fourth of the same size built by them for the Buffalo Street Railway Co.

Eschbach, McDonald & Co., 15 to 25 Whitehall street, this city, are large dealers in electric railway and other electrical securities. They also undertake the changing of horse-car roads to the electric system.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued September 29, 1891.

460,348. Car-Truck. William S. G. Baker, Baltimore, Md. Filed June 2, 1891.

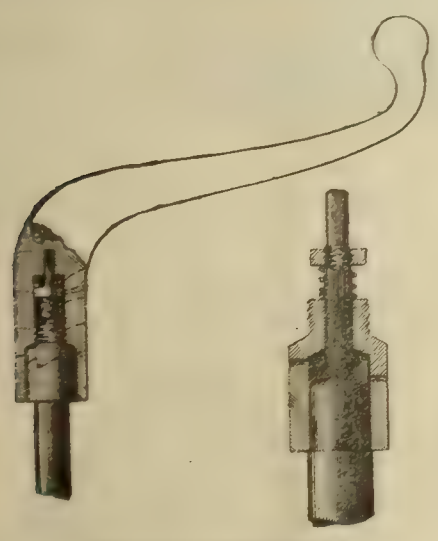
A truck-frame secured to the car-axle boxes and held against a vertical movement relatively thereto, and yielding connections between the car-body and the truck-frame, which check the vertical movement of the end of the car-body to which they are secured.

460,351. Car-Coupling. James A. Hinson, Des Moines, Iowa. Filed June 17, 1891.

A draw-head having a hollow buffer formed with an opening in its top and a swinging knuckle, and a pivoted latch having a horizontal slot at one end and a longitudinal slot in its body.

460,382. Car-Coupling. Henry E. Ricker, Meadowvale, assignor of one-third to Thomas Richard Earngey, Brampton, Canada. Filed March 5, 1891.

The combination, with a draw-head, of a swinging pivoted bail arranged to guide the link to the opposite draw-head and means to support the bail in different positions.



460,113.—CAR-BRAKE.

460,385. Car-Coupling. Charles N. Alderman, Streator, Ill. Filed June 18, 1891.

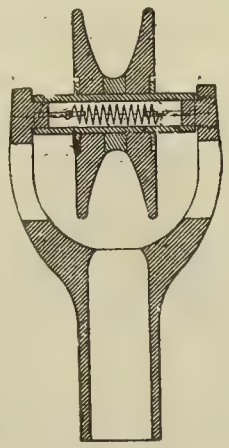
Uncoupling-bars having flexible connections attached thereto and to the pivot-pin of the latch located within the draw-head, and means for holding the bars so that their ends will be elevated.

460,402. Car-Coupling. William Richards, Big Springs, Ohio. Filed June 20, 1891.

A link-lifter for car-couplings, having at its forward end a hook curved above and below the plane of the lifter and between the inner end of the hook and its journalled end a support for the link.

460,426. Draw-Bar and Spring. Ferdinand E. Canda, New York, N. Y. Filed May 4, 1891.

A spring-casing formed integrally with a single casting having a closed top and an open bottom and constructed for attachment to the longitudinal draft-timbers.



460,163.—TROLLEY.

460,467. Track-Gage. Charles C. De Camp, Durand, Mich. Filed Jan. 9, 1891.

In a track-gage, the combination, with a car provided with wheels for moving over the track, of levers pivoted by their middle portions to opposite side portions of the car and with their opposite arms projecting above the car-floor to form indicators and having the outer sides of the free ends of their lower arms in contact with the inner edges of the rails, and means for actuating the ends of the lower arms outwardly.

460,488. Trolley-Switch. Harry L. Pierce, Leominster, Mass. Filed Oct. 22, 1890.

A switch for electric conductors, having a main plate and leads extending therefrom and arranged to be secured to the main conductors, a hinged tongue adapted to be swung into line with the terminals of the leads, a switch-lever for operating the tongue, provided with a lug arranged to be operated by the trolley-wheel and a suitable spring for holding the same in normal position.

460,510. Car-Coupling. William H. Kellogg, Lawton, assignor of one-half to William A. Forbes, Kalamazoo, Mich. Filed April 10, 1891.

The draw-bars of a car having a link-guide pivoted therein at the forward end, so as to be tilted to bring the forward surface of the guides at an incline and be forced back to place, the link-guides being provided with pin-holes in the rear of their pivot, in combination with the coupling link and pin and a support for the pin which will be tripped when the end of the link comes in contact with it.

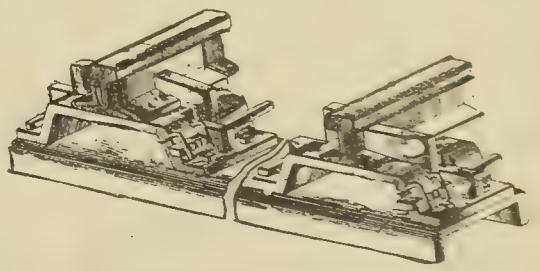
460,517. Blank for Girder-Rail Clamps. William C. Wood, Brooklyn, N. Y., assignor to The Lewis & Fowler Girder-Rail Company, same place. Filed Nov. 6, 1890.

A blank of bar iron or steel rolled in continuous lengths of uniform cross-section from end to end, having a transversely-arched back and internally-bevelled longitudinal flanges at the respective edges of its face and adapted to be converted into girder-rail clamps by punching and shearing.

460,531. Car-Coupling. John B. Graves, Cedar Rapids, Iowa. Filed Dec. 3, 1890.

The combination of a draw-head having a shoulder in the lower part of its mouth, a dog pivoted in the upper part of the draw-head and with a lever connected with or forming a part of its pivot, a link having a hole through its inner end, a pin connecting the link permanently with the draw-head, and a hole through the outer end of the link, through which the corresponding dog of another draw-head passes, and means for raising the dog to uncouple.

460,532. Car-Coupling. John B. Graves, Cedar Rapids, Iowa. Filed Jan. 19, 1891.



460,206.—RAIL-CHAIR.

The combination of a draw-head made crowning in the middle and having a slot to receive a coupling-dog, and a dog mounted pivotally in the slot and having a cap attached to or forming a part thereof to cover the slot and exclude rain, cinders, etc.

11,196. Means for Heating Railway-Cars [Reissue]. John Q. C. Searle, Chicago, assignor to Julia E. Searle, Cook County, Ill. Filed July 27, 1891. Original No. 370,897, dated Oct. 4, 1887. Reissue No. 11,101, dated Aug. 5, 1890. Reissue No. 11,170, dated June 2, 1891.

The combination of an oil-stove, a main oil-reservoir, an

STREET RAILWAY NEWS' PATENTS—Continued.

intermediate oil-feed tank located above the stove and reservoir, a valved pipe for conveying oil from the reservoir to the upper feed-tank, a pump located in the pipe for forcing oil from the lower reservoir to the upper tank, a valved pipe for conveying oil from the upper feed-tank to the stove, and a valved overflow-pipe leading from the upper tank to the main reservoir.

460,113. Car-Brake. Herbert E. Collett, Lynn, Mass., assignor of three-fourths to Austin B. Collett, same place, and Martin M. Tobin and James F. Gleason, Boston, Mass. Filed March 10, 1891.

A brake-rod having its upper end reduced to form a spindle, in combination with a clutch member secured to the rod adjacent to the spindle, a companion member mounted loose on the spindle, a push-spring interposed between a projection on the spindle and the loose member, and a brake-handle chambered to receive the clutch mechanism and detachably secured to the loose member.

460,146. Automatic Street-Railway Switch. Willeve T. Merriman, Minneapolis, Minn. Filed March 28, 1891.

Inclined guides securable to the fixed rails of the main track between the upper and lower flanges, slides mounted in the guides having connections to the switch-lever, strikers carried by the car for co-operation with the slides to control the switch.

460,163. Trolley for Electric Railways. Frederic F. Smith, Woburn, Mass. Filed Dec. 20, 1890.

A trolley for an electric car, consisting of a supporting-spindle, a pair of independent discs which freely move thereon, and one or more springs which constantly tend to press the discs toward one another.

460,171. Railway-Rail Connection. Luther Adams, Mattoon, Ill. Filed May 22, 1891.

A rigid-bar connection having an inner face of a contour corresponding to the sides of the rails, and a flange upon the outer side and provided with a lower projection resting between the ties, having spurs thereon which take into the ties.

460,198. Car-Coupling. Moses Claussen, Goldendale, Wash. Filed March 20, 1891.

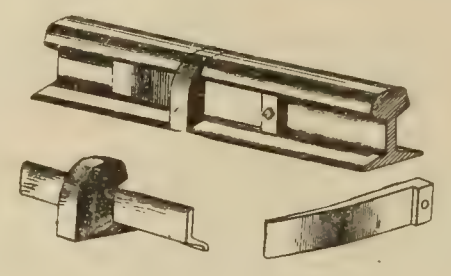
A car-coupling comprising a draw-head having a projection on its upper side with a central vertical bore, a pin moving through the draw-head and bore with an enlarged head at its upper extremity, the bottom of the opening in the draw-head inclining forward toward its mouth, a depending finger at the top of the mouth whose edges converge approximately to a point standing in front of the mouth, and a ball within the draw-head normally resting against the finger.

460,206. Rail-Chair. John P. Lancaster, Goshen, Ind. Filed Dec. 3, 1890.

Fish-plates arranged on opposite sides of the joint, hooked clamping-plates adapted to be inserted through the side slots and with their hooked ends through the top slots in the chair, and keys for locking the clamping-plates in place.

460,225. Car-Coupling. William G. Smith and John E. Kohrer, New Haven, Conn. Filed June 17, 1891.

The combination of a buffer having a longitudinal cavity or recess to receive the coupling-link, and vertical lengthwise slots opening into the recess through the upper and



460,273.—RAIL-COUPLER.

lower sides of the buffer, a rock-arm hinged or pivoted to swing vertically in the upper slot and provided with a coupling pin or hook upon its outer end, a holder pivoted or hinged to swing vertically and slide lengthwise in the lower slot and adapted to support the pin in its elevated or uncoupled position, locking means for automatically securing the holder in its elevated position, and a lifter or operating means for raising the holder into position for automatically coupling.

460,232. Self-Lubricating Trolley. William Hoen, Cleveland, Ohio. Filed April 13, 1891.

A journal-bearing for trolley-wheel or loose pulley, comprising an axial pin or shaft and an inner and outer bushing intermediate between the pulley or wheel and the axial pin or shaft, the outer bushing having numerous small holes distributed over the surface and extending radially through this bushing, the inner bushing having one or more slots extending lengthwise and winding more or less spirally around the bushing, the wheel having internal chambers for receiving dope, these chambers opening into the central bore of the pulley.

460,273. Rail-Coupler for Railways. Lewis Wallace, Crawfordsville, Ind. Filed March 5, 1891.

In a union-piece for rail-joints, a block adapted to fit between and conforming to the outline of the ends of the rails, and provided with a side piece and socket, and a spring key-plate adapted to the socket, the side-piece and key-plate having their bearings against the sides and between the heads and flanges of the rails.

460,281. Heating Apparatus for Railway-Cars. Henry H. Sessions, Chicago, Ill., assignor to the Pullman's Palace Car Company, same place. Filed April 15, 1890.

A tank or reservoir to maintain a head of water, having an upright partition extended from its bottom and one end wall toward its top and opposite end wall, and inlet and outlet openings for the circulating water in the end wall to which the partition is joined and on opposite sides.

460,325. Draft-Guard for Cars. Ernestine S. W. Rosenthal, Philadelphia, Pa. Filed May 18, 1891.

A draft-guard for a car, consisting of a main folding frame and an auxiliary folding frame, both adapted to be mounted adjacent to a car-window, so that the main frame when extended closes the space over the back of a seat and the auxiliary frame when extended closes the space on the side of the seat.

460,329. Car-Coupling. Joseph Callantine, Peru, Ind. Filed April 18, 189 .

A car-coupler with a draw-head formed with an interior recess, a rigid locking-jaw, a pivoted locking-jaw, a weighted lever and an arm carried by the lever.

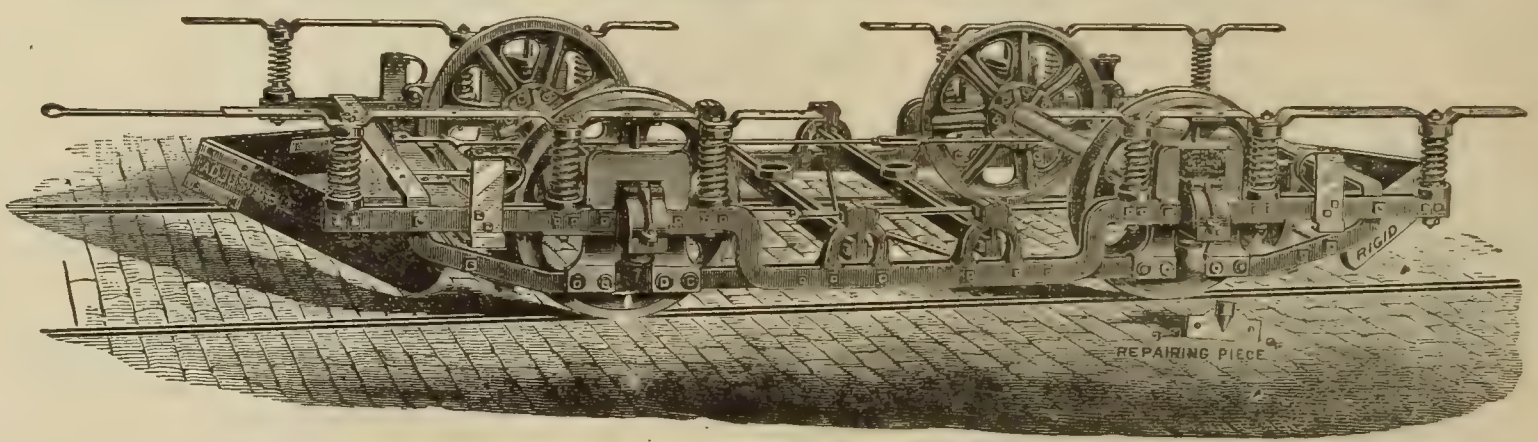


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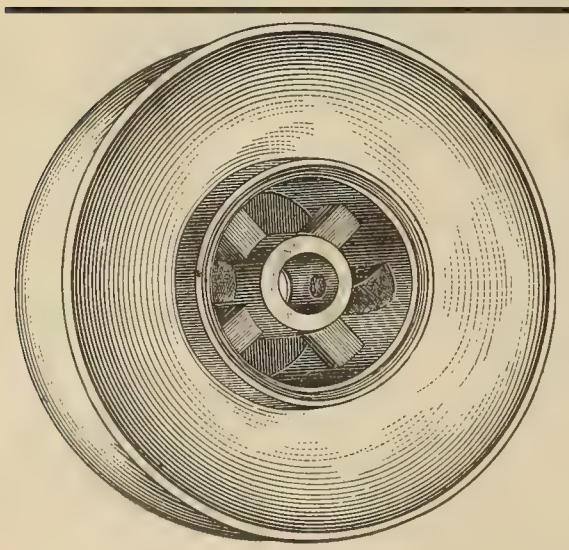
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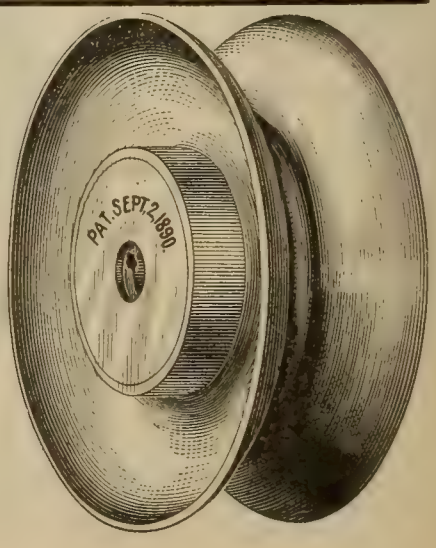
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Smooth running; ways well oiled, prolongs the life of the wheel.
It insures a good bearing always on the wire.
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Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

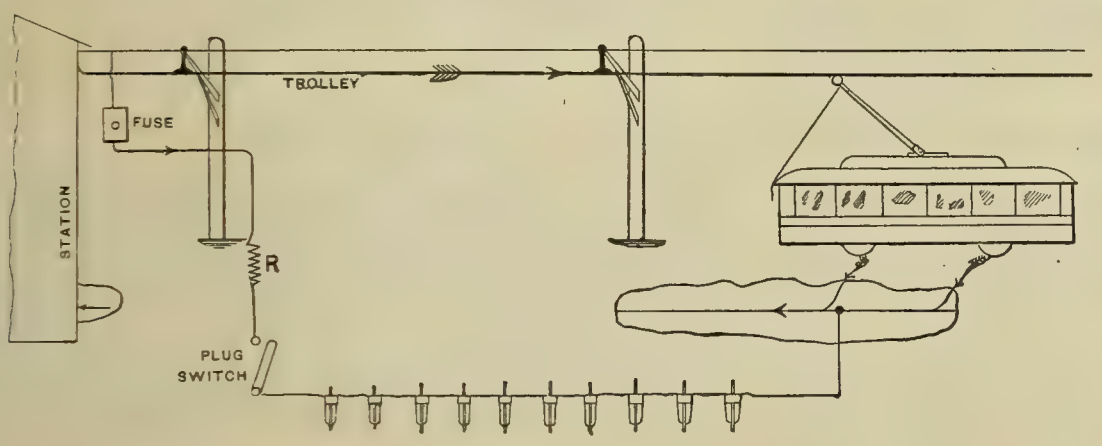
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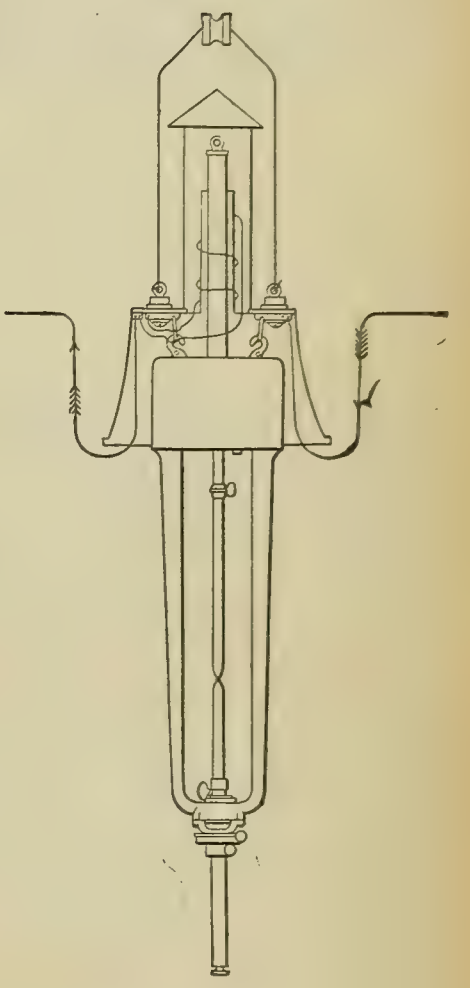


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AMERICAN STREET RAILWAY ASSOCIATION.

THE PITTSBURGH CONVENTION.

COMMITTEES TO REPORT.

"Perfect Electric Motor, A," - - - A. Everett, Cleveland, Ohio.

"Year's Progress of Cable Motive-Power," J. C. Robinson, Late of Los Angeles.

"Public and State Treatment of Corporations," - G. Hilton Scribner, N. Y.

"The Dependent—Overhead or Underground—System of Electric Motive-Power," } Geo. W. Mansfield, Boston, Mass.

"The Independent—Storage or Primary Battery—System of Electric Motive-Power," } Knight Neftel, New York.

OFFICIAL ANNOUNCEMENTS.

TO MANUFACTURERS OF STREET RAILWAY SUPPLIES.

In all probability the Tenth Annual Meeting of the American Street Railway Association, which will be held in Pittsburgh, October 21, 22 and 23, will be attended by at least three hundred leading street-railway officials, and will prove one of the largest and most interesting gatherings of practical street-railway men ever assembled in the United States. The headquarters of the Association will be at the Monongahela House, and the business sessions will be held in the banquet hall in the hotel building.

In view of the fact that this Convention will certainly attract to Pittsburgh a large number of inventors and manufacturers of street-railway supplies, who will require a suitable place for the exhibition of their products close by the Monongahela House, the Committee of Arrangements deem it expedient, thus early, to learn as far as possible how much exhibition space will be required to provide for the needs of all who expect to come. All the available room in the hotel has already been secured by a number of the leading manufacturers, and those who neglect to arrange for space elsewhere in advance will meet with great difficulty in securing what they need just before the opening of the Convention.

The Committee of Arrangements has chartered for the week of October 18 to 25 a large double-deck excursion boat, which will be moored to the wharf, alongside the Monongahela House, and used for exhibition purposes. Heavy supplies can be shown on the lower deck, and lighter products on the upper one. The boat will be suitably decorated and lighted in the evening, and so far as possible will be made a pleasant and profitable place for exhibition. If still more space is needed, the Committee will in some way make due provision for the requirements of all who give timely notice of their coming.

It is the purpose of the Committee to charge for space a sum sufficient to cover the actual expenses of the exhibition, such as rental of boat, decorations, lights, attendance, etc.

In any event, whether you are coming to Pittsburgh or not, kindly assist us in this matter by filling out the enclosed information blank, and mailing it to us at once.

Very truly yours,

THE COMMITTEE OF ARRANGEMENTS,

JOHN G. HOLMES, *Chairman.*

PITTSBURGH, PA., August 8, 1891.

REDUCED RATES TO PITTSBURGH.

OFFICE OF
THE AMERICAN STREET RAILWAY ASSOCIATION.
BROOKLYN, N. Y., September 12, 1891.

GENTLEMEN:

The rate of a fare and one-third has been allowed to delegates and all others, including members of their families, in attendance at the Tenth Annual Meeting of this Association, which will be held in the city of Pittsburgh, Pa., October 21–23, 1891, by the following Associations, namely: Boston Lines Passenger, Central Traffic, New York and New England Passenger, Southern Passenger and Trunk Line; also on the Chicago and Alton Railroad from all points in the State of Illinois. Michigan is excepted from the Central Traffic Association.

This covers nearly all the territory of the United States, with the exception of that controlled by the Western Passenger Association.

Sincerely yours,

WM. J. RICHARDSON, *Secretary.*

THE AMERICAN STREET RAILWAY ASSOCIATION.

The Tenth Regular (Annual) Meeting of THE AMERICAN STREET RAILWAY ASSOCIATION will be held at the Monongahela House, Pittsburgh, Pa., the third Wednesday in October (the 21st), 1891, commencing at 10 o'clock A.M.., and continuing three days.

The forthcoming meeting will, from present indications, be much more largely attended than any preceding. The following is a general

PROGRAMME OF THE MEETING.

FIRST.—*Reports of Committees.* Special Committees will report on the following subjects: "A Perfect Electric Motor;" "A Year's Progress of Cable Motive-Power;" "Public and State Treatment of Corporations, No. 3;" "The Dependent—Overhead or Underground—System of Electric Motive-Power," and "The Independent—Storage or Primary Battery—System of Electric Motive-Power." Notice has been received by the Secretary from the President of one of the member-companies that a special paper will be read, under the following title: "Standards in Machinery and Appliances for Electric Railways."

SECOND.—*Exhibition of Street-Railway Supplies.* The Local Committee of Arrangements, of which John G. Holmes, Esq., President of the Citizens' Traction Company, is Chairman, has chartered for the week of October 18–25, a double-decked excursion boat, which will be moored to the wharf alongside the Monongahela House, to be used for the exposition. Heavy supplies will be placed on the lower deck, and lighter ones on the upper. The boat will be suitably decorated, and lighted in the evening, and will be made a pleasant and interesting place for the exhibition of supplies.

THIRD.—*Local Entertainment.* The Pittsburgh Street-Railway Companies have not yet fully completed the arrangements for the special entertainment of those in attendance. Preparations for two excursions are under way; and they will assuredly be of a very enjoyable character. A handsome souvenir of the meeting is being prepared.

FOURTH.—*Reduced Rates of Fare.* The Boston Lines Committee, Central Traffic Association, New York and New England Passenger Lines Committee, Southern Passenger Association and Trunk Line Association have united in granting the courtesy of the special rate of a fare and one-third for the round trip to all, including friends and members of the families of gentlemen in attendance at the Convention. The territory to which the concession applies is all of the United States except the Western and Pacific Coast States and Michigan. All will, of course, avail themselves of the reduced rates where possible. For careful guidance, the rules governing reduced rates, *strict conformity with which is required,* are given, as follows:

FIRST.—Each person must purchase (not more than *three* days prior to the date of the meeting) a first-class ticket (either unlimited or limited), to Pittsburgh, for which he will pay the regular tariff fare, and upon request, the ticket agent will issue a certificate of such purchase, properly filled up and signed by said ticket agent.

SECOND.—Where the journey is made over more than one line, it may be necessary for the passenger to purchase separate local tickets, and procure certificates thereof for each of the lines over which he travels in going to Pittsburgh, as some lines do not honor the certificate of any other line. The passenger should ascertain from the ticket agent what portion (if not all) of his journey can be covered by the certificate procurable of him, and purchase tickets and secure certificates filled in accordingly. In case a ticket on the certificate plan cannot be procured at the starting-point, the person should purchase to the nearest point where such tickets can be obtained, and there repurchase through to Pittsburgh, requesting a certificate properly filled out by the agent at the point where the repurchase is made.

THIRD.—Tickets for the return journey will be sold by the ticket agents at Pittsburgh, at one-third the highest limited fare, to those only who hold certificates signed by the ticket agent at the points where through tickets to Pittsburgh were purchased, and countersigned by the Secretary of the Convention, certifying that the holder has been in attendance upon the Convention.

FOURTH.—It is absolutely necessary that a certificate be procured, as it indicates that full fare has been paid for the going journey, and that the person is therefore entitled to the excursion fare returning. It will also determine the route by which the ticket for the return journey should be sold, and without it *no reduction will be made,* as the rule of the Association is: "No refund of fare will be made because of the failure of the parties to obtain certificates."

FIFTH.—Tickets for the return journey will be furnished only on certificates procured not more than *three days* before the meeting assembles, nor later than *two days* after the commencement of the meeting, and will be available for continuous passage only; no stop-over privileges being allowed on tickets sold at less than full fares. Certificates will not be honored unless presented within *one day* after the date of the adjournment of the Convention. The certificates are not transferable, and the signature affixed at the starting-point, compared with the signature to the receipt, will enable the ticket agent to detect any attempted transfer.

N. B.—Please read carefully the above instructions, and be particular to have the certificates properly filled out and certified by the railroad agent from whom you purchase your going ticket or tickets. *Tickets and certificates should be obtained at least thirty minutes before the departure of trains.*

A certificate is void if altered, if not presented within prescribed dates, if not signed by the Secretary of the Association, and viséd by the agent of the Central Traffic Association in attendance at the meeting at Pittsburgh, or if blank spaces on the going side are not filled out, signed and stamped by the agent of the line at the point from which the passenger started.

The Secretary suggests to all who will attend the meeting, and who desire to transact business at any other city *en route,* to arrange to do so on the trip *to* Pittsburgh, as the going ticket will, of course, carry with it, in most cases, stop-over privileges; while the return ticket does not.

FIFTH.—*Attendance of Ladies.* The attendance of the wives and daughters of gentlemen attending the Convention, having become an established custom, grows more and more in popular favor every year. The pleasure of the society of ladies adds largely to the general interest of the meeting, and their participation in the excursions and banquet will be fully arranged for as heretofore.

SIXTH.—*The Banquet.* The Annual Dinner will take place on Thursday evening, the 22d prox., at the Monongahela House. Each Company that is a member is entitled to the free admission to the Banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting not an officer of a member-company, will be charged ten dollars; ladies' tickets, five dollars each.

In order to facilitate the Executive and the Local Committees, will you please inform the Secretary immediately upon the receipt of this notice of the number that will be present from your Company, enclosing the additional amount covering the number in excess of the two to which the Company is entitled free, that definite arrangements as to the number that will attend the Banquet may be promptly made.

SEVENTH.—*Hotel Accommodation.* The Local Committee of Arrangements desires to announce that it has secured one hundred rooms at the Monongahela House, for the exclusive use of delegates and members of their families. These rooms will be assigned in the order of the applications received therefor; and, as far as possible, in accordance with the expressed wishes of the applicants. Those who expect to be present are requested to communicate with the Committee at once, stating whether they will be accompanied by members of their families, and if so, how many; in order that due provision may be made for the accommodation of all who may come. As orders for rooms will be taken subject to cancellation on or before October 16, it will be readily seen that no risk is taken by any one who, expecting to be present, engages a room at once. It is certain that immediate action in this respect can only be to the advantage of the applicant; for the hotel proprietors can readily dispose of any room that may have been engaged prior to the said date, should its engagement, for any reason, be afterwards cancelled. In case a preference for rooms at any other hotel should be expressed, the Committee will undertake to secure such quarters as are desired, if notified in due time. Concerning hotel accommodation, please address all communications to the Committee of Arrangements, American Street-Railway Association, Room 6, Jackson Building, Pittsburgh, Pa.

A list of the present membership of the Association, numbering 172 Companies in the United States and Canada, is sent herewith. If your Company is not already a member, it is cordially invited to join, and be represented at the meeting. Will you please acknowledge receipt of this letter as soon as possible, stating whether you expect to be present? On the enclosed delegate's card kindly fill in the names of those who will attend from your Company, and return it with your letter of acknowledgment in the accompanying envelope.

Awaiting your *prompt* reply, I remain,

Sincerely yours,

WM. J. RICHARDSON,
Secretary.

BROOKLYN, N. Y., September 21, 1891.



VOL. I. NEW YORK, OCTOBER 17, 1891. No. 15.

STREET RAILWAY NEWS.

THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

J. B. TALTAVALL, *President.* T. R. TALTAVALL, *Sec. and Treas.*
W. T. HUNT, *Vice-President.* E. V. CAVELL, *General Manager.*

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THE APPROACHING CONVENTION.

THE "FLOATING EXHIBITION"—EXHIBITS SCATTERED EVERYWHERE—DISADVANTAGES OF THE PRESENT SYSTEM—THE REMEDY—THE MONTREAL EXHIBITS—MEMBERS' DELEGATES CROWDED OUT, ETC.—THE REASON—"BEST ROOM IN THE HOUSE"—WHOLESALE AND RETAIL—SUPPLY AND DEMAND—THE SUPPLY MEN—CONCENTRATE THE EXHIBITS, ETC.

To those who have conversed with prospective exhibitors at the approaching street-railway convention, it is very clear that the supply houses in general do not take as kindly to the "floating-exposition" idea as it was hoped that they would.

* * *

A supply man attends a convention mainly for the purpose of seeing and being seen—of meeting old friends and acquaintances and making new ones—of ascertaining, as far as possible, when his constituency (the members' delegates) expects to be in the market. He goes to considerable expense in arranging for an exhibit, so that he can show up his goods alongside those of his competitors, and he has a perfect right to expect that he will be compensated for his trouble and expense by at least being provided with adequate accommodations for a proper display. Now the question suggests itself, "What constitutes a proper display?" An exhibit in a room in the hotel where the headquarters of the convention are? Then only a chosen few can ever hope to secure it. In the hotel corridor? The same answer still applies, for no hotel in the world has corridors sufficiently capacious for such a purpose. Street-railway men attending conventions have neither the time nor the inclination to go rambling around from room to room, from corridor to corridor, from floor to floor, then about the street (where large exhibits are frequently placed), and again to other points located at some distance from the hotel. They want to keep abreast of the times, to investigate for themselves all new practical inventions designed for the purpose of solving the problem of the economical operation of tramways and the comfort of the city-travelling public, and would gladly give their attention to all meritorious devices brought to their notice at such a time, but under the present system, that of individuals and companies having their goods scattered around in four or five places, it is simply impossible, as no one has yet attained the degree of omnipresence. The result is an unhappy one all around; supply men feel badly in that, owing to lack of adequate accommodations, they have to hide their light under a bushel, where it can only be seen by a minority instead of by a majority. Railway men go away feeling that their time has only permitted them to investigate but a very few out of a large number of most interesting exhibits.

* * *

The disadvantages of the present system (or lack of system) appeared to us to suggest the remedy—viz., the securing of a hall, year by year, by the Association, of sufficient capacity to permit of an almost unlimited display of street-railway appliances, and a portion of which could probably be used as the convention hall, or, at any rate, space sufficient to provide for all exhibits. Let the idea be, not to make money out of the deal, but to assess each exhibitor in proportion to the amount of space occupied, in order to meet expenses, etc. In fact, let all rules governing regular expositions obtain, and it is not difficult to predict the result.

* * *

Ever since the Washington Convention, when official action was first taken towards holding an exhibit of street-railway supplies, there has been manifested such a deep interest in that direction that it has now become one of the principal, and certainly one of the most interesting, features of the annual meeting. Why, then, should exhibitors be handicapped for lack of space?

* * *

In an experience with conventions—one that extends over a good many years, embracing many varied interests—we do not hesitate to name that of the National Electric Light Association, recently held in Montreal, as one of the most, if not the most, complete and successful, at least so far as the exhibits were concerned, and why? Simply because exhibitors were well and properly cared for; because ample accommodations were provided for them; because a perfect organization was established and maintained from first to last; because such interest was shown in their work that exhibitors laid themselves out to make their mark—and they made it. And who will assert that a convention of gentlemen whose lives are spent in the public service—for all who work to serve the public must be in the public service—in providing accommodations for the transportation of the public is one jot less important than that of those who give it light? The two are analogous, their relations to the public are of equal importance, their wealth, the capital represented, of approximately equal magnitude. Why, then, should not the laurels of success rest equally upon the twain?

* * *

Again, of recent years, and especially since it has become customary to exhibit, the influx of the representatives of supply houses has in many cases which have come to our knowledge literally crowded out the gentlemen who attend the conventions as delegates or members, thus compelling them to accept inferior accommodations, and no little amount of murmuring has been heard from time to time on account of it. Assembling the exhibits, gathering them together under one roof, would mitigate this trouble to a great extent, as numbers of exhibitors would not care very much then about having the accommodations they now call for.

* * *

The insistance on the part of the supply men upon having the "best room in the house" (a procedure rendered necessary under the present go-as-you-please plan of holding exhibits) naturally enough arouses the cupidity of the average hotel-keeper, and the management of the convention-headquarters caravansary in Pittsburg has not been the least derelict in availing itself of the argentiferous opportunity of placing itself in a position to clip coupons for the remainder of its days after the whirl of the convention is over and the enterprising man hath departed with a ten per cent. octopus lien on his exhibit and personal effects in his pocket as a lasting souvenir of the princely hospitality of one of the Pittsburg hotels.

* * *

According to the general understanding of the fundamental principles of commercial law, one should pay less when buying by wholesale than when by retail; but the hotel management which we have in mind puts that argument on one side and confronts you with the undeniable assertion that prices are governed by the law of supply and demand. It says that while it may be true that the influx of guests is wholesale, yet the payments are simply retail; that what the hotel gains in increased business temporarily it loses in permanent business eventually, and that it must raise prices accordingly in order to save it from being called upon to face supplementary proceedings.

* * *

Specious as this argument may appear from a certain knowledge of the actual facts in the case, we do not hesitate to brand it as a fallacy, for there are not many hotels which are fortunate enough to have "permanent" guests who pay anything like from $25 to $75 per day for the simple use of one or two rooms or some few feet of space in a corridor.

* * *

The supply men are a very open-handed, liberal lot of fellows; men willing to pay well for what they want; long-suffering to a degree; men who act as superb advertisements in their peregrinations for hotels at which they are well treated, but they can condemn a hotel as well and as effectually as they can praise it, and woe-betide a hotel when once the ill-will of these gentlemen is incurred. Treat them well, treat them fairly and squarely, and hotel men are invariably the gainers; impose upon them, overcharge them, or anything of that sort, and the word goeth forth to steer clear of that hotel—aye, it passeth on from Dan to Beersheba.

* * *

To sum up, we are of opinion that the interests, the power and the influence of the A. S. R. A. would be considerably enhanced if the exhibit matter was absolutely in the hands either of the Association itself or of a committee duly appointed by the supply men themselves, instead of being the go-as-you-please affair which it is to-day; that the selection of the city wherein to hold the next convention should be left to the Executive Committee, which should be governed in such selection by the accommodations afforded in the way of halls for convention and exhibit purposes; by assurances on the part of the management of the hotel where it is proposed to establish headquarters that there will be no raising of rates, as well as by those other considerations which have helped to decide this important matter in bygone years.

A NEW COMPOUND ENGINE.*

The rapid development of electric machines which demands the use of the high-speed automatic engine has led to the improvement of that class of engine and brought it to the state of a more serviceable machine, in points of regulation, durability and economy. The necessity of an engine of the high-speed type which would give more economical results than the single-cylinder engine has led to the introduction of the high-speed compound engine, and a typical engine of this class is herewith illustrated, which is known as the "Dick & Church" Tandem Compound Engine.

Fig. 1 is a perspective view of the engine, showing the side on which the valve-gear is carried; Fig. 2 is a plan of the engine in outline; Fig. 3 the elevation; Fig. 4 a rear-end view of the engine; Fig. 5 is a reproduction of a photograph taken in the engine-room of the Lincoln Street Railway, Lincoln, Neb., showing four of these engines which are at work in this station. Since this photograph was taken two more of these engines have been added. At the time the photograph was taken all the engines were in motion and developing their full rated power. The engines in this station are 11″ and 17″ x 12″ compound non-condensing, running at a speed of 275 revolutions per minute under 120 pounds boiler-pressure.

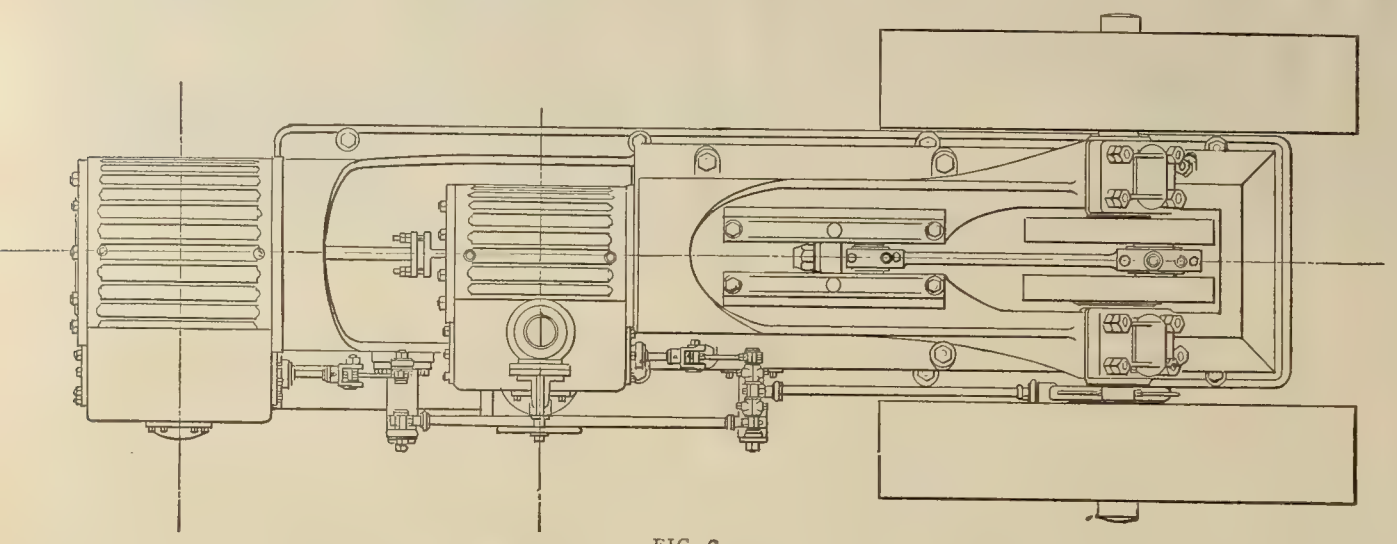


FIG 2.

The most notable feature in the design of this engine is the method employed to allow each cylinder to expand freely and independently of the other; for it will be seen from the illustration that each cylinder is on a separate frame, to the forward end of which the cylinder is attached. In tandem engines of this class, designs heretofore presented have had the two cylinders connected by a yoke and the forward cylinder hung from the frame of the engine; the result being that the expansion of the forward cylinder carried the rear cylinder farther away from the frame, the overhang of the two cylinders being equal to the length of both cylinders and of the yoke connecting them. In the design presented herewith it will be seen that the overhang is no greater than the length of one cylinder. This new construction makes an excessively rigid and heavy bed-plate and allows easy access to either cylinder without disturbing the other. The hoods which carry the cylinders are rigidly tied together by a rod which extends from the inside of the rear hood to the top of the forward hood.

The valve-gear is so constructed that the valves of both cylinders are controlled automatically by one governor, whereby is obtained a better distribution of loads and temperatures between the two cylinders at all points of cut-off, and the additional advantage of more properly adjusting the receiver pressure, and controlling this pressure to give the best results under the conditions under which the engine works.

In the design of the engine particular care has been given to the matter of the wearing surfaces and to make the proportions such as to meet the requirements of extreme and varying loads as are met with in electric-railway service. The oiling devices have been made as simple and as thorough as possible, so that all parts can be lubricated while the engine is in motion, and arranged so as to prevent throwing and wasting of the oil. The governor is oiled by means of a centrifugal oiling device which carries lubrication to all of its working parts.

A test of one of these engines was recently made at Jamestown, N. Y. The engine was of the size rated by the manufacturers at 150 H. P., but the greatest average load obtainable at the time of the test was 105 H. P., and, considering the particular conditions under which the test was made, the results obtained show the engine is capable of very economical performance. The engine tested had a high-pressure cylinder 11 inches in diameter, low-pressure cylinder 20 inches in diameter and stroke of 15 inches; revolutions per minute, 240; boiler-pressure, 103 pounds. The steam was supplied by a Manning Patent Vertical Boiler, also built by the manufacturers of this engine. Had the engine had a heavier load, the results obtained from the boiler would have been much better, in that it would have worked more nearly to its rated capacity. The test, however, showed that even under these unfavorable conditions the engine developed a horse-power on 17½ pounds of steam per hour, and on an actual coal consumption of two pounds of coal per horse-power per hour, or 1.89 pounds combustible. The coal used was an inferior grade of bituminous slack and nut mixed. The engine was charged with the entire cost of driving the condenser and boiler feed-pump. The bed-frame of the engine is from the design of Mr. H. C. White, the manager of the New York office of the company.

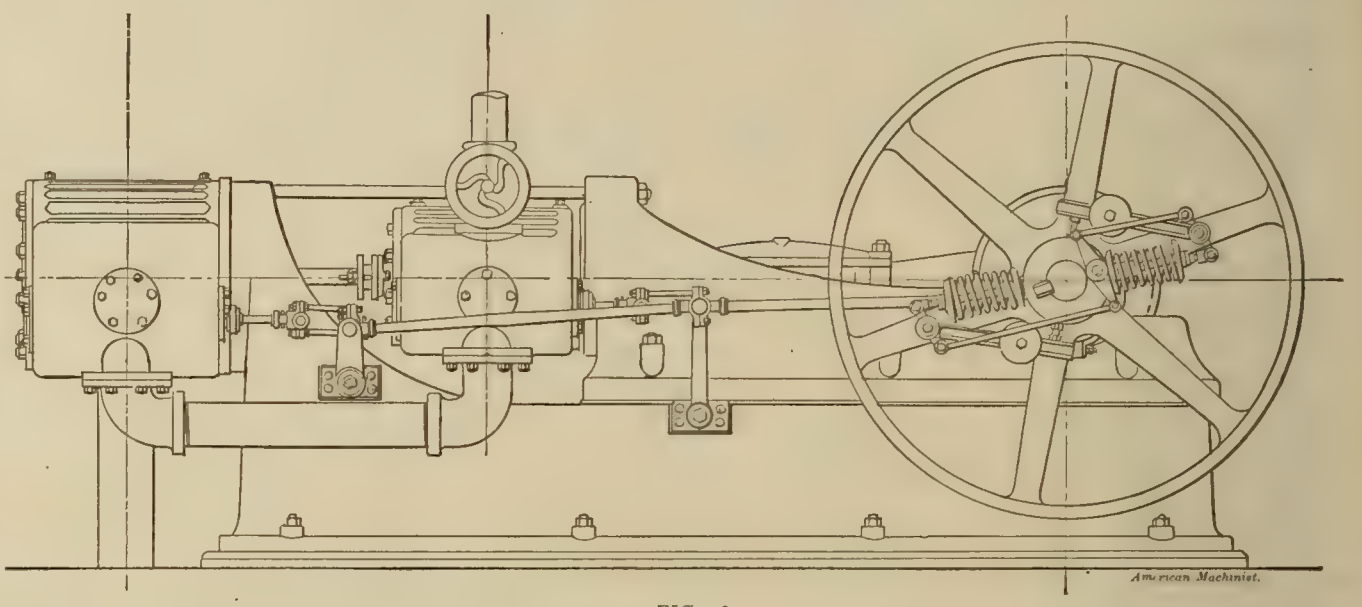


FIG. 3.

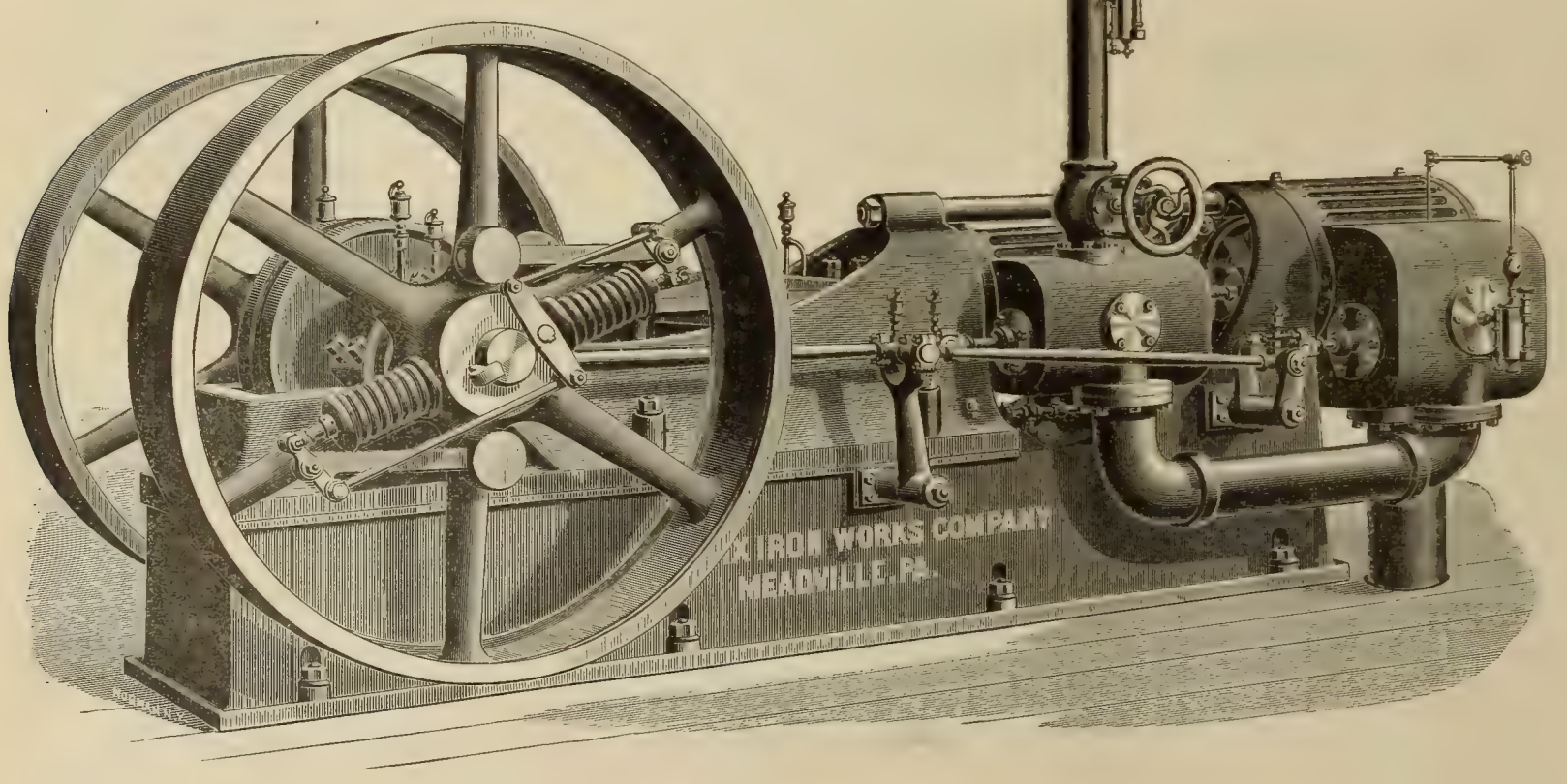


FIG. 1.

* Phœnix Iron Works Co., Meadville, Pa.

OF INTEREST TO PURCHASERS OF ELECTRICAL PLANTS.

We have received advance proofs of a very valuable and instructive pamphlet about to be issued by the well-known firm of electrical engineers, H. Ward Leonard & Co., Electrical Exchange Building, New York.

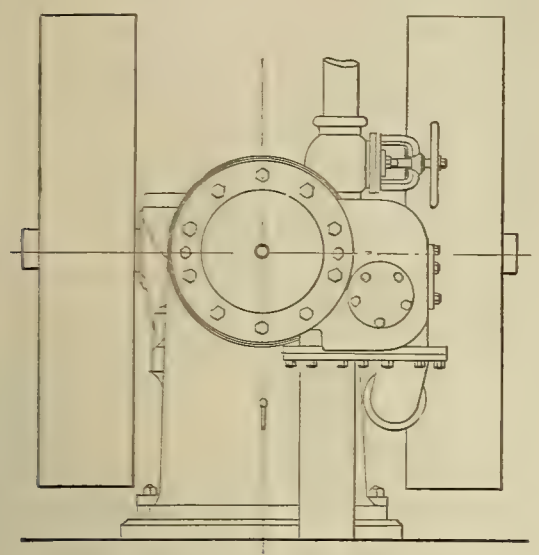


FIG. 4.—NEW COMPOUND ENGINE.

The title of the pamphlet is "The Value of the Services of a Consulting Electrical Engineer to Persons Investing in Electrical Plants." The pamphlet tells in a very clear manner the value of such services in many directions, and in reference to street-railway plants says:

"The construction of electric street-railways is such that the entire work is in plain view, and is of such a nature that a saving or an improvement is evident to the most inexperienced. It is probably this fact that has led to the retaining of electrical engineers for supervising such work more than in any other electrical work. Any purchaser sees with perfect certainty the saving that such service has resulted in for him, and also the errors which would have been made but for the supervising engineer.

"Instances of this nature are too numerous to require citations. Any street-railway company which has equipped its road electrically without such service will serve as an instance.

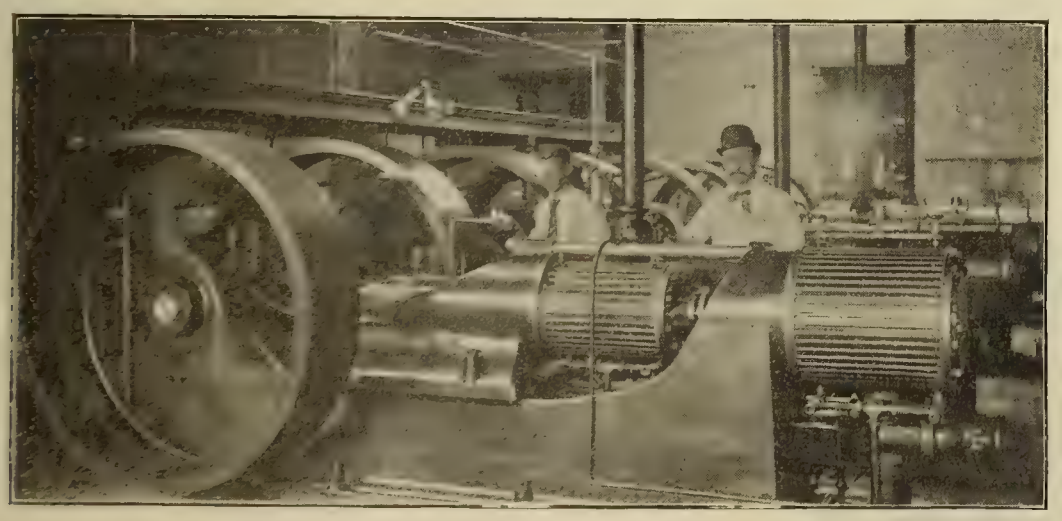


FIG. 5.—ENGINE-ROOM LINCOLN ELECTRIC RAILWAY.

"Perhaps the purchaser who lives in a foreign country or at a great distance from the headquarters of the principal electrical companies is the one who is most dependent upon competent advice and the representation of his interest by a consulting electrical engineer.

"The day has passed when a purchaser can afford to use any one system for his entire equipment for any comprehensive plant. How, then, is a distant purchaser going to judiciously determine the best methods of operation, the kind and amount of the various apparatus and materials he will require, and to whom is he going to look to see that everything necessary will be secured, that nothing unnecessary will be sent, that everything purchased will operate properly and without interfering with the best operation of other parts of the plant, that everything will be shipped simultaneously and economically, and that full instructions as to the installation and operation of the entire plant will be sent with it?

"The services of a competent and independent electrical engineer are in such cases essential for the best and most economical result.

"For such the firm acts for the purchaser to tell him, first, just what data is required in order that it can advise him as to what general plan he should pursue, what power he shall use, where he shall locate his plant, what type of apparatus he had better use, what size plant he should provide for, and how much to install in the beginning.

"Having secured such data it sends him a plan and estimate for the work contemplated, and also statistics based on practice as to the probable earnings and expenses of operation.

"If he then decides to go ahead the firm draws a specification and secures bids, which it submits with its advice. Having received instructions from him, it then proceeds to purchase the required apparatus and materials of all kinds under a clear specification and contract. It inspects the goods, sees that all goods are properly assembled, marked and shipped, and that complete information is sent to the purchaser, enabling him to install and operate the plant according to the best practice.

"Under such methods good and profitable plants are installed, and not only the purchaser but the manufacturing companies are benefited, and a great many hesitating purchasers, seeing the good results obtained, proceed with undertakings which might otherwise never be consummated."

DECORATIVE GLASS IN STREET CARS.*

How easy it is to distinguish the prosperous individual or corporation from the unsuccessful person or the non-dividend-paying company who fails to make both ends meet. The individual shows it in his dress and actions, and the corporation in the decorations of its offices and the general method of conducting its business. Step into an office containing partitions, doors, windows, etc., on the glass of which is traced handsome designs by the acid process, producing an embossed translucent glass that is soft and pleasing to the eye, or by the sand-blast method, which gives that white, obscured effect that appears solid and substantial, and one is impressed with the idea that he is dealing with a firm of means. The visitor finds everything about the office pointing to the same prosperity. If it is a street-railway company it is even seen in the cars, and a marked difference is seen between them and those of less-favored corporations.

Stand alongside a track used by a number of street-railway companies and compare the cars as they pass. Some are clean and bright and have a general appearance of attention, showing by the decorated glass in the car doors, windows and deck-lights, by the upholstered interior, and by the general neatness about the painted work that the company has money at its back and that it looks after the comfort of its patrons. Then come the cars which show by contrast the financial condition of the corporation to which they belong—dirty and scratched paint, common panes of glass in the doors and windows, bare seats, and horses that move as if their days were numbered.



FIG. 1.

It is human nature to select the best that can be had, and where two or more roads run between two given points, the best equipped is always the most patronized.



FIG 2.

The glass on some cars is pretty enough to tempt an artist to copy the designs. Who would think that a design like that shown in Fig. 1 could be transferred to the glass used in a car transom, or those shown in Figs. 2 and 3 to the glass used along the deck of the cars? Can a better-designed vine than that shown in Fig. 4 be placed on canvas?



FIG. 4.

It is not the design alone that produces such rich effects, but the manner of cutting it into the glass. The embossing or sand-blast processes, producing a translucent or an obscured design on a clear background, or *vice versâ*, give effects that cannot be produced on any other material.

It pays railroad companies to give patrons the best they can, and as far as decorated glass is concerned they have an unlimited variety of designs to select from.



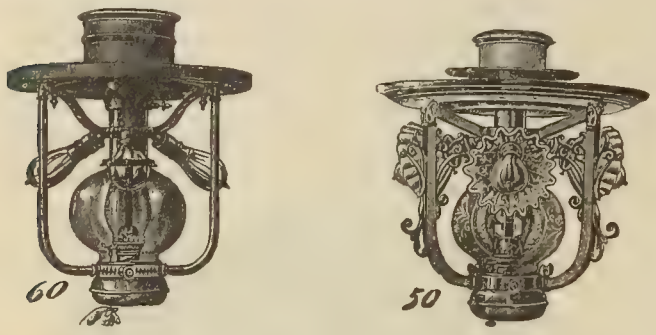
FIG. 3.

* Matthews Decorative Glass Co., New York.

The Ottumwa Railway Electric and Steam Company, Ottumwa, Ia., has just added two 25-light Thomson-Houston arc dynamos and one 135 H. P. generator to its plant. It contemplates increasing the capacity of its incandescent plant in the near future.

COMBINATION STREET-CAR LAMP.*

Electric street-railway companies in lighting their cars by electricity met with an unforeseen difficulty in the changing of the direction of the car at the termini of the lines. In reversing the position of the trolley-pole the lamp circuit is broken as well as the motor circuit, and consequently for the time being the car is in complete darkness unless it is lighted with some other illuminant besides electricity. It is



COMBINATION STREET-CAR LAMPS.

very unpleasant for the passengers to be in darkness from 5 to 15 minutes while the trolley is being changed ; besides, there is always more or less danger from pickpockets on such occasions. Cars lighted by electricity are very brilliantly illuminated, and as the amount of current required is very small and always at hand it is a very cheap method, and other illuminants are only required to tide over the period of no current at the termini of the road.

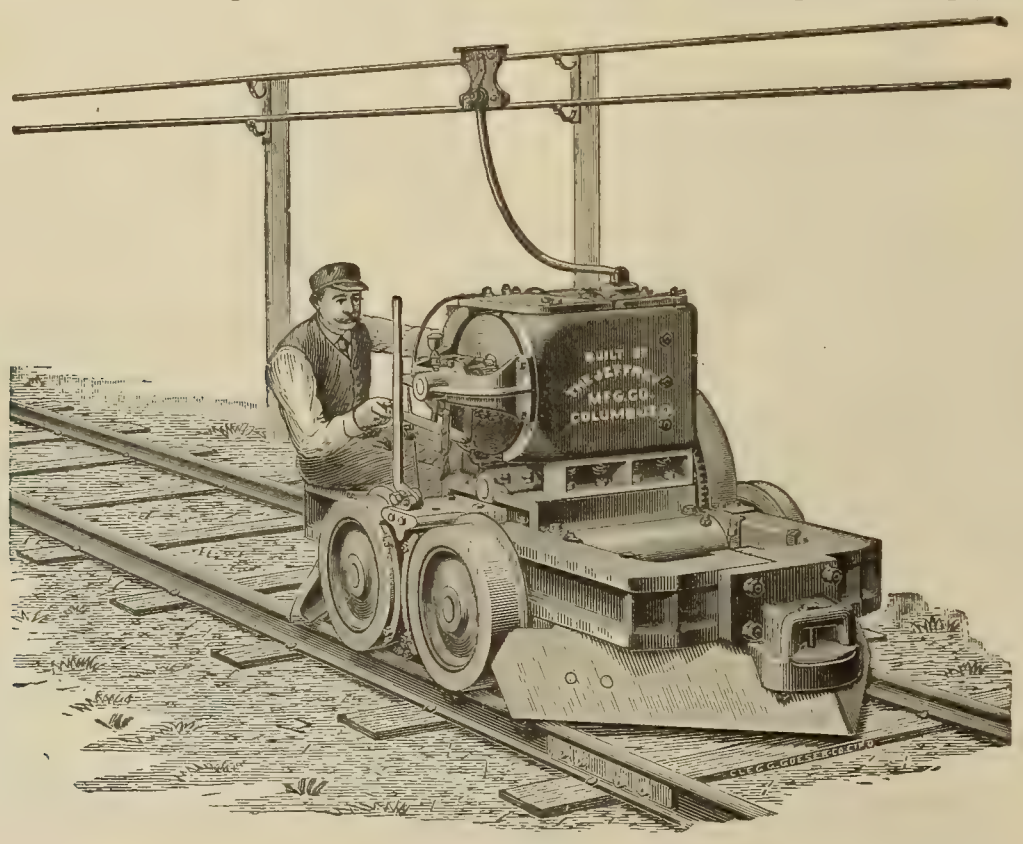
One of the best devices for this purpose is the combination electric and oil fixture shown in our illustrations, the working of which is so evident as to need no description. Fig. 1 shows a plain fixture consisting of three incandescent electric lamps and an oil lamp. Fig. 2 shows a fixture of the same kind, but artistically decorated.

Large numbers of these combination lamps are supplied to electric street-railway companies, as well as electric car head-lights and electric-light fixtures for cars of all kinds.

The West End Company of Boston has ordered 250 head-lights, and a large order has been received from J. M. Jones' Sons, West Troy, N. Y. The Lewis & Fowler exhibition car at Pittsburg is being fitted with combination lamp fixtures of the above make.

MOTOR CAR.†

The frame of this car is made of cast-iron, giving strength and weight combined. It is furnished with an electric motor of 220 voltage. Power is transmitted from the armature to the axles by means of and through a series of steel gears.



ELECTRIC MOTOR CAR.

The car is fully equipped with toggle-joint brakes, sand-boxes and electric head-lights. The usual rate of speed on level track is eight miles per hour.

The car is about 9 feet long by 46 inches high. It is furnished with a 20 horse-power motor and weighs, complete, 10,000 pounds on the rail. The electric current is transmitted to the motor by means of an overhead trolley running on a double trolley line of the company's own invention, no rail or ground return being used, as it is not required.

*J. D. Smith, 350 and 352 Pearl street, New York.
†Jeffrey Manufacturing Co., Columbus, Ohio.

FINANCIAL DEPARTMENT.

I am frequently asked to advise in reference to the propitiousness of the times for seeking subscriptions from the public for the various electric securities. During the holidays, of course, there could be but one reply: "Make your preparations for the fall." Meantime get your plant in the very best possible condition. The fall is here and the proof of our assertions is borne out by the fact that such high financial authorities as Messrs. August Belmont, Charles Francis Adams, Brayton Ives and Henry B. Hyde, after mature deliberation, are now offering, with a certainty of success, $3,000,000 in preference shares of theWestinghouse Company. Among others which are on the market are the entire electric and gas plant, of Fremont, O., earning 10% net; $200,000 preference 6% Detroit Electric Light & Power Co., which lights the whole city; $60,000 Marysville, O., gold 6% light and water, a first-mortgage 30-year bond; $30,000 Morristown, N. J., Electric Light Co. 5%, and $25,000 shares of the Russell Electric Lamp Co., of Mass., whose single-carbon lamp burns 24 hours without trimming. Farmingdale and Florence, S. C., two young National corporations just completed, are also offering their first bonds. Street-railway securities are offering from all directions. This winter will not only test the electric roads, but educate the public all over the country. To us who know what the result must be, it is beyond all doubt that immense investments will be made within the fiscal year. The Electrical Age and Street Railway News are to-day the standard authorities in these securities, and through their columns judgments can be formed by which mistakes in placing your investments are quite unpardonable. Their readers have information continually laid before them which, if acted on promptly, surely leads to fortune.

THE PITTSBURG CONVENTION.

The following-named concerns are among those who have already secured space at the Monongahela House, Pittsburg, Pa., for exhibits during the convention of the American Street Railway Association, on the 21st inst:

Edison General Electric Co., New York.
Calorific Ventilating Co., Chicago, Ill.
Electric Merchandise Co., Chicago.
Electrical Age and Street Railway News, New York.
Street Railway Gazette, Chicago.
Lewis & Fowler, Brooklyn.
Street Railway Publishing Co., New York.
Street Railway Review, Chicago.
The Short Electric Railway Co., Cleveland, Ohio.
J. G. Brill Co., Philadelphia, Pa.
Westinghouse Electric and Manufacturing Co., Pittsburg, Pa.
New York Car Wheel Works, Buffalo, N. Y.
Post & Co., Cincinnati.
Johnson Co., Johnstown, Pa.
Okonite Co., New York.
Peckham Motor, Truck & Wheel Co., Kingston, N. Y.
Vacuum Oil Co., Rochester, N. Y.
New Process Raw Hide Co., Syracuse, N. Y.
Eastern Electrical Supply and Construction Co., Boston.
U. S. Steam and St. Ry. Adv. Co., New York.
The Gould & Watson Co., Boston.
Thomson-Houston Electric Co., Boston.
Jewell Belting Co., Hartford, Conn.
Electrical Supply Co., Chicago, Ill.

HIS EXCELLENCY'S PRIVATE CAR.

One of the prettiest sights ever witnessed in Ottawa, Canada, was the passage of the private car No. 23 of the Ottawa Electric Railway, conveying His Excellency, Lord Stanley, from Government House to the Exhibition grounds.

The car, which was operated on the Westinghouse system, was a magnificent specimen of the latest vestibule type. It was most sumptuously furnished with fur rugs and decorated with rosebuds and smilax, while flags floated gayly from the trolley-arm. It was driven by Motorman Young and was in charge of Conductor Hanly.

Mr. Soper accompanied His Excellency and Lord Kilcourcie on the outward trip, which was made in exactly twenty-one minutes. On the return trip Mr. J. W. McRae accompanied the vice-regal party.

The taste displayed in all the arrangements of the trip reflected credit upon the electric company.

CURVES.

The citizens of Minneapolis and St. Paul, Minn., take great pride in their superb electric-railway system, and no sane person can deny that they have just cause to feel so.

The operation of the electric lines as compared with the cable roads is carefully noted, and the odds are in favor of the former.

Touching the smoothness with which the electric cars pass curves, the Minneapolis *Tribune* of the 3d instant makes the following interesting observations:

"It has been remarked often of late by people who have occasion to use both the electric lines in Minneapolis and the cable lines in St. Paul that the former are much more comfortable means of locomotion. Especially is this so in rounding a curve. They claim that the cables pull around a curve with an uncomfortable and continued jerk, which is highly annoying to the vertebra. Several opinions are given as to why the electric cars run around so smoothly, and the generally accepted one appears to be because the train is the more compact. This may be true, but one who is better informed, and has made a study of the matter, states that the real reasons are mechanical, and in order to mention all in the list according to their responsibilities, the track-laying comes first. Whenever the track of a curve is laid on the 'easement' plan the points of entrance and exit are flattened, while the centre of the curve is sharper than its true radius would call for, producing the same mechanical effect as though each and every part formed one and the same quarter circle, while the physical effect is very smooth. Again, the gauge of the track should be wider than usual, permitting the slipping motion of the wheels. The coupling of trains, and more especially the bunters, are the most crude and unmechanical things imaginable; in the place of these monstrosities the bunters should be steel half-spheres, back to back, which would necessarily produce the same effect as that of the 'ball-and-socket' joint. With these appliances the train, however long, would pass through the curve without a jar, even though the grip-lever be handled by the newest substitute. But aside from mechanical causes, the pleasure of rounding a curve on a short car with trucks not more than six feet apart could only be improved by using a single two-wheeled truck like the deacon's shay."

INCREASED SEATING CAPACITY.

Upon invitation of Mr. Pullman, quite a number of gentlemen, including Mr. Pullman and Messrs. Charles L. and A. B. Pullman, Marshall Field, George H. Wheeler and others, with several members of the press, including a representative of STREET RAILWAY NEWS, met at the Van Buren Street Station of the Illinois Central Railway about two o'clock on Thursday last, and went out to Pullman on the 2 P.M. regular train for the purpose of inspecting and witnessing the operation of a street car of novel design.

Two brand-new Pullmans were attached to the regular train, and upon arriving at Pullman, an inspection of the car was made.

The car is thirty-two feet (32′) long over the body proper, and its full length is thirty-three feet and seven inches (33′ 7″). The width of the car is seven feet and four inches (7′ 4″) over the body. Its height is fourteen feet nine and one-half inches (14′ 9½″).

Forty passengers can be seated in the lower portion of the car, and the upper deck seats forty. If crowded the car can carry one hundred and fifty (150) passengers. The upper seats are so constructed as to be sixteen inches below the central top of the upper deck. The lower part of the car is supplied with spring seats handsomely upholstered.

The car is equipped with electric chandeliers, ten incandescent lamps being placed under the canopy, and fifteen such lamps in the lower portion of the car. There is also one double oil-lamp in each compartment. Electric heaters are also set in the car.

The car is operated by two of the Westinghouse single-reduction motors, each of twenty-five (25) horse-power. The two trucks are of special design, arranged with double-brake attachments, also with a friction-brake on each truck. This places the car under the easy control of the motor-man. The trucks have the Allen Steel Tired car-wheels. The construction of the car places its load directly over the trucks.

The stairways on either side leading to the upper deck are four in number of special and unique design. They are combined into two at the bottom, but separate toward the top leading to either end of the car.

The car-body is arranged for passengers to enter at the centre on either side, where spiral stairways lead directly to the upper deck from within. The entrances at the centre occupy no more space than the end platforms on ordinary street cars, the length of the central platform being only eight feet. The car-body proper (lower part) consists of two compartments each twelve feet long with circular ends. The seats are carried around the end as well as the sides, thereby increasing materially the seating capacity. There is a pilot-house in each end of the upper part of the car for the use of the motor-man and for the brake arrangements. The upper deck is entirely covered with a canopy, which is attached to the pilot-houses and supported from the car-body by stanchion pipes, to which it is attached by means of ornamental bronze brackets. The centre platform joining the two ends of the car-body is very strongly built, ample provision being made for the maximum load the car will have to carry. The car is finished in mahogany, handsomely decorated, and painted a very beautiful carmine. The canopy and pilot-houses are so made as to be easily detached from the car-body. There are electric bells for stopping the car. Mirrors and decorated glass are used in the lower part, and the pilot-houses are largely of glass. No convenience known to the art of street-car construction has been omitted, and much special work is embodied in the car.

This car is capable of carrying more than twice as many passengers as the ordinary street car of the same length, hence a road may be operated with half the usual number of cars and half the ordinary number of employés.

While the cost of this car will exceed by about thirty per cent. that of a car of the same length without the upper seats, this is more than offset by the largely increased seating capacity, which makes the comparative cost per seat very much less.

The lower portion of the car with its novel features, its side entrance and circular end (which latter considerably increases the seating capacity), together with the elevated cab for a motor-man or grip-man, were designed by Mr. Chas. L. Pullman.

A majority of the members of the party appeared to be very much pleased with the car, which latter is undoubtedly one of the handsomest specimens of car architecture which we have seen for some time.

The party returned to Chicago in the two special Pullman cars in which a very delicious lunch had been spread for their entertainment.

STREET-CAR COMPANIES TO PAVE STREETS.

A case of great interest and importance to street-railroad companies was decided by the Pennsylvania Supreme Court a few days ago in Philadelphia. The question at issue was whether the city of Philadelphia had the right to compel street-railroad companies to pave the streets occupied by their tracks.

The history of the case is an interesting one. The use of cobble-stones as pavement was forbidden by ordinance in 1881, at which time many of the streets of the city were repaved according to the latest methods. The city contended that the street-car companies must pave the streets through which their tracks ran, and from 1881 to 1886 the efforts of the city to induce the companies to take that view of the case were in vain. To test the right claimed by the city, the company operating the Ridge Avenue line was notified to repair the pavement on a portion of one of the streets occupied by its tracks. The railroad company paid no attention whatever to this notice, not acknowledging the city's right to exercise such power. The result was the city paved the street in question and sued the railroad company for the recovery of the cost of the work.

The suit was vigorously fought, and after many long delays the case was finally argued and a verdict rendered in favor of the city.

As usual, the Supreme Court was appealed to, and it has had the matter under consideration all summer until a few days ago, when a decision was rendered as above.

The settlement of this suit means to Philadelphia the recovery of several hundred thousand dollars spent by it in repairing streets traversed by railroad tracks, and it gives the city the power to compel street-railroad companies to pave at their own expense the streets occupied by their rails.

While this case was of great local importance it will have considerable bearing on similar cases in other cities. It establishes a precedent on a point which is disputed in other places besides Philadelphia. In many cities the railroad companies are required to keep the space between their tracks and a certain distance beyond the outside rails paved and in good repair, while in others the question of pavements is not considered at all.

NEW YORK ITEM.

Mr. C. W. Price has just returned to the city after an extended trip through the Northwest. Mr. Price has met with big success in various cities in that section of the country in introducing electric-railway systems, and returns loaded with information and news of great value to the street-railway people. Mr. Price is preparing to locate in the East. Whoever secures his services first will be rewarded in handsome business returns.

PERSONALS.

Mr. Charles M. Swain, of the Riverside Road of Sioux City, was met in Chicago lately.

Our old friend, Harrison, late of the Edison Company, but now an active exponent of the many electric railway specialties of Mr. Charles [illegible], of New York, was met in Chicago a few days ago.

Mr. John N. Stewart, President of the Ohio Tramway Association, was in Springfield last week.

Mr. John Hoppes, of the Hoppes Manufacturing Company of Springfield, Ohio, was down through Kentucky last week.

Mr. L. H. Griffiths, President of the Seattle Consolidated Street Railway Company, was met in Chicago a few days since.

President Whitney, of Boston, was in Chicago a short time ago for the purpose of inspecting the new Pullman double-decked street car recently on exhibition there, and we understand that he has already placed an order for a number of these cars.

Mr. B. F. Stewart, of the Chicago office of the Westinghouse Electric and Manufacturing Company, was met in Pittsburg a few days ago.

THE WEEK'S RECORD OF STREET-RAILWAY NOTES.

CALIFORNIA.

SANTA ROSA.—The Central Street Railway Company expected to have its lines in operation by October 15.

The Santa Rosa City Railroad Company and the Central Street Railway Company are fighting for possession of Fourth street.

CONNECTICUT.

HARTFORD.—The Hartford and Wethersfield Horse Railroad Company contemplates using electric power on all of its lines in the near future.

ILLINOIS.

CHICAGO.—The Ogden Street Railway Company was incorporated October 1, with a capital stock of $2,000,000, to construct and operate street railways. Incorporators: Houston C. Adcock, Nathan G. Moore and Edward P. Towne.

INDIANA.

LOGANSPORT.—The electric street railway will be in operation in a few days.

VINCENNES.—A trial trip on the Citizens' Street Railway Company's line October 1. The Westinghouse electric motors are used by this company.

MAINE.

BIDDEFORD.—The Biddeford and Saco Railway Company is changing its motive power to electricity.

MASSACHUSETTS.

JAMAICA PLAINS.—A successful trial trip was made on the electric street railway October 1.

LOWELL.—The Lowell and Dracut Street Railway Company is constructing a one-story brick power-house 170 x 130 feet.

LYNN.—Alphonso Martin, Superintendent of the Belt Line Street Railway Company, has resigned his position to take charge of the Gloucester Street Railway Company's affairs. Prior to his departure for that city he tendered a supper to about 100 of his employés, at which he was presented with a handsome gold watch and chain as a token of their esteem and good-will.

NEW BEDFORD.—It is reported that the Union Street Railway Company has just paid a quarterly dividend of $2 per share.

SPENCER.—It is reported that the Worcester and Shrewsbury Street Railway Company will build a car-house here.

SPRINGFIELD.—A successful trial trip on the Maple street electric line October 1.

WHITMAN.—Street railway opened September 29.

MICHIGAN.

DETROIT.—On October 2 a mortgage for $3,000,000 was placed on record by the Citizens' Street Railway Company.

NEBRASKA.

OMAHA.—A successful trial trip was made September 29 over the electric street railway on South Thirteenth street.

NEW YORK.

HUNTINGTON.—The gross earnings of the Huntington Railroad Company from the time the road was opened, August 15, 1890, until October 1 last were $7,186.18. The company paid a dividend on the anniversary of its opening.

NEW YORK.—The National Convention of Street Car Drivers will be held in this city, October 28, to discuss among other things the effect of the rapid change of motive-power from horse to cable and electricity.

ROME.—It is reported that the Rome City Street Railway Company discontinued operations October 1, the road not paying expenses.

OHIO.

Cleveland.—The Woodland Avenue and West Side Street Railroad Company is to increase its capital stock from $1,100,000 to $2,000,000.

Toledo.—On the trial trip of the compressed-air car on the consolidated lines, September 29 the car stooped for want of air, before making the complete trip.

OREGON.

Portland.—It is reported that $200,000 worth of mortgage bonds of the Portland Cable Railway Company have been sold.

PENNSYLVANIA.

McKeesport.—Construction work has been begun on the extension of the electric street railway to River View Park.

Philadelphia.—It is reported that the Philadelphia Traction Company will issue 20,000 shares of new stock, making the capital stock $6,000,000. The increase is to be used for paying for extensions and improvements.

Pittsburg.—The Duquesne Traction Company has just received about a dozen new electric cars, manufactured by the J. G. Brill Company, of Philadelphia.

Pottsville.—Construction work on the electric street railway between Mahanoy, Shenandoah, Girardville and Ashland will be begun shortly.

UTAH.

Ogden.—The Ogden City Street Railway Company began operating its electric street railway system September 28.

Increase of Capital.

Marquette, Mich.—The Marquette Street Railway Company has increased its capital stock to $200,000.

Schenectady, N. Y.—The Schenectady Street Railway Company has increased its capital stock from $25,000 to $300,000.

Elections of Officers.

Bay City, Mich.—On September 26 the stockholders of the West Bay City Street Railway Company elected the following Board of Directors: S. O. Fisher, T. F. Shepard, H. H. Norrington, James Davidson, C. E. Jennison, J. F. Eddy and Joseph Turner. At a subsequent meeting of the Board S. O. Fisher was elected President, T. F. Shepard Vice-President and H. H. Norrington Treasurer.

Beaumont, Tex.—At a meeting of the Directors of the street-railway company, September 21, the following officers were elected for the ensuing year: F. P. Gague, President; N. Blanchett, Vice-President, and J. H. Rachford, Secretary and Treasurer.

Detroit, Mich.—At a meeting of the stockholders of the Citizens Street Railway Company, September 24, a Board of Directors was elected as follows: D. M. Ferry, M. S. Smith, W. C. Colburn, H. B. Ledyard, George H. Russell, Thomas M. Waller and W. W. Cook. At a subsequent meeting of the Board D. M. Ferry was elected President, W. C. Colburn Vice-President and George H. Russell Secretary and Treasurer.

Duluth, Minn.—F. S. Wardwell has been appointed General Manager of the Duluth Street Railway Company.

New Haven, Conn.—At a meeting of the stockholders of the Winchester Avenue Horse Railroad Company, October 3, the following Board of Directors was elected: Edward P. Shaw, A. C. Pond, I. A. Kelsey, S. A. Stevens and F. H. Kelley. At a subsequent meeting the Board elected I. A. Kelsey President, S. A. Stevens Secretary and F. H. Kelley Treasurer.

Sioux City, Ia.—At a meeting of the stockholders of the South Sioux City Railway Company, September 29, the following Board of Directors was elected: F. Hunt, P. L. Griffey, J. M. Moan, C. F. Smiley and E. C. Palmer. At a subsequent meeting of the Board F. Hunt was elected President, P. L. Griffey Vice-President, J. M. Moan Secretary and C. F. Smiley Treasurer.

Change of Power.

Helena, Mont.—Steps are being taken to change the motive force of the Helena Steam Motor Line to electricity.

Malden, Mass.—The East Middlesex Street Railway Company has filed a petition with the Board of Aldermen of Woburn asking for permission to use the trolley system on Main street in that place.

Track Extensions.

Berkeley, Cal.—The Berkeley Rapid Transit Company contemplates an extension of track.

Chicago, Ill.—The West Chicago Street Railway Company has beegranted permission to extend its tracks along West North avenue.

Columbus, O.—The Consolidated Street Railway Company has been granted the right to extend its track on Chestnut street from High to Fourth streets, and thence to Chittenden avenue.

Lawrence, Mass.—The Merrimac Valley Street Railway Company contemplates laying double tracks on Broadway and South Broadway in the near future.

Marquette, Mich.—The Marquette Street Railway Company will make large extensions to its track in the near future.

Newton, Mass.—Strenuous efforts are being made to induce the West End Street Railway Company to extend its tracks to this place.

Peru, Ill.—The extension of the street-railway lines to the suburbs is being agitated.

Reading, Pa.—The extension of the City Passenger Railway Company's tracks to Tartown is being agitated.

San Francisco, Cal.—It is reported that the Castro street cable line will be extended to the San José road.

Wilmington, Del.—The Wilmington City Railway Company will extend its electric lines to South Wilmington and the city limits in the near future.

Possible Purchases.

McKeesport, Pa.—Contracts will be made for an electric street railway between this place and Christy Park, to be constructed in the near future. Address W. H. Challoner or W. H. Smith, McKeesport, Pa., for further particulars.

St. Paul, Minn.—The Northwestern Guarantee and Loan Company, owner of the bonds of the Helena (Mont.) steam motor line, may desire electrical equipment in the near future. (See Change of Power.)

New Roads.

Bluffton, Ind.—It is reported that a street-railway system is to be constructed here.

McKeesport, Pa.—An electric street railway is to be constructed from this place to Christy Park.

Legal.

Baltimore, Md.—The Baltimore, Hampden and Lake Roland Railroad Company, has enjoined the North Baltimore Passenger Railway Company, the Baltimore Traction Company and City Commissioner Smyrk from laying tracks on First and Oak streets and North and Maryland avenues, claiming that it alone has the right, by city ordinance, to lay tracks on those streets.

Battle Creek, Mich.—The Battle Creek Electric Railway Company has been enjoined from laying its tracks on Maple, Jefferson and Merritt streets.

Danbury, Conn.—In a suit brought against the Danbury and Bethel Horse Railroad Company by the relatives of a Miss Kane, who received fatal injuries by the car in which she was riding, being struck by a New York & New England train last December, thirty-six hundred dollars damages have been awarded to the plaintiffs, who also have suit for $4,000 pending against the New York & New England Railroad Company for the same cause.

Dubuque, Ia.—The Electric Railway, Light and Power Company, is being sued for $5,000 damages by the father of a little girl who was run over and killed by a street car on the company's line.

Lansing, Mich.—The Lansing City Railway Company is being sued for $5,000 damages by a lady who was severely injured by one of the company's cars jumping the track.

Lowell, Mass.—On October 7 a verdict of $2,400 damages was returned against the Lowell and Suburban Street Railway Company in the Superior Court, in a suit by Mrs. Anna Johnson for damages for personal injuries sustained in a collision of one of the company's cars with the carriage in which she was riding.

Milwaukee, Wis.—The Milwaukee & Wauwatosa Rapid Transit Company has been served with an injunction restraining it from extending its electric railway tracks over those of the Chicago, Milwaukee and St. Paul Company's at Walnut street.

New York, N.Y.—Three judgments, aggregating $611,563, were filed October 6 against the New York Cable Railway Company. They went by default.

Philadelphia, Pa.—The Supreme Court upholds the right of the city to compel street railway-companies to pave the streets occupied by their tracks.

Pittsburg, Pa.—In the injunction suit brought by the Pittsburg, Oakland and East Liberty Passenger Railway Company and the Pittsburg Traction Company et al. *vs.* The Howe Street Passenger Railway Company and the Duquesne Traction Company, enjoining them from constructing a street railway on Denniston avenue, claiming the right of way on that street, a verdict in favor of the defendant companies has been granted.

Saginaw, Mich.—The Saginaw Union Street Railway Company is being sued for $10,000 damages by a lady who was severely injured when alighting from a car by being thrown to the ground by the car's sudden starting.

Salem, Mass.—P. J. McCusker, a lawyer, has attached the funds of the Naumkeag Street Railway Company deposited in the Asiatic and the Exchange National Bank for legal services.

Toledo, Ohio.—The Consolidated Street Railway Company is being sued for $5,000 damages by J. N. Sarra, for injuries received by being forcibly ejected from one of the company's cars.

Worcester, Mass.—The Worcester, Leicester and Spencer Street Railway Company is being sued by L. Harrington and wife for $10,000 for injuries caused by an accident on the road last December.

Franchises.

Cumberland, Mass.—The Town Council has granted the Inter-State Street Railway Company the right to lay double tracks on a number of streets here.

Kansas City, Mo.—The West Side Electric Street Railway Company has asked for a franchise for a street railway here.

San Francisco, Cal.—The Metropolitan Railway Company has been granted a franchise to extend its tracks.

San José, Cal.—A 50-year franchise has been granted Felix Chappelett and others to construct and operate an electrical street railway from this place to the Alameda county line.

A franchise has been granted to Jacob Rich and associates to construct an electric street railway from San José to the Tully road.

Santa Cruz, Cal. –C. B. Byrne and associates have been granted a franchise to construct and operate a street railway here.

Casualties.

Bethlehem, Pa.—On October 6 an electric car ran into a wagon loaded with stones, upsetting the wagon and disabling the car.

Brooklyn, N. Y.—On October 7 three horses were killed by becoming entangled in a fallen trolley wire.

Chicago, Ill.—On September 28 two cable trains collided at Thirty-ninth and State streets, severely injuring 8 or 9 of the passengers.

Cincinnati, Ohio.—On October 2 a boy who was amusing himself by jumping on and off an East End motor car fell under the wheels of the trailer and was killed.

Harrisburg, Pa.—On October 3 two motor cars collided owing to a dense fog, severely injuring both motorneers.

Lawrence, Mass.—On September 23 a motor car ran into and overturned a buggy, severely injuring the occupants. On September 24 a boy riding on the steps of an open car fell under the car, the wheels passing over one of his limbs. On September 25 a lady was thrown down while alighting from an electric car by the motorneer failing to give her time to properly alight.

New York, N. Y.—On September 25 a man had both ankles fractured by falling under a Madison avenue car. On the same date another man had his right leg crushed by falling under a Third avenue car.

Peoria, Ill.—On October 2 an electric car of the Central Railway Company jumped the track and ran with great force against the curbing. The car was crowded with passengers, nearly all of whom were injured.

Pittsburg, Pa.—On September 25 a motor car ran into and crushed a carriage, and severely injured its occupants.

On September 28 a street car on the Birmingham Traction Line was struck and badly damaged by a car which had broken loose from a switching engine on the Pittsburg, Virginia and Charleston Railroad.

Sacramento, Cal.—On September 24, on account of the brakes of an electric car failing to work, the car ran against a bumper at the end of the line, injuring several of the passengers severely.

Salt Lake City, Utah.—On September 29 a passenger on the Rapid Transit Railroad struck his head against a pole carrying the trolley wires, receiving serious injuries. The accident was caused by the conductor's failure to place the movable wire screen in its proper position.

On September 27 a collision between a car of the Salt Lake Rapid Transit Company and a car of the Salt Lake City Railway Company gave the passengers a severe shaking up and tore an entire side from one of the cars.

Spokane, Wash.—On September 27 a heavily loaded car ran away, owing to the trolley-wheel becoming detached from the wire and the failure of the brake to hold. As the car was going down a heavy grade at the time it attained a very high speed, and a large number of frightened passengers jumped to the ground, receiving more or less serious injuries. Those who retained their seats escaped unhurt.

New Incorporations.

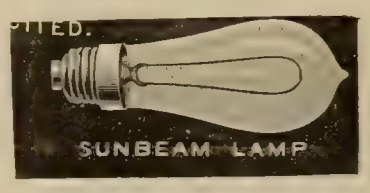
Bucyrus, Ohio.—The Suburban Electric Railway Company was incorporated September 26, with a capital stock of $200,000, to construct and operate an electric street railway. Incorporators: W. C. Lemert, G. Donnenwrith, C. W. Fisher, O. L. Hays, John Blyth, N. A. Sager, J. W. Gwynn and J. B. Gormly.

Buffalo, N. Y.—The Buffalo, Kenmore & Tonawanda Electric Railway Company was incorporated September 26, with a capital stock of $150 000, to construct and operate a street railway between this place and Tonawanda Incorporators: Louis E. W. Arend, Frederick G. Sikes, George H. Frost, all of Buffalo, N. Y.

Jacksonville, Fla.—The Jacksonville and Panama Rapid Transit Company has been incorporated to construct and operate a street railway from Jacksonville to Panama Park, a distance of five miles. Incorporators: T. T. Stockton, J. S. Bell, H. W. Clark, C. D. Mills, M. L. Broward, G. W. Arnold and J. M. Elkins.

BUSINESS NOTES.

W. H. Gordon & Co., 115 Broadway, this city, in their special railway department, call particular attention to their Simplex feeder wires and Sunbeam lamps, and also their full stock of electric-railway line supplies. They particularly request all street-railway companies who contemplate the introduction of electric power, and all electric railways that contemplate extensions or enlargement of their plants, to write them and furnish a list of materials needed on which they are willing that this firm should make





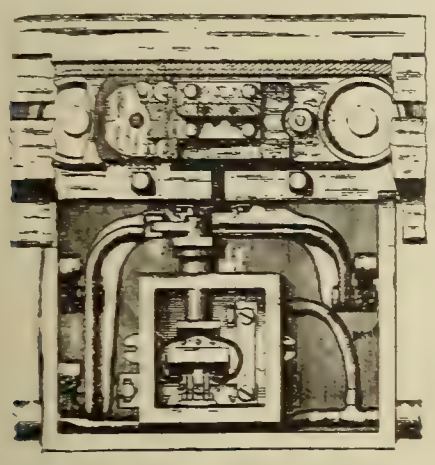
them a bid. They are always pleased to consider requests of this kind, and their aim is to handle a line of goods of the very best quality for railway construction. It would be well to correspond with this firm before placing orders. Their Sunbeam incandescent lamp for railway circuits is very strong and efficient and can be used without steadying-hooks. It has long life, while consuming much less current, it is said, than other lamps, and it shows a remarkable freedom from blackening. They have many other valuable specialties of great usefulness in the operation of electric railways. Among these may be mentioned their Ellis waste-oil filter, which our readers should have full particulars of.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued October 6, 1891.

460,571. Turn-Out or Switch for Trolley-Wires. Daniel W. Edwards, Saginaw, Mich., assignor to the Murray Overhead Trolley Switch Company, same place. Filed Oct. 2, 1890.

A turn-out or switch forming the intersection of a branch wire with the main wire, the main wire leading to each end of the switch or turn-out at an acute angle to the main track of the car, and the branch wire leading from the overhead switch or turn-out parallel with the switch-track of the car.



460,780.—UNDERGROUND RAILWAY CONDUIT.

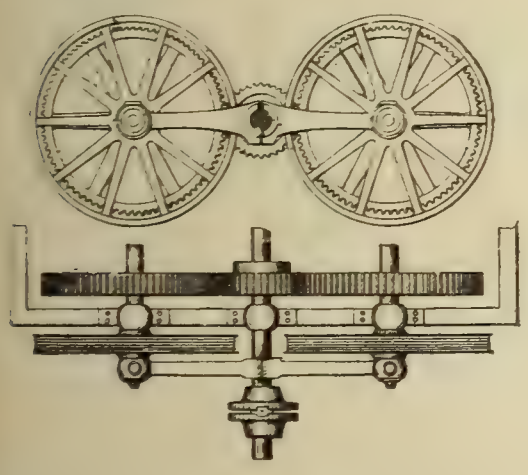
460,604. Axle-Box for Cars. Timothy B. Stewart, Hartford, Conn. Filed June 29, 1889.

An axle-box having a central chamber, a dust-box and oil-chambers, with removable partitions.

460,615. Rail Connection for Electric Railways. Merle J. Wightman, Scranton, Pa. Filed May 15, 1891.

A rail-return divided into sections insulated from one another and provided with intermediate electric switches normally connecting the sections with one another, but each adapted to be turned at will to break the connection between adjacent sections of the rail-return.

460,634. Trolley-Wire Support. Thomas Fricker, Ashtabula, Ohio, assignor of one-half to L. W. Smith and J. L. Smith, same place, and Sarah A. Reed, Erie, Pa. Filed Dec. 15, 1890.



460,794.—DRIVING MECHANISM FOR CABLE RAILWAYS.

In a clamp for trolley and other supported wires, the combination of jaws, with half-round screw-threaded shanks, fitting together to form a bifurcated shank, a screw-cap screwing upon the shank, and attaching means connected with the screw-cap.

460,735. Trolley-Wire Support. Nelson Weeks, Jr., Long Island City, N. Y. Filed April 1, 1891.

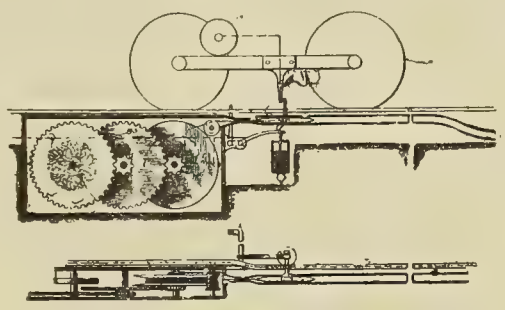
A clip for clamping the conductor to leave an interrupted contact-surface, and a suspended device having bearings for the clip, adapted to permit a free bodily movement of the conductor and its clip.

460,742. Railway-Rail. Benjamin F. Curtis, Atlanta, Ga. Filed Sept. 23, 1890.

The combination of a section having an outwardly curved or bowed web and provided at its top with a tread and provided at its bottom with a flange and a bevel edge, and another section having an oppositely curved or bowed web secured to the section by bolts, and provided at its bottom with a flange and a bevelled edge, engaging the bevel of the opposite section and having its top engaging the lower bevel of the tread and conforming thereto, and provided with a laterally-extending guard-flange, whereby the flange of a wheel is prevented coming in contact with paving-stones and the like.

460,780. Underground Railway-Conduit. Emil E. Keller, Chicago, Ill. Filed April 13, 1891.

The combination of an insulated conductor with a series of circuit-closing devices connected therewith at intervals therealong, a series of movable conductors in the conduit, composed each of a heavy rail or the like substantially parallel with the conduit and suspended so as to move across such conduit, and connections between the movable conductors and the circuit-closers, the heavy rails so constructed and disposed as normally to be in a position out of engagement with the insulated conductor and adapted when moved against its gravity across the conduit to bring its connection and the circuit-closers together, so that each of the rails is successively pushed aside and placed in circuit by the trolley and is then permitted by gravity to be restored to its normal position out of circuit.



460,887.—ELECTRIC RAILROAD.

460,781. Electric-Railway Trolley. Emil E. Keller, Chicago, Ill. Filed April 21, 1891.

A conductor-body connected with the part to which the current is to be led, and a series of rollers in contact with the body and disposed so that two or more of them will engage the conductor, which delivers the current simultaneously.

460,792. Car-Coupling. James A. Molseed and James Finch, Vail, Iowa. Filed April 11, 1891.

The combination of a hollow coupling-head, two coupling-levers therein, a spring to hold them together, means to hold the coupling-levers in their normal position in the head, a pivotal block upon which the levers are mounted, and a cam to open the levers, carried by the shaft.

460,794. Driving Mechanism for Cable Railways. John Walker, Cleveland, Ohio. Filed Oct. 22, 1890.

A strut for adjusting the distance between the drum-shafts, having a loop or hole through which the driving-shaft may pass.

460,848. Rail-Joint. Robert J. Colvin, Lancaster, Pa. Filed March 4, 1891.

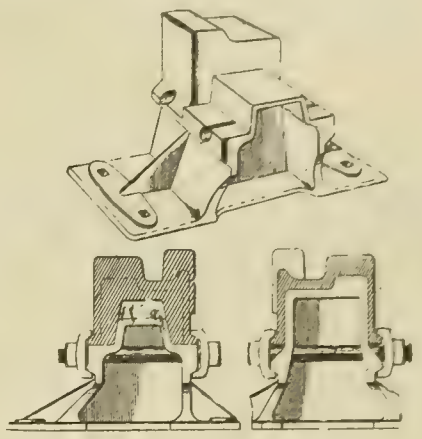
A rail-joint composed of two portions having horizontal portions, which fit one within the other, and vertical flanges, which engage the sides of the rail, and a horizontal projection extending inward from one of the vertical flanges for engaging the ends of the rails and preventing creeping thereof.

460,887. Electric Railroad. Ira Robbins, Sheffield, Ala. Filed Jan. 19, 1891.

The combination, with a continuous main conductor, of a series of resilient or returning shunt-wires, connected electrically to the main conductor and a drag connection for the wires arranged to be pulled along by the car and transmitting the electric current thereto from the main conductor.

460,912. Cable-Crossing. Joseph Dunott, Philadelphia, Pa., assignor of one-fourth to Frank J. Richards, same place. Filed May 8, 1891.

A conduit with a diverging branch, tracks in the conduit and branch, a carriage consisting of linked blocks guided on the tracks, cords connected with the carriage, and mechanism for operating the cords.



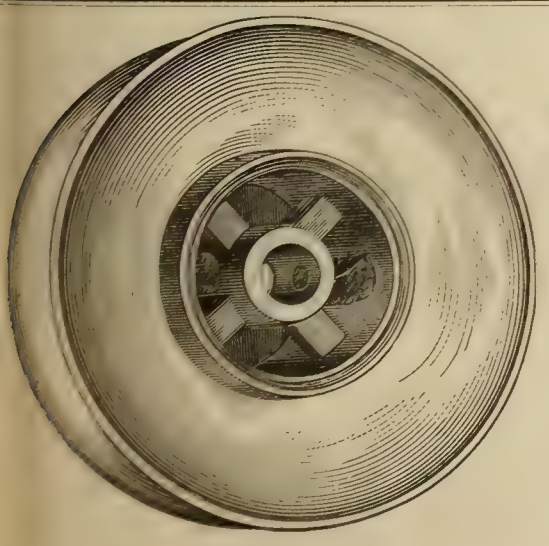
460,927.—GIRDER-RAIL TRACK.

460,927. Girder-Rail Track for Street-Railways. William C. Wood, Brooklyn, N. Y., assignor to The Lewis & Fowler Girder-Rail Company, same place. Filed Feb. 27, 1891.

The combination, in a street-railway track, of a track-casting constructed with an open-ended longitudinal recess in its bottom, including a relatively-shallow saddle portion and with lateral flanges bevelled on top on its respective sides, a chair therefor having a seat projection at top fitted to the saddle portion and lateral projections bevelled at bottom matching the bevelled flanges, a pair of clamps having internally-bevelled flanges matching the lateral flanges and projections, and a bolt or bolts passing through the chair and clamps below the bottom of the track-casting.



If you want to use electricity for any purpose whatever, write to us for full information and descriptive pamphlets. Office, Electrical Exchange Building, New York City.



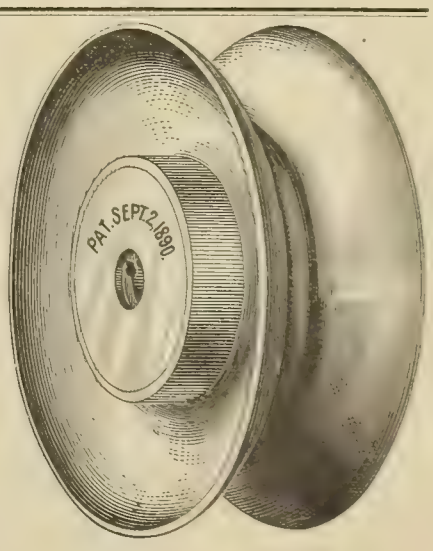
BADGER'S PATENT

SELF-OILING TROLLEY WHEEL,

For Electric Railway.

Smooth running; ways well oiled, prolongs the life of the wheel,
It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

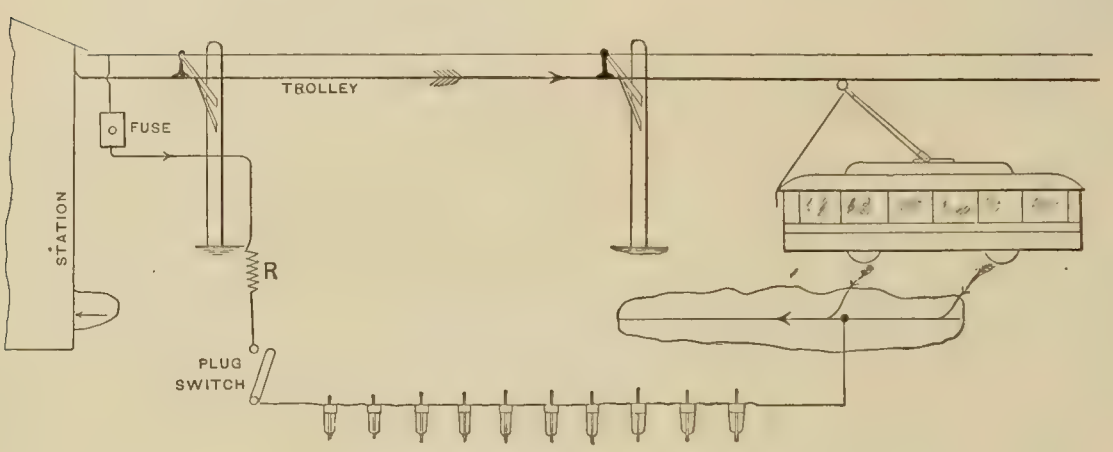
BADGER BROTHERS, West Quincy, Mass.

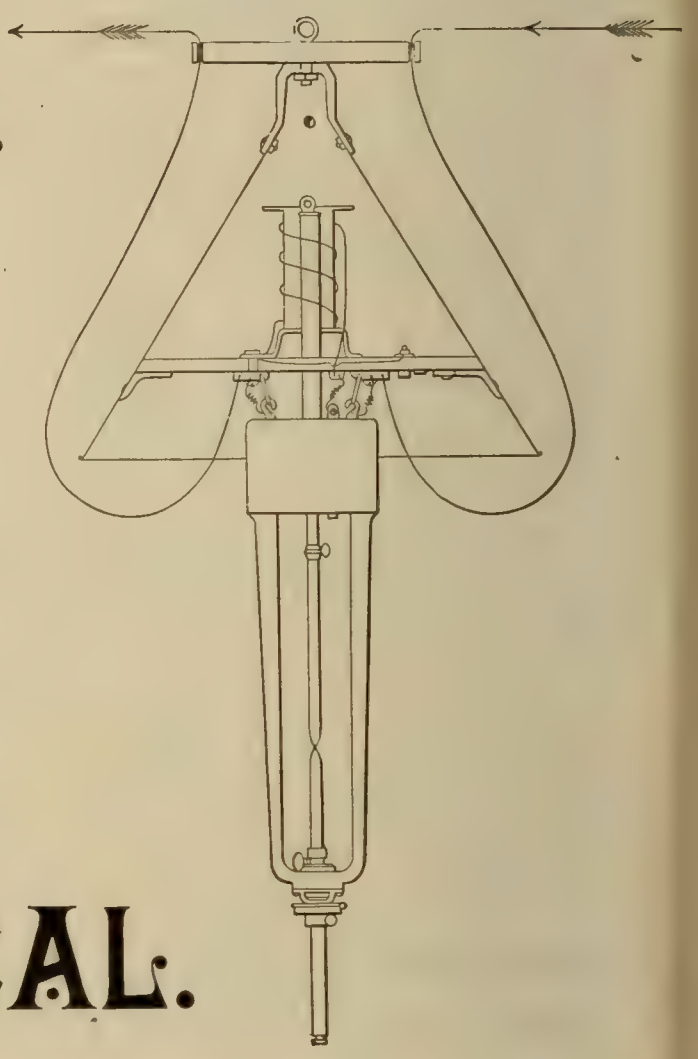


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J. B. TALTAVALL, *President.* T. R. TALTAVALL, *Sec. and Treas.*
W. T. HUNT, *Vice-President.* E. V. CAVELL, *General Manager.*

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THE APPROACHING CONVENTION.

THE "FLOATING EXHIBITION"—EXHIBITS SCATTERED EVERYWHERE—DISADVANTAGES OF THE PRESENT SYSTEM—THE REMEDY—THE MONTREAL EXHIBITS—MEMBERS' DELEGATES CROWDED OUT, ETC.—THE REASON—"BEST ROOM IN THE HOUSE"—WHOLESALE AND RETAIL—SUPPLY AND DEMAND THE SUPPLY MEN—CONCENTRATE THE EXHIBITS, ETC.

To those who have conversed with prospective exhibitors at the approaching street-railway convention, it is very clear that the supply houses in general do not take as kindly to the "floating-exposition" idea as it was hoped that they would.

* * *

A supply man attends a convention mainly for the purpose of seeing and being seen—of meeting old friends and acquaintances and making new ones—of ascertaining, as far as possible, when his constituency (the members' delegates) expects to be in the market. He goes to considerable expense in arranging for an exhibit, so that he can show up his goods alongside those of his competitors, and he has a perfect right to expect that he will be compensated for his trouble and expense by at least being provided with adequate accommodations for a proper display. Now the question suggests itself, "What constitutes a proper display?" An exhibit in a room in the hotel where the headquarters of the convention are? Then only a chosen few can ever hope to secure it. In the hotel corridor? The same answer still applies, for no hotel in the world has corridors sufficiently capacious for such a purpose. Street-railway men attending conventions have neither the time nor the inclination to go rambling around from room to room, from corridor to corridor, from floor to floor, then about the street (where large exhibits are frequently placed), and again to other points located at some distance from the hotel. They want to keep abreast of the times, to investigate for themselves all new practical inventions designed for the purpose of solving the problem of the economical operation of tramways and the comfort of the city-travelling public, and would gladly give their attention to all meritorious devices brought to their notice at such a time, but under the present system, that of individuals and companies having their goods scattered around in four or five places, it is simply impossible, as no one has yet attained the degree of omnipresence. The result is an unhappy one all around; supply men feel badly in that, owing to lack of adequate accommodations, they have to hide their light under a bushel, where it can only be seen by a minority instead of by a majority. Railway men go away feeling that their time has only permitted them to investigate but a very few out of a large number of most interesting exhibits.

* * *

The disadvantages of the present system (or lack of system) appeared to us to suggest the remedy—viz., the securing of a hall, year by year, by the Association, of sufficient capacity to permit of an almost unlimited display of street-railway appliances, and a portion of which could probably be used as the convention hall, or, at any rate, space sufficient to provide for all exhibits. Let the idea be, not to make money out of the deal, but to assess each exhibitor in proportion to the amount of space occupied, in order to meet expenses, etc. In fact, let all rules governing regular expositions obtain; and it is not difficult to predict the result.

* * *

Ever since the Washington Convention, when official action was first taken towards holding an exhibit of street-railway supplies, there has been manifested such a deep interest in that direction that it has now become one of the principal and certainly one of the most interesting, features of the annual meeting. Why, then, should exhibitors be handicapped for lack of space?

* * *

In an experience with conventions—one that extends over a good many years, embracing many varied interests—we do not hesitate to name that of the National Electric Light Association, recently held in Montreal, as one of the most, if not the most, complete and successful, at least so far as the exhibits were concerned, and why? Simply because exhibitors were well and properly cared for; because ample accommodations were provided for them; because a perfect organization was established and maintained from first to last; because such interest was shown in their work that exhibitors laid themselves out to make their mark—and they made it. And who will assert that a convention of gentlemen whose lives are spent in the public service—for all who work to serve the public must be in the public service—in providing accommodations for the transportation of the public is one jot less important than that of those who give it light? The two are analogous, their relations to the public are of equal importance, their wealth, the capital represented, of approximately equal magnitude. Why, then, should not the laurels of success rest equally upon the twain?

* * *

Again, of recent years, and especially since it has become customary to exhibit, the influx of the representatives of supply houses has in many cases which have come to our knowledge literally crowded out the gentlemen who attend the conventions as delegates of members, thus compelling them to accept inferior accommodations, and no little amount of murmuring has been heard from time to time on account of it. Assembling the exhibits, gathering them together under one roof, would mitigate this trouble to a great extent, as numbers of exhibitors would not care very much then about having the accommodations they now call for.

* * *

The insistance on the part of the supply men upon having the "best room in the house" (a procedure rendered necessary under the present go-as-you-please plan of holding exhibits) naturally enough arouses the cupidity of the average hotel-keeper, and the management of the convention-headquarters caravansary in Pittsburg has not been the least derelict in availing itself of the argentiferous opportunity of placing itself in a position to clip coupons for the remainder of its days after the whirl of the convention is over and the enterprising man hath departed with a ten per cent. octopus lien on his exhibit and personal effects in his pocket as a lasting souvenir of the princely hospitality of one of the Pittsburg hotels.

* * *

According to the general understanding of the fundamental principles of commercial law, one should pay less when buying by wholesale than when by retail; but the hotel management which we have in mind puts that argument on one side and confronts you with the undeniable assertion that prices are governed by the law of supply and demand. It says that while it way be true that the influx of guests is wholesale, yet the payments are simply retail; that what the hotel gains in increased business temporarily it loses in permanent business eventually, and that it must raise prices accordingly in order to save it from being called upon to face supplementary proceedings.

* * *

Specious as this argument may appear from a certain knowledge of the actual facts in the case, we do not hesitate to brand it as a fallacy, for there are not many hotels which are fortunate enough to have "permanent" guests who pay anything like from $25 to $75 per day for the simple use of one or two rooms or some few feet of space in a corridor.

* * *

The supply men are a very open-handed, liberal lot of fellows; men willing to pay well for what they want; long-suffering to a degree; men who act as superb advertisements in their peregrinations for hotels at which they are well treated, but they can condemn a hotel as well and as effectually as they can praise it, and woe-betide a hotel when once the ill-will of these gentlemen is incurred. Treat them well, treat them fairly and squarely, and hotel men are invariably the gainers; impose upon them, overcharge them, or anything of that sort, and the word goeth forth to steer clear of that hotel—aye, it passeth on from Dan to Beersheba.

* * *

To sum up, we are of opinion that the interests, the power and the influence of the A. S. R. A. would be considerably enhanced if the exhibit matter was absolutely in the hands either of the Association itself or of a committee duly appointed by the supply men themselves, instead of being the go-as-you-please affair which it is to-day; that the selection of the city wherein to hold the next convention should be left to the Executive Committee, which should be governed in such selection by the accommodations afforded in the way of halls for convention and exhibit purposes; by assurances on the part of the management of the hotel where it is proposed to establish headquarters that there will be no raising of rates, as well as by those other considerations which have helped to decide this important matter in bygone years.

OFFICERS.

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THOS. C. KEEFER, - - - - Ottawa, Can.

AMERICAN STREET RAILWAY ASSOCIATION.

THE PITTSBURGH CONVENTION.

COMMITTEES TO REPORT.

"Perfect Electric Motor, A," - - - A. Everett, Cleveland, Ohio.
"Year's Progress of Cable Motive-Power," J. C. Robinson, Late of Los Angeles.
"Public and State Treatment of Corporations," - G. Hilton Scribner, N. Y.
"The Dependent—Overhead or Underground—System of Electric Motive-Power," } Geo. W. Mansfield, Boston, Mass.
"The Independent—Storage or Primary Battery—System of Electric Motive-Power," } Knight Neftel, New York.

OFFICIAL ANNOUNCEMENTS.

TO MANUFACTURERS OF STREET RAILWAY SUPPLIES.

In all probability the Tenth Annual Meeting of the American Street Railway Association, which will be held in Pittsburgh, October 21, 22 and 23, will be attended by at least three hundred leading street-railway officials, and will prove one of the largest and most interesting gatherings of practical street-railway men ever assembled in the United States. The headquarters of the Association will be at the Monongahela House, and the business sessions will be held in the banquet hall in the hotel building.

In view of the fact that this Convention will certainly attract to Pittsburgh a large number of inventors and manufacturers of street-railway supplies, who will require a suitable place for the exhibition of their products close by the Monongahela House, the Committee of Arrangements deem it expedient, thus early, to learn as far as possible how much exhibition space will be required to provide for the needs of all who expect to come. All the available room in the hotel has already been secured by a number of the leading manufacturers, and those who neglect to arrange for space elsewhere in advance will meet with great difficulty in securing what they need just before the opening of the Convention.

The Committee of Arrangements has chartered for the week of October 18 to 25 a large double-deck excursion boat, which will be moored to the wharf, alongside the Monongahela House, and used for exhibition purposes. Heavy supplies can be shown on the lower deck, and lighter products on the upper one. The boat will be suitably decorated and lighted in the evening, and so far as possible will be made a pleasant and profitable place for exhibition. If still more space is needed, the Committee will in some way make due provision for the requirements of all who give timely notice of their coming.

It is the purpose of the Committee to charge for space a sum sufficient to cover the actual expenses of the exhibition, such as rental of boat, decorations, lights, attendance, etc.

In any event, whether you are coming to Pittsburgh or not, kindly assist us in this matter by filling out the enclosed information blank, and mailing it to us at once.

Very truly yours,

THE COMMITTEE OF ARRANGEMENTS,
John G. Holmes, *Chairman.*

Pittsburgh, Pa., August 8, 1891.

REDUCED RATES TO PITTSBURGH.

Office of
The American Street Railway Association.
Brooklyn, N. Y., September 12, 1891.

Gentlemen:

The rate of a fare and one-third has been allowed to delegates and all others, including members of their families, in attendance at the Tenth Annual Meeting of this Association, which will be held in the city of Pittsburgh, Pa., October 21–23, 1891, by the following Associations, namely: Boston Lines Passenger, Central Traffic, New York and New England Passenger, Southern Passenger and Trunk Line; also on the Chicago and Alton Railroad from all points in the State of Illinois. Michigan is excepted from the Central Traffic Association.

This covers nearly all the territory of the United States, with the exception of that controlled by the Western Passenger Association.

Sincerely yours,

WM. J. RICHARDSON, *Secretary.*

THE AMERICAN STREET RAILWAY ASSOCIATION.

The Tenth Regular (Annual) Meeting of THE AMERICAN STREET RAILWAY ASSOCIATION will be held at the Monongahela House, Pittsburgh, Pa., the third Wednesday in October (the 21st), 1891, commencing at 10 o'clock A.M.., and continuing three days.

The forthcoming meeting will, from present indications, be much more largely attended than any preceding. The following is a general

Programme of the Meeting.

First.—*Reports of Committees.* Special Committees will report on the following subjects: "A Perfect Electric Motor;" "A Year's Progress of Cable Motive-Power;" "Public and State Treatment of Corporations, No. 3;" "The Dependent—Overhead or Underground—System of Electric Motive-Power," and "The Independent—Storage or Primary Battery—System of Electric Motive-Power." Notice has been received by the Secretary from the President of one of the member-companies that a special paper will be read, under the following title: "Standards in Machinery and Appliances for Electric Railways."

Second.—*Exhibition of Street-Railway Supplies.* The Local Committee of Arrangements, of which John G. Holmes, Esq., President of the Citizens' Traction Company, is Chairman, has chartered for the week of October 18–25, a double-decked excursion boat, which will be moored to the wharf alongside the Monongahela House, to be used for the exposition. Heavy supplies will be placed on the lower deck, and lighter ones on the upper. The boat will be suitably decorated, and lighted in the evening, and will be made a pleasant and interesting place for the exhibition of supplies.

Third.—*Local Entertainment.* The Pittsburgh Street-Railway Companies have not yet fully completed the arrangements for the special entertainment of those in attendance. Preparations for two excursions are under way; and they will assuredly be of a very enjoyable character. A handsome souvenir of the meeting is being prepared.

Fourth.—*Reduced Rates of Fare.* The Boston Lines Committee, Central Traffic Association, New York and New England Passenger Lines Committee, Southern Passenger Association and Trunk Line Association have united in granting the courtesy of the special rate of a fare and one-third for the round trip to all, including friends and members of the families of gentlemen in attendance at the Convention. The territory to which the concession applies is all of the United States except the Western and Pacific Coast States and Michigan. All will, of course, avail themselves of the reduced rates where possible. For careful guidance, the rules governing reduced rates, *strict conformity with which is required,* are given, as follows:

First.—Each person must purchase (not more than *three* days prior to the date of the meeting) a first-class ticket (either unlimited or limited), to Pittsburgh, for which he will pay the regular tariff fare, and upon request, the ticket agent will issue a certificate of such purchase, properly filled up and signed by said ticket agent.

Second.—Where the journey is made over more than one line, it may be necessary for the passenger to purchase separate local tickets, and procure certificates thereof for each of the lines over which he travels in going to Pittsburgh, as some lines do not honor the certificate of any other line. The passenger should ascertain from the ticket agent what portion (if not all) of his journey can be covered by the certificate procurable of him, and purchase tickets and secure certificates filled in accordingly. In case a ticket on the certificate plan cannot be procured at the starting-point, the person should purchase to the nearest point where such tickets can be obtained, and there repurchase through to Pittsburgh, requesting a certificate properly filled out by the agent at the point where the repurchase is made.

Third.—Tickets for the return journey will be sold by the ticket agents at Pittsburgh, at one-third the highest limited fare, to those only who hold certificates signed by the ticket agent at the points where through tickets to Pittsburgh were purchased, and countersigned by the Secretary of the Convention, certifying that the holder has been in attendance upon the Convention.

Fourth.—It is absolutely necessary that a certificate be procured, as it indicates that full fare has been paid for the going journey, and that the person is therefore entitled to the excursion fare returning. It will also determine the route by which the ticket for the return journey should be sold, and without it *no reduction will be made,* as the rule of the Association is: "No refund of fare will be made because of the failure of the parties to obtain certificates."

Fifth.—Tickets for the return journey will be furnished only on certificates procured not more than *three days* before the meeting assembles, nor later than *two days* after the commencement of the meeting, and will be available for continuous passage only; no stop-over privileges being allowed on tickets sold at less than full fares. Certificates will not be honored unless presented within *one day* after the date of the adjournment of the Convention. The certificates are not transferable, and the signature affixed at the starting-point, compared with the signature to the receipt, will enable the ticket agent to detect any attempted transfer.

N. B.—Please read carefully the above instructions, and be particular to have the certificates properly filled out and certified by the railroad agent from whom you purchase your going ticket or tickets. *Tickets and certificates should be obtained at least thirty minutes before the departure of trains.*

A certificate is void if altered, if not presented within prescribed dates, if not signed by the Secretary of the Association, and vised by the agent of the Central Traffic Association in attendance at the meeting at Pittsburgh, or if blank spaces on the going side are not filled out, signed and stamped by the agent of the line at the point from which the passenger started.

The Secretary suggests to all who will attend the meeting, and who desire to transact business at any other city *en route,* to arrange to do so on the trip *to* Pittsburgh, as the going ticket will, of course, carry with it, in most cases, stop-over privileges; while the return ticket does not.

Fifth.—*Attendance of Ladies.* The attendance of the wives and daughters of gentlemen attending the Convention, having become an established custom, grows more and more in popular favor every year. The pleasure of the society of ladies adds largely to the general interest of the meeting, and their participation in the excursions and banquet will be fully arranged for as heretofore.

Sixth.—*The Banquet.* The Annual Dinner will take place on Thursday evening, the 22d prox., at the Monongahela House. Each Company that is a member is entitled to the free admission to the Banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting not an officer of a member-company, will be charged ten dollars; ladies' tickets, five dollars each.

In order to facilitate the Executive and the Local Committees, will you please inform the Secretary immediately upon the receipt of this notice of the number that will be present from your Company, enclosing the additional amount covering the number in excess of the two to which the Company is entitled free, that definite arrangements as to the number that will attend the Banquet may be promptly made.

Seventh.—*Hotel Accommodation.* The Local Committee of Arrangements desires to announce that it has secured one hundred rooms at the Monongahela House, for the exclusive use of delegates and members of their families. These rooms will be assigned in the order of the applications received therefor; and, as far as possible, in accordance with the expressed wishes of the applicants. Those who expect to be present are requested to communicate with the Committee at once, stating whether they will be accompanied by members of their families, and if so, how many; in order that due provision may be made for the accommodation of all who may come. As orders for rooms will be taken subject to cancellation on or before October 16, it will be readily seen that no risk is taken by any one who, expecting to be present, engages a room at once. It is certain that immediate action in this respect can only be to the advantage of the applicant; for the hotel proprietors can readily dispose of any room that may have been engaged prior to the said date, should its engagement, for any reason, be afterwards cancelled. In case a preference for rooms at any other hotel should be expressed, the Committee will undertake to secure such quarters as are desired, if notified in due time. Concerning hotel accommodation, please address all communications to the Committee of Arrangements, American Street-Railway Association, Room 6, Jackson Building, Pittsburgh, Pa.

A list of the present membership of the Association, numbering 172 Companies in the United States and Canada, is sent herewith. If your Company is not already a member, it is cordially invited to join, and be represented at the meeting. Will you please acknowledge receipt of this letter as soon as possible, stating whether you expect to be present? On the enclosed delegate's card kindly fill in the names of those who will attend from your Company, and return it with your letter of acknowledgment in the accompanying envelope.

Awaiting your *prompt* reply, I remain,

Sincerely yours,

WM. J. RICHARDSON,
Secretary.

Brooklyn, Y., September 21, 1891.

RADIAL GEAR FOR ELECTRIC CARS.*

With the introduction of electric power for the propulsion of street cars the necessity for improved trucks became at once apparent. Provision had to be made for properly supporting the motors, necessitating longer trucks. Another problem which had

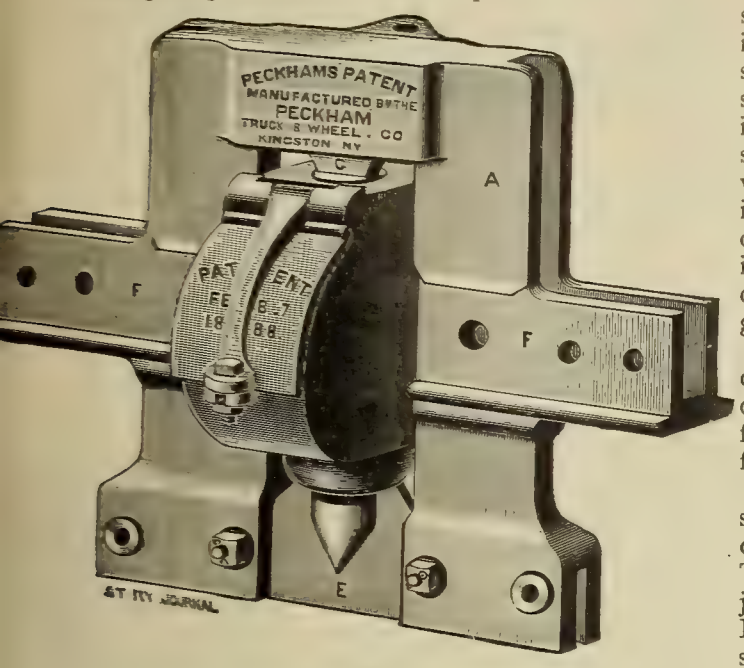


FIG. 1.

to be solved was to overcome the violent oscillation of the car-body, which was a natural result of the increased speed with which the electric cars are run. Various improvements in the construction of the trucks have been made with this end in view, and the truck herewith described is claimed to entirely overcome this objection.

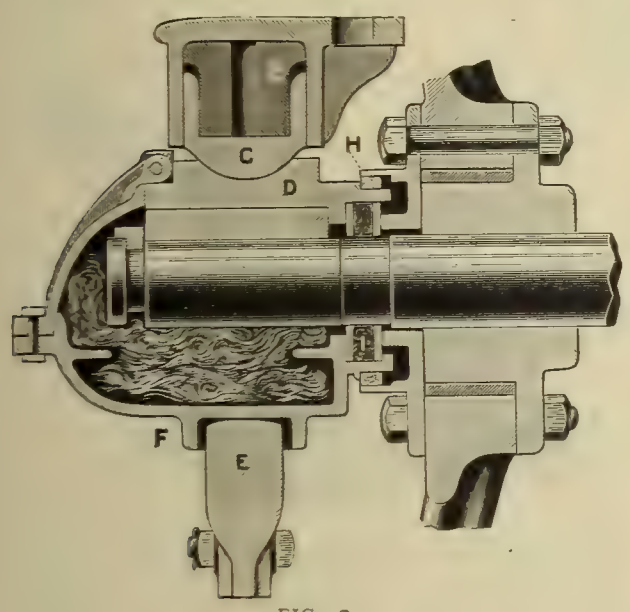


FIG. 2.

In our issue of September 19 last we described some of the improvements in this car-truck, and it remains for us to describe more particularly the radial gear, which is one of its most important features.

Fig. 1 gives a perspective view of the Radial Gear, and Fig. 2 shows a sectional view of the same.

This feature of the truck is radically new in construction. The malleable iron or steel yoke-piece is



FIG. 3.

provided at its upper cross-section with a pocket into which is inserted a rubber cushion. This pocket is shown in Fig. 2 at C, and a general view of the same is shown in Fig. 3. The rubber cushion is represented by B in Fig. 2, and Fig. 4 gives a perspective view.

This cushion sustains the entire weight of the side frame of the truck to which the yoke is riveted, and consequently one-half of the weight of the motors and the entire weight of the car-body, and relieves them of all sudden shocks due to imperfections in the track, crossing, switches, etc.

The pocket in which the rubber cushion is set is constructed of a hollow cylinder having its outer surface accurately turned to fit the cylindrical cavity in the yoke, which is also machine-fitted to correspond with the size of the rubber pocket so as to insure a positive cushion of the rubber, and by its flexibility relieves the car and motors from shocks and strains (incident to rigid journal-box connections) when stopping and starting electric cars. The flexibility of this bearing, together with the lateral play of the pendulum motor hanger with which this truck is equipped, is intended to relieve the motor frames of all side strains, and insure a true mesh to the gears.

To prevent the side oscillation of the cars and to do away with stay-bolts, the inner side of the top cross-section of the yoke is provided with brackets for receiving steel plungers, secured to the main top frame of the truck.

The lower sections of the yoke are riveted at one side of the end truss extension and at the other to a centre steel bar connecting the two yokes together. The centre cross-section of the yoke underneath the journal-boxes is provided with a projection (E in Figs. 1 and 2) which fits into a socket on the under side, and is secured in the jaws of the yokes by bolts which can be easily removed when desired to remove the wheels and axles. This is called the repairing piece. The socket on the under side of the journal-box is constructed of oblong shape, so as to allow for the lateral or end play of the axle. The sections of the yokes that embrace the sides of the journal-boxes are constructed with apertures that allow for a removal of the journal-boxes without jacking up the car-body.

Another feature of this truck is that it is provided with a double dust-tight box, thus preventing the entrance of dust and other injurious substances into the journal-box.

The following claims are made for this gear:

1. It provides a positive "rubber cushion" for the side frames of the truck, which relieves them,

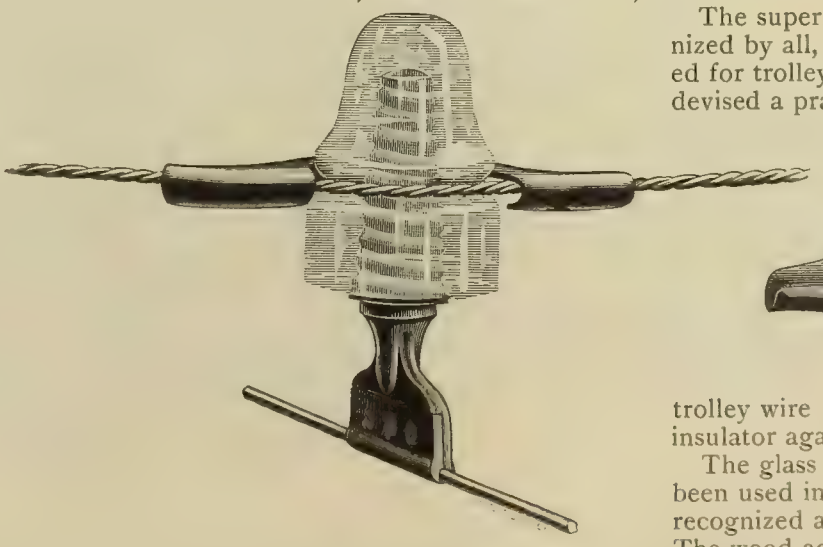


FIG. 1.—GLASS INSULATOR FOR TROLLEY LINES.

and also the motor-frames connected thereto, from shocks, and prevents loose bolts and breakages.

2. That its "flexible ball-shaped journal-box bearing" readily adjusts itself to any unevenness in the track, and it relieves the car from shocks when suddenly stopping and starting.

3. That it allows the journal-boxes to be removed without jacking up the car.

4. That it holds the car-body firmly in place and does away with the use of stay bolts and rods.

5. That it provides for the easy removal of the wheels and axles.

Fig. 5 is an illustration of a car on the Coney Island and Brooklyn Electric Road equipped with this



FIG. 4.

truck. The easy riding of this car as compared with the cars not having this make of truck is very noticeable to the passengers and favorably commented on. The car rides as smoothly as a railroad car, and there is an entire absence of that violent jumping and tossing so common with most electric cars. In-



FIG. 5.—CAR ON CONEY ISLAND AND BROOKLYN ELECTRIC ROAD.

deed, it is possible to read a newspaper on this car with comfort and ease, which is something that cannot be done on the ordinary vehicle. The car can run at a very high speed with perfect comfort to the passengers, and there is very noticeable freedom from end and lateral oscillation.

TROLLEY-LINE INSULATOR.*

The superiority of glass as an insulator is recognized by all, and would no doubt have been adopted for trolley-line insulation heretofore had any one devised a practical plan of connection between the



FIG. 2.—YOKE.

trolley wire and the span wire, securing the glass insulator against breakage.

The glass insulator screwed on the wood pin, has been used in all electrical line work for years and is recognized as the best practice for line insulation. The wood acting as a cushion, adapts itself to any condition arising from unequal expansion of the wood and glass and thus securing the glass insulator against breakage.

A glass insulator is shown in Fig. 1. The glass of this insulator is grooved, into which is screwed a wooden plug. The bolt has a round head at the

* The Peckham Motor Truck and Wheel Co., Kingston, N. Y.

* The Creaghead Engineering Co., Cincinnati, Ohio.

top and a thread at the bottom and is screwed into the clamp.

The method of connecting the insulator to the span wire is very simple and secure. The yoke shown in Figure 2 fits loosely in the groove of the insulator as shown in Figure 1. The inner curve of the yoke coming in contact with the insulator is a half circle with a slightly larger radius than that of the smallest circle of the groove. It is necessary to remove the yoke from the insulator about ¾″ before it becomes disengaged from the groove. The yoke can be put on and taken off the span wire easily and without tools. All strains on the insulator tend to increase the hold of the yoke and span wire on the insulation. While the attachment of yoke and trolley wire is secure, it is at the same time flexible and will adjust itself to unequal expansion of materials.

The action of this insulator where in use comes fully up to the company's expectations, and the result is very encouraging.

ELECTRIC RAILWAY WITH CONDUCTORS UNDERGROUND.*

The necessity for a reliable method of laying electric-railway wires underground has led to many inventions with this object in view. It can be said of them all that each possesses some merits not possessed by the others, and in the system we herewith describe and illustrate there seems to be a good many valuable features.

This system of electric distribution for railways is now on exhibition in practical operation, on a miniature scale, in the World Building, New York, and the inventor thereof, Mr. Granville T. Woods, claims his ability to prove every point advanced in favor of the system. The objection to overhead wires of course is entirely overcome, by the wires being placed underneath the surface of the ground. The usual conduit is dispensed with in this system and the electrical feeder is insulated throughout and completely inclosed, thus obviating all dangers incident to the operation of ordinary systems of this character. It is said to be the only system which has every electrical contact exposed to view—and the only one with generating and distributing stations. The electrical contacts are six feet apart.

The mechanism of the system is such that no current is taken from the wire at any point, except immediately under the car as it moves over the rails, and as soon as the car has passed the current is cut off by the same mechanism. Whatever leakage there may be on the line is limited only to the point immediately beneath the moving car; after the car has passed there is no further possibility of leakage of the current.

Both of the conductors may be placed under water and the system will remain unaffected. This, it will be understood, is a valuable feature, inasmuch as it is rendered practicable to operate a road of any character or under any conditions.

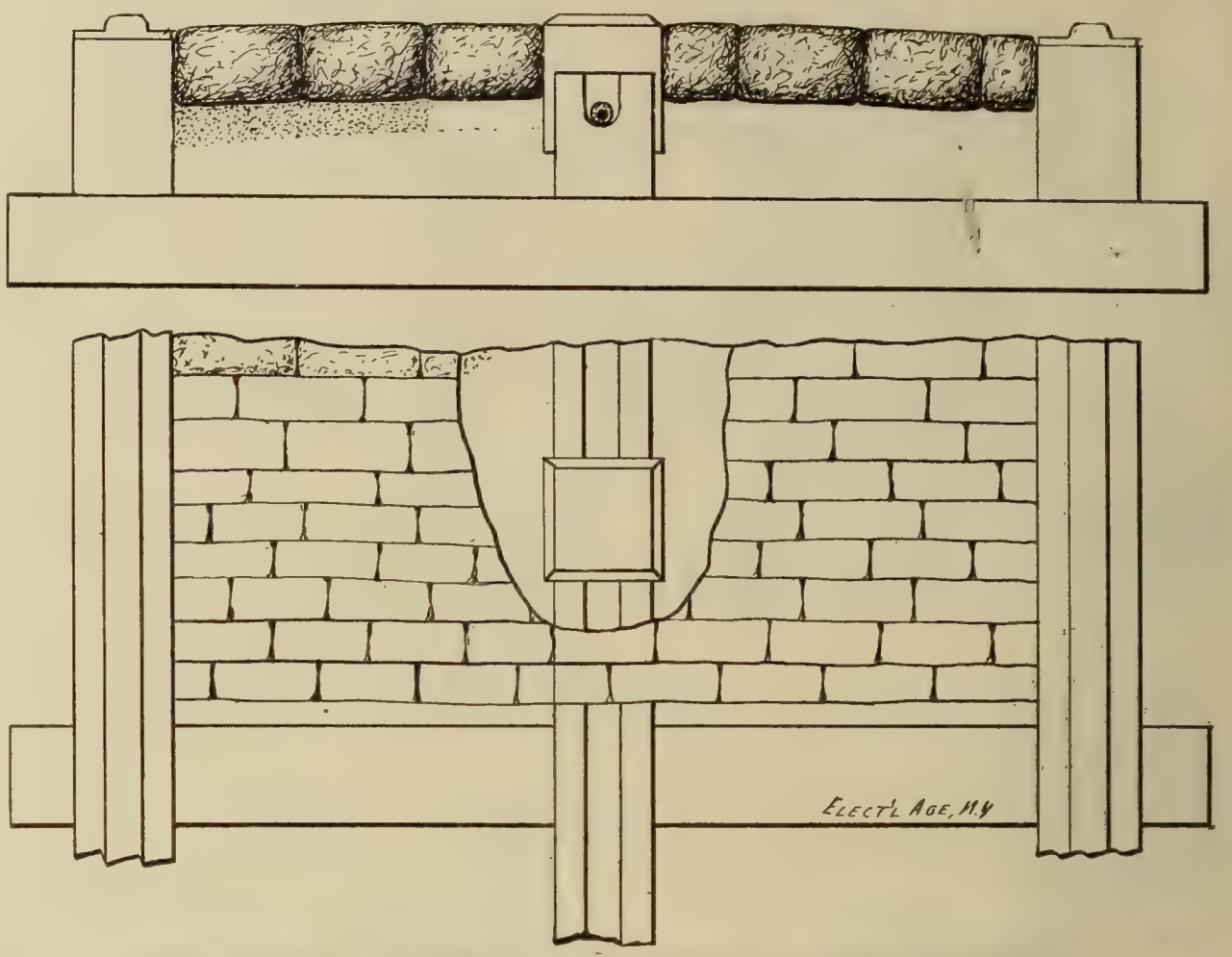
Another claim for this system is that it is the only one which has the positively "dead" line electrically in front and behind the car.

One of the chief points of value is that the system can be installed on any existing road without disturbing the rails, stringers, or ties, therefore rendering it unequalled by any other system in the matter of first cost.

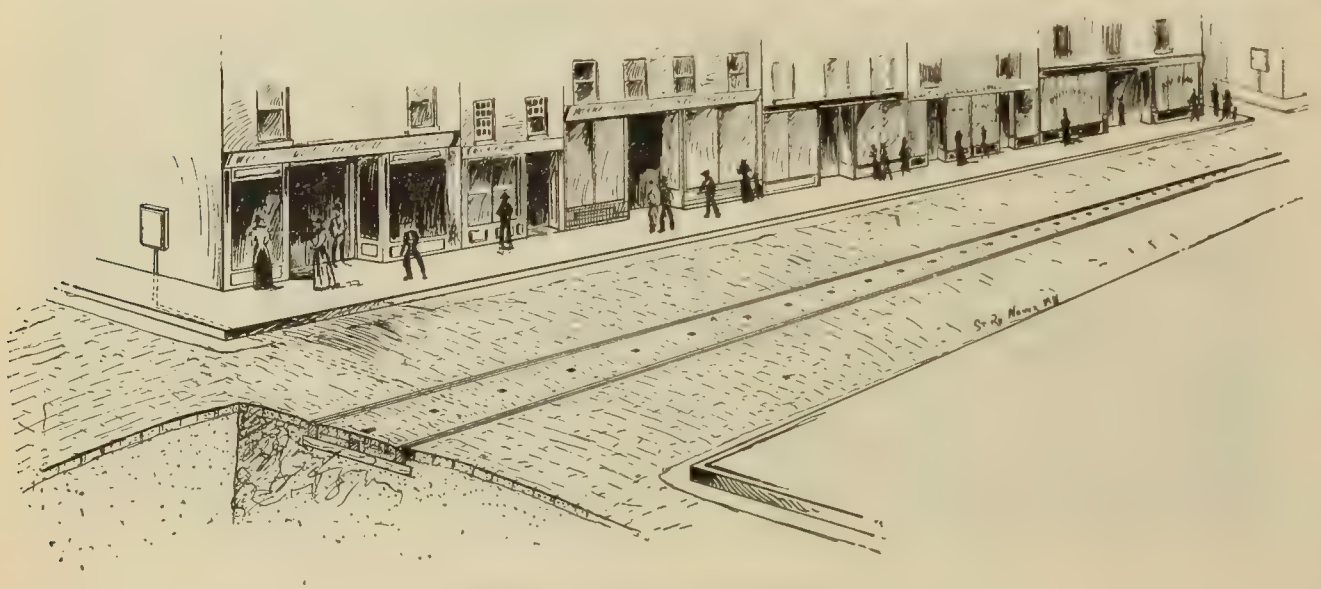
One of the difficulties to contend with in the operation of ordinary electric railways is the liability to damage from lightning or other external electrical causes, but it is claimed that this system possesses complete immunity from these abnormal conditions.

The system operates by direct circuit, induction playing no part whatever, and the mechanism is arranged in boxes in the street, two blocks apart.

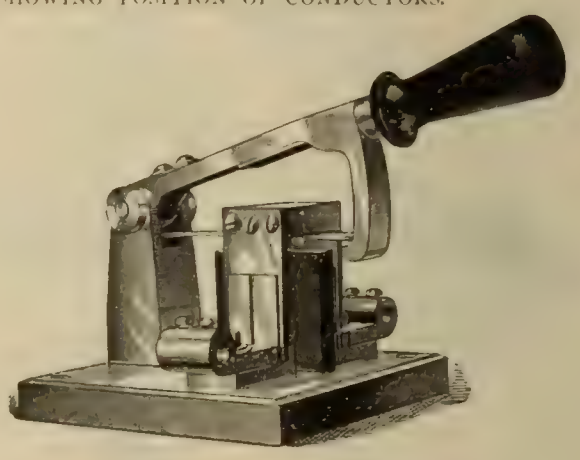
The company which owns the system is now constructing a line which will shortly be completed and in running order.



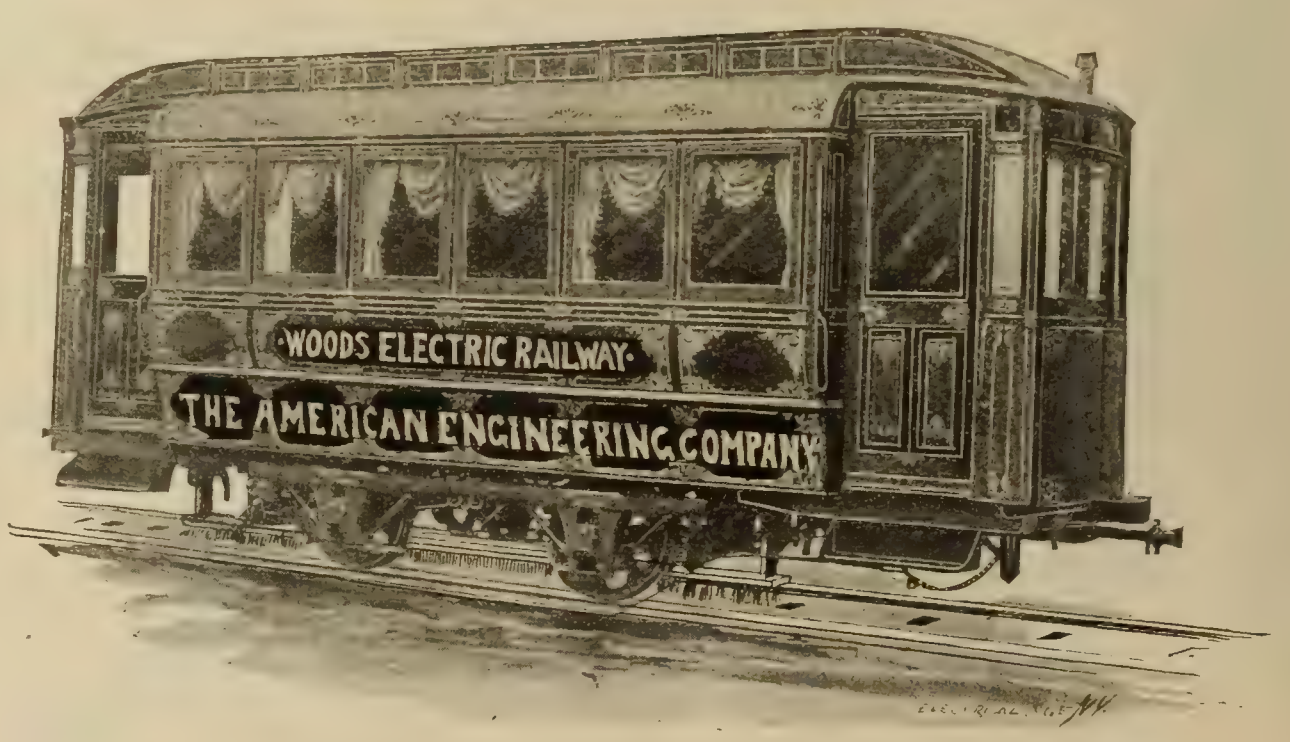
SECTIONAL AND PLAN VIEWS OF ROAD BED SHOWING POSITION OF CONDUCTORS.



GENERAL VIEW OF ROAD-BED.



current without heating and the breaking is done so quickly that all arcing is prevented. The switches are made in three sizes, ranging from 150 to 450 ampéres capacity, and special sizes are furnished up to 1,000 ampéres. The switch will beon exhibition at the Pittsburg Convention.



VIEW SHOWING METHOD OF OF CONVEYING CURRENT TO THE CAR.

QUICK BREAK SWITCH.*

The cut illustrates the new railroad switch just put on the market. This switch has been especially manufactured for railroad work. The parts are of highly polished red brass and hard rolled sawed copper, mounted on a handsomely marbleized slate base. The switch is well designed mechanically; the wearing parts are heavy and durable and easily replaced, as all the parts are interchangeable. The contacts are of ample proportion to carry the rated

—F. H. Hayward, of the Ball & Wood Co., New York, manufacturers of Ball Engines, will be present at the Pittsburg Convention.

—Mr. Lafayette Coles will represent Holmes, Booth & Hayden, of New York, at the Pittsburg Convention.

* American Engineering Co., World Building, New York.

* W. H. Weston & Co., Philadelphia, Pa.

ELECTRIC CAR FOR SPOKANE. *

The accompanying illustration shows a combined open and closed car of a number recently built for the Electric Street Railway Company. It is arranged with a closed compartment seating 16 persons and an open compartment at each end, the total seating capacity of the car being 42 persons, and the extreme length 29 feet over all. The total weight of the car and trucks is less than 10,000 pounds.

The car is handsomely finished in cherry wood, with ceilings of bird's-eye maple, decorated in color, and the seats are upholstered in Wilton carpet. Sliding doors shut out the draft from the open compartment; the sashes are glazed with plate-glass, and tastefully embroidered linen shades on spring rollers hang on the windows to protect passengers from the glare of the sun. The metal-work is solid polished bronze.

The arrangement of the car is unique, and its advantage is that it can be used throughout the entire year with comfort to the passengers, and more especially in the equable climate of the Pacific slope. Even along the Atlantic coast the open seats present an attraction to riders who smoke, and to the other class of passengers who always insist on riding on the platform and standing in the way. The cable grip-cars universally used in Chicago and now coming into use in Philadelphia are always well filled with smokers, which shows that winter's cold blasts are not sufficient to deter them from the enjoyment of their tobacco if a place is provided where they are permitted to smoke.

The strong feature about the car is the new kind of truck, called the Maximum Traction truck. Its arrangement is such that at least 92 per cent. of the load comes on the two driving-wheels, by means of which far less power is required to move the car, and the extra long cars, which are coming into favor with railroad companies, have been made practicable by the use of this particular truck.

The Spokane cars have attracted a great deal of attention from the railroad and electric companies along the Pacific coast.

BIOGRAPHICAL SKETCHES.

MORRIS W. MEAD.

The subject of our sketch, Morris W. Mead, the well-known Superintendent of the Bureau of Electricity Department of Public Safety, Pittsburg, Pa., was born at Underhill, near Burlington, Vt., October 28, 1854. In 1860 he moved to Pittsburg with his parents. Here Morris received his education and graduated from the Central High School in 1873. After leaving school he studied law for two years with J. H. Baldwin, abandoning the study of that profession, because he was compelled to support his mother and sister on account of the death of his father. He spent two years in Venango County in oil operations, then returned to Pittsburg and became a salesman in the large florist and seed establishment of J. R. and A. Murdock.



MORRIS W. MEAD.

He became an operator in the Fire Alarm Office in 1879, where after two years' service he was appointed chief operator, and later was made Superintendent of the Fire Alarm Telegraph System. A portion of this time—about two years—he held the combined position of Secretary to the Board of Fire Commissioners and Superintendent of the Fire Alarm System.

Shortly after the new charter of 1888 went into effect he was appointed Superintendent of the enlarged Bureau of Electricity by J. O. Brown, Chief of the City Department of Public Safety.

He moves in the highest circles and is known as one of the highest "Shriners" in Pittsburg.

As evincing the steady application of Mr. Mead to whatever he undertakes, it may be stated that he paid his way through High School, including all expenses for board, clothing, books, etc., by establishing a daily newspaper route, which he served for five years.

THE FLORENCE AND FIESOLE ELECTRIC RAILWAY.

The following abstract of a paper recently read before the Institution of Civil Engineers will interest our readers, describing as it does an electric railroad a parallel in point of grades to that constructed by Mr. Sprague at Richmond, Va. It is a curious coincidence, also, that the road should use an improved form of the same system as used at that place.

The electric road referred to is between Florence, Italy, and Fiesole, a suburb 4½ miles from and 800 feet above it. The line has gradients up to 8 per cent. and is the first continuous steep-grade electric railway in Europe. It is owned and operated by the Chianti and Florentine Hills Railway Company, of Florence, and was opened for traffic in September, 1890.

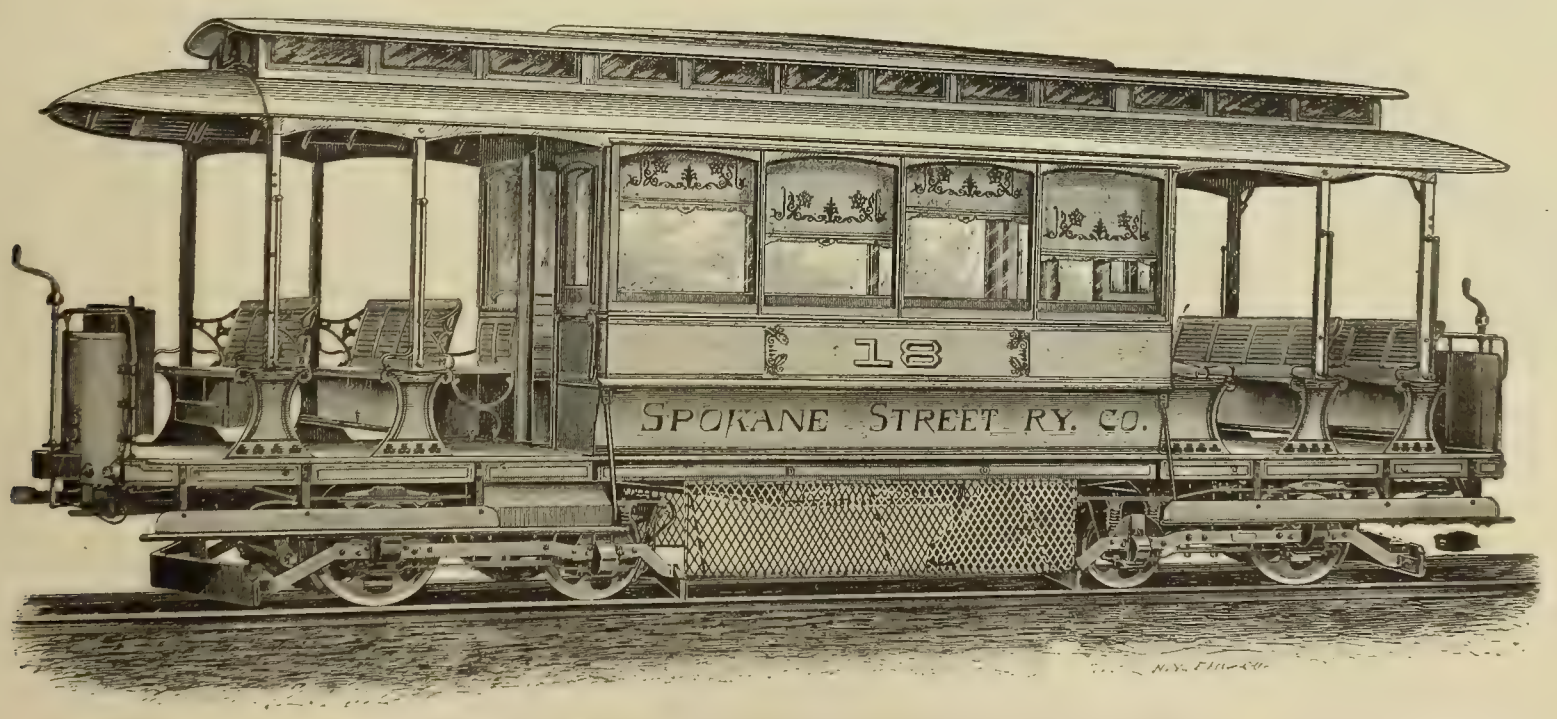
The line is a single track, 4 feet 8½ inches gauge, laid alongside the public road, except for a length of about two miles, where it occupies the centre. With the exception of a short paved section in Florence, where the permanent way consists of heavy Phœnix girder rails, the line is laid throughout with 48-lb. steel rails, each fastened to ten oak sleepers, which, with the steel angle fish-plates, bolts, sole-plates and stout spikes at the suspended joints, make a substantial road-bed for a light steep-grade railway with sharp curves and constant traffic.

No less than 52 per cent. of the entire line is in curves, the sharpest of which, down to 59 feet radius, occur on the steep-grade section, which begins about one and three-fifths miles from Florence, the track being practically level to that point. Guard-rails are used only at the inside rail and in curves sharper than 262 feet radius, the greatest super-elevation of the outer rail being 3.9 inches, and the gauge being widened 0.4 inch. About half-way up the steep-grade section a reversing station was put in to avoid too sharp a curve, and at the following curve a safety siding was built with an incline of 34 per cent. Between the termini there are six stations with sidings, or passing-places, the points and crossings of which work automatically.

At about a mile from Florence the line crosses on the level two trunk lines, one at right angles, the other at an angle of 76°. These level crossings are formed by a solid framework of longitudinal and transversal bearings to which iron plates are screwed parallel and contiguous to the rails of the light railway crossing the trunk line. At one crossing 72-lb. rails are used for both track and guard rails on both the trunk and local line, the rails on the latter being raised and cut at the points of intersection, so that the flanges of the wheels of the local line rolling-stock pass over the main-line rails. On the other crossing the practice is to cut the main-line rails by forming a small groove in the head of the rail for the passage of the wheel-flange at the points of intersection in crossing at angles between 90° and 75°, and not to cut them in crossings between 75° and 45°. On the light line, the rails used at crossings are of a special grooved section with parallel and contiguous iron plates, or the whole crossing is formed of one solid piece. Both lines are protected by gates and signals worked by a signalman on the main line, the nearest stations on both sides of which are connected with the crossing by electric bell or by telegraph.

The power station is situated at the end of the flat section about 1 3-5 miles from Florence, and consists of three 80 H. P. return-flue boilers, supplied by Messrs. Tosi, of Legrano, near Milan; three 80 H. P. compound engines with vertical cylinders, made by the Oerlikon Works, of Zurich, working at 225 revolutions per minute, and three Edison compound dynamos, which, at 900 revolutions per minute, give 110 ampères at 500 volts, each dynamo developing 75 effective horse-power, or 93 per cent. of the engine-power. One dynamo is sufficient for the ordinary winter service, furnishing power and light for the cars and light for the works. Another is added during the summer and holiday season, the third engine and dynamo being always kept in reserve.

An overhead main conductor consisting of a No.



COMBINATION OPEN AND CLOSED CAR ON SPOKANE ELECTRIC ROAD.

* J. G. Brill Co., Philadelphia, Pa.

3 B. W. G. covered copper wire is carried on poles placed at a distance of from 6½ to 13 feet from the centre of the line, 130 feet apart in straight sections, and 80 to 100 feet in curves. They are 30 feet high and are let 6½ feet into the ground. In Florence they consist of ornamental cast-iron columns with brackets, the insulators being fixed to the top, while on the rest of the line timber poles are used. The contact wire, which is of No. 4 B. W. G. silicon bronze and one-fifthinch in diameter, is suspended over the centre of the line 20 feet above the rails, from the brackets of the iron columns or poles, in those places where the line runs alongside the road, and from transverse wires hung from poles on both sides of the road, where the line is situated in the centre of the roadway, while in curves the contact wire is kept in position by diagonal wires as well.

The main conductor transmits the current to the contact wire in sections of about 130 feet, there being, moreover, between the station and Fiesole two subsidiary conductors, which are connected with the main conductor. From the overhead wires the current passes through the trolley and motors of the car to the rails which form the return circuit. No earth plates are used; but to insure perfect continuity of the circuit, the rails are connected at the joints by a copper wire fixed to small iron pins, which pass through the flange of the rail.

A small trolley wheel, 2 inches in diameter, running along the lower surface of the contact wire, is carried on a tubular pole 15 feet high and 2 inches in mean diameter. This trolley pole, which has a lateral play of 3 feet and a vertical play of 10 feet, is reversible, its lower end being fitted to a ⎯⎍⎯ shaped iron, which is riveted to the centre of the roof of the car. When the train is in motion the trolley pole is inclined in the direction opposite to that in which the car is running, at an angle of about 40°, so that it projects beyond the back platform, and by means of a loose cord suspended from it is brought under the control of the guard.

Each car carries two 20 H. P. Sprague motors, whose armatures consist of 28 spirals of 0.64 ohm resistance each, the maximum efficiency being 90 per cent. less 25 per cent. due to loss by gearing. They are suspended between the car-axles and a transversal iron riveted to the car-frame. The motion is transmitted to the car-wheels by toothed gearing, the smaller wheel of each pair being of bronze, in view of the greater tensile strain on steep grades.

The motors have three conductors, which, by means of a regulator on the platform, can be coupled in seven different ways, the speed being increased according as an arrow on the disc of a regulator is moved from the central or "off" position to the left, the seventh point on the disc marking the maximum tractive effort. In the same way the motion can be reversed by moving the arrow of the regulator from the "off" mark to the right.

The pinions are now being incased in metallic boxes, which has the double advantage of deadening the noise, which, however, is not great, and of protecting them from dust. The motors are placed immediately under the floor of the car, where they are easily accessible for inspection by four covered openings in the central passage.

The car seats twenty-four passengers and has a length of 20 feet, including the platforms, the rigid wheel-base being 6 feet. It is lighted with five incandescent lamps inside. Each platform is fitted with a regulator disc, a sand-valve handle, a mechanical chain-brake, and an electric safety brake, all four being within easy reach of the driver, while the guard on the back platform has to watch the trolley, the two platforms being in communication by electric bells. The outside width of the car is 8½ feet and the total height above the rails is 10 feet, the centre of the roof being 10 feet below the contact wire. The electric plant, including car-frames and motors, was supplied by the Edison General Electric Company, of New York, while the cars, which can be easily removed from the frames, were built at the Desireau Works of Florence.

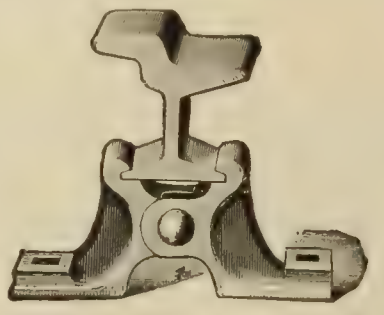
The brakes are three in number, and are independent of each other. The first reverses the motors by moving the arrow of the regulator from the "off" point to the right, in the manner already described. The second brake, of recent application, is worked by a handle fixed over the door, and utilizes the power generated in the motors themselves when rotating, and therefore acting as dynamos. This brake, being independent of the current *per se*, is obviously the more economical of the two. Both of these, however, are only to be used in case of danger. The third and ordinary brake, which can be worked from either platform separately or from both platforms jointly, is a powerful mechanical chain brake acting by means of a system of stout lever-plates on all four wheels simultaneously, the ratio of increase of the pressure exerted at the handle of 12 inches radius being 1 in 136.

The company, besides keeping its own line in repair, pays to the local authorities an annual easement of $184.68 per mile of paved road and $92.34 per mile of open road.

"LA GRIPPE."*

Talk about rail-chairs! Can anything be devised that will grip the rail with more tenacity than the one we illustrate herewith? Is there another principle that can be applied which will make a chair that will grip the tighter the harder it is "pushed," as this one does, without bolts, clamps or nuts to work loose?

It can be seen with half an eye that this chair



"LA GRIPPE" RAILWAY-CHAIR.

must be both economical and durable, and that any upward or spreading strain exerts a shearing force on the spikes that will not pull them out. There is an equal distribution of all crushing strains. The conduit formed below the rail will help to prevent the accumulation of water and the formation of ice on the ties—a great aid in keeping a street railway free of slush.

We think the chair appropriately named, as it will have "La Grippe" on street-railway men.

NEW INTER-URBAN ELECTRIC ROAD.†

After much competition the contract for electrical equipment to be used on the East Liverpool and Wellsville Railway has been awarded. The road will be about eight miles in length, connecting Ohio City, Wellsville and East Liverpool, with the power station in the last-named place. Eighty-two-pound Johnson girder rails will be used throughout the entire road-bed, grading for which has been pushed vigorously. A force of five hundred men has been at work for two weeks on the road-bed, which has been cut and filled according to the best practice for steam railways, and will, when completed, be practically level. Thirteen acres of ground have been purchased in East Liverpool, on part of which a handsome red brick power station is in process of erection. Power will be furnished by two one-hundred-and-fifty H. P. Reynolds-Corliss engines with accompaniment of two three-hundred H. P. boilers and a Worthington Duplex pump. Two multipolar slow-speed dynamos of one hundred and fifty H. P. each, and a handsome marbleized slate switchboard of the latest type, fitted with all necessary appliances for the modern electric power station, will complete the equipment of the power station.

Seven twenty-six-foot car-bodies have been purchased of the J. G. Brill Company, Philadelphia. These will be equipped with fourteen "Gearless" motors, having a capacity of twenty horse-power each. Line construction will be on the Contracting Company's system throughout.

It is expected that the road will be put in operation on Thanksgiving Day, when the citizens of the two enterprising towns have arranged to decorate their streets and cars, and to give a banquet in honor of the occasion. At this writing the usually quiet streets of both East Liverpool and Wellsville are filled with foreign workmen—several hundred men being employed at different points along the line. The greatest enthusiasm has been shown from the start by the people of the two towns, the cause of their hearty co-operation being immediate relief from the steam-cars which have been their only method of communication thus far.

* Elmira Railway Chair Company, Elmira, N. Y., and 45 Dey street, New York City.

† Short Electric Railway Co., Cleveland, Ohio.

NEW RAILS IN PHILADELPHIA.

An inspection of the rail and the combined members of the track now being laid on the People's Line, on Eighth St., above Walnut, Philadelphia, reveals some interesting points. The track is being laid by The Price Railway Appliance Co., of Philadelphia, and the rail used in the combination weighs 56 lbs. per yard. It is said that the system of this company cannot be surpassed by any other in steadiness; vertical strength from edge to edge; elasticity; smoothness and quality of the joints, at a cost, too, for all metal in it, distinctly less per foot.

This construction makes practically a continuous rail from crossing to crossing. There is no jar or metallic concussion over the chairs, because there is no metallic contact of the chairs and rails. The wooden sleeper is so protected on its top and sides as to promise durability as great as that of the ties, and the rail can be worn down longer and with much less of ultimate scrap than any other.

The system is the invention of Mr. James M. Price, of Philadelphia.

CLINTON (MASS.) STREET RAILWAY COMPANY'S REPORT.

At the adjourned meeting of the Clinton Street Railway Company, the following report was made:

We have examined, and so far as the time given us or which we thought it proper to take at this time allowed, investigated the condition, cost, method of construction and maintenance of various electric and horse railways in this region, especially those whose circumstances were similar or comparable with those of our proposed road.

We find that the average cost, including wiring, both above and below, and paving between rails—as is necessary where the line runs through the centres of much-used thoroughfares—is between $10,000 and $1,000 per mile. We present the following estimate of the cost of one mile of roadway:

Eighty tons steel rails at $32	$2,560
Rail fastenings and spikes	500
Stringers, 4 x 6 inches	450
Ties	400
Laying track, etc.	1,000
	$4,910
Ten per cent. added	491
	$5,401
Paving, average cost	2,000
Wiring, not less than	1,500
	$8,901

We offer this estimate as about the lowest that it would be in any case safe to reckon on, and from this up to $11,000 or $12,000, as was the case with the Leicester electric road. This amount we, however, consider excessive, and we think a road could be built thoroughly well for the figures first given, that is, between $9,000 and $10,000 per mile. We find that in every case we have looked into the success of the road has greatly exceeded the expectations of the promoters. In the cases of the Leicester electric road and the horse railway of Leominster, their age is not sufficient to allow us to pronounce upon their success with absolute certainty, but only to repeat what we were assured by certain of their officers, viz.: that their business had more than quadrupled their expectations, and that their desire and intention is to extend their line as rapidly as circumstances will allow and traffic demand.

In short, we find that street railways are, as a rule, safe but not speculative investments. The railroad commissioners of Massachusetts give the average dividend of 46 street railways in this state as 6.82 per cent. We therefore venture to believe that a street railway built within the limits of Clinton can be made a satisfactory investment, provided judgment is used in the selection of its location and in the method of its construction; we should say that beginning at the Lancaster Mills bridge and extending out Chestnut to Union, down Union to High and High to Water, down Water to Main and out Main to the line between Lancaster and Clinton, would be the main artery of trade and business, and

from this stem other lines could be built as the need appeared.

The course or route above described would involve the construction of about two to two and a half miles of railway at a cost of $10,000 per mile ($20,000 to $25,000); equipped for electricity, this would also involve the purchase of a generator, $3,000, and a motor on each car, $1,500 each, so that an electric plant of the smallest and cheapest description would be :

Construction	$25,000
Car house	2,000
Generator	3,000
Two cars with motors	4,000
Switches, side tracks, etc.	2,500
	$36,500
Ten per cent, for contingent	3,650
	$40,150

In addition to this the cost of electricity as a motive-power would be a very serious source of expense chargeable to running account and not construction, for as Mr. Pratt, president of the consolidated street railways in Worcester, informed us, we should have to pay for a great deal more power than we had use for. His company are running two cars to the lake and back and have an 80 H. P. generator at the power station, and have to pay for the whole amount, although they use less than 40 H. P. We are unable to see at this moment what horse-power we would require or what size generator we could make use of, and can therefore not state what the outlay for power would be, but it is safe to say that we should be obliged to pay for twice as much as we should ordinarily need, which would probably be not less than 40 H. P. ($2,400) per year for power at present rates. As a matter of fact, when used under the most favorable conditions electricity, as a power to move street cars, is more economical than horse-power in the ratio of .21 to .26, according to the recently-published statement of the West End company in Boston. A horse-railway plant, assuming the same route as the one already taken, would be at

$8,000 per mile	$20,000
Car house and stable	3,000
Two cars, $500	1,000
Switches and side tracks, etc.	2,500
	$26,500
Add 10 per cent	2,650
	$29,150
Eight horses	1,000
	$30,150

with probably much smaller annual outlay for power.

This would seem, in the present state of our information, to point at the use of horses, under the circumstances, as the best for us; but we only presume to lay the facts before you without venturing upon suggestions as to which should be taken. We should state further that the underground wire to be used in the circuit could, with hardly any additional cost, be put in when the track was being laid, so that the road could be changed from horse railway to electric without trouble—no waste of time and no added expense. The result of our deliberations is that to us it seems most expedient to organize our company with a capital of from $35,000 to $50,000, with the plan of building the line over substantially the route herein set forth, and obtain our franchise and charter therefor; for certainly this route will test the remunerative capacity of Clinton, and if it doesn't prove successful the less built the better, and if a demand for larger capacity should be made, our franchise could and would of necessity be extended to cover such demand. And to increase the capital of a paying corporation is a matter easily compassed.

We further recommend that we hold ourselves together and receive no suggestions or assistance from outside interested persons until we are able and in a position to deal with them both understandingly and with profit to ourselves, and the first things to secure is franchise and charter, and complete our organization.

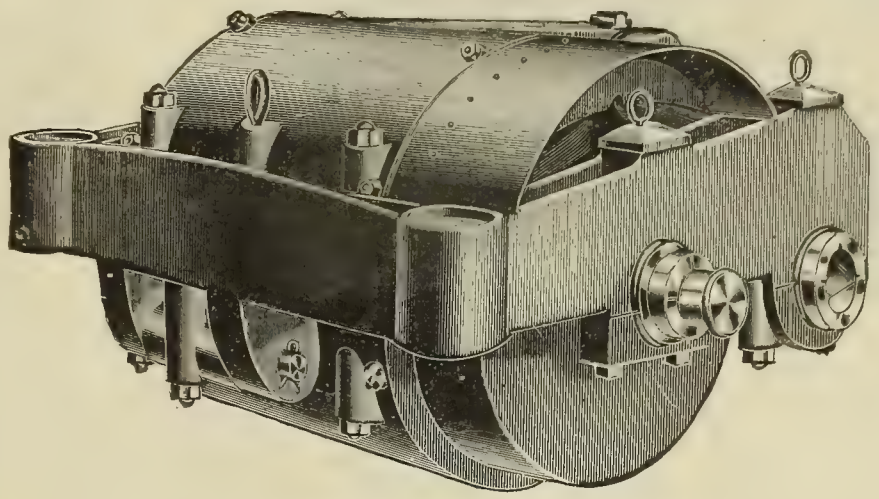
Articles of association for the formation of a street-railway company may be seen and subscriptions for stock will be received at the store of A. J. Witherell in Clinton. Although there are outside parties who are ready to take almost any amount of stock, it is the desire of the directors to give Clinton people the preference, and if there is a dollar to be made or a good per cent. to be received from the earnings of the road it should stay in Clinton. We hope that every one interested in the growth and prosperity of Clinton will subscribe liberally to the stock at once.

Arthur J. Witherell,
Charles A. Vickery,
John McQuaid,
Walter P. Bowers,
Henry C. Greeley,
Walter R. Dame,
Harold Parker,
Board of Directors.

THE GREAT ELECTRICAL INDUSTRY OF THE CITY OF PITTSBURG.

THE WESTINGHOUSE ELECTRIC AND MANFG. COMPANY.

In view of the Convention of the American Street Railway Association now being held in the city of Pittsburg, Pa., it is particulary appropriate to review the recent history of the Westinghouse Electric & Manufacturing Company and the many improvements in electrical apparatus for the equipment of street railways which have been made by this company since they entered this field.



WESTINGHOUSE "SINGLE-REDUCTION" MOTOR.

The wonderful increase in the number of electric roads in the United States in the last two years has been largely due to the great advances made in the construction of that all-important element in an electric-railway system, the motor. Less than a year ago the large majority, practically the whole number, of electric cars then in operation were driven by motors which transmitted the power to the axles through a train of gears high speed, noisy and expensive to maintain. This double-reduction motor has now become a thing of the past, having been so entirely superseded by later types that all demand for it has disappeared. The history of the Westinghouse Company during the past year is also the history of the fall of the double-reduction motor.

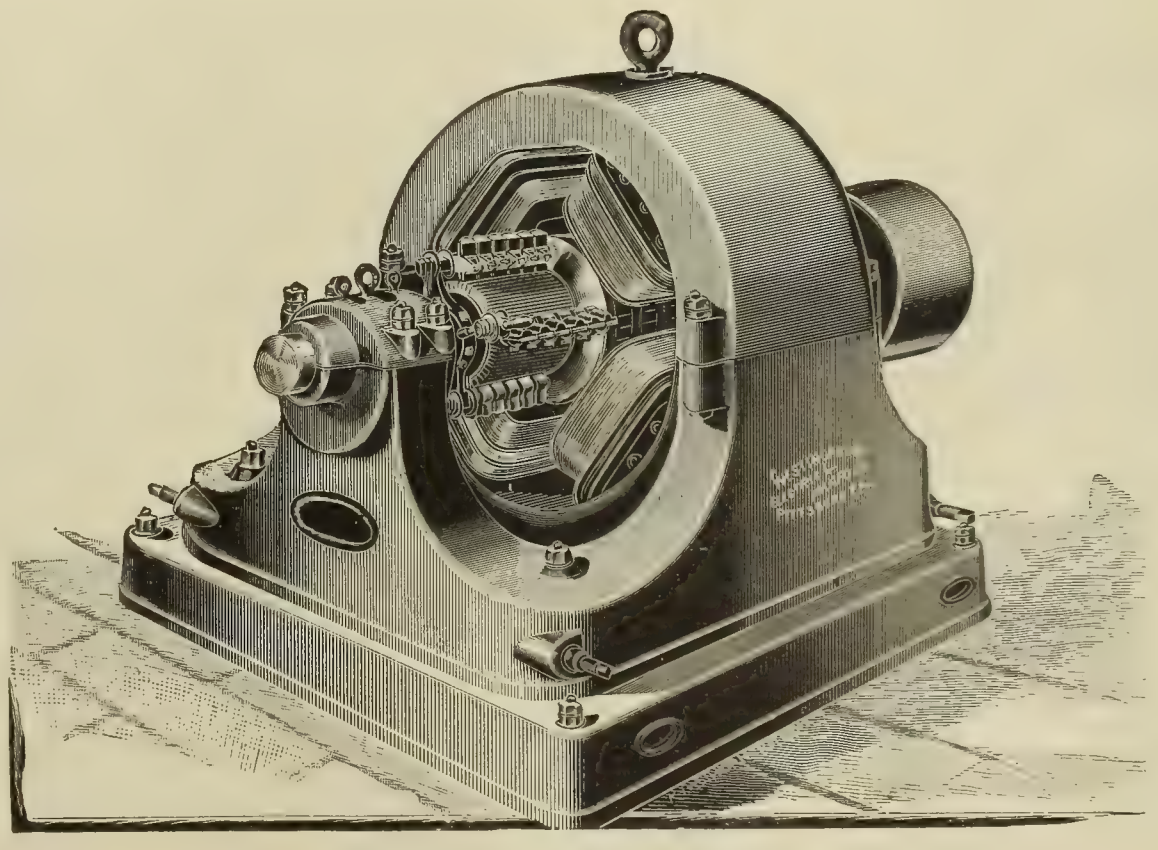
About eighteen months ago the Westinghouse Company began the manufacture of street-railway apparatus and immediately began taking contracts for the electrical equipment of street railways. The record which the company had made through its well-known apparatus for incandescent lighting, for excellent mechanical and electrical construction, combined with the world-wide reputation of the man who has been at the head of the company since its inception Mr. George Westinghouse, Jr. was at once accepted as a sufficient guarantee that its railway apparatus would be up to the high standard which the company had set for itself in other branches of electrical construction. That this confidence was well placed is shown conclusively by the growth of the company's railway business. A little more than one year ago the first road equipped with Westinghouse motors was put into operation : to-day there are nearly one hundred roads using that company's apparatus and the list is constantly increasing. Notwithstanding the fact that when the Westinghouse Company entered the field it had been occupied for years, the increase in its railway business has been greater proportionately than that of any other company.

THE WESTINGHOUSE RAILWAY MOTOR.

Let us glance briefly at the details of these motors. For complete descriptions we refer the reader to recent numbers of this paper. Recognizing that the two great objections—expense of maintenance and noisy operation—then raised to the use of electric-railway motors were well founded and would seriously limit the application of electricity in this direction unless remedied, the Westinghouse Company's aim when starting out was to overcome these faults, the former by improvements in mechanical and electrical construction and the latter by the employment of some device for smothering the noise, and later by the elimination of the noise-producing parts.

The first motors manufactured by this company were of the Double-Reduction type, but they embodied certain features which are worthy of note, namely, Gear Casings completely inclosing the gears and so reducing the wear and noise ; an ingenious arrangement of the field-magnets on hinges to give greater accessibility ; and a frame surrounding the motor to give rigidity to the bearings and to insure proper meshing of the gears.

A few months later this company placed on the market a motor in which the use of high-speed gearing was avoided. In this Single-Reduction motor the three features of the older type mentioned above were retained, although in all other respects the two types were entirely distinct. The new motor, a view of which is given herewith, was of the "iron-clad" construction, the field-magnet yoke being cylindrical in form and so completely surrounding the armature and field-coils that they were almost perfectly protected from injury. In this motor the armature made only one-fourth the number of revolutions per minute as in the Double-Reduction for the same speed of the car, and as a consequence the wear and noise were reduced in a much greater ratio.

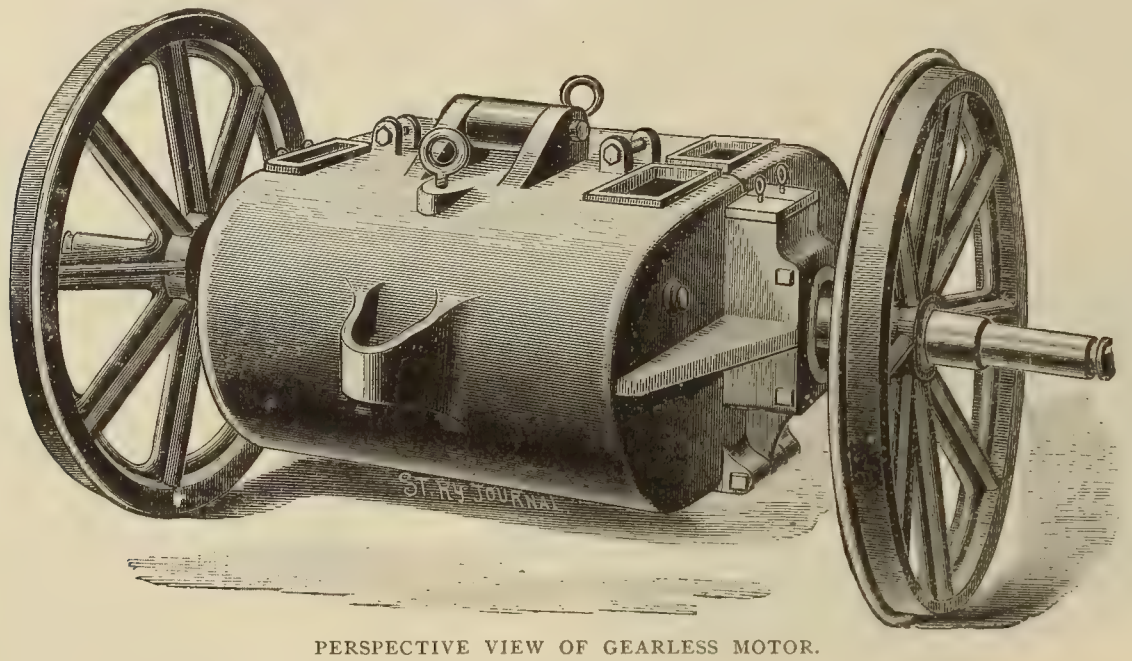


WESTINGHOUSE RAILWAY GENERATOR.

Later in the present year a motor constructed on similar lines to the Single-Reduction, but designed to have the armature directly on the car-axle and thus dispense entirely with gears and other methods of connection, was brought out by the Westinghouse Company. This was called the "Iron-Clad Gearless," and aptly so, since the entire exterior of the motor is iron. The feature of protection mentioned above was carried to a much greater degree in this motor,

and with such success that water on the track even to the height of the car-axle would prove no obstacle to its operation. In the Gearless motor the expense of operation and maintenance is reduced to the lowest possible point. Owing to the saving effected by directly connecting the armature to the car-axle the efficiency is very high, and the repair expense has been reduced in the same proportion as the wearing parts, which are brought down to three in number.

The Westinghouse Multipolar Railway Generators, which were fully described in these columns recently, are of a character to make the operation of the power

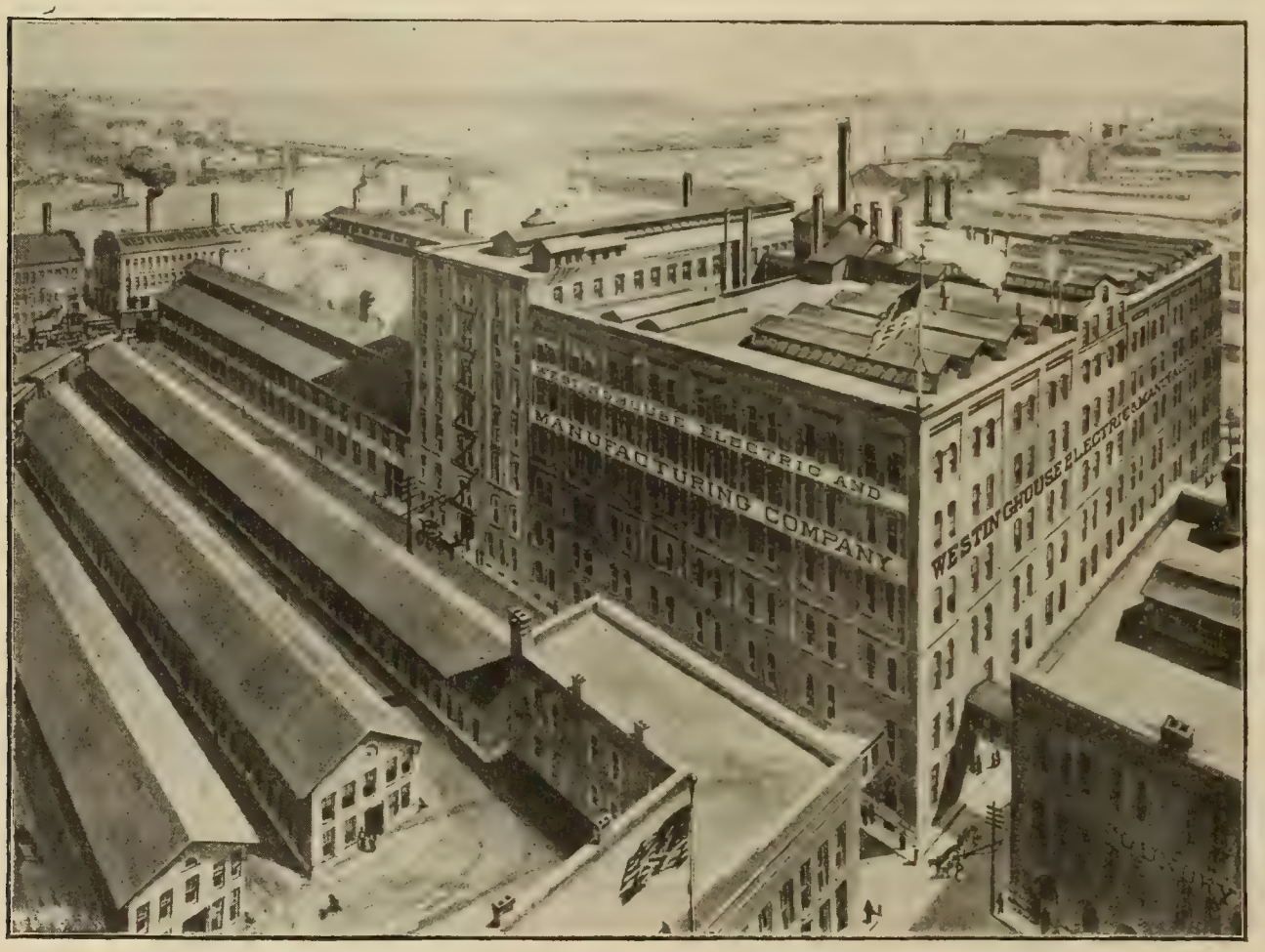


PERSPECTIVE VIEW OF GEARLESS MOTOR.

station as economical and reliable as possible, and the results obtained with these machines have been most satisfactory.

THE WESTINGHOUSE FACTORY.

The main factory of the company is located in the city of Pittsburgh, and here the bulk of the railway business is done, the other factories, located in New York City and Newark, N. J., being almost entirely confined to the production of lighting apparatus. The Pittsburgh factory is located near the business centre of the city and will no doubt be an object of much interest to the visitors to the Convention. The plant



WESTINGHOUSE FACTORY, PITTSBURGH.

consists of two immense main buildings, around which are grouped the machine-shops, foundries and blacksmith, cabinet and paint shops. The equipment and arrangement of this factory is perfect, and the facilities for turning out large quantities of electrical apparatus could not be improved upon. The machine-shop is particularly noticeable in this respect, being equipped with the latest and most improved machinery throughout.

THE WESTINGHOUSE INTERESTS IN PITTSBURGH.

The Westinghouse Electric and Mfg. Co. is but one of a large group of industries which centre around the name of Mr. Westinghouse and which occupy an important place in a city noted for the magnitude and number of its great industries. These associated interests are as follows :

Westinghouse Air Brake Company, manufacturer of the Westinghouse Automatic brake.

The Philadelphia Company, supplier of natural gas.

The Union Switch and Signal Company, manufacturer of railway switching and signalling appliances.

Westinghouse Machine Company, manufacturers of high-speed steam-engines.

The Standard Underground Cable Company, manufacturer of insulated wires and cables.

The Standard Car Heating and Ventilating Company, manufacturers of heating and ventilating apparatus for railway cars.

The Fuel Gas and Manufacturing Company, Ltd., manufacturer of fuel gas and regulating appliances for use with the same.

In addition to these there are the United States Electric Lighting Company, having its factories at Newark, N. J., and the Sawyer-Man Electric Company, with its factory located in New York City, both of which companies are leased and operated by the Westinghouse Electric and Mfg. Company.

PERSONAL.

Mr. L. K. Perot, lately of the Thomson-Houston Co., has been appointed assistant engineer of the Equitable Engineering and Construction Co., Philadelphia.

Mr. F. W. Sabold, formerly of the Western Union Telegraph Company, Albany, N. Y., is now general manager of the Westchester Telephone Company, Yonkers, N. Y.

Mr. J. Dale, 90 Fulton street, this city, manufacturing electrician, has just installed an isolated 200-light plant in the factory of the Wilson Folding Blind Company, Olean, N. Y. The Wilson Company is very much pleased with its new plant and takes great pride in it.

THE HARRIS CONDUIT.*

A SIMPLE, EFFECTIVE CONDUIT OR SUBWAY FOR ELECTRIC RAILWAYS, CABLE RAILWAYS, ETC.

A few years ago there was much said and printed in regard to placing electric railways on the streets of New York City. At about the same time the subject of subways for electric wires for various purposes was agitated.

The last bore fruit; the first, owing in part to the serious and valid objections to overhead trolley wires in city streets, has not been a success in New York.

The inventor of the system illustrated herein considered that the principal requisites should be strength sufficient to withstand the heavy shocks caused by heavily-loaded teams, simplicity, ready access, quick repair, thorough drainage, convenience for pulleys or for motor conductors, or for several *sets* of motor conductors, and that all spare room should be utilized as subways for electric wires, pneumatic tubes, etc.

We have seen his full-sized steel-plate model of the conduits which he designed a few years ago, and which can be seen by all interested in such matters.

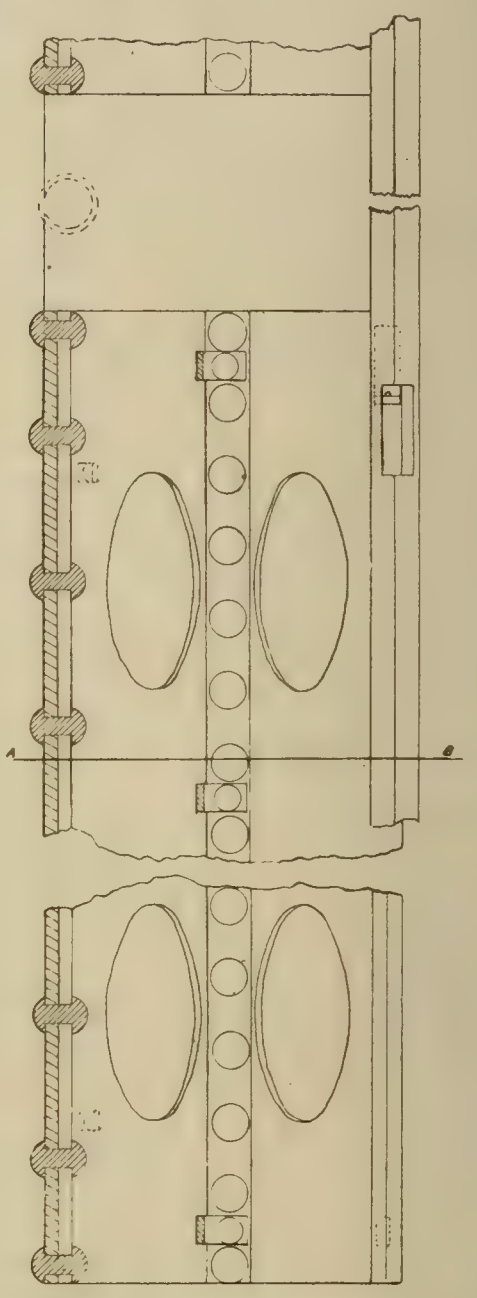


FIG. 2.—HARRIS CONDUIT.

The present description and our illustrations may explain it; of course the shape and size will be modified to suit various localities and conditions.

The x shaped vertical cross-section of the conduit shown in Fig. 1 (patent 358,609) is the strongest figure adapted to carry the thrust from heavy shocks directly to the base; moreover, it will be seen the width of tube-slot will remain uniform, as built. The conduit may be covered with an insulating or protecting compound. It is bedded in concrete and may be laid to line and level independently of the rails of the track, or of the second rail when a conduit-cover forms one rail of an electric railway; the other rail can be of any approved sub-form and may be laid similarly in a concrete bed, thus avoiding in many cases the removal and replacement of much expensive paving, yet once thoroughly built, the rails will remain true to gauge and level.

The metal conduit is made in such lengths as are convenient ; these are separated sufficiently for drainage to pass therefrom to the drain-pipe, laid a little below, which has frequent exits to the common sewers. The separation spaces are also for manholes, or for pulley-pits where the conduit is used for a cable railway.

The body of the conduit between the ends of sec-

*Robert L. Harris, C.E., 1 Broadway, New York.

tions is formed of concrete. After the sections of metal conduit are placed, the contents are arranged and the covers or rails are then readily and securely fastened.

The rail or cover completes the truss of each section of the conduit and fastens the same and itself by means of the dove-tailed flanges on its bottom edges; this is laid continuously and with little reference to the breaks in the metal conduit. This cover is simply and securely fastened by wedges or their equivalents; after the wedges are placed (with far less labor than spiking) a follower may be put in the wedge-slot, when the wedge cannot loosen and the rest of the wedge-slot may be filled with asphalt, etc., to prevent the formation of a rust joint.

The dove-tailed rail-base is a separate invention (patent 357,316) and can be used to advantage, independently of the conduit, with all usual top forms of rails, but is especially adapted to street railways.

The arrangement above described combines a conduit, subways and one rail of an electric railway.

Among the various forms of conduit designed by the inventor is one more especially adapted to the usual construction of steam railways (patent 344,962) which can be adapted thereto with little trouble to existing road-bed and fixtures. There is also an invention to protect motor conductors of various shapes and in various positions against moisture, drip, etc.

UNDERGROUND TROLLEY WIRES.*

A method of placing electric-railway conductors under the surface of the ground, where they cannot be tampered with or become broken and cause damage or injury, has been brought to our notice. On looking over the diagrams there seems to be considerable merit to the system, and we present a description of the same for the consideration of our readers.

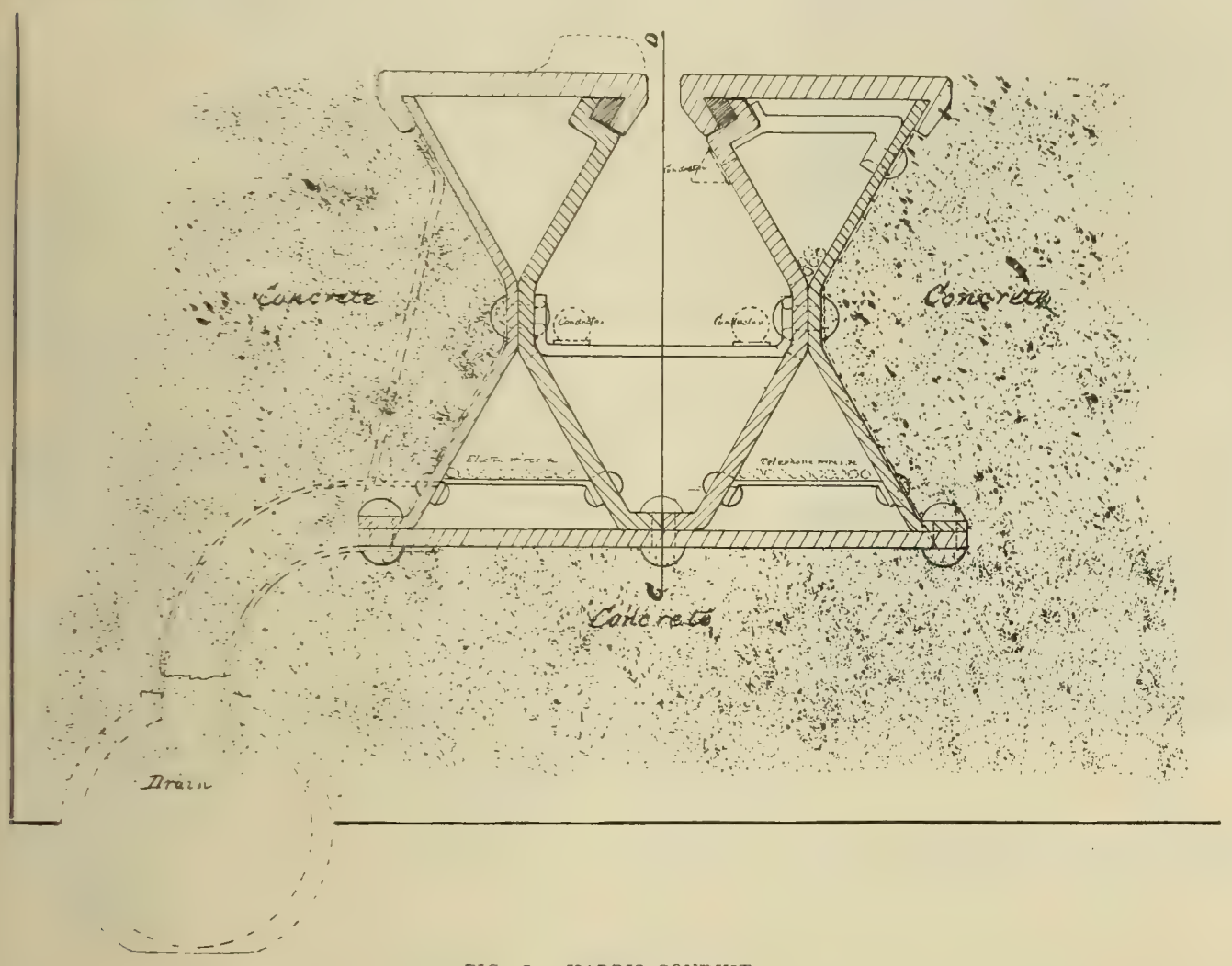


FIG. 1.—HARRIS CONDUIT.

There are no spikes to be loosened by travel, wear and tear, etc., while any rail can be removed or replaced in a crowded thoroughfare with little detention to traffic.

The main central chamber may be used for the pulleys and cable of a cable railway, or for several conductors for electric motors (resulting in underground trolleys), thus enabling several sets of motors, operated by separate currents, to be used according to the varying business; two or three of the other chambers may be utilized as subways for telegraph, telephone, electric-light, etc., wires, or for pneumatic tubes, etc., to all of which there is ready access without disturbing the street paving, by simply drawing the wedge-keys of one cover or length of rail and lifting it independently of all else and using the hand-holes formed in the inclined walls of the central chamber, as also the spaces between the metal sections.

Fig. 1 is a view of the top of the conduit as it is exposed between the rails. It is formed of alternate sections of metal and stone or any suitable non-magnetic insulating substance. The ends of each section rest on and are screwed to an iron support extending across and countersunk into the sides of the conduit. This support is corrugated to facilitate making a durable water-tight joint. The sides of the conduit are banked up with asphaltum and a plank as shown in Fig. 3.

Fig. 2 is an open side view of the conduit illustrating the circuit-closing device, also the arrangement of the trolleys and the electromagnets which operate the armatures in the conduit in such a manner as to expose the current in a metal section of the conduit top just before the trolley rolls onto it. The armature in the conduit is made of wood covered on the upper side with thin iron, and resting near its centre on a hinge that is made fast to the bottom of the conduit. To this hinge the feed wire is fastened and the current is directed to the long end of the armature by means of a strip of copper that is fastened to its lower side and connected to the hinge. To the copper strip is fastened a tip that reaches out beyond the long end of the armature to make a sliding contact on the spring that is screwed fast to the under side of the metal sections. This tip is made separate so that it can be renewed at a small cost in case it becomes worn too much to reach the spring. The trolleys are so arranged that one of them is on a metal section at all times and they will reverse automatically; they are also reversed or lifted from the track by a cord connected to an arrangement similar to a brake-rod. Fig. 4 illustrates the construction of the springs that hold the trolleys in contact with the conduit.



FIG 1.—UNDERGROUND TROLLEY.

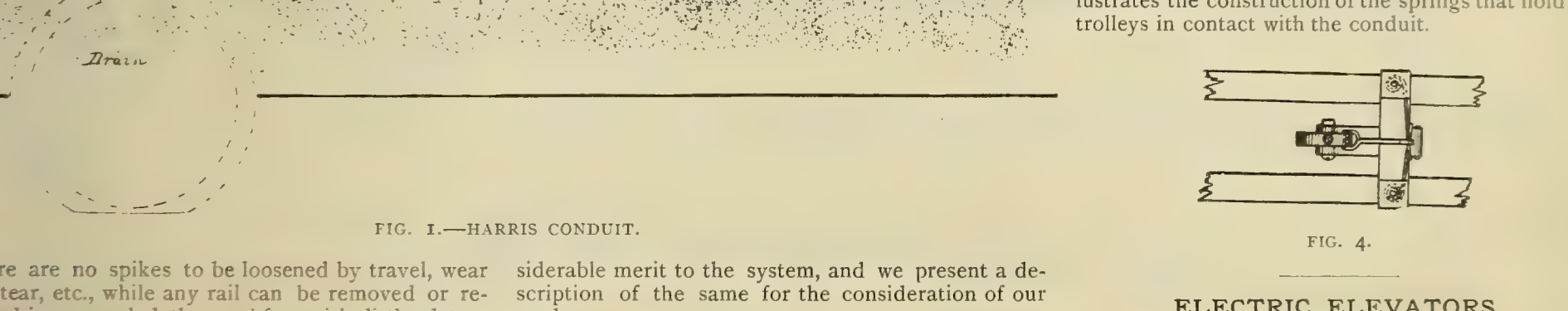


FIG. 2.—UNDERGROUND TROLLEY.

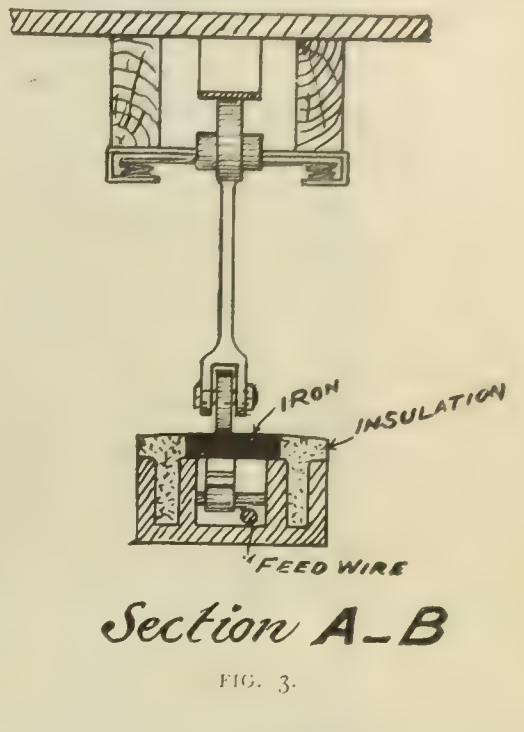


FIG. 3.

FIG. 4.

ELECTRIC ELEVATORS.

The first elevator to be operated upon the new principle invented by Mr. H. Ward Leonard was tested on Thursday, the 6th inst., and the result was an unqualified success in every particular. The elevator is that in the central station of the Edison Electric Illuminating Co., of Brooklyn. The operation of the elevator is controlled entirely by the movement of a handle in the elevator car, and the operation of the elevator is under the most perfect control. The smoothness of the motion of the elevator, both in increasing and decreasing the speed and in reversing the direction of motion, is extremely surprising to those who have been used to the peculiar sinking sensation experienced in the modern high-speed elevator.

* Will Bates, Minneapolis, Minn.

A NOVEL CAR.

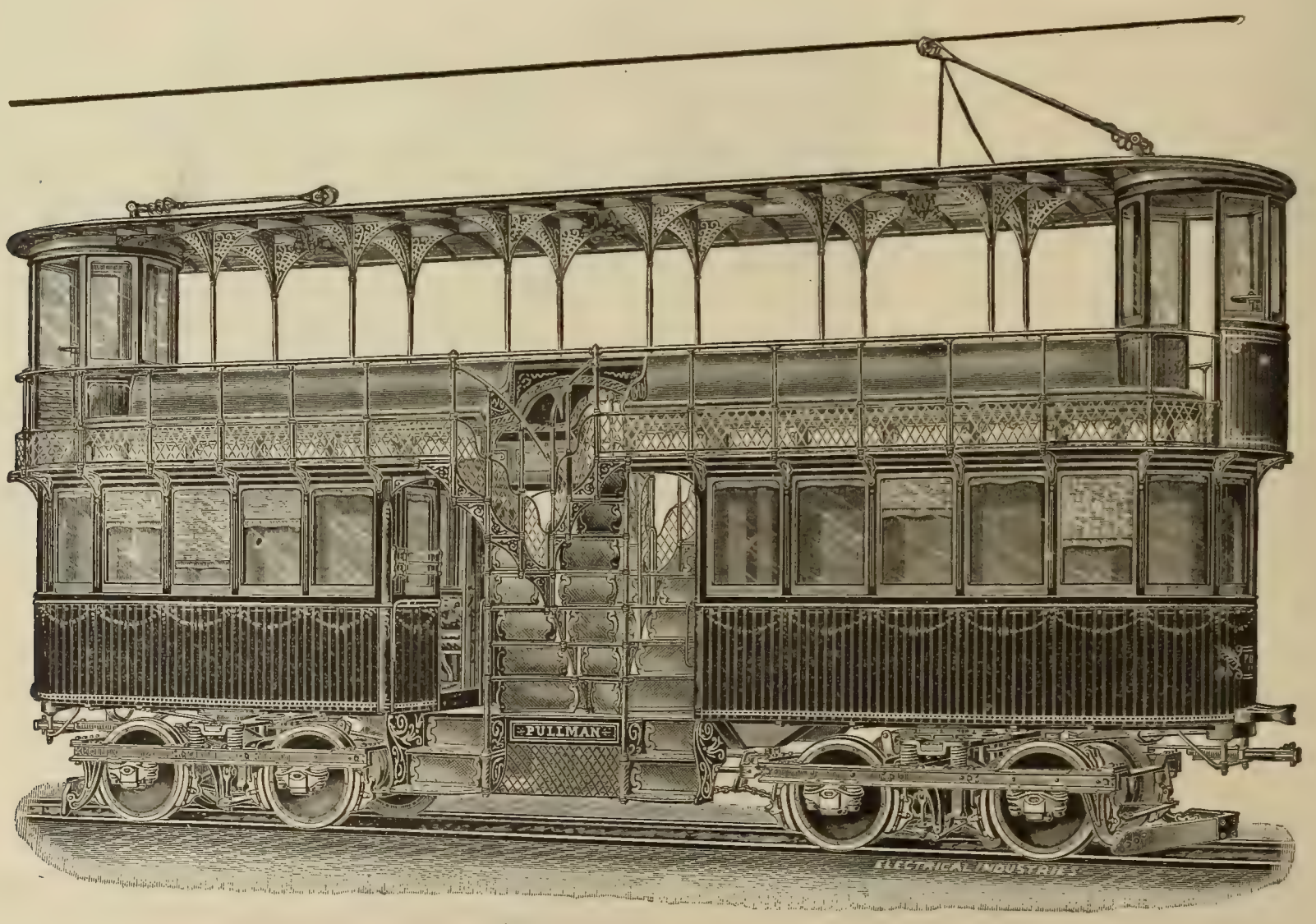
Upon invitation of Mr. Pullman, quite a number of gentlemen, including Mr. Pullman and Messrs. Charles L. and A. B. Pullman, Marshall Field, George H. Wheeler and others, with several members of the press, including a representative of STREET RAILWAY NEWS, met at the Van Buren Street Station of the Illinois Central Railway about two o'clock on Thursday last, and went out to Pullman on the 2 P.M. regular train for the purpose of inspecting and witnessing the operation of a street car of novel design.

Two brand-new Pullmans were attached to the regular train, and upon arriving at Pullman, an inspection of the car was made.

The car is thirty-two feet (32′) long over the body proper, and its full length is thirty-three feet and seven inches (33′ 7″). The width of the car is seven feet and four inches (7′ 4″) over the body. Its height is fourteen feet nine and one-half inches (14′ 9½″).



INTERIOR VIEW OF CAR.



EXTERIOR VIEW OF CAR.

Forty passengers can be seated in the lower portion of the car, and the upper deck seats forty. If crowded the car can carry one hundred and fifty (150) passengers. The upper seats are so constructed as to be sixteen inches below the central top of the upper deck. The lower part of the car is supplied with spring seats handsomely upholstered

The car is equipped with electric chandeliers, ten incandescent lamps being placed under the canopy, and fifteen such lamps in the lower portion of the car. There is also one double oil-lamp in each compartment. Electric heaters are also set in the car.

The car is operated by two of the Westinghouse single-reduction motors, each of twenty-five (25) horse-power. The two trucks are of special design, arranged with double-brake attachments, also with a friction-brake on each truck. This places the car under the easy control of the motor-man. The trucks have the Allen Steel Tired car-wheels. The construction of the car places its load directly over the trucks.

The stairways on either side leading to the upper deck are four in number, of special and unique design. They are combined into two at the bottom, but separate toward the top, leading to either end of the car.

The car body is arranged for passengers to enter at the centre on either side, where spiral stairways lead directly to the upper deck from within. The entrances at the centre occupy no more space than the end platforms on ordinary street cars, the length of the central platform being only eight feet. The car-body proper (lower part) consists of two compartments, each twelve feet long with circular ends. The seats are carried around the end as well as the sides, thereby increasing materially the seating capacity. There is a pilot-house in each end of the upper part of the car for the use of the motor-man and for the brake arrangements. The upper deck is entirely covered with a canopy, which is attached to the pilot-houses and supported from the car-body by stanchion pipes, to which it is attached by means of ornamental bronze brackets. The centre platform joining the two ends of the car-body is very strongly built, ample provision being made for the maximum load the car will have to carry. The car is finished in mahogany, handsomely decorated, and painted a very beautiful carmine The canopy and pilot-houses are so made as to be easily detached from the car-body. There are electric bells for stopping the car. Mirrors and decorated glass are used in the lower part, and the pilot-houses are largely of glass.

No convenience known to the art of street-car construction has been omitted, and much special work is embodied in the car.

This car is capable of carrying more than twice as many passengers as the ordinary street car of the same length, hence a road may be operated with half the usual number of cars and half the ordinary number of employés.

While the cost of this car will exceed by about thirty per cent. that of a car of the same length without the upper seats, this is more than offset by the largely-increased seating capacity, which makes the comparative cost per seat very much less.

The lower portion of the car with its novel features, its side entrance and circular end (which latter considerably increases the seating capacity), together with the elevated cab for a motor-man or grip-man, the invention by Mr. Chas. L. Pullman.

The entirety of the members of the party appeared to be very much pleased with the car, which latter is undoubtedly one of the handsomest specimens of car architecture which we have seen for some time.

The party returned to Chicago in the two special Pullman cars, in which a very delicious lunch had been spread for their entertainment.

SHALL STREET RAILWAY SECURITIES BE LISTED?

In order to get a general opinion as to the advisability of having Street Railway securities listed on the N. Y. Stock Exchange, the following questions were put to a number of well-known brokers, and we publish a few of the replies received so far:

"First. Is the public sufficiently educated on the subject to make it desirable to list the Street Railway securities of the country on the New York Stock Exchange?

"Second: In your opinion would sufficiently profitable business result, or would you advise waiting for some more propitious time, and why?

"Third. Would you advise a trust for all electric and other Street Railway bonds and stocks as an intermediary, or that each company list its own?

Do you think there is a demand for such securities so listed? If not, why not?

What would be the probable effect on other securities if a large number of the surface railway securities were duly listed?"

A. J. Weil & Co., N. Y. City.

E. V. Cavell, Esq., General Manager "Street Railway News":

"Dear Sir: Replying to your favor 28th ult., we have not the time to answer your questions as fully as the subject requires, but will state that our answers to your questions are:

"Your first question, No.

"Second question: It had better be deferred indefinitely for the reason that the securities will always command a better price in the local market where they are known, and the Managers are known, than they will in this market, where people have not the time or inclination to investigate the security and the character of the management (which is very important).

"Securities of this class command a better price in the local markets than securities paying the same rate of interest do here on the Exchange. Chicago, St. Louis, Cincinnati, are illustrations of this fact. By referring to local quotations for Street R. R. bonds in either of the places named you will find that 5% Street Railroad bonds bring better prices than a great many 5% R. R. and other bonds bring on the New York Stock Exchange. People like to make investments in property that they can see every day and that is managed by people they know.

"Third: No. A trust would not be desirable, for there is great prejudice against that sort of a combination, and it would be injurious to the interests of the first-class properties to be joined with the many enterprises that have been floated merely to make the money that is to be had by excessive bonding and capitalization that has been done to a great extent in the past two years.

"We don't notice any demand for such securities so listed; for instance, the Denver City Cable Company bonds were listed on New York Exchange about a year ago, and transactions on them are not made once in thirty days.

"Don't think the listing of this class of securities would affect other securities at all. If Street Railroad securities have merit, and are well managed, there is always a good demand for them in the home market. If the city or town is so small that there is no demand at home for the securities, it is a pretty safe proposition to bet on, that they don't pay.

"Small places of 10,000 or 20,000 people don't pay to run Street Railroads. Another thing wants to be borne in mind—that is, if the securities of a Street Railroad are all, or the majority of them, owned abroad, the Managers find it hard sledding to get any favors from the municipal authorities, and are always liable to meet with competition."

Haskins & Co., 80 Broadway, N. Y. City.

"In our opinion, the public is sufficiently educated on the subject to make the listing of Street Railway securities desirable. We do not advise waiting for some more propitious time as in our opinion sufficient profitable business would result from immediate action.

"Regarding a trust, we are opposed to it, and believe that each company should list its own securities. The listing of such securities will assuredly create a demand for them, but we do not think that the listing of the surface railways would have any appreciable effect on other securities now listed."

Dwight, Braman & Co., New York and Boston.

"We think the public is sufficiently educated to have the street railway securities listed on the New York Stock Exchange, also that sufficient business would accrue, and the present time is favorable for listing.

"Each company should list its own. There is always demand for good investments. It would be hard to say what effect it would have on other securities. The country is so large there seems to be room for all."

Clark, Ward & Co., New York and Boston.

"We believe it *is* desirable to list Street Railway securities on the New York Stock Exchange, as the general high character of this form of investment should have as good a market as Railway shares.

"Second, we believe that now is the time, as so much money will seek investment during the next two years that this class of security should be kept before people.

"Third, we do not favor a trust, and believe it much better that each company should list its own securities and furnish regular monthly reports as to its earnings. operating, expenses, etc. With that done, we believe that Street Railway securities would soon become active and popular on the Exchange and always find a good market."

La Montagne, Clark & Co., N. Y. City.

"Replying to your favor Sept. 28th, we beg to say:

"First, we do not think it is a question of the education of the public at all. We do think it desirable that the securities of all good Street Railway Companies should be listed on the New York Stock Exchange.

"The great objections to dealings in such securities at present is that their value is only determined by the local demand for them, the majority of investors and speculators being averse to dealing in any securities that have not got a ready market and a quotable value.

"Second, we doubt if there would be any large speculation in the securities of the various companies, as only activity in the general market and a knowledge of the securities themselves would bring trading.

"We consider the present time the best in many years past, as we believe we are on the eve of a great speculative wave.

"Third, we would not advise a trust; on the contrary, would strongly advise against it.

"The trust stocks are unpopular at the moment, and their value affected by the lack of knowledge of their inside condition and actual earnings. To hold their position and to reach anything like their real value, it is necessary that the companies listing securities should publish full and complete statements of their earnings and general condition, and any doubt as to the fairness with which the public are informed of the actual condition of a company is sure to be followed by a loss in value of its securities.

"The prices of the various Vanderbilt issues is an illustration of this, the high prices of their stocks being due entirely to the faith the public have in the fairness of the management of the companies."

T. G. Corwin, of the U. S. Finance Co., Mills Bldg., N. Y.

"I am of the opinion that the public is sufficiently educated with regard to the listing of Street Railway securities to make it desirable, and that the best time to commence their listing will be when the bond market picks up a little, as it must do in the near future. But with regard to the formation of a trust, I do not think it would do, except for special systems in one and the same locality, on account of the unpopularity of trusts in general. Not only that, but the confusion would be too great.

"I do think, however, that there is a demand for such securities if properly listed and attended to as is usual in bond dealings.

"The probable effect on other securities of the listing of those pertaining to Street Railways would be that funds would come in from non-paying investments to paying Street Railway bonds."

The General Manager of a very well-known firm of brokers says:

"In our opinion, listing Street Railway securities would bring them to the public notice and thus improve their market and enhance their prices.

"No trusts; let each separate company list its securities.

"At present, there being little or no market for investments, Street Railway securities would not receive much attention; but their turn will come in time, and the fact of their having passed the Stock Exchange Committee would be a point in their favor with investors.

"If a sufficient number were listed, it would decrease markets for other securities and lower their prices, but it is not possible any such amount would be listed."

EXHIBITORS AT PITTSBURG.

AMERICAN INJECTOR COMPANY,
of Detroit, advises us that it will not be represented at the convention.

BALL ENGINE COMPANY,
of Erie, Pa., will be represented at the convention by its Pittsburg agents, Messrs. Dravo & Black, who have their offices in the Lewis Block there, but will hold their headquarters on the boat and will distribute photographs, etc.

BODFIELD BELTING COMPANY,
of Cleveland, will exhibit its leather belting on the boat, and will be represented by its secretary, J. F. Sweeton.

BOWERS MANUFACTURING COMPANY,
of Newark, N. J., write us that it is very doubtful that they will be represented at the convention, and if they are they will hold no exhibit.

CARLTON & KISSAM,
of Boston, will probably exhibit four different kinds of advertising racks, with cards explanatory, and will also distribute a number of books on street-car advertising. They have good space at the Monongahela House, but their real headquarters will be in the Eisner Building, at the corner of Fifth avenue and Wood street. Mr. George Kissam will be present.

DAYTON MANUFACTURING COMPANY,
of Dayton, Ohio, will have Messrs. J. & P. Leitenger present, but will make no exhibit.

DUPLEX STREET RAILWAY TRACK COMPANY,
of New York, will be represented by its General Manager, John D. Elwell, and will exhibit sections of track, frogs and rails, chairs and other parts or the track.

EKLEKTIK EQUIPMENT COMPANY,
of Pittsburg, will be represented there by its General Manager, S. J Macfarran, and while it will not exhibit there, will have at its office a number of devices for Electric Railways of deep interest to those connected with that industry.

ELECTRIC MERCHANDISE COMPANY,
of Chicago, will have an exhibit in Parlor 5 of the hotel, immediately adjoining the headquarters of Street Railway News, and will be represented by its General Manager, Mr. W. R. Mason, and other gentlemen connected with that most enterprising and successful company.

In addition to this exhibit it will also show the Burton Electric Heaters in operation, and Dr. W. Leigh Burton, the inventor of the heaters, will be present.

ENGINEERING EQUIPMENT COMPANY,
of New York, will exhibit the Boston trolley; Anderson line materials, Habirshaw wire, Etna arc lamp insulator, on the boat, and will also have an exhibit at the Monongahela House. The company will be represented by Messrs. Perrine and Crane.

EQUITABLE ENGINEERING & CONSTRUCTION COMPANY,
of Philadelphia, will be represented at the convention by Messrs. W. A. Stadelman and S. A. Hand, and will exhibit a number of appliances on the boat.

EUREKA TEMPERED COPPER COMPANY,
of North East, Pa., will not be represented at the convention.

GOULD & WATSON COMPANY,
of Boston and Chicago, will be represented by Mr. C. Tennant Lee, of Boston, and Judge R. B. Pierpont, of Chicago, and will exhibit some of its well-known insulators for electric roads, mica for insulating purposes, moulded mica water-proof keyless sockets, rosettes and cut-outs.

INTERIOR CONDUIT & INSULATION COMPANY
will exhibit specimens of underground conduits and man-holes. Messrs. E. H. Johnson, President, and Mr. E. T. Greenfield, Electrician, will be present.

LAMOKIN CAR WORKS,
of Philadelphia, will have its Superintendent, Mr. Henry Cochran, present, and will exhibit its patent reversible ratchet sign for denoting the route of car, also its patent open car-seat panels. Its headquarters will be at the Monongahela House, and will adjoin those of the Griffin Car Wheel Works.

LA ROCHE ELECTRIC WORKS,
of Philadelphia, will make no exhibit, but its General Manager, Mr. F. A. La Roche, will be present.

LIEB MACHINE WORKS,
of New York, will establish its headquarters at the Monongahela House, but will exhibit its electric line appliances and trolleys on the boat; it will be represented by Messrs. Charles A. Lieb and H. H. Harrison.

MASSACHUSETTS ELECTRICAL ENGINEERING COMPANY,
of Boston, will probably not be represented at the convention, but should it do so will exhibit some of its fuse wire and links.

NEW PROCESS RAW HIDE COMPANY,
of Syracuse, will be represented by President T. W. Meachem and Secretary A. C. Vosburg, and will have an exhibit on the boat consisting of its New Process Raw Hide pinions for the different electric-railway systems. This company has about completed extensive additions to its plant which will increase its capacity threefold.

NEW YORK CAR WHEEL WORKS
will be represented by its General Agent, Mr. Joseph R. Ellicott, who will have an exhibit on the boat consisting of "Machined" wheels for horse, cable, electric, mining and dump cars. The headquarters of the company will be at the Monongahela House.

NORTHERN CAR COMPANY,
of Minneapolis, will make no exhibit, neither will it have a representative present.

PULLMAN PALACE CAR COMPANY
advises us that it will send one if not two representatives to the convention, but in spite of working day and night it fears that it may be impossible for it to have its exhibit ready in time.

MESSRS. REED & McKIBBIN,
the well-known electrical engineers and railroad contractors, of New York, will be represented by Mr. Frank H. Reed and George N. McKibbin.

RICHARD VOSE CAR SPRING COMPANY,
of New York, will have three representatives present: John A. Guibert, Gus Suckow and A. W. Slee.

ROBINSON ELECTRIC TRUCK & SUPPLY COMPANY,
of Boston, will have an exhibit on the street consisting of Robinson Electric Radial car equipment, etc. Mr. Wm. Robinson, its General Manager, will be present, and its headquarters will be in the Monongahela House, where friends and railroad men will receive a hearty welcome.

ROBINSON MACHINE COMPANY,
of Bellewood, Pa., will have an exhibit (on the boat) of its new all-steel truck for electric street railways, the merits of which will probably be set forth by Albert E. Hay and Mr. Winfield Paugh.

SHORT ELECTRIC COMPANY,
of Cleveland, Ohio, will have an exhibit on the boat and also in Parlor 10 at the Monongahela House; it will show a full line of its motors, dynamos and appliances, and (if none of them get away) will be represented by the following-named gentlemen, to wit: S. H. Short, President; E. E. Higgins, General Manager; J. H. Gibson, Superintendent; F. A. Rogers, C. C. Curtiss, Wm. Hazelton, J. E. Ridall, M. K. Bowen, F. A. Willson, R. C. Garhart, W. S. Atchison, J. Potter and F. F. Downes. The company will have a car equipped with its gearless motor in daily operation on the line of the Pittsburg & Birmingham Traction Company.

STANDARD UNDERGROUND CABLE COMPANY,
of Pittsburg, will be represented by J. W. Marsh, G. L. Wiley and F. E. Degenhardt, and will have an exhibit both on the boat and in the Monongahela House, and among other things will show a very fine sample-case, which has been at a number of prominent expositions, and the entire exhibit which the company had at the exhibition of the National Electric Light Association, at Montreal, including electric cables of all kinds, insulated wire of all kinds, and especially our well-known Standard feeder-wires for electric railways, with interesting accessories, tools and devices.

STAR HEADLIGHT COMPANY,
of Rochester, will be represented by its President, Mr. E. C. Glazier. Its headquarters will be at No. 947 Liberty avenue, and some of its specialties, viz., electric headlight, kerosene headlight, etc., will be exhibited by the Electrical Supply & Construction Company.

STEAM GAUGE & LANTERN COMPANY,
of Syracuse, will be represented by its Mr. Sawyer and will have headquarters at the Seventh Avenue Hotel. Its exhibit will consist of some street-car headlights.

VACUUM OIL COMPANY,
of Rochester, advises us that it will be represented by its Mr. E. A. Record.

VAN NUIS, C. S.,
of New York, "will be there," and will hold "a little sideshow" of switches. ('Nuf sed.)

WALWORTH MANUFACTURING COMPANY,
of Boston, will have an exhibit consisting of electric railway poles and brackets, feed-arms, automatic pole tops, etc., which can be seen in the warehouse of the Pennsylvania Tube Works, on First street, opposite the Monongahela House. The interests of the company will be looked after by Col. Levi R. Green and George T. Coppins, Secretary.

WHITE, J. G., & COMPANY,
of New York, will be represented by President J. G. White.

WIGHTMAN ELECTRIC MANUFACTURING COMPANY
will have an exhibit on the boat consisting of the motor truck equipped with two 20-H. P. Wightman motors, which truck will be raised from the floor and the motors operated as if in actual service. It will also exhibit its single-reduction motors and controllers, trolleys, insulators and other articles pertaining to electric rai ways, and will also have a car equipment in operation on the Second Avenue road.

WOODBRIDGE & TURNER ENGINEERING COMPANY
will have its headquarters at the Monongahela House, and will be represented by Messrs. W. S. Turner and J. L. Woodbridge.

WOODMAN, JOEL H.,
the well-known manufacturer of car ceilings and seatings, will attend the convention in person, but will hold no exhibit.

PITTSBURG, OCTOBER 21, 1891.



The following gentlemen, representing members of the Association, have signified their intention of being present at the meeting:

Attleboro, Mass. George W. Mansfield, Director, Attleboro, No. A. & W. St. Ry. Co.

Brockton, Mass. Allston Burr, Brockton Street Ry. Co.

Brooklyn, N. Y. John G. Jenkins, Director, Broadway R. R. Co.

Buffalo, N. Y. Henry M. Watson, Pres., and H. H. Littell, Vice-Pres. and Gen'l Man'r, Buffalo Railway Co.

Baltimore, Md. Wm. A. House, Jr., General Manager, Baltimore Traction Co.
Nelson Perin, President, and Leon Fender, Secretary, Baltimore Union Pass. Ry. Co.

Birmingham, Conn. H. Horton Wood, President, and B. W. Porter, Supt., Derby Street Railway Co.

Brooklyn, N. Y. Wm. Richardson, Pres., Wm. J. Richardson, Sec., and John G. Jenkins, Director, Atlantic Ave. R. R. Co.
D. F. Lewis, Pres., A. W. Dickie, Supt., or David Parker, Foreman Cars and Buildings, and M. G. Starrett, Elec. Eng., Brooklyn City Railroad Co.
John N. Partridge, Pres., and John L. Heins, Supt., Brooklyn City and Newtown R. R. Co.

Boston, Mass., F. S. Pearson, Chief Engineer Elec. Dept., and Louis Pfingst, Master Mechanic, West End St. Ry. Co.

Brooklyn, N. Y., J. C. Cameron, Gen'l. Supt., Brooklyn City R. R. Co.

Canton, O. Wm. W. A. Lynch, Pres., and A. G. Davids, Supt., Canton St. Ry. Co.

Chicago, Ill. T. C. Penington, Treas., Chicago City Railway Co.
Charles F. Nagel, Supt., West Chicago Street R. R. Co.

Cincinnati, O. H. H. Littell, Pres., and H. M. Littell, Gen'l Man'r, Cincinnati Inclined Plane Ry. Co.
John Harris, Supt., and George Bullock, Director, Cincinnati St. Ry. Co.

Covington, Ky. George Bullock, Vice-President, and T. M. Jenkins, Supt., So. Covington & Cincinnati St. Ry. Co.

Cleveland, O. A. Everett, Pres., Chas. W. Wason, Vice-Pres., H. A. Everett, Sec. and Treas., and Edwin Duty, Supt., East Cleveland R. R. Co.
J. B. Hanna, Sec., Woodland Ave. and West Side St. R. R. Co.

Des Moines, Iowa. J. S. Polk, Pres., G. B. Hippee, Sec., Des Moines St. R. R.

Detroit, Mich. James H. Vhay, Pres., S. Schloss, Vice-Pres., N. W. Goodwin, Sec., and E. S. Heineman, Treas., Ft. Wayne & Elmwood Ry. Co.

Dover, N. H. Wm. D. Sawyer, Pres., Henry W. Burgett, Vice-Pres. and Treas., Union Street R. R. Co.

Easton, Pa. Henry A. Sage, Pres., Easton, S. E. & W. E. Pass. Ry. Co.

Erie, Pa. John C. Brady, Vice-Pres., and J. F. Pfetch, Gen'l Man'r, Erie Electric Motor Co.

Findlay, O. George B. Kerper, Pres., and Charles Smith, Supt., Findlay St. Ry. Co.

Grand Rapids, Mich. James R. Chapman, Vice-Pres., Consolidated St. Ry. Co.

Hamilton, Ont. B. E. Charlton, Pres., and T. B. Griffith, Sec., Hamilton St. Ry. Co.

Hartford, Conn. E. S. Goodrich, Pres., Hartford & W. Horse R. R. Co.

Houston, Texas. H. F. MacGregor, Gen'l Man'r, Houston city St. Ry. Co.

Indianapolis, Ind., W. S. Jewell, Supt. Elec. Dept. Citizens' St. R. R. Co.

Lexington, Ky. C. H. Stoll, Pres., W. J. Loughridge, Vice-Pres., R. H. Smith, Supt., Passenger and Belt Ry. Co.

London, Canada. V. Cronyn, Pres., and Thos. H. Smallman, Director, London St. Ry. Co.

Long Island City, N. Y. Walter C. Foster, Vice-Pres., Steinway & Hunter's Point R. R. Co.

Louisville, Ky. J. B. Speed, Pres., and T. J. Minary, Gen'l Man'r, Louisville Ry. Co.

Little Rock, Ark. H. P. Bradford, Gen. Man. Capital City St. Ry. Co.

Manchester, N. H. Charles Williams, Pres., Chas. H. Bartlett, Treas., and N. H. Walker, Supt., Manchester St. Ry. Co.

Milwaukee, Wis. Henry C. Payne, Vice-Pres., Geo. S. Jones, Director, Milwaukee St. Ry. Co.

Newark, N. J. Thomas C. Barr, Pres., John N. Akarman, Supt., and C. J. Field, Elec. Eng., Newark Pass. Ry. Co.

Newburyport, Mass. Charles Odell, Pres., Thomas H. Johnson and B. W. Russell, Directors, Newburyport & Amesbury Horse R. R. Co.

New York, N. Y. C. Densmore Wyman, Vice-Pres., C. P., N. & E. R. R. R. Co.
L. H. McIntire, Eng. and Man'r, Harlem Bridge, M. & F. Ry. Co.
William Richardson, Act'g Vice-Pres., D. D., E. B. & B. R. R. Co.
Thos. H. McLean, Sec., Twenty-third St. Ry Co.

Norfolk, Va. James W. McCarrick, Director, and N. G. Miller, Director, Norfolk City Railroad Co.

Omaha, Neb. W. W. Marsh, Treas., W. A. Smith, Gen'l Man'r, and Frank Marsh, Cashier, Omaha St. Ry. Co.

Paterson, N. J. H. Romaine, Vice-Pres. and, T. H. Bakewell, Director, Paterson Ry. Co.

Peoria, Ill. H. R. Woodward, Vice-Pres., Central Railway Co.

Philadelphia, Pa., Horace T. Potts, Pres., Second and Third St. Pass. Ry. Co.

Philadelphia, Pa. Chas. E. Ellis, Pres., and Thos. S. Manning, Director, Citizens' Pass. Ry. Co.
E. J. Moore, Pres., Lombard & South St. Ry. Co.

Philadelphia, Pa. D. C. Golden, Sec. and Treas., People's Pass. Ry. Co.
E. B. Edwards, Pres., Ridge Ave. Pass. Ry. Co.
Chas. D. Matlack, Sec., and Thos. D. Rulon, Supt. Car Dept., Second & Third St. Ry. Co.

Pittsburg, Pa. John G. Holmes, Pres., C. M. Gormly, Sec, and J. E. Rugg, Supt., Citizens' Traction Co.
D. F. Henry, Pres., Wm. H. Graham, Wm. McC. Ramsay, Elec. Supt., and Wm. A. Stone, Solicitor, Federal St. and Pleasant Valley Pass. Ry. Co.
S. J. Macfarren, Sec. and Gen. Man., Schenby Park and Highlands Ry. Co.

Providence, R. I. A. T. Potter, Gen'l Man. Union R. R. Co.

Rochester, N. Y. C. K. Minary, Gen'l Man'r, H.

San Antonio, Texas. W. H. Weiss, Pres., San Antonio St. Ry. Co.
Sellers McKee, Ch'n Ex. Committee, and Murray A. Verner, Director, Rochester Ry. Co.

Savannah, Ga. J. H. Johnston, Pres., George Parsons, Director, and Harry Parsons, Engineer, City and Suburban Ry. Co.

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Taunton, Mass. George C. Morse, Supt., Taunton St. Ry. Co.
Toledo, O. Albion E. Lang, Vice-Pres. and Fred. H. Lincoln, Elec. Eng'r, Toledo Consolidated St. Ry. Co.
Topeka, Kan. Chas. S. Gleed, Pres., and Elmer H. Littlefield, Supt., Topeka City Ry. Co.
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Washington, D. C. Wm. J. Stephenson, Pres., and R. F. Baker, Treas., Columbia Railway Co.
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Worcester, Mass. Chas. B. Pratt, Pres., and H. S. Seeley, Treas., Worcester Consolidated St. R. R. Co.
York, Pa. Wm. H. Lanius, Pres., D. K. Trimmer and Frank Geise, Directors, York St. Ry. Co.

ADDITIONAL DELEGATES OF MEMBERS.

Brooklyn, N. Y., David W. Binns, Director, Atlantic Avenue R. R. Co.
Camden, N. J., Wm. S. Scull, Pres., G. Genge Browning, Treas., and Samuel J. Fenner, Supt., Camden Horse Railroad Co.
Orange, N. J., Francis M. Eppley, Pres., Orange Cross-Town and B. Ry. Co.
Raleigh, N. C., John C. George, Pres., Raleigh St. Ry. Co.
St. Louis, Mo., John Mahony, Vice-Pres., People's Railway Co.

The following is a list of gentlemen who have stated their intention to be present from companies not members of the Association. Many of these, however, will undoubtedly join the Association:

Ann Arbor, Mich. Hudson T. Morton, Sec., Ann Arbor St. Ry. Co.
Ashland Ky. A. C. Campbell, Pres., and S. P. Hager, Supt., Ashland & Catlettsburg St. Ry. Co.
Augusta, Ga. George E. Macomber, Treas., Augusta, H. & G. R. R. Co.
Aurora, Ill. D. A. Belden, Sec. and Treas., Aurora St. Ry. Co.
Bloomington, Ill. W. H. Patterson, Sec. and Treas., Bloomington City Ry. Co.
Boston, Mass. Washington G. Benedict, Pres., and B. F. Peacch, Director, Boston and Revere Electric St. Ry. Co.
Charleston, West Va. George Davis, Gen. Man'r, Charleston St. Ry. Co.
Chicago, Ill. David J. Kennedy, Pres., and P. H. Quaid, Supt., Cicero & Proviso St. Ry. Co.
Fort Wayne, Ind. L. D. McNutt, Supt., Fort Wayne St. R. R. Co.
Lynn, Mass. A. Martin, Treas., Lynn Belt Line St. Ry. Co.
Mansfield, O. Clark Rude, Pres., and Reid Carpenter, Treas., Citizens' Electric Ry. Co.
Maysville, Ky. Robert A. Cochran, Jr., Sec., Maysville St. R. R. Co.
Muncie, Ind. F. G. Brownell, Supt., Muncie St. Ry. Co.
Nashville, Tenn. T. W. K. Wrenne, Pres., United Electric Ry. Co.
New Brunswick, N. J. W. B. Price, Sec. and Treas., New Brunswick City Ry. Co.
Newport, R. I. F. E. Johnson, Supt., Newport St. Ry. Co.
Newark, Ohio. C. A. Lark, Supt., Newark City Ry. Co.
Petersburg, Va., George Beadle, Propr., Petersburg Street Railway.
Piqua, Ohio. F. C. Davies, Sec., Piqua St. Ry. Co.
Racine, Wis. C. H. Holmes, Pres., Belle City Ry. Co.
Salem, Ohio. Wm. H. Whildey, Man'r, Salem Electric Ry. Co.
Steubenville, Ohio. J. F. Flood, Supt., Steubenville St. Ry. Co.
Syracuse, N. Y. A. Bartlett, Supt., Consolidated St. Ry. Co.
Waterbury, Conn. E. A. Bradley, Supt., and J. R. Smith, Director, Waterbury Horse R. R. Co.
Waterloo, Ont. Thomas M. Burt, Pres., Berlin and Waterloo St. Ry.
Williamsport, Pa., H. R. Rhoads, Pres., and Wm. Haines, Supt., Williamsport Passenger Ry. Co.

The Week's Record of Street-Railway Notes.

ALABAMA.

BIRMINGHAM.—A successful trial trip was made on the electric line, October 10.

COLORADO.

DENVER.—It is reported that the Lawrence street electric line proposes to take up its single track on Fortieth street from Franklin to William streets, and construct a double track on Thirty-eighth street, between the same streets.

CALIFORNIA.

LOS ANGELES.—The Pacific Rolling Mill Company expects to have its electric road completed by January 1.

The Los Angeles Consolidated Electric Railway Company is running cars to Vernon, a distance of about three miles.

SAN FRANCISCO.—The North Beach Mission Railway Company is to convert its horse-car line into an electric road.

GEORGIA.

ROME.—The different street railway companies have been granted permission to raise their tracks.

ILLINOIS.

CHICAGO.—It is reported that the mayor would neither veto nor sign the ordinance granting the West North avenue street railway's extension, wishing it to become a law without his signature.

On October 8, the West Chicago Street Railway Company filed its acceptance of the North avenue extension ordinance with a $10,000 bond, which has been approved by the mayor.

MARYLAND.

BALTIMORE.—The Baltimore City Passenger Railway Company has purchased several lots on South Eutaw street, on which it will erect a power house.

On October 10 the police had to quell a disturbance between the employés of the Baltimore Union Passenger Railway Company and those of the Baltimore, Hampden and Lake Roland Railway Company, who were trying to clear the streets of the Union Company's tracks to make room for its own.

MASSACHUSETTS.

BEVERLEY.—The Selectmen have refused to grant the petition of the Naumkeag Street Railway Company for permission to extend its trolley system to this place.

BOSTON.—The Street Railway Commissioners recently sent a circular to different street railway companies of the United States and Europe, asking if they paid any compensation or premium for their franchises, and if they were required to pay any taxes or license other than ordinary on property. The majority of the United States replies are to the effect that no tax is paid and in a small minority of cases a license fee charged for each car run. The commissioners are now awaiting answers to their foreign letters.

CAMBRIDGE.—A fire in the offices of the West End Street railway stables, October 9, caused about $5,000 damages.

NATICK.—The electric street railway between this place and South Natick is nearly completed.

SPRINGFIELD.—A successful trial trip on the electric line on Maple street October 9.

WEST NEWTON.—On October 8 a successful series of tests were made of a safety fender for street cars, consisting of a large net with balances hung at an angle in front of and attached to the dash-board of the car, beneath and just over the front wheels of which was a large scoop forming an attachment which lowers automatically as far as the car rails whenever an object fails to fall into the net.

WORCESTER.—The Consolidated Street Railway Company has ordered a number of new cars.

MINNESOTA.

WINONA.—The street railway is being transformed into an electrical system.

MISSOURI.

KANSAS CITY.—On October 9 three masked men entered the offices of the Metropolitan Cable Railway Company and robbed the cashier of $400.

NEW YORK.

BROOKLYN.—The Brooklyn City Railroad Company is having a large stable built at the corner of Flatbush and Lefferts avenues.

It is reported that two men were ejected from an Eighth avenue car, October 11, and assaulted by the conductor, who reported them to headquarters as being drunk and disorderly.

OHIO.

COLUMBUS.—The street-railway tracks on North Third street are being relaid.

The Columbus Consolidated Street Railway Company has placed guard-wires above its trolley wires on West Broad street.

YOUNGSTOWN.—It is reported that the Wood-Elm Street Railway ordinance is void, owing to the trustees of a disputed piece of property along the railroad company's route refusing to give their consent.

PENNSYLVANIA.

PHILADELPHIA.—The J. G. Brill Company, the well-known manufacturer of street cars, contemplates large alterations in its works at Sixty-second street and Woodland avenue. A one-story brick car-house 84 x 90 feet is to be erected, and the present smith-shop will receive an addition of 20 x 35 feet.

PITTSBURG.—A successful trial trip of the new cars of the Duquesne Traction Company October 5.

SCRANTON.—The People's Street Railway Company has received a supply of new cable and feed wire.

SOUTH BETHLEHEM.—A successful trial trip of an electric car was made over Main and Church streets October 2.

WILKESBARRE.—The Wilkesbarre and West Side Railway Company is making an addition to its plant 150 x 332 feet.

WISCONSIN.

MILWAUKEE.—The Milwaukee Street Railway Company is making rapid progress in the construction of its electric street railway.

Legal.

BOSTON, MASS.—The West End Street Railway Company is being sued for $5,000 damages by Elizabeth Hogarty, who was thrown to the ground by the sudden starting of the car on which she was stepping, and seriously injured. The company is also being sued by K. A. Corlin for $3,000 damages for injuries received from the same cause.

BROOKLYN, N. Y.—In a suit by J. H. Ferris against the Brooklyn City Railroad Company, for $5,000 damages for being ejected from one of the company's cars and assaulted by the conductor, the jury gave a verdict for the company. The testimony was very conflicting.

A jury has rendered a verdict that the death of Mary O'Donnell, which was caused by a rapid-transit train, last June, was accidental, and released the company and its employés from all responsibility. The jury recommends the substitution of wire gates for those at present in use at the crossings.

CHICAGO, ILL.—The North Chicago Street Railway Company is being sued for $100,000 damages for the permanent crippling of a hand and minor injuries, by a lady who was thrown to the ground when alighting by the sudden starting of the car.

DULUTH, MINN.—The Duluth Street Railway Company and the Motor Line Improvement Company have been enjoined from constructing a street railway on the property of W. E. Richardson, who also claims $2,000 damages.

DUBUQUE, IA.—In the suit of Evans *vs.* The Dubuque Electric Street Railway, Light and Power Company for $10,000 damages for the worth of the plaintiff's child or its earnings during the period of life expectancy, a verdict of $280 damages was awarded the plaintiff. Another suit is to be brought against the company for the loss of the child to its parents.

LOS ANGELES, CAL.—The Supreme Court has decided that the lower court has a right to fix the compensation which the electric company shall pay for the use of the cable road's tracks in all places where it will have to run over them.

NEW YORK, N. Y.—In the appeal case of the Manhattan Elevated Railroad Company against four property holders along its lines the Court of Appeals has decided in favor of the property holders, Chief Judge Ruger holding that it would be impossible to sustain the company's appeal without unsettling the estab ished law of the State; the lapse of time on an action merely on the part of the plaintiffs is not sufficient to defeat the right of the owners from damages or injuries that are continuous.

SAN FRANCISCO, CAL.—City and County Attorney Durst has decided that the city and county authorities have power to grant a franchise authorizing the use to an extent not exceeding five blocks of the track or portion of the street occupied by the track of the existing company and without such company's consent.

TOLEDO, OHIO.—In the case of the Consolidated Street Railway Company against the Toledo Electric Street Railway Company, enjoining it from stringing trolley wires on the same streets, the court has decided that the Consolidated Company cannot be restrained from putting up its wires so long as they do nor interfere with the wires of the other company.

Possible Purchases.

AUSTIN, TEX.—The Austin Rapid Transit Company (Electric) may require construction material for an extension of its tracks.

FARGO, DAK.—Address the Fargo Gas and Electric Company regarding material required for an electric street railway. (See New Roads.)

LOCKPORT, N. Y.—Contracts for an electric street railway here may possibly be made with O. W. Cutler and John W. Cutler, of Suspension Bridge, this State.

NEW HAVEN, CONN.—Contracts may be closed for an electric street railway between Savin Rock and Woodmont. (See New Roads.)

PITTSBURG, PA.—The Suburban Rapid Transit Company may require material for a track extension.

Franchises.

COUNCIL BLUFFS, IA.—The Council Bluffs Transit Co. has been granted a franchise for a street railway between this place and East Omaha.

ERIE, PA.—On October 8 the Erie Electric Motor Company was granted a franchise to construct and operate a street railway here.

LOS ANGELES, CAL.—On October 5 the City Council granted the Los Angeles Electric Company and the Los Angeles Consolidated Electric Company franchises to construct an electric engine-house and to lay underground conduits to furnish electric current for light and street-railway purposes.

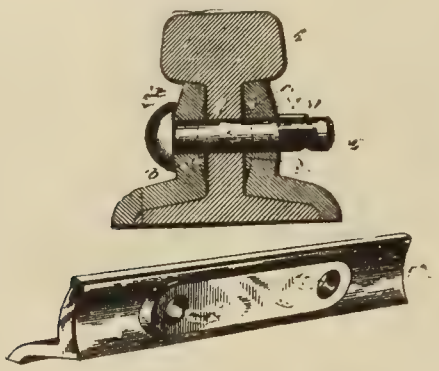
STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued October 13, 1891.

460,942. Trolley-Catcher for Electric Cars. William L. Browne, Boston, Mass., assignor of one-half to George E. Costello, same place. Filed June 26, 1891.

460,967. Track-Rail for Electric Street-Railways. John T. Hill and Bernard Meiring, Cleveland, Ohio. Filed Dec. 29, 1890.

A track-rail having a base, head, and connecting-web, the head having an inwardly-projecting flange on one edge, in combination with a removable tread provided with an upwardly-turned ledge, bolts adapted to engage the ledge and



461,088r—RAIL-JOINT.

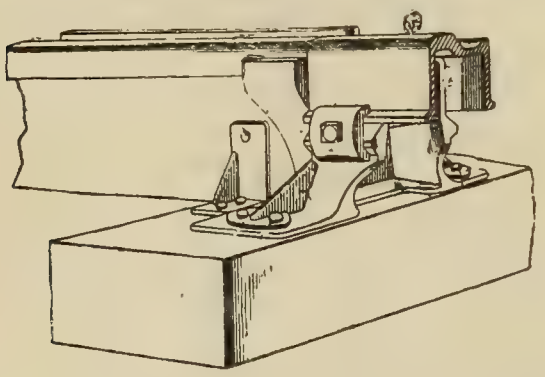
head of the rail at points approximately opposite each other, and means for holding the bolts in place.

461,057. Electric Railway. Barton R. Shover and William C. Dickson, Indianapolis, Ind. Filed Feb. 25, 1891.

In an electric railway, the combination, with the railway proper, of a bar of paramagnetic material, as iron, arranged longitudinally along the roadway between the rails and having in its upper exposed surfaces two or more grooves adapted to receive the line working electric conductor, and the line working electric conductor arranged in the grooves and forming one or more coils surrounding a portion of the bar between the grooves.

461,088. Rail-Joint. John M. Wiley, Bonham, Tex. Filed June 5, 1891.

Concaved fish-plates provided with vertical bearing-surfaces upon their inner faces, the rubber washers interposed



461,090.—TRACK FOR STREET RAILWAY.

between the bearing-surfaces and the web of the rail, the bolt, and the split key passed through a slot in the bolt and turned around the bolt.

461,090. Track for Street-Railways. William C. Wood, Brooklyn, N. Y., assignor to The Lewis & Fowler Girder-Rail Company, same place. Filed April 2, 1891.

The combination, with the adjoining ends of a flat rail and a girder-rail, the latter having laterally-projecting flanges at bottom, and with a pair of flanged clamps and a clamping-bolt, of a compromise-chair having at one end a seat fitted to the bottom of the flat rail and upwardly-projecting lugs at its respective sides and at the other end a suitable seat for the girder rail, lateral projections below its flanges to co-act with the clamps, and transverse bolt-holes to receive the clamping-bolt.

461,151. Car-Axle Lubricator. Augustus P. Mitchell, St. Paul, Minn., assignor of one-half to James E. McElroy and Richard L. Crescy, both of Chicago, Ill. Filed Jan. 19, 1891.

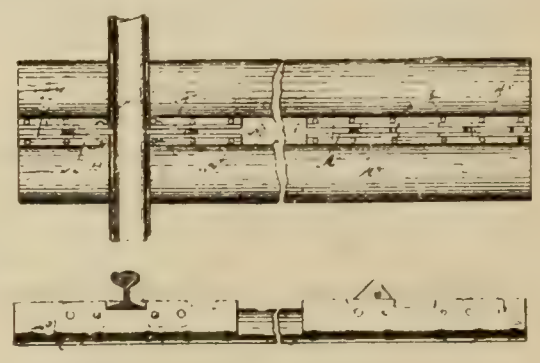
A receptacle for receiving the oil that drips from the journal, a source of fluid-pressure, a pipe leading therefrom and communicating with the oil-receptacle, whereby fluid under pressure may be admitted to the receptacle for expelling the oil therefrom, and a second pipe communicating with the receptacle for conveying the oil to the journal.

461,173. Car-Body. George J. Porter, Medford, Mass. Filed Sept. 15, 1890.

A car-body each side of which is formed in cross-section with a vertical portion and two or more inclined portions, composed of angular metal ribs extending around or nearly around the car-body, longitudinal metal girders at the bottom of the car, metal bracing intermediate of the girders, and metal plates secured to the ribs and bent at angle-points thereof to conform to the form of the ribs.

461,179. Car-Seat. Edwin L. Bushnell, Poughkeepsie, N. Y. Filed July 9, 1891.

In combination, a car-seat arm, back, and striker-arm, a lug on the striker-arm projecting beneath the seat-arm, a dovetailed recess in the lug opening upward, and a lock in the recess.



461,261.—METALLIC RAILROAD TIE.

461,198. Car-Seat. Fred H. Henry, Wakefield, Mass. Filed July 2, 1891.

In a car-seat, the combination of the frame, the seat-back, a slotted arm whose upper end is pivoted to the seat-back and which is pivoted near its lower end to the frame, the seat-arm provided with a horizontal grooved plate or track, and a link pivoted at one end to the seat-back and provided at the other end with a pin or projection extending through the slot in the arm and into the groove in the plate or track, whereby when the seat-back is swung from one side of the seat to the other the angle or inclination thereof is reversed.

461,228. Electric Car-Motor. George Willett, Englewood, Ill. Filed Dec. 22, 1890.

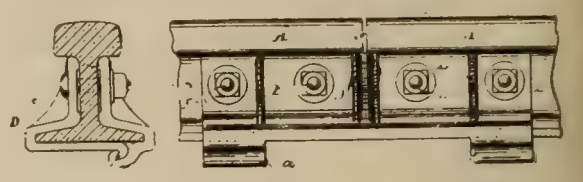
The shaft of a motor, with a worm rigidly attached thereto, in combination with a hub loosely mounted on a propelling axle or shaft, the hub being provided with discs, on the faces of which are rolls revoluble by the worms and having a bearing on studs, the rolls being at such a distance from each other as to conform to the pitch of the threads of the worm, substantially as specified.

461,261. Metallic Railroad-Tie. John F. Harris, Fort Edward, N. Y. Filed Jan. 31, 1891.

The combination, with a horizontal plate and wings projecting laterally therefrom, of a rail-supporting upright riveted to the horizontal plate, and means for securing the rail thereon.

461,293. Motor-Truck. Charles J. Van Depoele, Lynn, Mass. Filed Sept. 25, 1889.

The combination of a spring-supported truck-frame adapted to sustain the car-body, a secondary frame depending therefrom, one or more motors sustained at one end upon the truck axle or axles independent of the springs, and yielding connections between the free ends of the motor or motors and the secondary frame.



461,387.—FISH-PLATE.

461,300. Railroad-Spike. Charles D. Walcott, Russia, N. Y. Filed March 25, 1891.

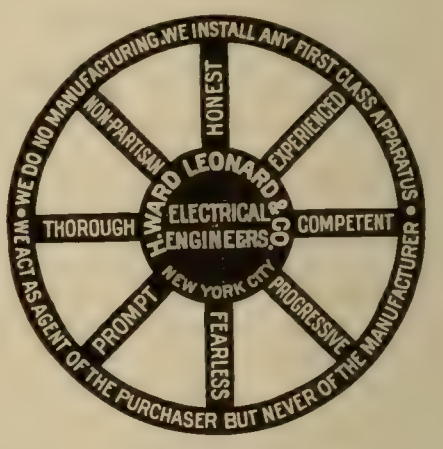
A spike having a round body portion of equal transverse dimensions throughout its length and having upon one side two longitudinal ribs arranged parallel to each other and extending away from the circle of the body portion to a tangential line to the latter.

461,318. Car-Truck. Ferdinand E. Canda, New York, N. Y., assignor to the Suspension Car-Truck Manufacturing Company, same place. Filed May 26, 1891.

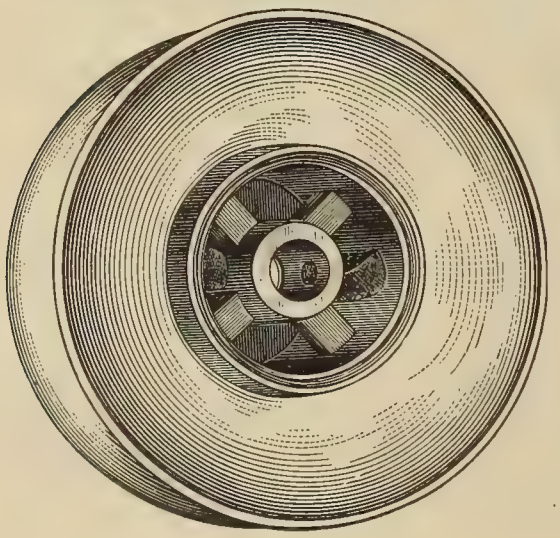
A stirrup for the side-bearings of a car, formed of a bar bent twice at right angles, with the parallel arms thus formed bent outwardly to form bearings and downwardly outside of the bearings, whereby the drawing in of the ends of the stirrup is prevented.

461,387. Fish-Plate. Hosea W. Libbey, Boston, Mass. Filed Sept. 5, 1890.

In combination with the ends of two adjacent railroad rails, fish-plates embracing the webs and flanges of the rails and passing under the flanges, the inner ends of the fish-plates having hooks that interlock with each other under the flanges, each plate having one or more ribs between the portions that fit against the webs and the flanges of the rails, and bolts passing through the sides of the fish-plates and webs of the rail.



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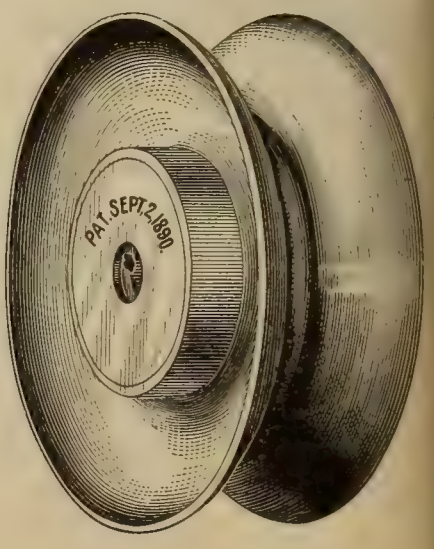
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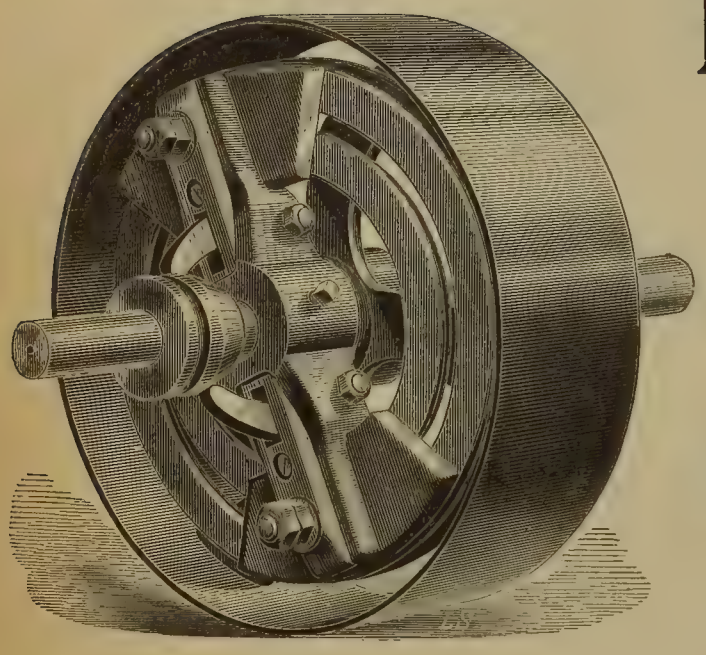
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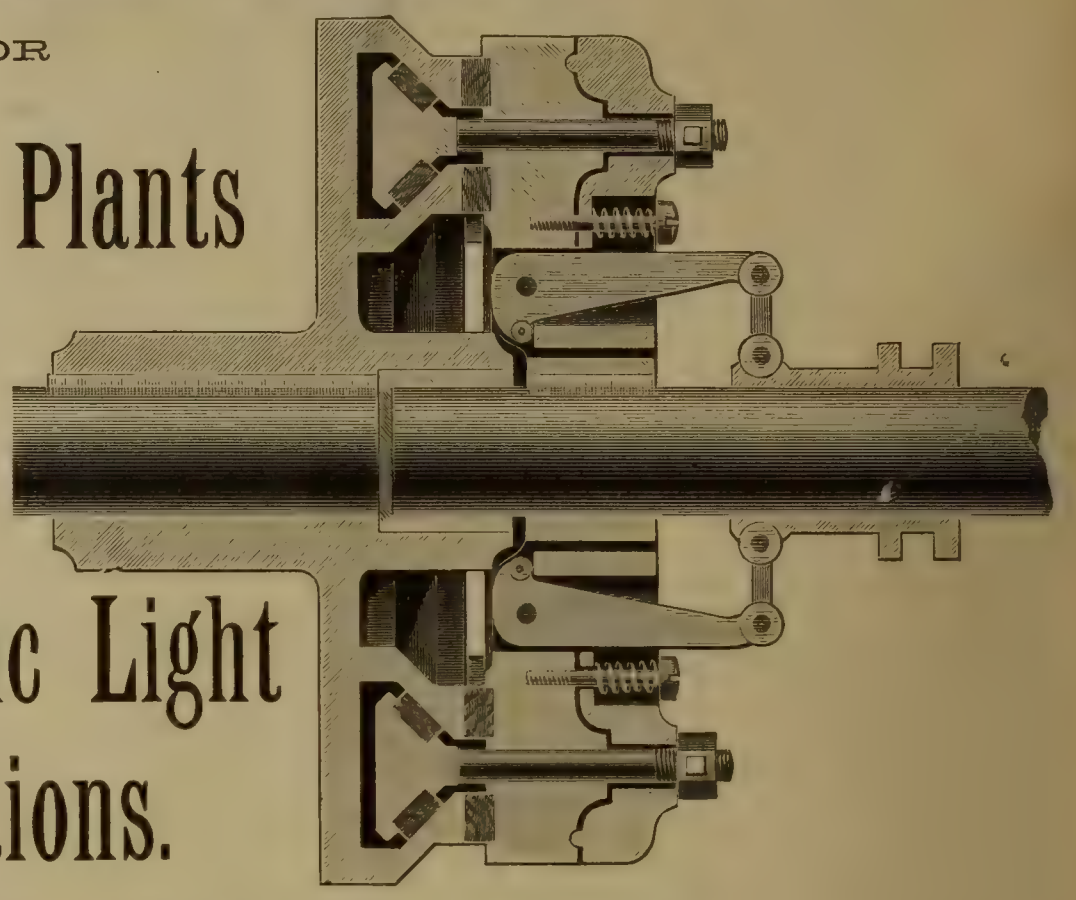
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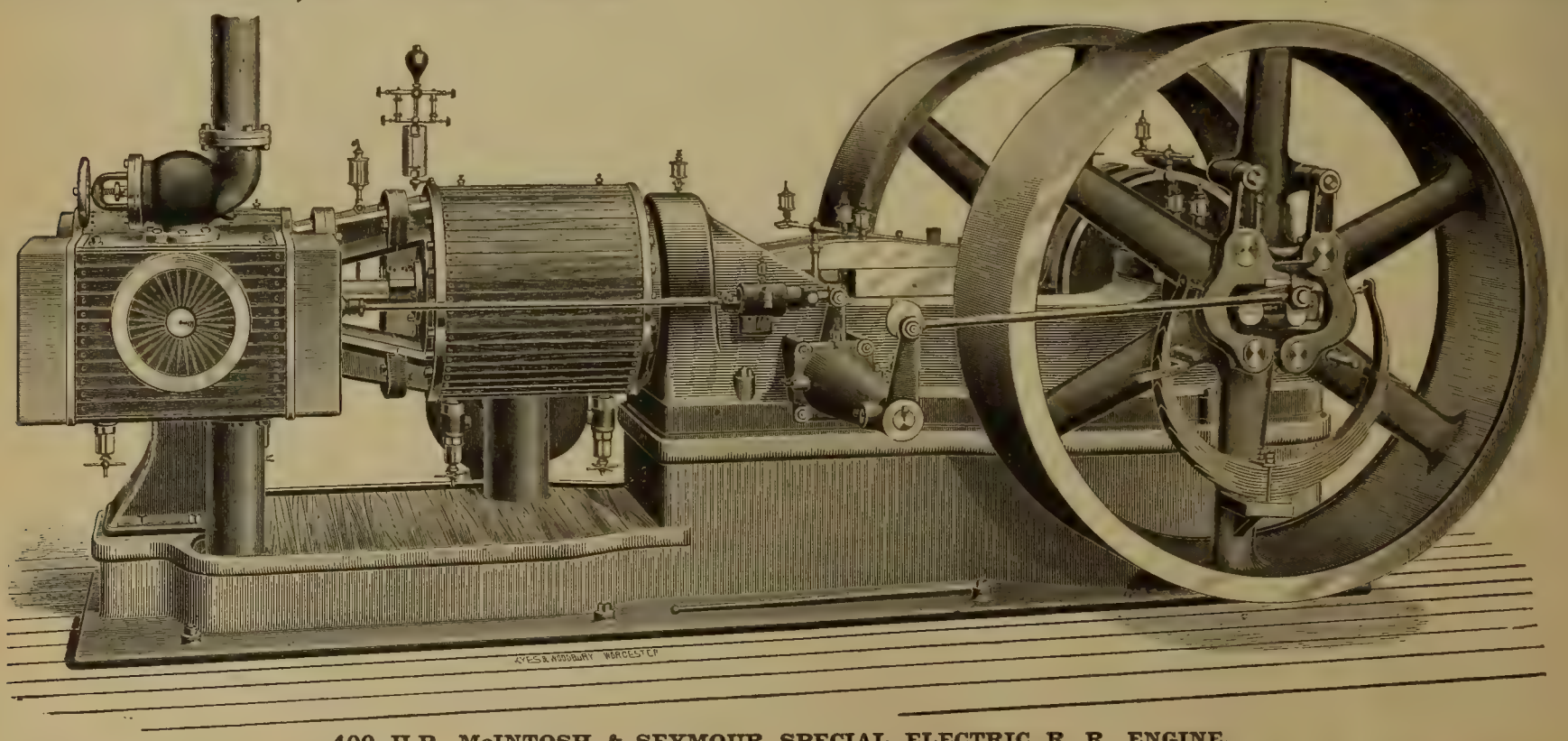
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We Contract for Complete Steam Plant Installations

OR

FURNISH ENGINES AND BOILERS.

☞ **REFERENCES:** *Maj. A. D. Rodgers, Pres't Columbus Consolidated R. R. Co., Columbus, O.; Daniel F. Lewis, Pres't Brooklyn City R. R. Co.; Hon. P. J. Gleason, Mayor Long Island City; John N. Beckley, Pres't Rochester Street R. R. Co., Rochester, N. Y.*

ELECTRIC RAILWAYS OF NORTH AMERICA.

See also Lists of Horse (*), Cable (‖), Dummy (†) Railways.

STATE.	CITY.	COMPANY.	CAPITAL.	BONDS.	MILES.	MOTOR CARS.	TRAILERS.	SYSTEM.	PRESIDENT.	SUPT., SEC. OR GEN. MAN.	DATE OF ANNUAL MEETING.
Ala.	Birmingham	Birmingham Ry. and Electric Co	3,000,000		58	35	25	T.-H.	T. H. Hellman	H. Jenkon, Gen. Mgr.	
Ark.	Little Rock	City Electric Ry. Co.							H. G. Allis	R. P. Bradford, Sec. and Man.	
B. C.	Victoria	National Elec. Tramway & Lighting Co.			10½	9	2	T.-H.	Hon. D. W. Higgins		
Cal.	Los Angeles	Electric Rapid Transit Co.	500,000		8.50	10	6	Edison	D. McFarland	W. W. Manspeaker, Sec.	
"	Oakland	Oakland & Berkeley Rapid Transit Co.	250,000		12	12	4	"	J. G. McNear	H. S. Hunt, Sec.	
"	Los Angeles	Oakland Cons. Elec. St. Ry. Co.	2,000,000		26	30	20	" & T. H.	J. W. Coleman		
"	"	Los Angeles Consolidated Elec. Ry. Co.	6,000,000		55				Gen. M. H. Sherman	P. V. McDonald, Sec.	
"	Sacramento	Central Street Ry. Co.	500,000		‖	10	10	Edison	J. J. Henry	L. L. Lewis, Mgr.	
"	San Jose	San Jose & Santa Clara R.R. Co.	500,000		13	10	6	T.-H.	J. H. Henry	W. N. Sheaf, Supt.	
"	"	First St. R.R.			6	5	5	"		E. M. Rosenthal, Sec.	
Can.	Ottawa	Ottawa Electric St. Ry. Co.							J. W. McRae	D. C. Dewar, Sec.	
Col.	Colorado Springs	Colorado Springs Rapid Transit Ry. Co.	500,000	350,000	22	21	14	Edison	F. L. Martin	Chas. Wilson, Supt.	Mar., 1st Mon.
"	Denver	Denver Tramway Co.				30	20	" & T.-H.	R. Curtis	W. G. Evans, Sec.	
"	"	University Park Ry. & Electric Co.			3.50	3		"	Milo A. Smith	S. G. Colins, Sec.	
"	"	Denver & Suburban Ry. Co.	500,000		16⅝				S. J. O'Donnell	L. V. Levington, Sec.	
"	"	So. Denver Cable Co.			4	4	4	"	R. Curtis	W. G. Evans, Sec.	
"	"	Colfax Ave. Electric Ry. Co.	150,000		6.5	5	4	"	M. A. Smith	S. M. Perry, Gen. Mgr.	
"	Pueblo	*Pueblo City Ry.	500,000	500,000	22	21	8	T.-H.	J. E. Downey	J. E. Downey, Gen. Man.	
Conn.	Birmingham	Derby St. Ry. Co.	50,000	5,000	3.26	5		Baxter	H. Holton Wood	B. C. Porter	Apr., last Mon.
"	Hartford	Hartford & Wethersfield Horse R.R. Co.			4	4		Edison			
"	Southington	Southington & Plantsville Tramway Co.	20,000	16,000	2	2		T.-H.	Jas. H. Osborne	L. E. Southworth, Sec.	Apr., 1st Mon.
Del.	Wilmington	Wilmington City Ry. Co.			12	10		Edison	W. Canby	J. F. Miller, Sec.	
D. C.	Washington	Eckington & Soldier Home Ry. Co.			10	10	10	T. H.	G. Truesdell	J. Paul, Sec.	
"	"	Georgetown & Tenallytown St. Ry. Co.	200,000		10	3		"	R. C. Drum	J. E. Beall, Sec.	
"	"	Glen Echo R.R. Co.	100,000		6	6		Westinghouse	E. Balzley	E. Balzley, Sec.	
"	"	Washington Elec. St. Ry. Co.	60,000		3	4		"	J. B. Wilson	S. B. Ewing, Sec.	
Ga.	Americus	Americus St. Ry. Co.			5	4		T.-H.	J. Felder		
"	Athens	*Athens Ry Co.			5.50	4		Rae	E. G. Harris	J. T. Voss, Sec.	
"	Atlanta	Atlanta & Edgewood St. R R Co.			3.50	4	4	T.-H.	Joel Hurst	Litt. Bloodworth, Sec.	
"	"	Fulton County St. Ry. Co.			12.75	10	6	"	L. J. Hill	W. S. Thompson, Sec.	
"	Augusta	Augusta Ry. Co.	300,000		24	19	3	Edison	S. B. Dyer	R. M. Spivey, Sec.	
"	Macon	Macon City & Suburban St. R. R. Co.			16	8	6	T. H.	G. F. Work	E. E. Winters, Gen. Mgr.	
"	Savannah	Savannah St. & Rural Resort Ry.	100,000		8.2	15	6	"	W. G. Cooper	C. Sassy, Gen. Mgr.	
Ill.	Aurora	Aurora St. Ry. Co.	300,000		13	15	10	Rae	R. B. Dodson	D. A. Belden	
"	Bloomington	Bloomington City Ry. Co.			12	12	20	United Elec. Trac. Co	J. J. Paterson	W. H. Paterson, Sec.	
"	Cairo	Cairo Elec. Ry. Co.	75,000								
"	Champaign	Urbana & Champaign St. Ry. Co	150,000		4	3	4	Westinghouse	F. G. Jaques	W. B. McKinley, Gen. Mgr.	
"	Chicago	Calumet Electric Ry. Co.	500,000		5	4		Rae	J. D. Harvey	O. S. Gaither, Sec.	
"	"	Cicero & Proviso Electric Ry. Co.	1,000,000		16	12		Edison	D. J. Kennedy	F. E. Ballard, Sec.	
"	Decatur	Citizens Electric St. Ry. Co.	150,000		9	11	5	T.-H.	D. S. Shellabarger	W. L. Shellabarger, Sec.	
"	"	Decatur Electric Ry. Co.			3.50	4		Rae			
"	Elgin	Elgin City Ry. Co.	200,000		10	12	3	Edison	Wm. Grote	A. B. Church, Sec.	
"	Joliet	Joliet St. Ry. Co			3	4		T.-H.			
"	Kankakee	Kankakee Elec. Ry. Co.			4½	4		Westinghouse			
"	La Salle and Peru	City Elec. Ry. Co. oper. Peru & La S. Horse and Dummy R.R.	125,000		8	8	6	Edison	L. P. Merrifield	W. C. Rule, Sec.	
"	Moline	Moline Central St. Ry. Co.	100,000	48,000	4	3	2	" & W'house	W. R. Moore	W. R. Moore	Sept. 26.
"	Ottawa	Ottawa Electric St. Ry. Co.	100,000		8	8	4	T.-H.	T. J. Evans	T. P. Bailey, Sec.	June.
"	Peoria	Central Ry. Co.	600,000	200,000	17	31	50	"	J. B. Greenhut	H. R. Woodward, Gen. Mgr.	
"	Quincy	Quincy Horse Ry. & Carrying Co.			11	15	7	"	W. S. Warfield	E. K. Stone, Jr., Sec.	
"	Rockford	Rockford City Ry. Co.	150,000		13	13	5	"	R. N. Baylies	R. N. Baylies, Mgr.	
"	"	*West End St. Ry Co.	30,000		4½	3	3	Short	J. S. Ticknor	S. Roseborough, Gen. Man.	
"	Springfield	Springfield City Ry. Co.	125,000	125,000	10½	12	6	T.-H.	R. N. Baylies	R. N. Baylies, Gen. Mgr.	April, 2d Tues.
"	"	People's Elec. Ry. Co.	200,000	200,000	11	10	32		J. H. Schieck	C. F. Henman, Sec.	May 1
"	Sterling	Union Electric Ry. Co.			6	7		Edison	A. H. Howland		
"	"	Union St. Ry. Co. of Sterling & Rock Falls			6	7		"	"	H. C. Ward, Sec.	
"	Streator	Streator Ry. Co.	250,000		5½	6		T.-H.	P. F. Barr	W. Miller, Mgr.	
Ind.	Anderson	Anderson St. Ry. Co.			5				D. C. Williams	D. C. Williams, Mgr.	
"	Elkhart	Elkhart Elec. & Ry. Co.	100,000		7	9		Rae	O. N. Lumbert	J. W. Ellis, Sec.	Mar. 1.
"	La Fayette	La Fayette St. Ry. Co.			5	9	3	Edison	G. E. C. Johnson	Rice J. Hawyer, Sec.	
"	Logansport	Logansport Street Railway			4½	5			S. Spencer	J. T. McNary, Gen. Mgr.	
"	Marion	Queen City Elec. Ry. Co.	150,000		5	4	1	Rae	G. L. Mason	W. H. Wiley, Supt.	
"	Richmond	Richmond City St. Ry. Co.			4	8	10	T.-H.	J. C. Shaffer	W. H. Shaffer, Sec.	
"	South Bend	South Bend & Mishawaka St. Ry.	250,000		16	6	6	"	J. McM. Smith	O. S. Baylies, Sec.	
"	Terre Haute	Terre Haute St. Ry. Co.	158,000		8.5	10	28	Westinghouse	R. W. Rippetoe	L. D. Thomas, Sec.	
Iowa.	Burlington	Burlington Electric Ry. Co.			12	12	12	"	W. F. Putman	F. G. Jones, Supt.	
"	Clinton	State Elec. Co.	300,000		5	6		T.-H.	E. C. Walsh	G. T. Brown, Supt.	
"	Council Bluffs	Omaha & Council Bluffs Ry. & Bridge Co.	1,500,000		20	26	26	"	J. T. Stewart	A. K. Stone, Gen. Supt.	January.
"	"	Council Bluffs St. Ry. Co.			8	46		" & Edison	"	C. H. Reynolds, Gen. Sup.	
"	Davenport	Davenport Central Ry. Co.	150,000		2.75	7		Edison	W. L. Allen	O. S. McNeil, Sec.	
"	"	" & Rock Island Elec. Ry. Co.	500,000		24	50	68	T.-H.	C. B. Holmes	E. A. Holmes, Sec.	
"	Des Moines	Des Moines St. R.R. Co.	1,000,000		29.51	36	12	"	J. S. Polk	G. P. Hipper, Sec.	
"	Dubuque	Dubuque St. R.R. Co.			15	22		E. D. Co. Stor	J. A. Rhomberg	J. H. Rhomberg, Supt.	
"	"	Electric Ry Light and Power Co.	500,000	100,000	10	12	6	Edison	W. L. Allen	P. A. Matthews, Sec.	
"	"	Key City Electric St. Ry. Co.	200,000		5½	6	4	"	W. R. Daum	Geo. P. Daum	
"	Keokuk	Keokuk Electric St. Ry. & Power Co.			6	6	4	"	G. L. Lincoln	J. Angell, Sec.	June, 1st Tues.
"	Ottumwa	*Ottumwa Ry., Electric and Steam Co.	200,000	100,000	7	5	3	T. H.	G. L. Reiner	O. J. Chapman, Sec.	
"	Sioux City	Sioux City St. Ry. Co.	300,000	400,000	15	30	16	Edison	J. F. Peavey	A. B. Peavy, Supt.	Jan., 1st Tues.
"	"	Riverside Park Ry. Co.			8	6	6	Westinghouse	C. W. Hornick	C. M. Swan, Sec.	Jan. 1st Thurs.
Kan.	Ft. Scott	Fort Scott Rapid Transit Ry. Co.	500,000	100,000	6	6	8	Edison	E. W. Brady	A. B. Brady, Sec.	
"	Salina	Salina Electric Ry. Co.							C. L. Baum	L. S. Winters, Secy.	
"	Topeka	Topeka Rapid Transit R. R. Co.	600,000		18	30	20	T.-H.	J. B. Bartholomew	J. M. Patten, Gen. Mgr.	Jan., 1st Mon.
"	"	Electric Rapid Transit Co.	500,000		8			Edison	D. McFarland	W. W. Manspeaker, Sec.	
"	Wichita	Wichita Electric Ry. Co.	1,000,000	300,000	25	25	10	T.-H.	J. O. Davidson	T. G. Fitch, Gen. Mgr.	
Ky.	Covington	The So. Covington & Cincinnati St. Ry. Co.	395,000		30	10	10	Short	E. F. Abbott	G. M. Abbott, Sec.	
"	Frankfort	Capital Ry. Co.	100,000						P. McDonald		
"	Lexington	Pass. & Belt Ry. Co.	500,000		12	10	15	Edison	C. H. Stoll	F. V. Bartlett, Sec.	
"	Louisville	Central Pass. Ry. Co.			10	16	20	T.-H.	B. Du Pont	T. J. Murray, Gen. Mgr.	
"	Maysville	Maysville St. R.R. Transfer Co.	30,000		3	4	7	Westinghouse	A. M. J. Cochran	R. A. Cochran, Sec.	
"	Paducah	Paducah St. Ry. Co.	100,000		9	10	6	Edison	G. C. Thompson	A. S. Thomson, Sec.	
La.	Shreveport	Shreveport Ry. & Land Improvement Co.	100,000		5.25	4	4	T.-H.	T. B. McCutcheon	T. G. Thatcher, Sec.	
Me.	Augusta	Augusta, Hallowwell & Gardiner R.R. Co.	120,000		8	4	4	"	J. M. Haynes		
"	Bangor	Bangor St. Ry. Co.			6	9	10	T.-H.	F. M. Laughton	M. H. Wardwell, Sec.	
Md.	Baltimore	North Ave. Electric Ry. Co.	500,000		3	6		Baxter	Wm. H. Whitridge	L. M. Frederick, Sec.	
"	Bay Ridge	Bay Ridge Electric Ry. Co.			2	4		Edison	H. Wellington		
"	Cumberland	Cumberland Elec. Ry. Co.	100,000		5	5	5		L. A. Fletcher	G. D. Landwehr, Sec.	
Manitoba.	Winnipeg	*Winnipeg St. Ry. Co.	100,000		3½	5		Edison	J. Austin	A. W. Austin	
Mass.	Beverly	Beverly & Danvers St. Ry. Co.			3	3				J. S. Baker, Supt.	
"	Boston	Boston & Revere Elec. St. Ry. Co.						T.-H.			
"	"	Lynn & Boston R.R. Co.	500,000		6	9		"	Amos F. Breed	E. C. Foster, Supt.	
"	"	*West End St. R.R. Co.	13,550,000	3,250,500	6.8	350	25	"	H. M. Whitney	F. H. Monks, Gen. Man.	
"	Brockton	East Side St. Ry Co.	45,000		528.5	6	6	Edison	A. C. Thompson	A. G. Reynolds, Gen. Man.	
"	Gloucester	Gloucester St. Ry. Co.	60,000		4	3	3	United Elec. Trac. Co	H. Souther	N. A. Shoryin, Sec.	
"	Holyoke	Holyoke St. Ry. Co.	50,000		7	16		T.-H.	L. Perkins	W. S. Loomis, Sec.	Janua y.
"	Lowell	Lowell & Dracut St. Ry. Co.	200,000		5	18		Bentley-Knight	August Fels	P. F. Sullivan, Sec.	
"	Lynn	Lynn Belt Line St. Ry. Co.	100,000		4.50	8	2	T.-H.	Q. A. Towns	G. H. Breed, Sec.	
"	Marlborough	Marlborough St. Ry. Co.	50,000		3.25	6	8	Edison	S. Boyd		
"	New Bedford	Union St. Ry. Co.	260,000		3½	5	5	T.-H.	Hon. W. Howland	W. H. Allen, Sec.	
"	Newburyport	Newburyport & Amesbury Horse R R. Co.	80,000		6	6		"			
"	Newton	Newton St. Ry. Co.			5	10	4		E. P. Shaw	E. P. Shaw, Gen. Man.	
"	North Adams	The Hoosac Valley St. R.R. Co.	50,000		5.93	5	5	T-H.	C. H. Richmond	H. A. Fitzsimons, Supt.	
"	North Attleboro	Interstate st. Ry Co.	120,000		9				H. M Daggell	P. E Brady	
"	"	Attleboro, N. Attleboro and Wrentham St. Ry. Co.	60,000	50,000	6¼	8	9	T.-H.	Peter Nerny	L. W. Dillon, Supt.	
"	Pittsfield	Pittsfield Electric St. Ry. Co.	40,000		3.33	4	4	Westinghouse	J. H. Cunningham	C. E. Baines, Gen. Man.	October, 3d Wed.
"	Plymouth	Plymouth & Kingston St. Ry. Co.	35,000	35,000	6¼	4		T.-H	J. H. Cunningham	C. E. Barnes, Supt.	October.
"	Quincy	Quincy & Boston St. Ry. Co.	50,000		9	4	12	"	J. Q. Adams	J. A. Duggan, Supt.	
"	Salem	Naumkeag St. Ry. Co.			5	12		T.-H.—Edison	Chas. Odell		
"	"	Essex Elec. St. Ry. Co.	50,000		5	7	21	T.-H.	Orlando W. Norcross	F. E. Farnham, Gen. Man.	
"	Springfield	Springfield St. Ry. Co.	400,000		18	20	4-H.	"	J. Olmsted	A. E. Smith, Gen. Mgr.	Jan., 2d Wed.
"	West Newton	Newton St. Ry. Co.	100,000		5.47	8	8	"	G. W. Morse	F. G. L. Henderson, Supt.	Jan. 29.
"	Whitman	Whitman St. Ry. Co.	40,000		3.12			"	G. O. Jenkins		
"	Worcester	Worcester & Shrewsbury Ry. Co.	40,000		2.75	2		United Elec. Trac. Co	H. H. Bigelow	J. E. Bigelow, Supt.	
Mexico	Nuevo Laredo	Int. Bridge Tramway Co.		80,000	1.27	2		Sprague	P. Ornelas	Chas. F. Yaeger, Pur. Agt.	
Mich.	Adrian	Adrian City Electric Belt Ry. Co.	50,000		2.80	3	1	Rae	J. H. Blain	W. W. Rhodes, Sec.	Jan., 2d Wed.
"	Ann Arbor	Ann Arbor St. Ry. Co.	100,000	60,000	5½	6	1	Edison	H. P. Glover	H. T. Morton, Gen. Mgr.	August.
"	Battle Creek	Battle Creek Electric Ry. Co.							John L. Beveridge	F. J. Wilson, Secy.	
"	Detroit	Detroit, Rouge River & Dearborn St. Ry. Co.			1	1		Edison			
"	"	East Detroit & Grosse Pointe Ry. Co.	100,000		9	5	2	Rae	W. H. Wells	H. Baker, Sec.	
"	"	Highland Park Ry. Co.	50,000		3.50	4	2	"	F. E. Snow	W. T. Hart, Supt.	
"	Grand Rapids	Reeds Lake Elec St Ry. Co.			3	2					
"	Lansing	Lansing City Ry. Co.	50,000	160,000	7	7	7	Westinghouse	H. L. Hollister	M. D. Skinner, Sec.	Jan. 1.
"	Marquette	Marquette City & Presque Isle Ry. Co.	100,000		4.5	3	6	T.-H.	F. O. Clark	M. E. Assire, Sec.	
"	Muskegon	Muskegon Ry. Co	100,000		11	13	8	Short	F. A. Nims	R. A. Fleming, Sec.	
"	"	Lake Michigan Extension			3	5	3	"			
"	Port Huron	Gratiot Electric Ry. Co.	25,000		2.25	6	6	Van Depoole	W. F. Botsford	J. H. Talbot, Sec.	
"	"	Port Huron Elec. Ry. Co.			2.50	8		" "			
"	Saginaw	Saginaw Union St. Ry.	200,000		25	26	12	Rae	F. E. Snow	W. J. Hart, Gen. Mgr.	
"	Sault Ste. Marie	*Sault Ste. Marie St. Ry. Co.	25,300		4.25	5	4	"	Thos. Ryan	J. R. Ryan, Sec.	
"	West Bay City	West Bay City St Ry. Co.	100,000		10	5		Edison	S. O. Fisher	Geo. A. Cody, Supt.	September
Minn.	Duluth	Duluth Street Ry. Co.	1,000,000		14	19			S. Hill	A. S. Chair, Sec.	
"	"	Motor Line Imp't. Co.	150,000		3.5	2			A. S. Chase	J. B. Geggie, Sec.	
"	Minneapolis	Minneapolis St. Ry Co.	5,000,000		79 101	110	53	T.-H. Edison	T. Lowry	C. G. Goodinch, Gen. Mgr.	
"	Stillwater	Stillwater St. Ry. Co.			5	6	2	Edison			
"	St. Paul	St. Paul City Ry. Co.			11 70	8 –	16 160	T.-H. Edison	T. Lowry	A. L. Scott, Supt.	
Mo.	Hannibal	Hannibal Electric St. Ry. Co.			2.50	3		T.-H.	M. Doyle	M. Doyle, Supt.	
"	Joplin	Joplin Electric Ry. & Motor Co.			4	4				H. L Newman, Gen Mgr.	
"	Kansas City	Metropolitan St. Ry. Co. (100 cable and 26 horse cars	2,800,000	2,000,000	44	11	11	"	C. F. Morse	R. J. McCarthy, Sec.	Jan. 15.
"	"	North East St. Ry. Co.	260,000		7	12	2	"	W. H. Winants	W. C Scanitt, Sec.	
"	"	Vine St. Ry. Co.			3	6		"			
"	Lebanon	Lebanon St. & Water Co.	100,000		¾	1	6	Westinghouse	B. F. Hobart	W. P. Heath, Sec.	
"	St. Joseph	St. Joseph Union Pass. Ry. Co.			8	12		Edison			
"	"	Wyatt Park Ry. Co.	300,000		12.88	17	4	"	W. J. Hobson	C. W. Hobson, Sec.	
"	St. Louis	St Louis & East St Louis Elec. Ry. Co.	250,000		2	6		T.-H.	D. R. Powell	D. Breck, Sec.	
"	"	Lindell Ry. Co.	2,500,000		35	107		Edison	G. D. Capen	J. Adkins, Sec.	
"	"	Missouri Ry. Co.			18	24		T.-H.			
"	"	Southern Ry. Co.	500,000		16	26	60	"	T. L. Johnson	J. S. Minary, Sec.	
"	"	Union Depot R.R. Co.			25	66		"			

ELECTRIC RAILWAYS OF NORTH AMERICA—Continued.

State.	City.	Company.	Capital.	Bonds.	Miles.	Motor Cars.	Trailers.	System.	President.	Supt., Sec. or Gen. Man.	Date of Annual Meeting.
Mo.	St. Louis	Mound City Ry. Co	.....	.....	8	25	25	"	J. Scullin	J. Scullin, Supt	
"	Sedalia	The Elec. Ry. L. & Pr. Co	200,000	150,000	8	6	4	Edison	W. E. Sterne	D. C. Metsker, Gen. Mgr	
"	"	Sedalia St. Ry. Co	.....	.....	4	4	..	"	J. D. Sicher	Chas. Conrad, Supt	
"	Springfield	Metropolitan Electric Ry. Co	500,000	.....	15.2	15	18	Westinghouse	B. F. Hobart	F. B. Smith, Sec	
"	Trenton	North Side Elec. St. Ry. Co	10,000	.....	3	3	..	.....	M. E. Bailey	R. V. Young, Man	
Mont.	Helena	Metropolitan Elec. Ry. Co	300,000	.....	5.50	5	5	Edison	W. L. Hoge	C. S. Warren, Sec	
"	Butte City	Helena Electric Ry Co	.....	.....	4½	5	2	T.-H.—W'house	C. W. Cannon	H. L. Walker, Sec	
"	Great Falls	Great Falls St. Ry. Co	250,000	.....	9	7	8	Baxter	Chas. K. Wells	L. E. Spencer, Sec	
Neb.	Beatrice	Beatrice Rapid Transit & Pr. Co	150,000	.....	9	9	8	.....	N. W. Walker	.....	
"	Kearney	Kearney Electric Co	.....	.....	6	4	..	.....	A. S. Bigelow	E. E Mandeville	
"			.....	.....			..	Edison	Geo. W. Frank	W. L. Dickenson, Supt	
"	Lincoln	Lincoln City Electric Ry	1,200 000	600,000	40	40	40	Westinghouse	F. W. Little	C. C. Upham	Feb , last Tues.
"	"	Lincoln St. Ry. Co	800,000	.....	18	20	17	Short	J. W. Dewell	E. L. Woolly, Supt	
"	Omaha	Omaha St. Ry. Co	.....	.....	85	..	..	.....	.....	.....	
"	Plattsmouth	Plattsmouth St. Ry. Co	30,000	.....	2.25	2	2	Edison	O. H. Ballan	Geo. E. Dovey, Sec	
N. H.	Concord	Concord St. Ry. Co	50,000	50,000	7.50	6	6	T.-H	Moses Humphrey	Geo. W. Pierce, Gen. Man	Jan., 3d Wed.
"	Dover	Dover & Union Elec. Ry. Co	.....	.....	7	6	12	"	W. D. Sawyer	H. W. Burgett, Gen. Man	
"	Exeter	Exeter Electric Light & Power Co	.....	.....	..	..	..	.....	Louis H. Rogers	R. P. Thompson, Supt	
N. J.	Asbury Park	Seashore Elec. Ry. Co	200,000	.....	3.8	21	..	United Elec.Trac.Co	Wm. P. Stevenson	W. J. Broadmeadow, Supt	
"	Atlantic City	Penn. R.R. Co	.....	.....	6.33	28	9	Edison		W. E Harrington	
"	" "	Camden & Atlantic R.R	.....	.....	6.32	25	9	.....	Roberts	A. O. Dayton, Supt	Feb., 4th Thurs.
"	Camden	*Camden Horse R.R. Co	250,000	.....	4.5	6	6	United Elec.Trac.Co	Wm. S. Scull	S. J. Fenner, Supt	
"	Jersey City	Jersey City & Bergen R.R. Co	600,000	250,000	16	3	3	T.-H	Charles Thurston	T. M. Sayre, Supt	
"	Newark	Essex Pass. Ry. Co	.....	.....	75	4	..	United Elec.Trac.Co	Wm. S. Scull	F. T. Kirk, Sec	
"	"	Rapid Transit St. Ry. Co	500,000	.....	10	16	..	Edison	E. S. Ward	S. J. Fenner, Supt	
"	Passaic	Passiac, Garfield & Clifton Ry. Co	60,000	.....	3	3	2	T. H	W. R. Brown	A. G. Earle, Gen. Mgr	
"	Paterson	Paterson Ry. Co	1,250 000	.....	23	20	..	.....	Garret A. Hobart	E J. Lawless, Gen Man	
N. Y.	Albany	Albany Ry. Co	750,000	.....	14	39	..	"	R. C. Pruyn	John McNamara, Gen. Mgr	
"	"	Watervliet Turnpike & R.R Co	.....	.....	23	19	4	T.-H & Short	W. B. V. Rensselaer	.....	
"	Auburn	Auburn Elec. Ry. Co	.....	.....	6½	7	..	"	T. B. Gould	J. E. Storke, Supt	
"	Amsterdam	Amsterdam St. Ry. Co	200,000	.....	3	6	4	Edison	E. H. Johnson	H. K. McCay, Gen. Mgr	June 15.
"	Binghampton	*Binghampton St. R.R. Co	160,000	200,000	14	24	4	"	J. B. Landfield	J. P. E. Clark, Supt	
"	Brooklyn	Bath & Bay Ridge Bensonhurst Elec. Ry. Controlled by	.....	.....	..	..	..	.....	.....	.....	
"	"	Brooklyn City Ry. Co.)	1,000,000	.....	..	20	..	T.-H	D. F. Lewis	.....	
"	"	Coney Island & Brooklyn R.R. Co	500,000	.....	22	..	..	Short	.....	.....	
"	Buffalo	Buffalo Ry. Co	.....	.....	..	4—5	..	Edison	H. M. Watson	H. H. Littell, Gen. Mgr	
"	Flushing	Flushing & College Point St.Ry. Co	.....	.....	..	13	..	Westinghouse	Joseph Dykes	Hugh Wilson, Supt	
"	Ithaca	Ithaca St. Ry. Co	25,000	.....	3	3	4	United Elec.Trac.Co	D. W. Burdick	Chas. H. White, Sec	Nov., 3d Tues.
"	Jamaica	Jamaica & Brooklyn Electric R.R. Co	500,000	.....	13	13	9	Edison & Van D'ple	S. Spencer	Wm. M. Scott, Supt	
"	Jamestown	Jamestown St. Ry. Co	250,000	.....	16	14	..	Short	A. N. Broadhead	G. E. Maltby, Supt	
"	Long Island	Long Island City & Newtown Ry. Co	150,000	.....	7	2	..	Edison	Patrick J. Gleason	B. C. Killien, Gen. Mgr	
"	Rochester	Rochester Electric Ry. Co	200,000	.....	10	11	10	T.-H. & Short	A. Luetchford	C. A. Derr, Gen. Man	June.
"	"	Rochester Ry. Co	5 000,000	.....	55	100	100	Short	A. G. Yates	.....	
"	Charlotte	Charlotte Elec. Ry. Co	100,000	.....	4	6	..	Edison	E. T. Letta	E. H. Allen, Supt	
"	Saratoga	Saratoga Electric Ry. Co	50,000	.....	2	2	5	T.-H	.....	W. E. Baker, Supt	
"	Seneca Falls	Seneca Electric Ry. Co	40,000	.....	4	2	2	"	S. L. Philips	E. F. Slack, Supt	
"	Syracuse	Third Ward Ry. Co. (Operated by Consolidated Ry. Co.)	.....	.....	4	8	..	"	W. S. Wales	A. Bartlett, Supt	
"	Troy	Troy City R.R. Co	50,000	.....	3.5	12	14	Edison	Chas. Cleminshaw	W. H. Bean, Supt	
"	"	Troy & Langsingburg R.R. Co	500,000	.....	23	..	..	"	"	C. H. Smith, Supt	
"	Utica	Utica Belt Line St. Ry. Co	500,000	.....	22	25	12	T.-H	O. T. Crosby	W. E. Baker, Gen. Man	
"	"	Utica & Mohawk R.R. Co	250,000	75,000	2.75	7	7	Edison	James F. Mann	F. Everts, Supt	Jan.
"	Watertown	Watertown St. Ry. Co	40,000	.....	3	5	2	.....	A. D. Remington	W. S. Cole, Supt	
"	"	Watertown and Brownsville St. Ry	60,000	.....	2	..	..	.....	.....	W. H. Cole, Supt	
N. C.	Asheville	Asheville St. Ry. Co	100,000	.....	5	9	..	Edison	J. G. Martin	John H. Barnard. Gen. Man	
"	Raleigh	Raleigh Electric Ry. Co	25,000	.....	5	6	8	"	J. A. Jones	S. W. Jacobs, Gen. Man	
"	Winston	Winston-Salem Ry. and Electric Co	150,000	.....	5	8	4	"	J. H. McClement	H. S. Cooper, Gen. Man	
Ohio.	Akron	Akron St. R.R. Co	300,000	185,000	11	25	11	"	J. F. Seiberling	F. A. Seiberling, Sec	Jan. 1.
"	Alliance	Alliance St. Ry. Co	100,000	.....	2	3	..	T.-H	N. W. Hazzard	W. W. Whitacre, Gen. Man	
"	Ashtabula	Ashtabula Rapid Transit Co	100,000	.....	4.50	5	4	"	.....	.....	
"	Canton	Canton St. Ry. Co. and Lakeside St. R.R. Co	200,000	.....	7	12	10	Edison	.....	.....	
"			100,000	.....	3.25	12	10		A. L. Conger	A. G. Davids, Supt	
"	Cincinnati	Cincinnati Inclined Plane Ry. Co	57,500	.....	14	30	10	"	H. H. Littel	H. M. Liftel, Gen. Man	
"	"	Cincinnati St. Ry. Co	5,500,000	.....	100	22	22	T.-H	John Kilgour	John Kilgour, Gen. Man	
"	"	Mt Adams & Eden Park Inclined Ry	.....	.....	7	24	12	"	" "	.....	
"	"	South Covington & Cincinnati St. Ry. Co	30,000	.....	30	18	10	Short	E. F. Abbot	T. M. Jenkins, Gen. Man	
"	Cleveland	Brooklyn St. Ry. Co	.....	.....	20	46	60	T.-H & Short	Tom L. Johnson	A. L. Johnson, Supt	
"	"	Broadway & Newburgh St. R.R	1,000,000	.....	26.52	36	30	Edison & Short	H. E. Andrews	E. Fowler, Sec	
"	"	East Cleveland R.R. Co	1,500,000	.....	45	84	140	Edison	A. Everett	R. Blee, Gen. Man	
"	"	Lake View and East Cleveland St. R.R. Co	25,000	.....	12	2	2	"	"	E. Duty, Supt	
"	Columbus	Columbus Consolidated St. Ry. Co	100,000	.....	25	30	40	T.-H	Col. A. D. Rogers	J. H. Atcherson, Supt	
"	"	Glenwood and Green Lawn St. Ry. Co	1,000,000	.....	7	7	7	Edison	Col A. D. Rogers	R. R. Rickley, Sec	
"	Dayton	White Line St. R.R. Co	200,000	.....	13.50	16	12	Van Depoele & Bax	J. A. McMann	Wm. Beach, Supt	
"	"	Dayton and Soldiers Home R.R. Co	100,000	.....	4	2	2	Edison	D. B. Corwin	T. E. Howell, Supt	
"	Findley	Findley St. Ry. Co	.....	.....	8	10	11	"	Thos. Milliken	Ira S. Milliken, Gen. Man	
"	Hamilton	Hamilton & Lindenwald Electric Transit Co	100,000	.....	8	10	4	.....	G. B. Kerper	Chas. Smith, Supt	
"	Lima	Lima St. Ry. Motor & Power Co	50,000	.....	4	7	..	Van Depoele	B. C. Faurot	S. W. Moore, Gen. Man	
"	Mansfield	Mansfield Electric St. Ry. Co	75,000	.....	5	5	..	Daft	M. V. Renssalaer, Jr.	G. M. Macey, Supt	
"	Newark	Newark and Granville Electric St. Ry	90,000	.....	8.50	4	5	Edison	R. Scheidler	W. C. Christian, Sec	
"	Piqua	Piqua St. Ry. Co	75,000	.....	4	4	..	"	A. M. Orr	F. C. Davies, Sec	
"	Salem	Salem Electric Ry. Co	100,000	50,000	3½	4	2	T.-H	Milton Davis	W. H. Whildey, Gen. Man	Jan. 1.
"	Sandusky	Sandusky St. Ry. Co	100,000	.....	8	9	..	Edison & W'house	J. A. Morse	C. Rute, Supt	
"	Steubenville	Steubenville Electric St. Ry. Co	70,000	.....	5	6	..	Edison	R. S. Newcombs	J. F. Flood, Supt	
"	Toledo	Toledo Electric Ry. Co	800,000	.....	24	35	8	T.-H	.....	.....	
"	"	Toledo Consolidated St. Ry. Co	1,500,000	1,500,000	58	28	40	"	N. B. Ream	A. E. Lang, Gen. Mgr	
"	Youngstown	Youngstown St. R.R. Co	.....	.....	7	6	..	Edison	J. Parmelee	H. K. Taylor, Supt	
Ont.	Windsor	Sandwich, Windsor & Amhurstburg	200,000	100,000	6	8	4	.....	J. M. Clark	W. C. Turner, Gen. Man	May 1.
Ore.	Portland	Metropolitan Ry. Co	400,000	.....	7	17	2	"	Geo. A. Steel	G. A. Steele, Gen. Man	
"	"	Multnomah St. Ry. Co	100,000	.....	10	16	27	"	G. B. Markle	J. E. Thielsen, Supt	Jan., 1st Mon.
"	"	†Willamette Bridge Ry. Co. (formerly Woodstock & Waverly)	.....	.....	21.1	19	3	Edison, T.-H. & W'h	H. C. Campbell	J. W. Campbell, Supt	
"	Salem	Capital City Ry. Co	50,000	.....	4	4	2	Edison	D. Simpson	T. H. Barnes, Gen. Man	September.
Penn.	Allegheny	Pittsburgh, Knoxville and St. Clair Ry. Co	60,000	.....	2	5	4	Daft	T. Evans	N. W. Fawcet, Sec	
"	Allentown	Allentown and Bethlehem Rapid Transit Co	650,000	.....	15	15	10	T. H	G. H. Campbell	A. H. Hayward, Supt	
"	Altoona	The City Passenger Ry. Co	180,000	.....	6	8	8	.....	J. P. Levan	J. J. Buch, Supt	
"	"	Oakton and Fairview Electric Passenger Ry. Co	40,000	.....	3.3	..	..	.....	L. Plack	F. L. Scheider, Sec	
"	Beaver Falls	Beaver Valley Traction Co	.....	.....	..	..	..	.....	J. C. Whitla	A. R. Leyda	
"	Chester	Union Ry. Co	100,000	.....	..	..	..	.....	Richard Peters, Jr.	W. J. Schaeffer, Sec	
"	Carbondale	Carbondale and Jerwyn St. Ry. Co	.....	.....	1.50	3	..	Edison	J. W. Aitken	J. E. Burr, Sec	
"	Easton	Pennsylvania Motor Co	80,000	.....	2.50	6	..	Daft	J. M. Young	W. W. Neven, Sec	
"	Erie	Erie Electric Motor Co	.....	.....	15	40	10	Edison	J. S Casement	J. F. Pfetch, Gen. Mgr	
"	Greensburg	Greensburg & Hempfield Electric St. Ry. Co	60,000	60,000	2.5	3	..	Westinghouse	R. S. Jamison	F. G. Clopper, Gen. Mgr	Jan. 6.
"	Harrisburg	E. Harrisburg Pass. Ry. Co. (Con. with Harrisb'g Pass. Ry.)	150,000	.....	5	12	5	T.-H	J. Q. Denney	F. B. Musser, Supt	Jan., 1st Mon.
"	Johnstown	Johnstown Passenger Ry. Co	128,000	.....	10	20	20	Short	T. L. Johnson	J. B. Holfgen, Gen. Man	
"	Lancaster	Lancaster City St. R.R. Co	..	.....	6	10	10	Daft & Edison	J. A. Coyle	Wm. Ring, Supt	
"	New Castle	New Castle Electric St. Ry. Co	40,000	.....	3	..	..	T.-H. & W'house	T. W. Phillips	Wm. M. Brown, Gen. Mgr	
"	"	New Castle St. Ry. Co	.....	.....	2.5	3	..	Storage	J. S. Wallace	.....	
"	Philadelphia	Lehigh Av. Ry. Co	300,000	.....	6	6	..	Elec.CarCo.of N.Am.	Frank Weckerly	R. C. Brinster, Sec	
"	Pittsburgh	Pittsburgh, Knoxville and St. Clair Ry. Co	60,000	.....	1.50	5	..	UnitedElec.Trac.Co.	.....	.....	
"	Pittsburgh	Duquesne Traction Co	.....	.....	25	25	60	T.-H	C. L. Magee	Jas. M Devitt, Sec	
"	"	Federal St. and Pleasant Valley Ry. Co	1,300,000	.....	18	50	30	Edison	D. F. Henry	Wm. Crozier, Supt	
"	"	Pittsburgh Suburban Rapid Transit	120,000	.....	2.50	5	2	UnitedElec.Trac.Co.	H. Miller	J. Suitz, Mgr	
"	"	Pittsburgh & Birmingham Traction Co	3,000,000	.....	7	30	..	Short & Edison	C. F. Stevens	Murray Nimer	
"	Pottsville	Schuyler Electric Ry. Co	50,000	.....	1.75	3	3	"	J. K. Sigfried	J. H. Zerbey, Sec	
"	Reading	East Reading R.R. Co	100,000	.....	3	6	..	Edison	A. J. Brumbach	A. H. Fegley, Sec	
"	"	Neversink Mountain Electric Ry	.....	.....	..	..	..	.....	R. T. Leaf	P. D. Mutholland, Supt	
"	"	Reading & South W. Electric Co	.....	.....	9	4	..	T.-H	H. Ahrnes	.....	
"	Scranton	People's St. Ry. Co. of Luzerne Co	400,000	.....	15	23	12	Edison	R. T. McCabe	J. H. Vanderpeer, Gen. Mgr	
"	"	Scranton Passenger Ry. Co	.....	.....	1.5	5	..	T.-H	P. S. Page	" "	
"	"	Scranton Suburban Ry. Co	.....	.....	9	16	..	"	Arthur J. Moulton	" "	
"	Sunbury	Sunbury and Northumberland St. Ry. Co	75,000	.....	3.5	8	..	UnitedElec.Trac.Co.	H. E. Davis	S. S. Scholl, Supt	
"	Washington	Washington Electric St. Ry. Co	60,000	.....	5	4	..	Westinghouse	J. B. Wilson	S. B. Ewing, Sec	
"	West Chester	West Chester St. Ry. Co	60,000	.....	6	3	..	Edison	W. M. Hayes	M. Hoopes, Supt	
"	Wilkesbarre	Wilkesbarre and Suburban St. Ry. Co	100,000	$30,000	8	8	4	"	Morgan B. Williams	W. A. Armstrong, Jr., Supt	Jan. 2.
"	"	Wilkesbarre and West Side Ry. Co	.....	.....	3.34	5	..	"	J. B. Reynolds	Pierce Butler, Sec	
R. I.	Newport	Newport St. Ry. Co	100,000	.....	4.17	8	7	T. H	A. C. Titus	F. E. Johnson, Supt	January.
So. Dak.	Sioux Falls	South Dakota Rapid Transit Electric Ry. Co	100,000	.....	7.50	3	2	Edison	W. R. Hingsbury	C. C. Crandall, Supt	
Tenn.	Bristol	Bristol Belt Line Ry. Co	25,000	75,000	5	4	4	.....	A. H. Leftwich	W. A. Stadleman, Gen .Mgr	
"	Chattanooga	Chattanooga Electric Ry. Co	1,500,000	.....	38	18	2	Edison	C. A. Lyerly	S. W. Devine, Gen. Man	
"	"	Chattanooga & North Side St. Ry. Co	40,000	.....	4	4	3	T.-H	S. R. Read	D. R. Rankin, Supt	
"	Knoxville	Knoxville St. Ry. Co	.....	.....	15	10	2	"	W. G. McAdoo	M. R. McAdoo, Gen. Man	
"	Memphis	Citizens' St. Ry. Co	1,500,000	.....	40	60	..	Edison	J. R. Goodwin	R. Semmes, Gen. Man	
"	"	City and Suburban R.R. Co	150,000	.....	10	5	5	T.-H	H. Cummins	G. B. Shebley, Supt	
"	Nashville	Citizens' Rapid Transit Co	.....	.....	4	5	..	Edison	W. N. Mitchell	D. Deadrick, Man	
"	"	City Electric Ry. Co	.....	.....	3.60	5	..	"	.....	.....	
"	"	United Electric Co	1,000,000	.....	52	63	..	.....	T. W. Wrenne	E. G. Connette, Supt	
Tex.	Austin	Austin Rapid Transit Ry. Co	200,000	.....	5½	4	2	Westinghouse	M. M. Shipe	J. K. Urie, Sec	
"	Dallas	Dallas Rapid Transit Ry. Co	200,000	.....	13	9	..	Edison—W'house	B. S. Wathen	Geo. D. Hoxston, Supt	
"	"	*Dallas Consolidated Traction Ry. Co	1,000,000	1,500,000	26 3–16	12	..	T.-H.—Edison	Royal A. Ferris	L. S. Garrison, Gen. Man	
"	"	North Dallas Circuit Ry. Co	80,000	.....	5	4	4	T.-H	J. E. Schneider	Royal A. Ferris, Gen. Man	
"	Fort Worth	Fort Worth and Arlington Heights St. Ry. Co	300,000	.....	5.50	3	2	Edison	H. W. Tallant	W. E. Winthrop, Sec	
"	"	Fort Worth Land and St. Ry. Co	400,000	.....	10.50	15	2	Rae	W. P. Quigg	J. F. Greene, Sec	
"	"	Riverside St. Ry. Co	200,000	.....	3	6	3	"	E. W. Taylor	W. M. Berry, Supt	
"	Galveston	Galveston City R.R. Co	318,674	300,000	20	20	10	.....	Wm. H. Sinclair	D. Atwood Gen. Man	
"	"	Galveston Rapid Transit Belt Line	100,000	.....	12	..	..	.....	S. W. Sydner	E. H. Porter, Sec	
"	Houston	Houston City St. Ry. Co	800,000	.....	..	..	..	.....	E. A. Allen	H. F. MacGregor. Gen. Man	
"	Laredo	Laredo Improvement Co	1,200,000	500,000	5¾	6	2	Edison	G. Bedell Moore	Chas. F. Yaeger, Man	
"	San Antonio	San Antonio St. Ry. Co	200,000	.....	35	40	55	" & T.-H	W. N. Weiss	J. W. Greer, Supt	
"	"	Alamo Electric St. Ry. Co	200,000	.....	3.70	10	10	T.-H	J. B. Shepard	J. Molloy, Mgr	
"	"	West End St. Car Co	100,000	16,000	5	3	3	.....	Geo. W. Russ	F. M. Devden, Supt	
"	Sherman	College Park Rapid Transit Co	100,000	.....	4	5	..	Edison	J. M. Cullers	C. W. Lewis, Sec	
"	Waco	Citizens' Ry. Co	250,000	.....	16	10	26	Westinghouse	H. C. Scott	J. L. Brockenbrough, Mgr	
Utah.	Salt Lake	Salt Lake City R.R. Co	300,000	600,000	35	32	10	Edison	A. W. McCune	W. P. Read, Supt	April 21, 1891.
"	"	Salt Lake Rapid Transit	500,000	300,000	20	20	7	" W'house & T.-H.	J. S. Cameron	A. M. Hinckley, Supt	April 14.
Va.	Danville	Danville St. Car Co	50,000	.....	2	4	..	T.-H	T. B. Fitzgerald	N. W. Berkley, Jr., Supt	
"	Hampton	Hampton and Old Point St. Ry	.....	.....	3	4	2	Edison	.....	.....	
"	Manchester	Richmond and Southside Ry	300,000	.....	9	8	2	Baxter	A. H. Rutherford	B. R. Selden, Supt	
"	Richmond	Richmond Ry. and Electric Co	.....	.....	..	..	..	.....	G. E. Fisher	F. J. Cragie, Sec	
"	"	Richmond City Ry. Co	.....	.....	18	44	20	Edison	Dr. Muncie	Chas. Seddon, Gen. Mgr	
"	"	Richmond Union Passenger Ry. Co	.....	.....	13	42	..	"	.....	J. W. Wilbur, Gen. Mgr	
"	"	Richmond Passenger Ry. Co	500,000	.....	13	40	..	"	Per. A. Pizzoni	.....	
"	"	[illegible] Electric Ry	.....	.....	..	2	..	.....	N. V. Randolph	.....	
"	Roanoke	Roanoke St. Ry. Co	300,000	.....	17	8	..	Westinghouse	C. O'Leary	J. F. Christain, Pur. Agt	

ELECTRIC RAILWAYS OF NORTH AMERICA—Continued.

State.	City.	Company.	Capital.	Bonds.	Miles.	Motor Cars.	Trail-ers.	System.	President.	Supt., Sec. or Gen. Man.	Date of Annual Meeting.
Wash.	Anacortes	Anacortes and Skaget Motor Ry. Co	200,000		52	..	..	T.-H	T. B. Childs	C. R. Donnell, Sec	
"	"	Fidalgo City and Anacortes Ry. Co	250,000		12	4	..	"	J. Pierce	E. Dutcher, Supt	
"	Port Townsend.	Port Townsend BeltElec. Ry. Co			5½	4	2	T.-H	Julius S. Potter	L. Dutcher, Supt	
"	Seattle	Seattle Con. St. Ry. Co	1,500,000	1,000,000	22½	24	..	"	L. H. Griffith	L. J. Griffith, Supt	Jan. 21 Mo
"	"	Green Lake Elec. Ry. Co	150,000		4.50	2	..	"	Wm. D. Wood	E. C. Kilbourne, Gen. Man	
"	"	Rainier and Power Ry. Co	500,000		2½	2	..	Westinghouse	D. T. Denny	D. T. Denny, Man	
"	"	West St.& North End Elec. Ry. Co	1,000,000		8	12	..	T.-H	D. H. Gilman	C. L. F. Kellogg Sec	
"	Spokane Falls	Ross Park St. Ry. Co	150,000		4	8	3	"	E. J. Webster	O. De Camp, Supt	
"	" ..	City Park Transit Co	250,000		4½	5	..	T.-H	D. Glass	Chester Glass, Gen. Man	July.
"	" ..	Spokane Electric Ry. Co	100,000		..	4	2		W. M. Byers	H. J. Cook, Sec	
"	" ..	* " St. Ry. Co	500,000	350,000	16	16	..		H. Bolster	W. S. Norman, Gen. Mgr	
"	Tacoma	Pacific Ave. St. R.R. Co			6	8	..	Edison			
"	"	Peninsula Electric Ry. Co			30	..	..	T.-H	T. A. Abbot	Hy. Shaw, Gen. Man	
"	"	Tacoma & Pyallup St. Ry. Co	50,000		10	6	..	"	W. E. Anderson	A. H. Garretson, Sec	
"	"	Tacoma & Steilacoom Ry. Co	500,000		14	7	4	"	T. A. Abbott	Hy. Shaw, Gen. Man	
W. Va.	Huntington	Huntington Elec. Light & St. Ry. Co	80,000		4	2	2	Short	J. L. Caldwell	J. L. Caldwell, Gen. Man	
"	Wheeling	Citizens Ry. Co	100,000		8	24	6	T.-H. & Van Depocle	J. A. Miller	M. Loftus, Supt	
"	"	Wheeling Ry. Co	50,000		15	2	..	"	John M. Sweeney	M. Loftis, Supt	
Wis.	Appleton	Appleton Elec. St. Ry .Co			3.50	6	..	Van Depocle	G. W. Gerry	A. A. Johnson, Supt	
"	Eau Claire	Eau Claire St. Ry. Co			6	6	6	Edison	W. Lewis	A. F. Gerald, Gen. Man	
"	Merrill	Merrill Ry. & Lighting Co	20,000		2	3	..	Westinghouse	W. A. Scott	F. E. Matthews, Supt	
"	Milwaukee	Milwaukee Elec. Ry. Co	500,000		13	12	..	T.-H	J. A. Hinsey	G. J. Melms, Supt	Feb., 1st Tues.
"	"	West Side St. Ry. Co			6	19	..	Edison	Washington Becker	A. McNaughton, Division Sec.	
"	West Superior	Douglass County St. Ry. Co	100,000	118,000	9	10	5	T.-H	S. T. Norvell	S. T. Norvell, Gen. Man	March 12.

DIRECTORY
OF
Street and Suburban Railways Using Dummy Locomotives, Steam or Tramway Motors.

(ALPHABETICALLY ARRANGED ACCORDING TO NAMES OF ROADS.)

SEE ALSO LIST OF HORSE (*), ELECTRIC (†), CABLE (‖) RAILWAYS.

UNITED STATES.

Name of Road.	City.	State.	Name of Maker.
Albany St. R.R. Co	Albany	N. Y	Porter.
Alton & Upper Alton Horse Ry. and Carrying Co	Alton	Ills	Baldwin.
Alton Improvement Association	"	"	"
Ann Arbor & Ypsilanti & Ann Arbor St. R.R. Co	Ann Arbor	Mich	Porter. Baldwin.
Bay Ry. Co	Astoria	Oregon	Baldwin.
Belt Line R.R.	Rome	Ga	"
Belt Line R.R. Co	Montgomery	Ala	"
Bessemer & Birmingham R.R	Birmingham	"	"
" " "	"	"	Richmond.
" " "	"	"	Porter.
Birmingham & Jones Valley R.R	"	"	Richmond.
* " Ry. & Elec. Co	"	"	
" Union Ry	"	"	Baldwin.
" Powderley & Bessemer St. R.R	"	"	"
Brooklyn City R.R	Brooklyn	N. Y	"
Butte City St. R.R	Butte	Mont	Porter.
Camden & Atlantic R.R	Atlantic City	N. J	Baldwin.
Cedar Rapids & Marion Ry	Cedar Rapids	Iowa	"
Chino Valley R.R	Chino	Cal	Porter.
City Electric St. Ry	Little Rock	Ark	Baldwin.
City and West Portland Park Motor Co	Portland	Ore	
Colfax Avenue Ry	Denver	Colo	Baldwin.
Columbus R.R. Co	Columbus	Ga	Porter.
"	"	"	Richmond.
Concord Horse Ry. Co	Concord	N. C	"
" " R.R	"	N. H	Baldwin.
Coronado R.R	San Diego	Tex	Porter.
Corpus Christi Imp. Co	Corpus Christi	Cal	
Deadwood Central R.R	Deadwood	So. Dakota	Porter.
Denison Land & Investment Co	Denison	Tex	Baldwin.
Denver & Berkley Park Rapid Transit Ry	Denver	Colo	"
Des Moines Belt Line Ry	Des Moines	Iowa	"
East Birmingham Dummy Line	Birmingham	Ala	Porter.
" End R.R	Memphis	Tenn	Baldwin.
" End Ry. Co	"	"	Porter.
" Fifth St. Ry	Kansas City	Mo	Baldwin.
Eastside Circle Ry	Topeka	Kansas	Richmond.
Elmira & Horseshead Ry. Co	Elmira	N. Y	Porter.
Evansville, Suburban & Newburg R.R	Evansville	Ind	Baldwin.
Florence R.R. & Improvement Co	Florence	Ala	Richmond.
Fountain Head R.R	Knoxville	Tenn	Baldwin.
Gadsden Land & Improvement Co	Gadsden	Ala	"
Geary St., Park & Ocean R.R	San Francisco	Cal	"
Grand Avenue Ry	Kansas City	Mo	"
Great Salt Lake & Hot Springs Ry	Salt Lake City	Utah	"
Helena, Hot Springs & Smelter R.R	Helena	Montana	"
" Motor Ry	"	"	"
Highland Avenue and Belt Ry. Co	Birmingham	Ala	"
Home Avenue R.R. (freight)	Dayton	Ohio	Porter.
Houston Belt & Magnolia Park R.R	Houston	Tex	Baldwin.
Huntsville Belt Line & Monte Sano R.R	Huntsville	Ala	"
Independence & Monmouth R.R	Independence	Oregon	"
Interstate Consolidated Rapid Transit Ry	Kansas City	Kansas	"
Kansas City, Independence & Park Ry	"	Mo	"
Lake Manaway Railway	Council Bluffs	Iowa	Porter.
Leavenworth Rapid Transit Co	Leavenworth	Kansas	Baldwin.
Lincoln Rapid Transit Co	Lincoln	Neb	Porter.
Long Beach Land & Water Co	Los Angeles	Cal	"
Meridian St. Ry. Co	Meridian	Miss	Richmond.
Metropolitan St. Ry	Atlanta	Ga	Porter.
" " R.R	"	"	Baldwin.
Milledgeville & Asylum Dummy Line R.R	Milledgeville	"	Porter.
Milwaukee & Whitefish Bay Ry	Milwaukee	Wis	"
Mt. Penn Gravity R.R	Reading	Pa	Baldwin.
Mt. Tabor St. R.R	Portland	Oregon	"
Muncie St. Ry. Co	Muncie	Ind	Porter.
Nashville & West Nashville Ry	Nashville	Tenn	Baldwin.
New Orleans City & Lake R.R	New Orleans	La	Porter.
New Orleans, Spanish Fort & Lake R.R	"	"	"
North Birmingham St. Ry	Birmingham	Ala	Baldwin.
North Hudson County R.R	Hoboken	N. J	Baldwin.
" " "	"	"	Porter.
North Park St. Ry. Co	Grand Rapids	Mich	Baldwin.
North St. Paul R.R	St. Paul	Minn	"
Ogden City Ry	Ogden	Utah	"
Onset Bay Grove Association	Onset	Mass	"
Overland Ry	Nashville	Tenn	"
Oxford Lake Line	Anniston	Ala	Porter.
Pacific Improvement Oakland R.R	San Francisco	Cal	"
Park Ry	Denver	Col	"
Pasadena City Ry	Pasadena	Cal	Baldwin.
Petersburg & Asylum R.R	Petersburg	Va	"
Point Defiance Ry	Tacoma	Wash	Porter.
Portland City Real Estate Association	Portland	Ore	Baldwin.
Portland & Vancouver Ry. Co	"	"	
Port Townsend Construction & St. R.R	Port Townsend	Wash	Porter.
Prospect Park & Belt R.R	Memphis	Tenn	Baldwin.
Provo City Ry	Provo City	Utah	"
Rapid Transit Co. of Baltimore	Baltimore	Md	"
Richmond City Ry. Co	Richmond	Va	Richmond.
" " & Seven Pines Ry	"	"	"
Roanoke St. R.R	Roanoke	"	Baldwin.
Rochester & Lake Ontario R.R	Rochester	N. Y	"
Rome Land Co	Rome	Ga	"
San Bernardino & Redlands R.R	San Bernardino	Cal	"
" Diego & Pacific Beach Ry	San Diego	"	"
Selma St. R.R	Selma	Ala	"
" Ry. Co	"	"	Porter.
Seymour St. Car Co	Seymour	Ind	Baldwin.
Sheffield St. Ry	Sheffield	Ala	Richmond.
Sioux City & Highland Park Motor Ry	Sioux City	Iowa	Porter.
" Rapid Transit Co	"	"	"
Southern California Motor Ry	Colton	Cal	Baldwin.
" " " R.R	San Bernadino	"	Porter.
Spokane & Montrose Motor R.R	Spokane Falls	Wash	"
St. Louis Cable & Western Ry	St. Louis	Mo	"
St. Ry. of Grand Rapids	Grand Rapids	Mich	Baldwin.
Tacoma & Fern Hill St. Ry	Tacoma	Wash	Porter.
" & Puyallup R.R	"	"	"
" St. Ry	"	"	"
Tallapoosa St. Ry. Co	Tallapoosa	Ga	Baldwin.
Tampa St. Ry	Tampa	Fla	Porter.
Topeka Rapid Transit Co	Topeka	Kansas	Baldwin.
Tower & Soudan R.R	Tower	Minn	Porter.
Tuscaloosa Belt Ry	Tuscaloosa	Ala	Baldwin.
Vicksburg St. R.R	Vicksburg	Tenn	Porter.
Waco St. Ry	Waco	Tex	"
West End & Atlanta Ry	Atlanta	Ga	Richmond.
" Jersey R.R	Sea Isle City	N. J	Baldwin.
" Side Rapid Transit Co	Salt Lake City	Utah	
" Side Circle Ry	Topeka	Kansas	Baldwin
Wheeling and Elm Grove R.R	Wheeling	W. Va	"
Wichita Rapid Transit Co	Wichita	Kansas	Porter.
" & Valley Centre Motor Ry	"	"	Baldwin.
Willamette Bridge Co., formerly Woodstock & Waverly R.R	Portland	Oregon	"
	Seattle	Washington	

FOREIGN.

Cucuta R.R	Cucuta	U. S. of Colombia	Porter.
Empreza Mayrink	Santos	Brazil	Baldwin.
Hamilton & Dundas St. Ry	Hamilton	Ontario	"
Lacorda, Camargo & Co	Santos	Brazil	"
La Prueba R.R	Havana	Cuba	"
Maracaibo Tramways	Maracaibo	Venezuela, S. A	Porter.
Mexican National Ry. (Zacatecas Tramway)	Zacatecas	Mexico	Baldwin.
Paramatta City Tramways	Paramatta	New South Wales	"
Sydney City Tramways	Sydney	" "	"
Tramway Rural	Buenos Ayres	S. A	Porter.
Urbano R.R	Havana	Cuba	Baldwin.

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DOUBLE SELF-CONTAINED HORIZONTAL and VERTICAL ENGINES.

COMPOUND SELF-CONTAINED HORIZONTAL and VERTICAL ENGINES.

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STEAM BOILERS OF ALL TYPES AND SIZES, AND BUILT WITH SPECIAL REFERENCE TO CARRYING OF HIGH STEAM PRESSURE.

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OVER THIRTY YEARS' PRACTICAL EXPERIENCE.

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BEST MATERIALS AND WORKMANSHIP THROUGHOUT, AT LOWEST POSSIBLE PRICES.

HORSE RAILWAYS IN NORTH AMERICA—Continued.

State.	City.	Company.	Capital.	Bonds.	Miles.	Cars.	Gauge.	President.	Gen. Man., Sec. or Supt.	Date of Annual Meeting.
Fla.	Orlando	Orlando St. Ry	.....	.....	3	3	4-9	N. L. Mills	W. M. Mathus, Supt	
"	Palatka	Palatka & Heights St. Ry. Co	10,000	.....	2	3	3	Wm. P. Craig	D. A. Boyd, Gen. Mgr	
"	Pensacola	Pensacola St. Car Co	100,000	.....	3	8	4-8½	A. V. Clubbs	W. A. Blount, Sec	
"	"	Pensacola Terminal Co	200,000	.....	14	30	4-8½	G. Gordon	W. F. Chipley, Supt	
"	Tampa	Tampa St. Ry. Co	50,000	.....	3½	6	3-3	Everisto Mounc	C. E. Parcell, Supt	
Ga.	Atlanta	Atlanta St. Ry. Co	400,000	.....	30	55	4-8½	A. E. Thornton	W. S. Larendon, Supt	
"	"	† Metropolitan St. R.R. Co	.....	.....	13	25	4 8½	Aaron Haas	John D. Paterson, Supt	
"	Athens	* Athens Ry. Co	.....	.....	6	4	4-8½	E. G. Harris	John T. Voss, Gen. Man	May 1.
"	Brunswick	Brunswick St. R.R. Co	200,000	$ 100,000	9	5	4-8½	C. P. Goodyear	A. B. Rowe, Supt	
"	Columbus	Columbus R.R. Co	25,000	.....	17	12	5-8½	John F. F. Conroy	J. H. Henderson, Supt	May, 3d Wed.
"	Covington	Covington & Oxford St. R.R. Co	16,000	.....	3½	6	4-8½	W. C. Clark	R. O. Usher, Supt	
"	Gainesville	Gainesville & Hall R.R. Co	.....	15,000	2½	5	4-8½	Jas. R. Barnes	Robt. E. Green, Gen. Mgr	
"	Griffin	Griffin St. R.R. Co	20,000	.....	2½	3	4-8½	J. G. Rhae	R. H. Drake	Nov. 11, 1891.
"	Macon	Central City Ry. Co	.....	.....	5	4	4-8½	to Macon City & Suburban St. R.R.		
"	Milledgeville	Milledgeville & Asylum Dummy Line R.R.	25,000	.....	4	2	4-8½	W. W. Lumkin		
"	Rome	Rome St. R.R. Co	20,000	.....	7¾	10	4-8	John J. Seay	W. L. Legg, Supt	
"	"	North & South St. Ry. Co	.....	.....	2¼	3	4-9	J. A. Stansbury	Henry Harvey, Sec	
"	Savannah	City & Suburban R.R.	50,000	25,000	6	22	5	J. H Johnson	G. W. Allen, Supt	Dec. 31.
"	"	† Coast Line R.R. Co	.....	.....	7	20	5	Geo. Parsons	A. G. Drake, Supt	
Ill.	Aurora	Aurora St. Ry. Co	300,000	.....	11½	23	4-8½	R. B. Dobson		
"	Alton	Alton & Upper Alton Horse R.R. & Carrying Co.	.....	.....	3	5	4-8½	C. W. Milnor	H. R. Phinney, Supt	
"	"	Alton Improvement Association	25,000	.....	3½	2	4-8½	" "	" "	May, 2d Wed.
"	Belleville	Citizens H. R.R Co	.....	.....	4½	9	4-8½	D. P. Alexander	Carrie T. Alexander, Mgr	
"	Cairo	Cairo St. Ry. Co	100,000	10,000	4	6	3-6	Henry Wells	Thos. Lewis, Supt	Nov., 3d Fri.
"	Centralia	Centralia & Central City Ry. Co	10,000	4,500,000	3	6	4-8¼	S. N. Pierce	S. N. Pierce	Feb. 6, 1892.
"	Chicago	‖ Chicago City Ry. Co	6,000,000	.....	48	1447	4-8½	George H. Wheeler	S. T. Pope, Supt	First week-day after Jan. 14.
"	"	Chicago Pass. Ry. Co	.....	.....	27	114	4-8½	J. Doyle	Geo. L. Webb, Sec	
"	"	‖ North Chicago St. R.R. Co	.....	.....	79	400	4-8½	Chas. T. Yerkes	John M. Roach, Supt	
"	"	South Chicago City Ry. Co	100,000	.....	7	9	4-8½	L. H Eames	R. L. Brooke, Supt	
"	"	‖ West Chicago St. R.R. Co	.....	.....	150	1150	4-8½	Chas. T. Yerkes	John B. Parsons, Gen. Mgr.	
"	Chillicothe	People's St. R.R. Co	40,000	.....	2¾	4	4-8½	C. A. Thomas	R. H. Truitt, Sec	
"	Danville	Citizens St. R.R. Co	.....	.....	5	10	4	Wm. P. Cannon	Adam R. Samuel, Sec	
"	Du Quoin	Du Quoin St. R. Co	.....	.....	3	3	4-8½	R. P. N. Pope	H. Horn. Gen. Mgr	
"	Freeport	Freeport St. Ry.Co	.....	16,000	4	6	4-8½	Jacob Krohn	John B. Taylor, Gen. Mgr	
"	Galesburg	College City St. Ry. Co	40,000	.....	6½	12	4-8½	Wilkins Scacord	W. Kellogg, Supt	July, 1st Mon.
"	Jacksonville	Jacksonville Ry. Co	.....	.....	4½	5	4-8½	Wm. S. Hook	B. F. Sibert, Supt	
"	Joliet	Joliet City Ry Co	.....	.....	4	..	....			
"	La Salle	La Salle & Peru Horse & Dummy Ry. Co	.....	.....	1 1-3	2	3-3	F. W. Mathieson	G. Werts, Sec	
"	"	La Salle & Peru St. Ry. Co	.....	.....	..	..	....			
"	Mattoon	Mattoon St. Ry. Co	.....	.....	5		4-8½	J. B. Craig	Jos. Withington, Sec	
"	Mechanicsburg	Mechanicsburg & Buffalo Ry. Co	.....	.....	7¼	3	3-10	J. B. Hunter	J. T. Fullenweder, Sec	
"	Milan	Davenport & Rock Island Ry	.....	.....	43	80	4-8½	W. B. Walker	D. H. Louderback, Gen. Man.	
"	Moline	Davenport & Rock Island Ry	.....	.....	43	80	4-8½	" "	" "	
"	"	Union St. Ry. Co	.....	.....	17.4		4-8½	Eugene Lewis	Jas. Cazatt, Supt	
"	Peoria	Fort Clark Horse Ry. & Carrying Co	.....	.....	10	34	4-8½	J. H. Hall	Willis Hall, Sec	
"	Rock Island	Rock Island & Milan Ry. Co	.....	.....	43	80	4-8½	W. B. Walker	D. H. Louderback, G.M. & Trus.	
"	Rockford	* West End St. Ry. Co	30,000	.....	4½	6	4 8½	J. S. Ticknor	S. Roseborough, Gen. Man	May, 1st Sat.
"	Springfield	Citizens St. R.R. Co	.....	.....	9½	32	4-8½	J. H. Shuck	Chas. Herman, Sec	
Ind.	Brownstown	Brownstown & Ewing St. R.R. Co	.....	.....	½	1	5-4	W. Frysinger	F. Falk, Supt	
"	Evansville	Evansville St. Ry. Co	.....	.....	17	68	4-8½	C. Hathaway	T. J. Gist, Supt	
"	Fort Wayne	C. L. Centlivre St. Ry. Co	.....	.....	2	4	4 8½	L. A. Centlivre	C. F. Centlivre, Sec	
"	"	Fort Wayne St. R.R. Co	.....	.....	16	30	4-8½	J. H. Bass	L. D. McNutt, Supt	
"	Goshen	Goshen St. Ry. Co	.....	.....	3	..	..	W. D. Platter	G. D.Osborne, Sec	
"	Green Castle	Green Castle City St. R.R. Co	32,000	.....	2.60	3	4-8½	Dudley Rogers	I. S. Nutt, Sec	Jan. 1.
"	Indianapolis	Citizens St. Ry. Co	.....	.....	70	250	4 8½	W. H. Fowler	W. T. Steele, Supt	
"	Jeffersonville	Ohio Falls St. Ry. Co	50,000	.....	5	8	4-8	John C. Cerlauf	Newton H. Meyers, Sec	
"	Logansport	Logansport Ry. Co	.....	.....	4	9	4	C. T. Christensen	A. E. Hann, Supt	
"	Madison	Madison St. Ry. Co	.....	.....	2½	7	4	Jacob Wendel	Jacob Wendel, Supt	
"	Michigan City	Citizens St. Ry. Co	.....	.....	4	4	4-8½	Wm. G. Knight	J. H. Knight, Supt	
"	Muncie	Muncie St. Ry. Co	150,000	.....	7	16	4-8½	Col. F. E. Smith	F. G. Brownell, Supt	May.
"	New Albany	New Albany Ry. Co	.....	.....	4	10	4-8½	Allen Tindolph	Edward F. Tindolph	
"	Vincennes	Vincennes Citizens St. Ry. Co	.....	.....	3	4	4-8½	G. W. Graeter		Jan. 1.
Ia.	Boone	Boone St. Ry. Co	.....	.....	3	3	3	L. W. Reynolds	John Reynolds, Supt	
"	Burlington	Burlington St. R.R Co	.....	.....	3¼	9	4-8½	John Paterson	C. T. Paterson, Sec	
"	"	Union St. Ry. Co	.....	.....	11	22	4-8½	Geo. A. Duncan	F. G. Jones, Supt	
"	Calliope	Calliope & Hawarden St. Ry. Co	.....	.....	..	..	....	E. C. Carpenter	E. C. Carpenter, Gen. Mgr	
"	Cedar Rapids	Cedar Rapids & Marion Ry	.....	.....	13	20	4-8½	W. J. Green	Wm. Elson, Supt	
"	Centreville	People's St. Ry	.....	.....	2	2	3 8	J. R. Wooden	C. R. Wooden, Sec	
"	Clinton	Clinton & Lyons Horse Ry. Co	25,000	.....	10	24	3-8			
"	Council Bluffs	Council Bluffs St. Ry. Co	75,000	.....	8	46	5 8½	J. T. Stewart	C. H. Reynolds, Gen. Supt	
"	"	Lake Manawa Ry. Co	100,000	.....	5	8	4-8½	F. C. Reed	Emmet Finlay, Gen. Man	
"	Davenport	Davenport & Rock Island Ry Co	500,000	.....	43	80	4-8½	W. L. Allen		
"	Des Moines	Des Moines Suburban Ry. Co	.....	.....	12½	..	4-8½	C. A. Galch	J. S. Polk, Sec	
"	Fort Madison	Fort Madison St. Ry. Co	.....	.....	3¾	8	4-8½	J. B. Morrison	H. Jones, Sec	
"	Lyons	Clinton & Lyons Horse Ry. Co	.....	.....	9½	24	3-8	D. Joyce	F. Crapser, Supt	
"	Marshalltown	Marshalltown Passenger Ry. Co	.....	.....	3	..	4	C. C. Gilmore	A. E. Shorthill, Gen. Mgr	
"	Muscatine	Muscatine City Ry. Co	.....	.....	3½	7	3-6	F. Dant	A. G. Butler, Sec	
"	Oskaloosa	Oskaloosa Ry. and Land Co	200,000	100,000	7	3	3-6	W. R. Daum	Geo. P. Daum, Sec	
"	Ottumwa	* Ottumwa Ry. Electric & Steam Co	.....	.....	4	4	4	W. M. Peatman	C. B West	Jan., 2d Mon
"	Red Oak	Red Oak St. R.R. Co	.....	.....	1¼	1	4-2½	J. Hayes	Marcius Bonham, Supt	
"	Sioux City	Sioux City Rapid Transit Co	.....	.....	3½	4	4 8½	E. E. Peters	W. Gordon, Sec	
"	"	Sioux City & Highland Park Ry. Co	.....	.....	6	21	4-8½	C. W. Hornick	T. L. Miller, Supt	
"	Waterloo	Waterloo St. Ry. & Bus Co	.....	.....	2	3	3	G. D. Clinger	J. H. Goodnet, Sec	
Kan.	Abilene	Abilene St. Ry. Co	.....	.....	3¾	3	4	M. M. Shipe	M. M. Shipe	
"	Atchison	Atchison City Ry. Co	.....	.....	9½	21	4-8½	John Weber	W. L. Chalis, Gen. Mgr	
"	Beloit	Beloit City Ry. Co	75,000	.....	2	..		D. W. Soper	F. T.Burnham, Sec	
"	Clay Centre	Clay Centre Ry. Co	100,000	.....	5	4	4-8½	G. M. Stratton	Wm. Sharpe	
"	Cottonwood Falls	Consolidated St. Ry. Co	.....	.....	2	..	3 6	W. M. Adare	W. H Holsinger	
"	Council Grove	Council Grove St. Ry. Co	.....	.....	1½	2	3-6	W. H. White	H. W. Gildermeister, Sec	
"	El Dorado	El Dorado City Ry. Co	.....	.....	..	..	....	John Foutch	Robt H. Hazlett, Sec	
"	Emporia	Emporia City Ry. Co	.....	.....	3½		3-6	Van R. Holmes	J. D. Holden, Sec	
"	Hartland	Hartland St. Ry. Co	.....	.....	..	10	4-6	L. A. Bigger	S. Bigger	
"	Hutchinson	Hutchinson St Ry. Co	50,000	.....	8	10	4-6	F. A. Forsha	John Severance, Sec	
"	Larned	Larned St. Ry. Co	.....	.....	1½	2	3-6	A. Scott	Ledru Silvey, Gen. Mgr	
"	Lawrence	Lawrence Transportation Co	.....	.....	5½	6	4-1	H. Tisdale	W. McElhaney	
"	Leavenworth	Leavenworth & Suburban St. Ry. Co	250,000	.....	5	8	4-8½	G. A. Baker	G. A. Baker	
"	Newton	Newton City Ry. Co	60,000	.....	6	6	3	Allan Moore	W G. Oldfield	
"	McPherson	McPherson St. Ry. Co	.....	.....		..	3	Wm. West	Wm. West	
"	Pratt	City Ry. Co	.....	.....	1½	6		T. E. Simgison	Geo. Kuhns, Sec	
"	Salina	Salina Ry Co	.....	.....	3½	4	3-6	E. W. Ober	A. L. Dodge, Sec	
"	Topeka	Belt Ry. Co	.....	.....	4	11	4-8½	Chas. S Gleed	E. H. Littlefield	
"	"	East Side St. Ry. Co	.....	.....	10	4	4-8½	.....	W. W. Bright	
"	"	Topeka City Ry. Co	.....	.....	15	51		Chas. S. Gleed	E. H. Littlefield	
"	"	West Side Circle Ry. Co	50,000	.....	6½	3	4-8½	J. O. Davidson	Thos. G. Fitch, Gen. Man	
"	Wichita	‖ The Wichita Electric Ry. Co	1,000,000	300,000	25	4	4-8½	Chas. S. Gleed	Geo. H. Nolte, Sec	Jan., 1st Tues. after 1st Mon.
"	Winfield	Union St. Ry. Co	25,000	.....	4½	5	4	Wm. Mathewson	C Ferguson, Gen. Mgr	July 7.
Ky.	Ashland	Ashland & Cattletsburg St. Ry. Co	.....	.....	2	3	4-8½	A. C. Campbell	S. P. Hager, Supt	May.
"	Dayton	South Covington & Cincinnati (Dayton Division St. Ry. Co.)	.....	.....	5	11	5-2¼	E. F. Abbott	Lawrence Williamson, Supt	
"	Henderson	Henderson St. Ry	100,000	.....	6½	7	4-8½	E. G. Sebre, Jr	John W. O'Brien, Supt	July 1.
"	Lexington	Lexington City Ry. Co	.....	.....	..	..	....			
"	"	Louisville City Ry. Co	.....	.....	73	270	5	J. B. Speed		
"	"	Crescent Hill R.R. Co	.....	.....	3	..	5	B. Du Pont	T. J Minary, Gen. Mgr	
"	"	Kentucky St. R.R. Co	.....	.....	8	..	5			
"	Newport	South Covington & Cincinnati St. Ry. Co	.....	.....	..	..	...		John A Williamson, Supt	
"	Owensboro,	Owensboro City R.R. Co	25,000	.....	4	11	4-8	Jno. Gilmore	R H. Neely, Supt	
La.	Alexandria	City Ry. Co	.....	.....	..	..	....	E. B. Wheelock	Albert Pettingen, Supt	
"	New Orleans	New Orleans R.R. Co	185,000	21,000	9½	32	4-9½	B. Beoubay	P. Cougot, Sec	Feb., 1st Mon.
"	"	New Orleans & Carlton Ry. Co	.....	.....	16	78	4-8½	Joseph Hernandes	Chris. V. Haile, Supt	
"	"	New Orleans R.R. Co	.....	.....	15	45	5-2⅝	Alden McLellan	Alden McLellan	
"	"	St. Charles St. R.R. Co	600,000	165,000	15	64	5-2½	Alden McLellan	Alden McLellan, Supt	Jan., 2d Mon.
"	"	Algiers & Gretna R.R	.....	.....	3¼	4	3	J. E Auvray	John Reaney, Supt	
"	"	Crescent City R.R Co	.....	.....	26	79	5-2½	W. J. Behan	A. V. Smith, Supt	
"	"	New Orleans City & Lake R.R. Co	.....	.....	60	..	5-2½	J. A. Walker	F. Wintz, Supt	
"	Natchitoches	Natchitoches St. R.R. Co	.....	.....	2	10	4-8½	Phanor Brezeale	J. A. Ducournan, Sec	
"	Shreveport	Shreveport City R. R. Co	.....	.....	..	..	....	S. Levy, Jr	P. J. Trezevant, Sec	
Maine.	Belfast	Waldo St. Ry. Co	.....	.....	1½	6	4-4	Nathan F. Houston		
"	Biddeford	Biddeford & Saco R.R	.....	.....	6	12	4-8½	H. Banks	Chas H Prescott, Mgr	
"	Fryeburg	Fryeburg Horse R.R. Co	10,000	.....	3	3	4-8½	Freeman Hatch	Seth W Fife, Supt	June, 1st Tues.
"	Portland	Ocean St. R.R. Co	.....	.....	..	..	....	H. J. Libby	E. A. Newman, Gen. Mgr	
"	"	Portland R.R. Co.	.....	.....	11	53	4-8½	" "	" "	
"	Lewiston	Lewiston & Auburn Horse R.R. Co	.....	.....	10	22	4-8½	F. W. Dana	J. E Fairbanks, Supt	
"	Waterville	Waterville & Fairfield Horse R.R. Co	.....	.....	3½	5	4-8½	G. W. Williams	John S. Brockett, Supt	
Md.	Baltimore	Baltimore & Powhatan Ry. Co	.....	.....	6	6	5-4½	E L. Freeman	James McKitrick, Supt	
"	"	Highlandtown & Port Breeze Ry. Co	.....	.....	11	25	5-4½	F. Hazlehurst	Jas. Smith, Supt	Feb., 1st Mon.
"	"	Baltimore City Pass Ry. Co	1,000,000	.....	46¾	136	5-4½	Oden Bowie	S. L. Bridge, Sec	Jan., 2d Wed.
"	"	Baltimore, Brooklyn & Cedar Hill Ry. Co	50,000	.....	10	25	5-2	C. Orrick Swan	I. M. Thompson, Supt	
"	"	Baltimore, Catonsville & Ellicott's Mills Pass Ry Co	.....	.....	6	10	5-4½	Nelson Perin	W. W. Orndorff, Sec	
"	"	‖ Baltimore Traction Co	.....	.....	35	..	5-4½	T. E. Hambleton	Wm. A. House, Jr., Gen. Man.	
"	"	Baltimore Union Pass Ry. Co	.....	.....	16	62	5-4½	N. Perrin	Leon Fender, Sec	
"	"	Baltimore & Hall Springs R.R. owned by Baltimore City Pass. R.R. Co.)	.....	.....	..	..	....	Oden Bowie	S. L. Bridge, Sec	
"	"	Baltimore & Yorktown Turnpike Road Co	.....	.....	11½	21	....	S. H. Tagart	A. B. Sanks, Supt	
"	"	Central Ry. Co	.....	.....	12	..	4½	Peter Thompson	Walter Blackistone, Sec	
"	"	North Baltimore Pass Ry. Co	.....	.....	21	..	5-4½	Jas. L. McLane	Thos. J. Wilson, Sec	
Mass.	Boston	Somerville Horse R.R. Co. (leased to West End St. Ry. Co.)	153,000	.....	..	..	4-8½	Josiah Q. Bennett	John N. Studley, Jr	Jan., 2d Mon.
"	"	Boston & Chelsea R.R. Co. (" Lynn & Boston)	.....	.....	4.15	..	4-8½	W. W. Whieldon	John H. Studley, Sec	
"	"	Winnisimmet R.R. Co. (leased to Lynn & Boston)	.....	.....	2	..	4-8½	T. N. Proctor	E. F. Oliver, Sec	
"	"	* West End St. Ry. Co	13,550,000	3,250,000	256.8	2000	4-8½	H. M. Whitney	F. H. Monks, Supt	Nov., 2d Thurs.
"	Brockton	Brockton St. Ry. Co	.....	.....	..	..	....	W. W. Cross	H. B. Rogers, Gen. Man	
"	Cottage City	Cottage City St. Ry. Co	150,000	.....	13½	39	4-8½	W. C. Vanderlip	E. G. Eldridge Sec	
"	East Wareham	East Wareham, Onset Bay & Point Independence St. Ry. Co	.....	.....	1¾	6	5-8½	T. B. Griffith	J. E. Eldridge, Supt	
"	Fall River	Globe St. Ry. Co	.....	.....	17½	68	4-8½	F. S. Stevens	J. H. Bowker, Gen. Man	
"	Fitchburg	Fitchburg St. Ry. Co	.....	.....	6.87	13	4-8½	H. A. Wallis	Wesley W. Sargent, Supt	
"	Framingham	Framingham Union St. Ry. Co	60,000	.....	7.35	14	4-8½	C. H. Emerson	J. R. Entwistle, Sec	
"	Haverhill	Haverhill & Groveland St. Ry. Co	144,000	.....	15	39	4-8½	Ira O. Sawyer	Jno. A. Colby, Sec	October.
"	Lawrence	Merrimack Valley St. R.R. Co	.....	.....	11	35	4-8½	W. B. Ferguson	N. E. Morton, Supt	
"	Lowell	Lowell Suburban St. Ry. Co	300,000	.....	27	53	4-8½	E. M. Tucke	P. F. Sullivan, Gen. Man	Oct., last Thurs.
"	Malden	Malden & Melrose Ry. Co	.....	.....	8	..	4-8½	Chas. E. Powers		
"	"	East Middlesex St. Ry. Co	.....	.....	16	58	4-8½	Amos F. Breed	Welsey Wentworth, Supt	
"	Milford	Milford & Hopedale St. Ry. Co	50,000	.....	6	6	4-8	E. P. Usher		
"	Natick	Natick & Cochituate St. Ry Co	.....	.....	3	8	4-8½	Harrison Hapwood	Frank Hayes, Sec	
"	"	Black Rocks & Salsibury Beach St. Ry. Co	.....	.....	21½	33	4-8½	E. P. Shaw	E. P. Shaw, Gen. Man	
"	"	Plum Island St. Ry. Co	100,000	.....	5½	6	4-8½	G. W. Morse	F. G. L. Henderson, Supt	
"	Northampton	Northampton St. Ry. Co	50,000	.....	3¼	11	4-8½	J. C. Hammond	E. C. Clark, Supt	Dec., 2d Tues.

HORSE RAILWAYS IN NORTH AMERICA—Continued.

STATE.	CITY.	COMPANY.	CAPITAL.	BONDS.	MILES.	CARS.	GUAGE.	PRESIDENT.	GEN. MAN., SEC. OR SUPT	DATE OF ANNUAL MEETING.
Mass.	Onset	Onset St. Ry. Co			1½	2	4 8½	E. Gerry Browne		
"	Quincy	Quincy St. R.R. Co			4½	10	4 8	Jno. Q. Adams	John A. Duggan, Supt	
"	"	Manet St. Ry. Co			4	2		A. D. S. Bell	C. W. Morton, Supt	
"	Salem	Essex Electric St. Ry. Co	50,000		4½	12	4 8½	King Upton	D. N. Cook, Supt	
"	Taunton	Taunton St. Ry. Co	100,000			10	4 8½	Wm. C. Lovering	Geo. C. Morse	Oct. 2d Mon.
"	Whittinsville	Whittinsville St. Ry. Co	20,000		9	15	4 8½	G. W. Lasell	J. W. Lasell, Sec	
Manitoba	Winnipeg	* Winnipeg St. Ry. Co	100,000		5	15	4-8½	Jas. Austin	A. W. Austin, Pur. Agt	Oct. 21.
Mex.	Matamoras	Matamoras & Santa Cruz Ry	12,000		2	8		F. Armendaiz, owner	G. Aramburu	
Mich.	Ann Arbor	Ann Arbor & Ypsilanti St. Ry. Co	100,000		5½	10	3-6	C. Beal	A. G. Haines, Gen. Man	
"	Battle Creek	Battle Creek Street Ry. Co			12	16	4-8½	J. E. Burridge	P. P. Judson, Supt	
"	Bay City	Bay City St. Ry. Co			20	32	4-8½	Jas. Clements	Byron Alley, Supt	
"	Detroit	Fort Wayne & Elmwood Ry. Co	250,000		13	59	4-8½	Jas. H. Vhay	N. W. Goodwin, Sec	Jan., 2d Tues.
"	"	Grand River St. Ry. Co			51	250	4-8½	Hugh McMillan	Jno. Grant, Gen. Man	
"	"	Hamtram & Grosse Point Ry			51	250	4-8½	George Henrie	Jno. H. Fry, Gen. Man	
"	"	Detroit City Ry. Co			26	112	4-8½	Geo. Hendrie	" "	
"	Grand Rapids	Grand Rapids St Ry. Co			12	88	4-8½	A. J. Bowne	J. R. Chapman, Supt	
"	"	Valley City Street & Cable Ry. Co	600,000		6	18	3-6	"	J. R. Chapman, Gen. Man	
"	"	Jackson City Ry. Co						Hiram H. Smith	Henry H. Smith, Supt	
Mich.	Kalamazoo	Kalamazoo City & County St. Ry. Co			12		4-8½	Wayne Griswold	F. H. Davis, Supt	
"	Mt. Clemens	Muskegon Ry. Co	25,000		1½	3	4-8½	C. W. D. Miller	A. W. Bishop, Supt	
"	Saginaw	City of Saginaw St. R.R. Co			3	9	4-8½	David H. Jerome	F. G. Benjamin, Supt	
"	"	Saginaw Union St. Ry	200,000		25	12	4-8½	F. E. Snow	W. J Hart, Gen. Man	Aug., 2d Tues.
"	Sault Ste. Marie	* Sault Ste. Marie St. Ry. Co	25,000		4¼	5	4-8½	Thos. Ryan	Geo. A. Cody, Supt	Jan. 1st Mon.
"	St. Joseph	St. Joseph & Benton Harbor St. Ry. Co			3	10	4- ½	W. W. Bean	W. W. Bean, Supt	
"	Ypsilanti	Ann Arbor & Ypsilanti St. Ry. Co	100,000		9	6	4-8½	S. C. Haines	T. Milton Sec	
Minn.	Anoka	Anoka St. Ry. Co			3	6	5-8½	R. Mahany	Jas. Mahany, Sec	
"	Duluth	Minnesota Point St. Ry	100,000		3½	4	3-6	J. J. Hibbard	Walter Murray, Man	May 1.
"	Mankato	Mankato St. Ry. Co	50,000		3½	5	3-6	W. M. Farr	John C. Noe, Sec	
"	Minneapolis	Minneapolis St. Ry. Co	5,000,000		22	252	3-6	Thos. Lowry	D. W. Sharpe, Supt	
"	"	Minneapolis, Lyndale & Minnetonka Ry. Co			14	40	4-8½	F. C. Pillsbury	E. H. Center, Sec	
"	St. Cloud	St. Cloud City St. Car Co			3	2	4-2	C. P. McClure	Frank Tolman, Sec	
"	Winona	Winona City Ry. Co			4	10	3-6	B. H. Langley	B. D. Hatchez, Sec	
Miss.	Enterprise	Enterprise St. Ry. Co			1¼	2	3-6	John Kampe	J. W. Gaston, Sec	
"	Jackson	Jackson City R.R.			1½	5	5	Maurice Moses		
"	Meridian	Meridian St. Ry. & Dummy Line	50,000	$ 10,000	6	11	4-8½	Geo. S. Court	Abe Moses, Sec	
"	"	Meridian Road Co			5	7	4-8½	W. W. George	H. S. King, Sec	
"	Natchez	Natchez St. Ry			3½	4	3-8½	M. Moses	Abe Moses, Sec	
"	Vicksburg	Vicksburg St. Ry. Co								
Mo.	Carthage	Carthage Horse Ry. Co	30,000		4½	5	3-6	L. B. Daughtry	C. E. Newell	
"	Clinton	Clinton St. Ry. Co			2	3	4-1	A. P. Frowein	A. P. Frowein, Gen. Man	
"	Harlem	Kansas City Ry. Co			2.01	4	4-8½	W. E. Weiner	J. R. Anderson, Supt	
"	Independence	Kansas City, Independence & Park Dummy Line								
"	Kansas City	East Fifth St. Ry. Co. (not now in operation)	100,000		5	9	4-8½	Wm. J. Smith	Wm. H. Lucas	
"	"	Grand Av. Ry. Co	1,200,000		1¾	7		W. H. Holmes	O. F. Holmes, Gen. Man	May, 2d Tues.
"	"	N. K. C. St. Ry. Co			2	4	8- ½	W. E. Winner	J. R. Anderson, Sup	
"	"	South Side St. Ry. Co	500,000					A. P. Smith	C. S. Palmer, Sec	
"	"	Kansas City, Independence & Park Ry	1,200,000		8.16	18	4-8½	W. H. Holmes	J. R. Chapman, Gen. Man	
"	"	Kansas City, Masten & Westport R.R. Co	100,000		22½	90	4-8½	"	C. F. Holmes, Gen. Man	
"	"	Waldo Park Ry. Co			10	20	4-8½	Jno. A. McDonald	E. F. Hill, Gen. Man	
"	"	Consolidated City & Chelsea Park Ry. Co			2.60	4				
"	Lexington	Lexington & Kansas City Land and Investment Co			2½	2	4-4	R. G. Estill	Jas. Wentworth, Sec	
"	Sedalia	Sedalia St. Ry. Co			70¼	6	4-10	Joseph Sichen	Chas. Carroll, Supt	
"	Springfield	Springfield Electric St. Ry. & Improvement Co			5⅓		4-8½		W. L. Bailey	
"	St. Joseph	People's St. Ry., Electric Light & Power Co			10	33	4-8½	L. R. Bacon	W. T. van Brunt, Gen. Man	
"	"	Circle Cable Ry. Co			15	22	4-8½	W. J. Hobson	C. W. Hobson, Sec	
"	Warrensburg	Elec. Springs Ry. Co			¾	4	4			
"	St. Louis	Benton Bellefontaine Ry. Co			8	72	4-10	Jas. Campbell	R. McCulloch, Sec	
"	"	Baden & St. Louis R.R	300,000		3¼	10	4-9½	Geo. S. Case	H. Nelson, Supt	
"	"	Cass Ave. & Fair Ground Ry. Co			8½	31	4-10	D. G. Hamilton	R. McCulloch, Gen. Mgr	March.
"	"	Citizens' Ry. Co			21	105	4-10	"	Thos. Jones, Gen. Man	
"	"	Forest Park & Laclede Ave. & Fourth St. Ry. Co			5¼		4-10	P. C. Maffit	J. F. Davidson, Supt	
"	"	Fourth St. & Arsenal Ry. Co			6	20	4-10	Chas. Green	Patrick Shea	
"	"	Jefferson Ave. Ry. Co	200,000	200,000	5	40	4-9	Jno. Scullin	Jas. H. Roach, Sec	
"	"	Northern Central Ry. Co			10½	26	4-10	D. G. Hamilton	R. McCulloch, Gen. Mgr	March.
"	"	South Broadway Line	600,000	150,000	3	13				
"	"	Union R.R. Co	50,000		8	33	4-10	D. G. Hamilton	Robt. McCulloch, Gen. Man.	March.
"	Warrensburg	Elec. Springs Ry. Co			2¼	4	4	M. F. Dowd	M. F. Dowd, Gen. Man	
"	Webb City & Carterville	Twin Cities Isl. Ry. Co			3	4	4-8½	A. H. Rogers	J. M. Maret, Supt	April, 1st Tues.
Mont.	Anaconda	Light & Power Co			4	8	4-8½			
"	"	Helena, Hot Springs & Smelter R.R. Co			6¼	6	4-8½	E. D. Edgerton	H. C. Hombert, Gen. Man	
Neb.	Beatrice	Beatrice St. Ry. Co			4	5	4-8½	J. D. Kilpatrick	A. L. Green, Sec	
"	Grand Island	Grand Island St. Ry. Co	50,000		7	11	4-6	A. H. Baker	W. C. Lamon, Supt	
"	Hastings	Hastings Improvement Co			11	12	4-8½	Jas. B. Heartwell	J. A. Kraft	
"	"	Citizens' St. Ry. Co	100,000		5	6	4-8½	Robt. Batty	Jno. Hampshire, Supt	
"	Kearney	Kearney Electric Co			6	2		Geo. W. Frank	E. E. Mandeville, Supt	Jan., 1st Mon.
"	Lincoln	Standard St. Ry. Co			5	6	4-8½	C. T. Brown	D. W. Brown, Supt	
"	"	Lincoln St. Ry. Co			17	36	4-8½	J. W. Dewessee	E. L. Wooley, Supt	
"	"	South Lincoln St. Ry. Co			2½	1	4-8½	S. W. Burnman	Wm. Olier, Sec	
"	"	Lincoln Rapid Transit Co			11½	12	4-8½	John Fitzgerald	C. A. Adams, Gen. Man	
"	Nebraska City	Nebraska City St. Ry. Co	50,000		3½	4	4-8½	H. H. Bartling	J. C. Watson, Sec	January.
"	Norfolk	Norfolk St. Ry. Co	50,000		2½	4	4-6	R. A. Stewart		March.
"	Omaha	Omaha St. Ry. Co			84½	216	4-8½	Frank Murphy	F. A. Tucker, Supt	
"	Red Cloud	Red Cloud St Ry			7½	3		L. M. Cravill		
"	Wymore	Wymore & Blue Springs Ry. Co			3½	4	3-6	J. H. Reynolds	E. P. Reynolds, Sec	
"	York	York St. Ry. Co			4½	4	4	W. T. Scott	M. A. Green, Sec	
N. B.	St. John	St. John City Railway Co			7		4-8½	Jno. F. Zebley		
N. C.	Hendersonville	Hendersonville Horse, Ry. Co			1	3	4-8½		S. V. Pilkins	
N. H.	Dover	Dover Horse R.R. Co			2½	6	3- ½	Mary E. H. G. Gow	A. C. Grout, Supt	
"	Laconia	Laconia & Lake Village R.R. Co			2.67	10	3	A. Q. Folsom	Edmund Little, Sec	
"	Manchester	Manchester St. Ry			9	24	3	C. Williams	G. H. Knowles, Supt	
"	"	Massabesic Horse R.R. Co	100,000		6			J. F. Briggs	Geo. I. McAllister, Sec	
"	Nashua	Nashua St. Ry. Co			6	20	3	G. H. Knowles	G. H. Knowles, Gen. Mgr	
N. J.	Bloomfield	Newark & Bloomfield R.								
"	Camden	* Camden Horse R.R. Co	250,000	250,000	11.25	42	5	Wm. S. Scull	S. J. Fenner, Supt	Jan., 3d Mon.
"	Elizabeth	Elizabeth & Newark Horse R.R. Co			75	200	5-2½	Thos. C. Barr	J. N. Akarman, Supt	
"	Hoboken	North Hudson Co. Ry. Co			30	150	4-10	John H. Bonn	F. J. Mallory, Sec	
"	Jersey City	Pavonia Horse R.R Co			4	30	4-10		M. E. Staples, Gen. Mgr	
"	Keyport	Keyport & Matawan St. Ry. Co	300,000		3	6	4-8½	Thos. R. Brown	A. M. Brown, Sec	
"	"	Penn R.R. Co			6½	37	4-8½			
"	New Brunswick	N. B. City Ry. Co			4	6		Henry Conger	Wm. F. Price, Supt	
"	Orange	Orange, Crosstown & Broomfield St. Ry. Co	60,000		7	13	5-2	Francis M. Eppley	Thos. Marsh, Sec	
"	Paterson	Paterson Ry. Co	1,250,000		23	30	4-8½	Garret A. Hobart	E. J. Lawless, Gen. Man	
"	Philipsburg	Philipsburg Horse Car R.R. Co			14	33	5-2	Col. Lewis Perrine	Benj. V. Hill	
"	Trenton	Trenton Horse R.R. Co			10	29	5-2	Daniel Runkle	J. H. Solomon, Sec	June, 1892.
N. Y.	Babylon	Babylon St. Ry. Co			1½		4-9	W. F. Norton	David S. Sammis, Supt	
"	Binghampton	Binghampton & Port Dickinson R.R. Co	280,000		7½	25	4-8½	H. Westcott	N. L. Ostom	Aug., 1st Mon.
"	"	* Binghampton St. R. R. Co	160,000	200,000	14	5	4-8½	J. B. Landfield	J. P. E. Clark, Supt	
"	"	Court St., East End R.R	35,000		3.27	9	4-8½	Charles M. Stone	Miles Leonard, Supt	
"	"	Main Court & Chenango St. Ry. Co			6	10	4-8	Harvey Westcott	N. L. Osborn, Supt	
"	"	West Side St. Ry. Co	25,000		1½		4-8½	C. M. Stone	W. G. Phelps, Sec	
"	Brooklyn	Van Brunt St. & Erie Basin R.R. Co	150,000		1½	13	4-8½	D. N. Binns	F. I. Lucas, Supt	
"	"	Atlantic Avenue R.R. Co., of Brooklyn	2,000,000		44	200	4-8½	Wm. Richardson	W. J. Richardson, Sec	May 1.
"	"	Broadway R.R. Co. of Brooklyn	525,000	350,000	11	90	4-8½	Edwin Beers	Robert Sealy, Sec	May, 1st Mon.
"	"	Brooklyn City & Newtown R.R. Co	1,000,000	1,000,000	21½	218	4-8½	Jno. N. Partridge	John L. Heins, Supt	Apr., 2d Mon.
"	"	Brooklyn City R.R. Co	6,000,000	2,289,000	176	540	4-8½	D. F. Lewis	H. M. Thompson, Sec	January.
"	"	Brooklyn, Bushwick & Queens Co. R.R	100,000		11	47	4-8½	Geo. W. Van Allen	F. Hartshorn, Supt	
"	"	Coney Island & Brooklyn R.R			22	90	4-8½	H. W. Slocum	D. W. Sullivan, Supt	
"	"	South Brooklyn Central R.R. Co	125,000		8½	45	4-8½	Wm. Richardson	W. J. Richardson, Sec	
"	Canandaigua	Canandaigua St. R.R. Co			2¾	6	4-8½	Frank O. Chamberlain	Chas. C. C. Sackett, Supt	
"	Cortland	Cortland & Homer Horse R.R. Co	40,000		4.09	19	4-8½	C. H. Garrison	B. B. Terry, Supt	July, 1st Tues.
"	Deerfield	Deerfield & Utica R.R. Co	12,000		4¼	3	4-8½	F. G. Weaver	A. T. Goodwin, Sec	
"	Elmira	Elmira & Horseheads Ry. Co. (runs six electric motors)	400,000		14	23	4-8½	D. C. Robinson	C. H. Baldwin, Gen. Mgr	Nov. 2.
"	Far Rockaway	Village Ry. Co			1	4	4-8½	C. A. Cheever	Andrew McTigue, Supt	
"	Frankfort	Frankfort & Ilion St. Ry. Co			2½	5	5	A. C. McGowan	J. L. Hoard, Supt	
"	Fredonia	Dunkirk & Fredonia R.R. Co	57,000		3½	6	4-10	W. McKinstry	M. M. Fenner, Gen. Mgr	Oct., 3d Sat.
"	Fulton	Fulton & Oswego Falls St. Ry. Co	15,000		6,000 ft	4	4-8½	Joseph Walker	Chas. Lyman, Sec	
"	Glen Falls	Glen Falls, Sandy Hill & Fort Edward St. R.R. Co			7½	8	3-6	J. M. Colridge	J. B. Fowler, Sec	
"	Greenbush	North & East Greenbush St., Ry. Co			1.7	6	4-8½	A. Bleeker Banks		
"	"	Albany & East Greenbush Horse Ry. Co			1.7	62	4-8	" "	J. W. Gascoigne, Supt	
"	Herkimer	Herkimer & Mohawk St. Ry. Co			1½	4	4-8½	H. D. Alexander	E. L. Prince, Sec	
"	Hudson	Hudson Electric Ry. Co	50,000		2¼	5	4-8½	H. McGonegal	E. J. Hodge, Sec	
"	Huntington	Huntington R.R. Co			3	3	4-8½	E. D. Davidson	C. M. Tilston, Sec	
"	"	West Side St. Ry. Co			1½		4-8½	C. M. Stone	W. G. Phelps, Sec	
"	Johnstown	Johnstown, Gloversville & Kingsbro' Horse R.R. Co			4	6	4-8½	W. S. Northrup	L. Caton, Supt	
"	Larchmont	Larchmont Horse R.R. Co			1½	3	4-8½	C. H. Murray	W. H. Campbell, Sec	
"	Lockport	Lockport St. R.R. Co			4	8	4-8½	John Hodge		
"	L. I. City	Steinway & Hunters Point R.R. Co			30	86	4-8½	G. A. Steinway	A. D. Moulton, Supt	
"	"	L. I. City & Newtown Ry. Co	150,000		7	17	4-8½	Isaac Buchanan	Michael Conway, Supt	
"	"	Riker Avenue & Sanders Point R.R. Co	20,000		4		4-8½	G. A. Steinway	A. D. Moulton, Supt	
"	Mohawk	Mohawk & Ilion R R Co	15,000		1½	4	4-8½	J. B. Rafter		June 3.
"	Mt. Vernon	Mt. Vernon & East Chester Ry. Co			3	7	4-8	W. R. Bergholz	Leo Bergholz, Sec	
"	Newburg	Newburg St. Ry. Co			5	11	4-8½	Antonio Rasines	Wm. P. Rayland, Supt	
"	New Rochelle	New Rochelle Ry. & Transit Co			8	14	4-8½	C. H. Coffin	Frank Ryan, Supt	
"	New York	Broadway & Seventh Avenue R.R. Co			16	227	4-8½	Henry Thompson	Henry A. Newell, Supt	
"	"	Central Crosstown R.R. Co			5.22	47	4-8½	Geo. S. Hart	Milton J. Masson, Sec	
"	"	Central Park North & East River R.R. Co			26	183	4-8½	G. B. Scribner		
"	"	Christopher & Tenth St. R.R. Co			7½	44	4-8½	Louis de Bebian	Geo. Linch, Sec	
"	"	Dry Dock, East Broadway & Battery R.R. Co	1,200,000		18½	181	4-8½	Wm. White	F. F. White, Supt	
"	"	Eighth Avenue R.R. Co			20	112	4-8½	Geo. Law	James Affleck, Sec	
"	"	Forty-second St. & Grand St. Ferry R.R. Co			10.14	72	4-8	Geo. Green	John M. Calhoun, Supt	
"	"	Forty-second St., Manhattanville & St. Nicholas Ave. Ry. Co.			8	85	4-8½	Jno. S. Foster	S. M. Sisson, Supt	
"	"	Harlem Bridge, Morrisania & Fordham Ry. Co			18.18	66	4-8½	H. Spratley	H. Spratley, Supt	
"	"	Houston, West St. & Pavonia Ferry R R Co	250,000		8	40	4-8¼	Daniel S. Lamont	H. W. Eddes, Supt	
"	"	Twenty-third St. Ry. Co	600,000	400,000	14	90	4-8½	W. L. Elkins	Thos. H. McLean, Gen. Man	June, 3d Mon.
"	"	Twenty-eighth & Twenty-ninth Sts. R.R. Co	500,000			50	4-8½	J. H. Crane	D. S. Apgar, Sec	
"	"	New York & Harlem R R. Co	10,000,000		18½	162	4-8½	C. Vanderbilt	Alfred Skitt, Supt	
"	"	Jerome Park R.R			12.3	5	4-8½	W. A. Duer	Fred. A. Lovecraft, Sec	
"	"	Ninth Avenue R.R. Co			16	20	4-8½	Geo. Law	Lewis P. Foulk, Supt	
"	"	Manhattanville & St. Nicholas Avenue Ry. Co			18.32	85	4-8½	John S. Foster	S. M. Sisson, Supt	
"	"	Third Avenue R.R. Co. (horse and cable)	5,000,000	5,000,000	28	423	4-8½	Lewis Lyon	John H. Robertson, Supt	
"	"	East Broadway & Battery R.R. Co			18½	181	4-8½	Wm. White	F. F. White, Supt	
"	"	Sixth Avenue R.R. Co			9½	117	4-8¾	Frank Curtiss	Peter A. Miller, Supt	
"	"	Chambers St. & Grand St. Ferry R.R. Co			5	25	4 8½	Henry Thompson	G. Carter, Supt	
"	Niagara Falls	Niagara Falls & Suspension Bridge Ry. Co			2½	14	4-8½	C. B. Gaskil	Chas. B. Hill, Sec	
"	Ogdensburg	Ogdensburg St. Ry. Co			5	7	4-8½	W. H. Daniels	E. A. Newell, Sec	
"	Olean	Olean St. Ry. Co	10,000		1.1	3	3-6	John Fobes	John Fobes, Supt	Sept., 1st Tues.

HORSE RAILWAYS IN NORTH AMERICA—Continued.

State.	City.	Company.	Capital.	Bonds.	Miles.	Cars.	Gauge.	President.	Gen. Man., Sec. or Supt.	Date of Annual Meeting.
N. Y.	Oneonta	Oneonta St. Ry. Co	20,000		2¾	4	4-8½	Geo. I. Wilber	F. D. Tallmadge, Gen. Man.	Mon. preceding 2d Tues. in Jan.
"	Oneida	Oneida Ry. Co	15,000		1½	3	4-8½	W. E. Northrup	H. C. Stone, Gen. Man.	Oct., 2d Tues.
"	Oswego	Oswego St. Ry. Co			2½	5	4-8½	F. J. Callanan	H. A. Wilcox, Sec	
"	Pelham	Pelham Park R R. Co			3	8	3-6	W. R. Lamberton	F. Underwood, Supt	
"	Port Chester	Port Chester & Rye Beach St. Ry. Co	50,000		5	6	4-8	F. H. Skeele	A. H. Farrar, Gen. Mgr	
"	Poughkeepsie	City R.R. Co			4	9	4-8½	W. Young	C. M. Davis, Supt	
"	Rochester	Rochester Ry. Co	5,000,000		60	274	4-8½	A. G. Yates	John N. Beckley, Sec	
"	"	Union St. Ry. Co						John Conway	W. S. Moore, Sec	
"	Rome	Rome City St. Ry. Co	50,000	50,000	6¾	14	4-8½	Antonio Rasines	W. P. Rayland, Supt	Oct., 1st Tues.
"	Rondout	Kingston St. R.R. Co			2.78	8	4-8½	James G. Lindsley	W. H. De Garmo, Supt	
"	Salina	Woodlawn & Butternut St. Ry. Co			1¾	6	4-8½	John S. Kaufman	Peter Kappener, Supt	
"	Schenectady	Schenectady St. Ry Co			2¼	5	4-8½	John Kruesi	W. B. Turner, Supt	
"	Staten Island	Staten Island Belt Line R.R. Co			9	10	4-8½		Thomas Moore, Supt	
"	"	South Beach Ry. Co	17,500			4		F. H. Skeele	A. H. Farrar, Gen. Mgr	
"	Stillwater Village	Stillwater & Mechanicsville St. Ry. Co			4½	4	4-8½	W. L. Denison	Edw. J. Wood, Sec	Nov., 2d Fri.
"	Syracuse	Syracuse & Onondaga R.R. Co			2½	11	4-8½	A. N. Palmer	H. H. Durr, Supt	
"	"	Central City Ry. Co			2.88	20	4-8½	J. D. Ochsner	H. H. Durr, Supt	
"	"	Fifth Ward R.R. Co			3.48	12	4-8½			
"	"	Fourth Ward Ry. Co			4	9	4-8½			
"	"	Genesee & Water St. R.R. Co			4½	8	4-8½			
"	Syracuse	New Brighton & Onondaga Valley R.R.			17.8	4	4-8½			
"	"	People's Ry. Co			6	30	4-8½	A. N. Palmer	H. D. Durr, Supt	
"	"	Seventh Ward Ry. Co			3		4-8½			
"	"	The Syracuse Consolidated St. Ry. Co			50	70	4-8	J. Dunn, Jr.	T. L. Pode, Sec	
"	"	Syracuse & Geddes Ry. Co			2½	13	4-8½			
"	"	Woodlawn & Butternut St. Ry. Co			3½	5	4-8½			
"	Utica	Utica, Clinton & Binghamton St. R.R. Co	849,485					James J. Scollard	R. S. Williams, Sec	
"	"	Oneida S. R.R. Co	40,000		1½	3	4-8	Henry Ney	F. J. Cronk, Sec	
"	Waterford	Waterford & Cohoes R.R. Co	25,000		2		4-8½	Thomas Breslin	C. C. Ormsby, Sec	
"	Yonkers	Yonkers St. Ry. Co			5½	14	4-8½	Edmund Stephenson	D. W. Stephenson, Supt	
N. C.	Charlotte	Charlotte St., Ry. Co			3¼	7	4-8	E. P. K. Osborne	I. H. Wilson, Supt	
"	"	City Ry. Co	50,000		5		4-8½	E. D. Latta	A. H. Allen, Supt	
"	Durham	Durham St. Ry. Co			2	2	4-8½	W. T. Blackwell	John L. Markham, Sec	
"	Hendersonville	Hendersonville St. Ry. Co			1	2	4-8½		S. V. Pickens, Supt	
"	Wilmington	Wilmington St. Ry. Co			4	11	4-8½	J. D. Bellamy	W. H. Howell, Supt	
Ohio	Bellaire	Bellaire St. R.R. Co			2½	5	4-8½	U. O. Crane	Fred. Rodenig, Mgr	
"	Berea	Berea St. R.R. Co			1½	2	3-6	C. W. D. Miller	A. W. Bishop, Supt	
"	Chillicothe	Chillicothe St. R.R. Co			4	10	4-8½	Warren P. Noble	Jos. P. Meyers, Supt	
"	Cincinnati	The Pendleton, Mt. Lookout & East Walnut Hill Ry. Co	150,000	9,500	1⅔	2	3	C. N. Kilgour	A. H. Meier, Sec	July, 1st Tues.
"	"	Price Hill Inclined Plane R.R. Co			8.13	4	5-6	H. H. Littell	M. H. Littell, Gen. Mgr	
"	Dayton	Dayton St. R.R. Co	300,000		8½	15	4-8½	C. J. Ferneding	A. W. Anderson, Supt	April, 2d Mon.
"	"	Oakwood St. Ry. Co	300,000		8	18	4-8½	Chas. B. Clegg	Harrie B. Clegg, Sec	Jan., 1st Mon.
"	"	Wayne & Fifth St. R.R. Co			6½	10	4-8½	G. W. Shaw	Eugene Weichet, Sec	
"	"	Fifth St. R.R. Co	400,000		10	30	4-8½	D. B. Corwin	T. E. Howell, Supt	
"	Defiance	Defiance St. Ry. Co	25,000		3	6		Andrew Sauer	Wm. Carter, Sec	
"	Findlay	Findlay St. Ry. Co			12	19	4-8½	G. B. Kuper	Chas. Smith, Supt	Jan., 1st Tues.
"	Fremont	Fremont St. Ry. Co	125,000		4½	2	4-8½	F. N. Carter	E. J. Carter, Supt	
"	Hamilton	Hamilton St. Ry. & Electric Co			7	6	4-8	Ellis M. Potter	Ch. E. Heiser, Sec	
"	Ironton	The Ironton & Pettersburg St. Ry. Co	100,000		4½	10	4-8½	C. H. Harman	T. T. Johnson, Supt	
"	Lancaster	Lancaster St. R.R. Co			3	3	4-8½	Wm. Duffy	Frank Burnett, Sec	
"	Marietta	The Marietta St. Ry. Co			3	4	4-8½	E. B. Dyer	Walter Kerby, Supt	
"	Middletown	Middletown & Madison St. R.R. Co			2	4	4-8½	C. F. Gunckel	D. L. Sutphin, Supt	
"	Newark	Newark City Ry. Co			7½	12	4-8½	J. W. Lanehart	C. A. Lark, Supt	
"	"	Newark City Ry. Co			7	4	4-8½	R. Scheidler	H. Scheidler	
"	Portsmouth	Portsmouth St. R.R. Co.			4½	8	3-6	James Skelton	G. B. Chase, Supt	
"	Springfield	Citizens St. R.R. Co	200,000		19	22	4	Ross Mitchell	Chas. A. Harris, Sec	Jan., 3d Mon.
"	Tiffin	Tiffin St. Ry. Co			5½	17	4-4½	D. A. Lindley	Joseph Murphy, Supt	
"	"	Toledo Com. St. Ry. Co			2	1				
"	Toledo	Central St. Ry. Co			11	15	4-8½		Gen. Man., Albion, E. Lacey	
"	"	Metropolitan St. Ry. Co			14	20	4-8½		Gen. Man., Albion, E. Lang	
"	"	Toledo Com. St. Ry. Co			2	1				Jan., 2d Tues.
"	"	Toledo Elec. Ry. Co			2¼	3				
"	"	Toledo Consolidated St. Ry. Co								
"	Zanesville	Zanesville & McIntire Ry. Co			3	16	3-6	F. M. Townsend	W. C. Townsend, Sec	
"	"	Zanesville St. Ry. Co	200,000		5		5-2½	W. D. Chapman	F. A. Wilcox, Sec	
Oregon.	Albany	Albany St. Ry. Co			1	2	3-6	L. Flinn	C. G. Burkhart, Supt	
"	Baker City	Baker City St. Ry. & Motor Co	50,000	10,000	2	2	3-6	J. H. Wilson	Ralston Cox, Sec. and Supt.	
"	Corvallis	Corvallis St. Ry. Co			1	1	3-6	S. F. Campbell	L. M. Robinson, Sec. and Mgr	December.
"	Portland	Portland St. Ry. Co			12	10	3-6	Jos. Holladay	H. S. Holmes, Sec	
"	"	City & West Portland Park Motor Co	100,000		6	8	4-8½	S. A. Wood	W. H. Wood, Sec	
"	"	Mt. Tabor St. Ry. Co			6	3	4-8½	G. W. Brown	G. W. Brown, Mgr	
"	"	Portland & Vancouver Ry. Co	150,000		7	6	3	F. Dekum	C. C. Grimes, Supt	
"	"	Transcontinental St. Ry. Co			16	36	3-6	Tyler Woodward	D. Wakefield, Sec	
Ont.	Hamilton	Hamilton St. Ry. Co			15	52	4-8½	B. E. Charlton	T. B. Griffith Pur. Agt	
"	Port Sarnia	Sarnia St. Ry. Co	40,000			2	5	O. D. Scarfe	Alex. J. Miller, Sec	
"	London	London St. Ry. Co	100,000		6	30	4-8½	V. Cronin		
Penn.	Alleghany	Numery Hill Incline Plane Ry. Co	20,000		2	5	4-8½	J. S. Symington	H. M. Miles, Pur. Agt	
"	"	Thirtieth St. Bridge & Troy Hill Inclined Plane Ry. Co				2	10-2	James Callery	J. J. Saint, Supt	
"	Allentown	Allentown Pass. Ry. Co	45,260		8	19	4-8½	C. H. Haman	J. A. Bonnell, Supt. and Mgr.	
"	Beaver Falls	Beaver Valley St. Ry. Co	610,000		3.1	8	5-2½	H. C. Patterson	James Owery, Supt	Jan. 1.
"	Bradford	Bradford & Kendall St. Ry	12,000		1½	2	4-8	J. Broder	G. H. Moore, Sec	January.
"	Bellevue				½				L. G. Fisher	
"	Chester	Chester St. Ry. Co			7½	18	2¼	J. W. Lindsay		
"	Easton	Easton & West End Pass. Ry. Co	120,000		7	15	5-2	H. A. Sage	Leander Stern, Supt	
"	Harrisburg	Harrisburg City Pass. Ry. Co	125,000		5	26	5-2½	H. A. Kelker	A. Roberts, Sec	May, 2d Mon.
"	Lancaster	Lancaster City St. R.R. Co			7	6	5-2	J. A. Coyle	E. J. Ackley, Sec; W. Ring, Sup.	
"	"	Lancaster & Millersville R.R. Co	40,000		5½	5	4-8½	J. C. Hager	C. Dennes, Sec	
"	Meadville	Meadville Elec. St Ry. Co						F. P. Ray	F. A. McFarland, Supt	
"	McKeesport	McKeesport Pass. Ry. Co	100,000		3	5	5-2½	J. C. Smith	L. Richardson, Supt	
"	New Castle	New Castle St. Ry. Co			1½		4-8½	J. S. Wallace	J. S. Wallace, Sec	
"	Norristown	Citizens Pass. Ry. Co	50,000		4¼		5-2½	H. M. Lutz	Louis Huck, Supt	Jan., 2d Mon.
"	Philadelphia	Germantown Pass. Ry. Co	80,000	100,000	3	6	5-2½	John Slingluff	Geo. R. Kite, Sec	
"	"	Green & Coates St. R.R. Co. (Leased to People's Pass. Ry. Co.)	500,000					Moses A. Dropsie	Louis S. Renshaw, Sec	Jan , 2d Mon.
"	"	People's Pass. Ry. Co	1,500,000		46	167	5-2	Howard A. Stevenson	C. Whiting, Mgr	
"	"	Lombard & South Sts. Pass. Ry. Co	500,000		10	51	5-2	E. J. Moore	R. B. Selfridge, Sec	
"	"	Empire Pass. Ry. Co	600,000		8½	32	5-2	J. McManes	D. W. Dickenson, Sec	
"	"	The Ridge Av. Pass. Ry. Co	420,000		15	64	5-2	E. B. Edwards	W. S. Blight, Sec	Jan., 2d Mon.
"	"	Citizens Pass. Ry. Co	500,000		12	37	5-2	Ch. E. Ellis	John Q. Adams, Sec	Jan., 2d Mon.
"	"	Frankworth & Southwork, Phila. City Pass. R.R. Co	1,000,000		18.10	108	5-2	Jeremiah J. Sullivan	W. H. Jauney, Supt	
"	"	Hestonville, Mantua & Fairmont Pass. R.R. Co	2,050,000		20	60	5-4½	Chas. H. Lafferty	W. C. Foster, Sec	
"	"	North Phila. Pass. Ry. Co	300,000					H. A. Stiles	F. H. Williams, Sec	
"	"	Phila. City Pass. Ry. Co	1,000,000		41.7	133	5-2½	W. W. Colket	T. W. Pennypacker, Sec	
"	"	Phila. Traction Co	5,000,000	1,193,000	104.4	515	5-2½	W. H. Kemble	D. W. Dickson, Sec	Nov., last Tues.
"	"	Phila. & Darby Ry. Co	200,000		8½		5-2½	Beauvean Borie	W. W. Colket, Sec	
"	"	Phila. & Gray's Ferry Pass. R.R. Co	308,750		10⅓	41		Matthew Brooks	W. H. Brooks, Supt	
"	"	Schuylkill River Pass. Ry. Co	500,000		3.11		5-2	Oliver Hopkinson	J. C. Dawes, Sec	
"	"	Second & Third Sts. Pass. Ry. Co	1,060,200		37	116	5-2½	Horace T. Potts	D. W. Stephens, Supt	
"	"	Seventeenth & Nineteenth Sts. Ry. Co	500,000		6½			Matthew S. Quay	J. B. Peddle, Sec	
"	"	Thirteenth & Fifteenth Sts. Pass. Ry. Co	1,000,000		15½	89	5-2	B. S. Kinkel	W. P. Cooper, Supt	
"	"	Union Pass. Ry. Co	1,500,000		70	348		W. H. Kemble	John B. Peddle, Sec	
"	"	West Philadelphia Pass. Ry. Co	750,000		18½	122	5-2½	Peter A. B. Widener	Jas. S. Gorman, Supt	
"	"				2		4-8½	G. K. Sigfried	Chas. T. Swan, Supt	
"	Pittsburgh	Mt. Oliver Incline Ry. Co	100,000	44,500	1.9	5	5-2½	D. S. Bricknell	M. S. Holden, Supt	May, 1st Tues.
"	"	Penn. Inclined Plane Ry						Joshua Rodes		
"	"	Pittsburg & Alleghany Traction Co	350,000		10	47	5-2½	"	James C. Cotton, Supt	
"	"	Pittsburg & Birmingham Traction Co	200,000		7		5-2½	Sellers McKee	Miller Elliot, Supt	
"	"	Pittsburg & West End Pass. Ry. Co	200,000		9	21	5-2½	John C. Reilly	William J. Burns, Supt	
"	"	Transverse Pass. Ry. Co			6⅓	39	5-2	C. L. McGee	Miller Elliot, Supt	
"	"	Central Traction Co	100,000		2	30	5-2½	G. I. Whitney	W. C. Smith, Supt	
"	"	Castle Shannon Incline Plane Ry						Walter Chess		
"	"	Citizens Traction Co. (10 electric Motors)	3,000,000		28	73	5-2½	Jno. G. Holmes	J. E. Rugg, Gen. Supt	November.
"	"	Duquesne Incline Plane Ry						Samuel Severance	Wm. H. Graham, Sec	
"	"	Fort Pitt Incline Plane Ry. Co	30,000		2		10	Wm. Fleim	S. H. French, Sec	
"	"	Pittsburg Union Pass. R. R. Co	100,000		8	23	5-2½	W. Dalzell	Jas. C. Cotton, Supt	
"	"	Second Av. Pass. Elec. Ry. Co	30,000		10	5	5-2½	Jas. V. Callery	C. G. McNor, Sec	
"	"	South Side Pass. R.R. Co				8	5-2½	D. Z. Birckell	Miller Elliot, Supt	
"	"	Squirrel Hill R.R. Co	40,000					G. W. Morris	R. J. Whetten, Sec	
"	"	Suburban Rapid Transit Ry. Co			3		5-2½	H. Miller	Thomas A. Noble, Sec	
"	"	Forty-third St. & Millvale St. Ry. Co			2	5	5-2	P. W. Siebert	P. W. Siebert, Supt	
"	"	Monongahela Inclined Plane Ry. Co	150,000			4	5	Jas. M. Bailey	John L. Awl, Supt	
"	"	The Pittsburg Traction Co	2,600,000			36	5-2	G. W. Elkins	J. G. Traggardi, Sec	
"	"	St. Clair Inclined Plane Ry. Co	60,000			2		U. S. Hughes	W. S. Jones, Sec	
"	Pittston	Pittston St. Car Co	10,000		1¾	3	5-2	I. Everitt	E. W. Mulligan, Supt	
"	Pottsville	People's Ry. Co			1	8	4-8½	T. A. Reilly	W. D. Pollard, Supt	
"	Reading	Neversink Mountain Ry							P. D. Millhedwand, Supt	
"	"	Reading City Passenger Ry. Co	300,000		23	36	5-2½	B. F. Owen	J. A. Rigg, Supt	Jan., 2d Tues.
"	"	Perkiomen Av. Pass. Ry. Co								
"	Roxborough	Manakuny & Roxborough Incline Plane & Ry. Co			5½	8	5-2½	C. J. Walton	A. Tibben, Supt	
"	Sanbury	Sanbury & Northumberland St. Ry. Co								
"	Scranton	Nayang Cross Town			1½	3			G. S. Shenck, Supt	
"	Stroudsburg	Stroudsburg Pass. Ry. Co	25,600		1½	3	4-8½	L. A. Bacon	J. H. Vanderveer, Man.	
"	Williamsport	Williamsport Pass. Ry. Co			5½	9	4-8½	J. Lautz	Jacob Houser, Sec	
"	Wilkesbarre	Wilkesbarre & Kingston Pass. Ry. Co	100,000		3	10	5-2	H. R. Rhoads	Wm. Haines, Supt	
"	"	Coalville Passenger Ry. Co	62,375		2½	3	4-8½	Wm. J. Harvey	A. J. Davis, Sec	
"	York	York St. Ry. Co	100,000		5½	15	4-8½	W. H. Lanius	Jno. F. Kell, Sec	Jan., 2d Mon.
R I.	Pawtucket	Pawtucket St. Ry. Co	200,000		8½	23	4	A. B. Chase	C. F. Luther, Gen. Man.	
"	Providence	Union R.R. Co	1,500,000		57	307	4-8½	Jesse Metcalf	C. F. Luther, Gen. Man.	
"	"	Providence Cable Tramway Co	300,000		8	21	4-8½	Benj. A. Jackson	A. T. Potter, Gen. Man.	
"	Woonsocket	Woonsocket St. Ry. Co	100,000		5.6	12	4-8½	B. A. Jackson	W. R. Talbot, Sec	
"	"	Lake View & East Cleveland St. Ry. Co			2.68	5 tow	4-8½	Oscar J. Rathbun	Herbert Young, Supt	
"	"	South Side St. R.R. Co			4½	40	4-8½	A. Everett	E. Duty, Supt	
"	"	Woodlawn Av. & West Side St. R.R. Co			4.5	150	4-8½	A. L. Johnson	J. J. Coleman, Supt	
S. C.	Charleston	Charleston City Ry.			13	35	4-8½	M. A. Hanna	G. G. Mulhern, Gen. Supt	
"	"	Enterprise R.R. Co	200,000	50,000	11	25	5	T. W. Passailaigue	John Mohlenhoff, Supt	April.
"	"	Middle St. Lullwar Island Ry. Co			2¼	7	4-8½	A. F. Ravenel	W. E. Hayne, Sec	
"	Columbia	Columbia St. Ry	50,000		4¼	6	4-8½	B. Callaghan	B. Buckley, Supt	
"	Greenville	St. Ry. Co. of the City of Greenville			2¼	6	5	W. R. Wister	W. D. Starling, Man	
Tenn.	Athens	Athens Mineral Man. & Imp't. Co			2½	2		T. C. Gower	A. G. Gower, Supt	
"	Chattanooga	City St. R.R. Co			20	32	4-8½			

HORSE RAILWAYS IN NORTH AMERICA—Continued.

STATE.	CITY.		COMPANY.	CAPITAL.	BONDS.	MILES.	CARS.	GAUGE.	PRESIDENT.	GEN. MAN., SEC., OR SUPT.	DATE OF ANNUAL MEETING.
Tenn.	Chattanooga		Chattanooga Union Ry. Co	.....	.....	44	56	4-8½	C. A. Lyerly	W. H. Forbes, Supt	
"	Clarksville		Clarksville St. Ry. Co	6,3.0	.....	2	3	4-8	C. E. James	H. Bouren, Supt	
"	Cleveland		Cleveland St. Ry. Co	.....	.....	1¾	2	4-9	W. M. Daniel	J. W. Faxon, Sec	
"	Columbia		Columbia St. Ry. Co	50,000	.....	2¼	4	4-8½	J. T. Craik	E. C. McDowell, Gen. Mgr.	
"	Jackson		Jackson & Suburban St. R.R. Co	50,0 0	.....	7	9	4	L. Windom	J. H. Dew, Sec & Man	
"	Knoxville		Fountain Head Ry. Co	.....	.....	..	8	4-8½	Curtis Cullen	R. T. Baker	
"	"		Elmwood St. Dummy Line	.....	.....	3	4	4-8½	A. P. White	J. Lapcomb, Sec	
"	"		West End St. Ry. Co	.....	.....	2¼	3	4-8½	B. Braine	T. J. Thomas, Gen. Man	
"	Memphis		East End Ry. Co	.....	.....	6	22	4-8½	B. M. Stratton	J. R. Long, Sec	
"	"		Citizens St. R. R Co	.....	.....	40	75	4-8½	J. R. Godwin	R. Semmes, Supt	Jan. 4th Tues.
"	"		Memphis & Fort Pickering St. Ry. Co	.....	.....	6	10	4-9	G. V. Rambaut	D. E. Meyer, Sec	
"	"		Memphis & Prospect Park R.R.	100,000	.....	5	4	4-8½	T. J. Latham	T. A. Lamb, Sec	
"	"		Jackson Mound Park R.R. Co	100,000	.....	19	5	4-8½	Holmes Cummings	J. S. Norton, Sec	
"	Nashville		Union Elec. Railway	100,000	.....	52	..	5	T. W. Wrenne	E. G. Councile, Supt	
"	"		Nashville & West Nashville St. Ry. Co	.....	.....	7	8	4-8½	W. Morrow	S. C. Paine, Supt	
"	"		Overland Ry. Co	100,000	.....	8	12	4-8½	Wm. Marrow	F. M. Morrow, Sec	
"	Murfreesboro		Murfreesboro St. R.R. Co	200,000	.....	6	6	5	"	F. B. Fowler, Sec	
Texas.	Austin		Austin City R.R. Co	.. ....	.....	10	28	3-6	Chas. E. Judson	G. L. Hurley, Supt	
"	Corsicana		Corsicana St. Ry. Co	200,000	.....	32¼	6	4-8½	B. G. McKie	W. J. McKie, Sec	
"	Corpus Christi	†	Corpus Christi Improvement Co	100.000	36,000	6½	7	4-8½	E. L. Ropes	H. Keller, Supt	June
"	Dallas		Dallas & Oak Cliff Ry. Co	460,000	.....	15	25	4-8½	T. H. Marsalis	E. L. Snodgrass, Sec	
"	"		North Dallas Circuit Ry. Co	80,000	.....	5	14	4-8½	E. Sweeney	N. A. McMillen	
"	"		Dallas Con. Traction Ry. Co	1,000,000	1,500,000	26¼	29	4-8½	Royal A. Ferris	L. S. Garrison, Gen. Man	Jan. 2d Tues.
"	Denison		Denison Rapid Transit Ry. Co	.....	.....	6½	6	4-8½	B. J. Derby	C. F. Pease, Sec	
"	Dublin		Dublin St. R.R. Co	25,000	.....	5	3	4	H. A. Smith	C. W. Travis, Sec	
"	El Paso		El Paso & Paso Del Norte St. Ry. & Bridge Co	.....	.....	6½	14	4-8½	J. F. Crosby	F. P. Blutt, Gen Man	
"	Fort Worth		North Side St. R.R. Co	.....	.....	15	30	4	W. Hendricks	J. T. Payne, Supt	
"	"		Chamberlain Investment Co	.....	.....	..	3	....	.....	.....	
"	"		Lampasas St. Ry. Co	.....	.....	3	4	4-8½	R. E. Maddox	W. H. Little, Sec	
"	Gainesville		Gainesville St. Ry. Co	.....	.....	4½	6	3-6	G. L. Hurley	Chas. T. Smith, Supt	
"	Galveston		Gulf City St. Ry. & Real Estate Co	....	.....	64	16	4-8½	S. H. Burnell	P. S. Wren, Sec	
"	"	*	Galveston Cy. R. R. Co	318,674	300,000	19	25	4-8½	Wm. H. Sinclair	D. Atwood, Gen. Mgr	Jan., 3d Wed
"	Houston		Bayou City St. R.R. Co	.....	.....	17	36	4-8½	E. A. Allen	...	
"	Lampasas Springs		Lampasas Springs St. R.R. Co	.....	.....	3	6	4-8½	W. H. Little, Treas	W. H. Little, Sec	
"	Laredo		International Bridge & Tramway Co	.....	.....	55	10	....	P. Ornelas	.....	
"	"		The Laredo Improvement Co	.....	.....	5	..	4	J. M. Hamilton	Ch. T. Gager, Sec	
"	Longview		Longview & Junction St. Ry	.. ....	.....	1	2	3-6	W. S. Mayfield	R. B. Levey, Sec	
"	Paris		Paris Ry. Co	50,000	. .....	4¼	12	4-8½	D. H. Scott	R. F. Grimes, Supt	
"	San Antonio		Prospect Hill St. Ry. Co	.....	.....	..	..	....	.....	.....	
"	"		West End St. Car Co	.....	.....	5	2	4-0	G. W. Pass	J. N. Groesbuck, Sec	November.
"	Sherman		College Park Rapid Transit Co	.....	.....	4	5	4-8½	J. P. Harrison	D. W. Lewis, Sec	
"	"		Sherman City R.R. Co	.....	.....	4	11	5	C. W. Batsell	J. M. Batsell, Sec	
"	Tyler		Tyler St. Ry. Co	100,000	.....	8	16	4-8½	W. C. Scott	J. P. Douglass, Sec	
"	Victoria		Victoria St. Ry. & Improvement Co	25,000	.....	2¼	4	3	L. D. Heaton	J. E. Carpenter, Sec	
"	Waco		Waco St. Ry. Co	.....	.....	13	26	4-8½	H. E. Scott	J. L. Griffith, Supt	
"	Waxahachie		Waxahachie St. Ry. Co	25,000	.....	18	3	....	T. A. Ferris	O. Goodwin, Sec	
"	Weatherford		Weatherford City & Suburban R.R. Co	100,000	20,000	3¾	6	4-8½	G. P. Levy	G. B. Willbanks, Supt	August 18, 1891.
Utah.	Ogden City		Ogden City St. Ry. Co	.....	.....	10	14	4-8½	H. M. Beardsley	C. H. Nicholet, Sec	
"	Provo City	†	Provo City Ry. Co	100,000	.....	9	2	4-8½	L. Holbrook	B. Bachman, Jr., Gen. Mgr	July, 3d Mon.
Va.	Berkley		The Berkley St. Ry. Co	10,000	.....	1½	2	4-8½	T. H. Synon	W. Tillotson, Supt	Dec. 1.
"	Charlotteville		Charlotteville & University St. Ry. Co	.....		1½	4	4-8½	R. P. Valentine	H. D. Porter, Supt	July.
"	Lynchburg		Lynchburg St. Ry. Co	.....	125,000	3½	10	5-1	Stephen Adams	Stephen Adams, Sec	
"	Norfolk		Norfolk City R.R. Co	100,000	.....	5¼	29	5-2	W. H. Taylor	James J. Ferris, Supt	Feb., 1st Tues.
"	Portsmouth		Portsmouth St. Ry. Co	.....	.....	15.2	9	4-8½	R. M. Stewart-Worthy	O. Emerson, Gen. Mgr	
"	Richmond		Richmond & Manchester Ry. Co	.....	... .	5	5	4-8	A. H. Rutherford	J. C. Robertson, Supt	
"	"		Manchester Ry. & Improvement Co	.....	.....	32½	10	4-8½	C. W. Turner	W. W. Winston, Sec	
"	Staunton		City St. Car Co	500,000	.....	5	2	4-8½	Samuel B. Adams	R. D. Apperson, Gen. Mgr	
Vt.	Burlington		Winooski & Burlington St. Ry. Co	.....	.....	7	11	4-8½	Elias Lyman	K. B. Walker, Supt	
"	Rutland		Rutland Street Railway	50,000	28,000	5	10	4-8½	J. W. Cranston	M. McKeogh, Gen. Mgr	July, 2d Wed
Wash.	Port Townsend		Port Townsend St. Ry. Light & Power Co	.....	.....	4½	3	4-8½	W. F. Hastings	C. R. Swigert, Sec	July, 2d Mon.
"	Seattle		Front St. Cable Ry. Co	.....	.....	4	8	4-8½	A. B. Stewart	M. McMichen, Sec	
"	"		Green Lake Elec. Ry. Co	150,000	.....	4½	2	4-8½	W. D. Wood	C. F. Chapin, Sec	
"	"		Madison St. Cable Ry. Co	.....	.....	7	..	3-6	H. G. Struve	Maurice McMichen, Sec	
"	"		North Seattle Cable Ry. Co	.....	.....	2	..	4-8½	A. P. Mitten	" "	
"	"		James St. Ry. Co	.....	.....	4	4	3-6	C. F. Witter	J. D. Loman, Sec	
"	"		Ranier Railway Power Co	.....	.....	..	..	3-6	D. T. Denny	.....	Jan., 1st Mon.
"	"		Seattle Citv Ry. Co	.....	.....	7	12	narrow G.	T. G. Grant	F. M. Haas, Sec	
"	"		South Seattle Cable Ry. Co	.....	.....	4		4-8½	A. P. Mitten	M. McMichen, Sec	
"	"		West Seattle Cable Ry. Co	.....	.....	2	4	S. Track.	Thomas Ewing	.....	
"	Spokane Falls		Spokane Falls & Montrose Steam Motor R.R	.....	.....	4	2	4	F. H. Cook	F. H. Cook, Treas	
"	"		Spokane Cable Ry. Co	200,000	.....	3	7	3	J. D. Sherwood	C. H. Moore, Sec	
"	Spokane	*	Spokane St. Ry. & Cable Co	500,000	350,000	19	8	4-8½	H. Bolster	W. S. Norman, Sec'y	Sept. 28, 1891
"	Tacoma		Tacoma Ry. & Motor Co	500,000	.....	25	5	3-6	Paul Schultze	L. M. Hamilton, Supt	
"	"		Point Defiance St. Ry. Co	50,000	.....	7	6	3-6	Hugh C. Wallace	N. Lawson, Supt	
"	"		Tacoma & Fern Hill St. Ry. Co	.....	.....	..	2	3-6	G. Brown	Newman Kline, Sec	
"	"		Tacoma Ave. St. R.R. Co	.....	.....	2	6	....	.....	.....	
"	Vancouver		Columbia Land & Improvement Co	160,000	.....	2½	2	3-6	Gen. Jno. Gibbon	L. M. Hidden, Supt	Jan. and July, 1st Mon.
"	Walla Walla		Walla Walla St. Ry. & Investment Co	100,000	.....	4	6	3-6	W. P. Winans	J. M. Hill, Supt	
W. Va.	Charleston		Charleston St. Ry. Co	.....	.....	2½	6	4-8½	J. D. Campbell, Treas	Geo. Davis, Gen. Man	
"	Parkersburg		Park City St. R.R. Co	13,000	18,000	4½	8	4-8½	D. Gould	J. R. Fox	January.
"	"		The Huntington Belt Line	.....	.....	1½	6	4-8½	C. L. Hafner	F. L. Doolittle, Sec	
"	Wheeling		Wheeling & Elm Grove Ry	.....	.....	8	12	4-8½	J. D. DuBois	J. S. Hall, Sec	
Wis.	Ashland		Ashland St. Ry. Co	50,000	.....	2½	6	4-8½	Edwin Ellis	G. W. Marshall, Supt.	July 13.
"	Baraboo		Baraboo, Devil's Lake & Kilbourn City Elec. Ry. Co	....	.....	..	..	....	F. S. Brewster	G. A. Korlick, Sec	
"	Fon du Lac		Fon du Lac St. Ry. Co	.....	. .....	4½	8	4-8½	H. Burkholder	H. S. Clark, Sec	
"	Janesville		Janesville St. Ry. Co	.....	.....	4⅓	5	4-8½	S G. Clark	L. D. Richardson, Supt	
"	La Crosse		La Crosse City Ry. Co	.....	.....	7	19	4-8	B. E. Edwards	H. E. West, Sec	
"	Madison		Madison City Ry. Co	.....	.....	5¼	17	4	C. B. Holmes	G. H. Shaw, Supt	
"	Marinette		Marinette St. Ry. Co	5),000	.....	4	6	4-8½	H. C. Higgins	T. Higgins, Sec	
"	Milwaukee		Cream City R.R. Co	.....	.....	26	100	4-8½	Winfield Smith	Wm. Damkoehler, Sec	
"	"		Milwaukee City Ry. Co	.....	.....	36	108	4-8½	W. G. Oakman	R. B. Dobson, Sec	
"	"		Milwaukee & Whitefish Bay R.R. Co	.....	.....	5.35	7	4-8½	W. H. Bradley	H. R. Bradly, Sec	
"	Oshkosh		Oshkosh St. R.R. Co	....	.....	8¾	13	4-8½	Chas. Barber	C. E. Montgomery, Supt	
"	Racine		Belle City St. Ry. Co	.....	.....	8	12	4	G. B. Hathaway	J. E. Dodge, Sec	
"	Sheboygan		Sheboygan St. Ry. Co	.....	.....	5	6	4-8½	J. M. Laemann	F. J. Leamann, Sec	
Wyo.	Cheyenne		Cheyenne St. R.R. Co	.....	....	5	5	3-6	F. W. Warren	J. C. Baird, Sec	

LIST OF CABLE RAILWAYS IN THE UNITED STATES.

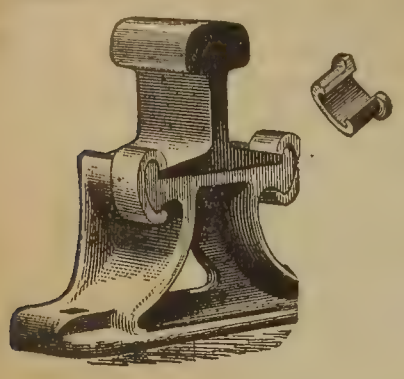
(ALPHABETICALLY ARRANGED ACCORDING TO CITIES.)

EXPLANATORY NOTE.

*A number of the companies recorded below also use horses and electrical cars over a portion of their roads, which is determined in the following list by reference to the signs placed immediately before the corporate name, the * signifying that the company also uses horses, the † that electricity and the ‖ that dummy locomotives are also used. For further particulars see also lists horse, electric and dummy roads.*

The miles given represent cable mileage only.

CITY.	STATE.		COMPANY.	STOCK.	BONDS.	MILES.	CARS.	TRAILERS.	PRESIDENT.	GEN. MGR., SUPT. OR SEC.	DATE OF ANNUAL MEETING.
Baltimore	Md.	*	Baltimore Traction Co	.....	1,500,000	10	....	....	T. Hambleton	W. A. House, Gen. Mgr	
Brooklyn	N. Y.		Brooklyn Heights Ry. Co	200,000	.....	2500 ft.	10	....	D. F. Lewis	A. Rodgers, Supt	
Chicago	Ill.	*	Chicago City Ry. Co	6,000,000	4,000,000	36	....	....	Geo. H. Wheeler	F. R. Greene, Sec	
"	"	*	No. Chicago St. Ry. Co	.....	.....	....	15	....	Chas. D. Yerkes	F. L. Threedy, Gen. Mgr	
"	"	*	West Chicago St. R.R. Co	10,000,000	4,100,000	18	150	1000	" "	John B. Parsons, Gen. Mgr	
Cincinnati	Ohio.	* †	Cincinnati St. Ry. Co	5,775,000	400,000	8	36	72	John Kilgour	John Harris, Supt	
"	"	* †	Fort Adams & Eden Pk. Inc. R.R. Co	1,400,000	600,000	8	....	....	" "	A. C. Starr, Pur. Agt	
"	"		Mt. Auburn Cable Ry. Co	300,000	300,000	8	22	23	Henry Martin	J. D. Davies, Supt	Sept., 3d Mon.
Cleveland	O.		Cleveland City Cable Ry. Co	4,000,000	.....	19	47	....	Frank De H. Robison	M. S. Robison, Jr., Supt	July, 3d Tues.
Dallas	Tex.		Dallas Cable Ry. Co	600,000	.....	6	12	12	J. M. Harry	Chas. W. Guild, Sec	
Denver	Col.	†	Denver Tramway Co	1,000,000	.....	18	102	....	Rodney Curtis	C. K. Durbin, 2d, Supt	
"	"		Denver Cable Ry. Co	500,000	.....	6	12	....	.....	.....	
"	"	*	Denver City Cable Ry. Co	3,000,000	.....	24	52	....	Geo. H. Holt	G. E. Randolph, Gen. Mgr	
Grand Rapids	Mich.	*	Consolidated Street Railway Co. of Grand Rapids	200,000	.....	9	24	....	A. J. Bowne	W. S. Crosby, Sec	
Hoboken	N. J.	*	No. Hudson Co. Ry	.....	.....	25	....	....	John H. Boun	Nicholas Goetz, Supt	
Kansas City	Kan.	†	Inter-State Cons. Rapid Ry. Co	.....	.....	15	14	5	T. M. Edgerton, Receiver	W. Stone, Supt	
"	Mo.		Kansas City Cable Ry. Co	1,575,000	.....	20.5	71	119	W. J. Smith	W. H. Lucas, Sec	May.
"	"		Grand Ave. Ry Co	1,200,000	1,200,000	8.5	80	....	W. H. Holmes	C. F. Holmes, Gen. Mgr	
"	"	* †	Metropolitan St. Ry. Co	3,000,000	.....	24	75	....	C. F. Morse	R. J. McCarthy, Gen. Mgr	
"	"		People's Cable Ry. Co	750,000	.....	6.5	....	....	H. P. Churchill, Receiver	F. Philips, Supt	
"	"		Union Ry. Co	300,000	.....	4.5	10	10	H. M. Broadwell	E. A. Morrison, Supt	
Los Angeles	Cal.	*	Pacific Ry. Co	2,500,000	2,500,000	20.56	100	50	C. B. Holmes	J. J. Akin, Supt	
"	"		Temple St. Cable Ry. Co	400,000	100,000	3	8	5	P. Beaudry	F. W. Wood, Gen. Man	
New York	N. Y.	*	Third Ave. R.R. Co	.....	5,000,000	28	....	....	Lewis Lyon	J. H. Robinson, Supt	Nov., 1st Wed. after 2d Mon.
Oakland	Cal.		Oakland Cable Ry. Co	.....	.....	....	....	....	.....	Geo. G. Loring, Supt	
"	"	*	Consolidated Piedmont Cable Co	2,000,000	1,000,000	21	25	....	Mont Howe	H P. Garthwaite	
Omaha	Neb.	* †	Omaha St. Ry. Co	.....	.....	9.5	....	....	Frank Murphy	W. A. Smith, Gen. Mgr	
Pawtucket	R. I.	†	Pawtucket Valley Electric Street Railway Co	.....	.....	....	....	....	.....	.....	
Philadelphia	Pa.	*	Philadelphia Traction Co	5,000,000	.....	23	....	....	W. H. Kemble	D. W. Dickson, Sec	
Pittsburg	"	*	Central Traction Co	1,500,000	.....	5	....	....	Geo. J. Whitney	W. C. Smith, Supt	
"	"	* †	Citizens Traction Co	300,000	.....	12.5	66	....	John G. Holmes	J. E. Rugg, Supt	
"	"	*	Mount Oliver Incline Railway Co	100,000	44,500	1.9	2	....	D. Z. Brickell	M. S. Holden, Supt	May, 1st Tues
Portland	Ore.		Portland Cable Ry Co	500,000	.....	5	....	....	C. H. Woodard	G. W. Lynch, Gen. Mgr	
Providence	R. I.	*	Providence Cable Tramway Co	300,000	.....	3	14	....	P. A. Jackson	A. T. Potter, Gen. Mgr	May, 2d Wed.
San Diego	Cal.		San Diego Cable Ry. Co	500,000	225,000	5¼	14	....	D. D. Dare	J. E. O'Brian, Sec	
San Francisco	"	‖	Ferries and Cliff House Ry	2,500,000	650,000	15	....	....	W. J. Adams	H. H. Lynch, Supt	
"	"	‖	Geary St. Pk. and Ocean Ry	1,000,000	250,000	5	....	....	C. F. Crocker	R. Stevenson, Pur. Agt	
"	"	*	Market St. Cable Ry. Co	.....	3,000,000	25	....	....	Leland Stanford	" "	
"	"	*	Omnibus Cable Co	2,000,000	2,000,000	23	143	....	Gustav Sutro	C. L. Anderson, Supt	
"	"	*	Presidio & Ferries R.R. Co	1,000,000	.....	4	....	....	W. Clift	John B. Leighton, Sec	
"	"		Sutter St. Ry Co	2,000,000	800,000	13	50	....	R. F. Morrow	J. Reynolds, Supt	
Seattle	Wash.		Front St. Cable Ry. Co	300,000	.....	5½	8	8	A. B. Stewart	E. Shephard, Gen. Mgr	
"	"		Madison St. Cable Ry. Co	750,000	.....	4	16	....	H. G. Struve	" "	
"	"		No. Seattle Cable Ry. Co. (Operated by Front St. Cable Ry.)	.....	.....	....	....	....	.....	.....	
"	"		Seattle City Ry. Co	600,000	.....	5	12	12	F. J. Grant	F. M. Haas, Gen. Mgr	
Sioux City	Ia.		Sioux City Cable Ry Co	.....	.....	1	25	....	J. P. Pierce	W. H. Mack, Gen. Mgr	
Spokane Falls	Wash.		Spokane Cable Ry. Co	200,000	.....	3	7	....	J. D. Sherwood	C. H. Moore, Sec	
"	"	* †	Spokane St. Ry. and Cable Co	500,000	350,000	3	20	....	H. Bolster	W. S. Norman, Gen. Mgr	
St. Louis	Mo.	*	Citizens Ry Co	1,500,000	1,500,000	13	55	....	D. G. Hamilton	Robt. McCullock, Gen. Mgr	
"	"		Missouri Ry. Co	2,400,000	500,000	11	....	....	P. C. Maffit	Jas. F. Davidson, Supt	
"	"		People's R.R. Co	1,000,000	1,000,000	10	40	40	Chas. Green	J. Mahoney, Gen. Mgr	
"	"		St. Louis Ry. Co	2,500,000	1,500,000	14.5	80	200	D. G. Hamilton	Robt. McCullock, Gen. Mgr	
"	"	† ‖	St. Louis Suburban Ry. Co	2,000,000	.....	6.5	26	47	C. H. Turner	A. de Figuersedo, Supt	
Tacoma	Wash.		Tacoma Ry. and Motor Co	500,000	.....	1.75	5	....	Paul Schultze	J. H. Cummings, Gen. Mgr	
Washington	D. C.		Washington & Georgetown R.R. Co	500,000	.....	6	11	....	A. Henry Hurt	C. C. Sailer, Supt	



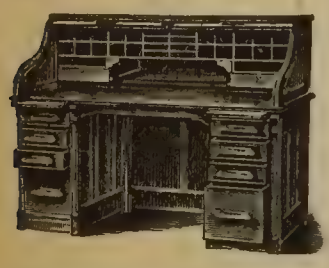
THIS CHAIR POSSESSES THE FOLLOWING DECIDED ADVANTAGES:

No bolts, rivets or wedges are used.
Chairs are firmly secured to rail.
Have a broad base and large surface on tie.
Paving block can be laid close to rail.
Rail may at any time be removed from chair without drawing spikes or changing position of chair.
Small hammer only is required to attach chair to the rail.
Labor and time saved in track construction.

Burnham & Duggan Railway Appliance Co.,
70 KILBY STREET, BOSTON.
(Room 24.)

WM. SCHWARZWAELDER & CO.,
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STREET RAILWAY NEWS.

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VOL. I. NEW YORK, NOVEMBER 7, 1891. No. 18.

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(WEEKLY.)

Entered at New York P.O. as second-class matter.

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SUBJECTS FOR SPECIAL COMMITTEES.

For the past few conventions of the American Street Railway Association the subject of electric traction has ruled almost supreme, and while the interests of cable railways has not been entirely neglected, yet, as was perfectly natural, all other subjects have been practically shocked into inanimate nothings by the preponderance of attention given to the thirst for more light by those interested in the new motive power.

But while we admit the immense importance of learning all we possibly can regarding electric traction; while we concede the imperative necessity of pushing our investigations deep down into hidden mysteries of bed-rock economy, of ascertaining by hard-pan, indisputable facts and figures just what it costs to operate an electric car on a level—on a grade of any given percentage—of the exact horse-power required to overcome the inertia of a car under any and all conditions, of the loss in transmission, of the thousand-and-one things which go to make up a railway—yet we must not lose sight of the fact that the question of proper track construction—of car building—of paving—of the most systematic method of conducting the details of the accounts of operating companies—all these and many more figure largely in the economical administration of those corporate affairs, and the solving of the problems involved in the subjects indicated would prove of the deepest possible interest not alone to electric railway men, but to street-railway officials the world over.

Therefore in the appointing of the special committees for next year we would earnestly suggest their appointment with a view of obtaining information of more general instead of merely specific interest.

OHIO STATE TRAMWAY ASSOCIATION.

The tenth annual meeting of the Ohio State Tramway Association will be held at Akron, O., on Wednesday, November 11, and we have every reason for believing that the attendance at the meeting will be a large one.

A desire has been expressed among the gentlemen constituting the members' delegates to the convention that supply-men be asked to present the merits of what they advocate to the meeting, and are authorized by the President of the Association to extend an invitation to those desiring so to do, to submit the nature of their business to the Secretary of the Association, Mr. J. B. Hanna, of Cleveland, O., and the subject upon which they wish to prepare papers for reading before the Association, so that they may all receive proper recognition and assignment.

LIST THE SECURITIES.

We have been to considerable trouble and expense lately to obtain a consensus of reliable competent opinion in regard to the listing of street-railway securities on the New York Stock Exchange, and from letters on the subject (a few of which we published in our issue of Oct. 24), we find that fully five-sixths of the investors and traders in this class of bonds and shares are most decidedly in favor of it.

Several reasons for this are given. Among them are the following: They are public corporations, and as officers of such chartered organizations are not permitted by law to deal in the shares, there should be some place where their value can be ascertained and a market found; this would be reached from the periodical reports made to the Exchange. Again the public undoubtedly have the right, equally with the stockholders, not only to know the earnings of such common carriers, but to participate if they so desire in the profits.

After listing, there is no doubt that the market value would be the amount on which the net earnings were six per cent.

The dealings all along the line, prices steady and strong, fluctuations fractional, mainly to cover brokerage and floor traders' profits; as a collateral for long loans it would be superior and fill a demand; as street-railway incomes never deteriorate, but merge or consolidate into, in this country, ever-increasing business.

A majority look with disfavor on listing as a trust giving as the reason that trusts are unpopular and favor the separate presentation of each security.

Of one thing we are most positive, and that is the street-railway industry has now attained a point when its securities should have a negotiable and marketable value as collateral; that its financial statements will bear the closest possible scrutiny, and that, as investment securities, its stocks and bonds cannot but prove remunerative.

INFORMATION.

Less than a week ago a letter reached us from one "A. T. B." (see last issue) asking information regarding street railways in Kimberley, South Africa; Warsaw, Poland; Acapulco, Mexico, and Nuremberg, Kingdom of Bavaria. Although that issue of the STREET RAILWAY NEWS was just about on the press, yet we held it back long enough to pen our reply to our correspondent, and to give him the information asked for in the fullest detail.

When information concerning street railways extending over three or four continents is sought for at the hands of a publication devoted to that interest and a reply given almost instantaneously, it speaks volumes for the information in the hands of the publication in question.

WONDERFUL GROWTH.

How interesting—how deeply interesting—are the statistics furnished in the annual address of the President (Watson) at the late convention: In December, 1889, 476 cities in the United States possessed rapid-transit facilities—now where is a city with a population 10,000 or over without its street railroad? In November, last year, 116,795 horses were employed on street-railway lines—to-day not over 88,114 are utilized for the purpose of car hauling, a loss of 28,681 in less than twelve months. Fifty-four cable lines are in operation as against 412 electric and 537 animal, 1,003 companies are operating street railroads and 75 companies are building new lines.

"NO STRING ATTACHED TO THIS."

In cleaning out our desk, after the hubbub of the convention was over, we ran across the wedding-cards of that popular and enterprising representative of the Electric Merchandise Company, Mr. Dwight B. Dean, who, upon the seventh day of the tenth month of this year of grace took unto himself a wife, and was duly and truly initiated into the order of Benedicts.

We believe we were in Chicago upon that eventful day, and rumors which reached our ears at about noon on that day almost upset our dignity and caused a two-by-four smile to ripple over our usually placid face. However, the matter has now passed into history, and we can only assure brother Dean that STREET RAILWAY NEWS wishes him and his bonny bride the fullest possible measure of happiness, and most earnestly trusts that their run of good luck may prove even longer than the emblem of the same which some of their well-wishers caused to verily jump for joy at the end of many feet of cord behind the carriage which carried them from the scene of their nuptials to the M. C. Depot.

ELECTRIC RAILWAY POWER-HOUSE.*

Recognizing the necessity of a perfectly reliable source of power, the Federal Street and Pleasant Valley Ry. Co., of Allegheny and Pittsburg, Pa., has spared no expense in fitting its power-house with the best of steam and electric machinery. The building is absolutely fire-proof, with brick walls and tile roofing.

The boilers are of the Hazleton type, rated at 1,000 H. P. in two units, and each furnished with three independent Roney stokers.

Four lines of street railway are operated by the company, and the current is furnished by five 80-watt Edison dynamos, one 150-watt Edison dynamo, and three 40-watt Thomson-Houston dynamos.

In practice these two differently-wound makes of generators are not found to work well together, and in a short time the electric machinery will probably be exclusively Edison.

The power originally consisted of one 18 x 33 and two 24 x 33 Buckeye engines, and with a view to guarding against possible delay through accident, a system of clutches and countershafting was adopted and so arranged that any engine might run any dynamo, or even take all the load. In spite of these precautions, the company has had more than its share of trouble.

That it has been so unsuccessful in this respect has been the fault of the design of the plant, rather than carelessness in its operation or the policy of the purchasing agent.

Belts and clutches always seemed to slip when the load was heaviest, and the shaft bearings got hot when greater service was demanded and when a shut-down was most vexatious.

Finally, losing all patience, the company has installed an 18 and 30 x 16 Westinghouse high-duty compound engine, belted direct to a 150-watt Edison dynamo, and intends to thoroughly test the combination by comparison. Its success seems to be already demonstrated to be as great as the failure of the system whose work it shares. It is quite probable that independent engines will eventually displace the centralized power with its expensive complication of shafting, clutches, belting, etc.

The interior view of the station given herewith shows the disposition of the machinery and the contrast between the simplicity of the one plant and the intricate construction of the other.

* Westinghouse Machine Co., Pittsburg, Pa.

RAPID TRANSIT IN BERLIN.

As will be seen from the following, which is communicated to the London *Electrical Review* by its Berlin correspondent, the question of improved means of transit in the German capital is as momentous as it is in New York at the present time.

For a considerable time the question of improved communications in the German capital, says the correspondent, has been more and more coming to the front, especially since the population is approaching the second million. Some time ago the firm of Siemens & Halske submitted a project for urban lines to the municipal authorities, but a report was circulated that they objected, on principle, to elevated lines, which, it would seem, are the sole kind practicable in Berlin. This report is an error, since both the municipality and the Minister of the Interior have given their general consent, though the question of details is still under consideration.

The fact that the present means of communication in Berlin are insufficient is at once conceded. The so-called "city line," which is useful only to those parts which lie to the north of the Leipzigerstrasse, has reached the limit of its capacity. Any increase in the tram-cars in the centre of the city is conceivable only if electric power is brought into play instead of horses. But even this would be a very imperfect remedy. The only resource is the construction of new urban lines which shall not interfere with the traffic in the streets.

The projected lines cannot be underground like those of London, on account of the high-water level and the system of sewerage, but must be elevated. They cannot be planned as gigantic structures for heavy trains drawn by locomotives.

The new lines are to be in their structure and working similar to the "elevated railroads" of New York. They are to be of normal gauge, and constructed merely to bear the weight of carriages, but not of locomotives.

The traffic will not be effected by long trains at intervals of 10 minutes, as on the existing urban lines, but by single electric carriages supplied with current from a central station, and succeeding each other at intervals of two to three minutes. They will, however, admit of being coupled in groups of 2—4. If the carriages or trains follow each other at intervals of three minutes, each carriage conveying only 40 passengers, the yearly traffic on working 18 hours daily will amount to 10½ million persons. If the interval is reduced to two minutes, the yearly number of possible passengers will reach 15¾ millions, and if double carriages or short trains of 3—4 carriages are used, the capability of the line will reach to twice or four times the above numbers.

The estimated cost, inclusive of stations, etc., is 1½ million marks per kilometre run.

Siemens & Halske propose at present merely the construction of one line, the South line, which will consist of a number of portions not intelligible without a plan of Berlin. The cost of the line will reach a total of 84 million marks. The South line, taken singly, will measure 8.9 kilometres in length and will cost 13½ million marks.

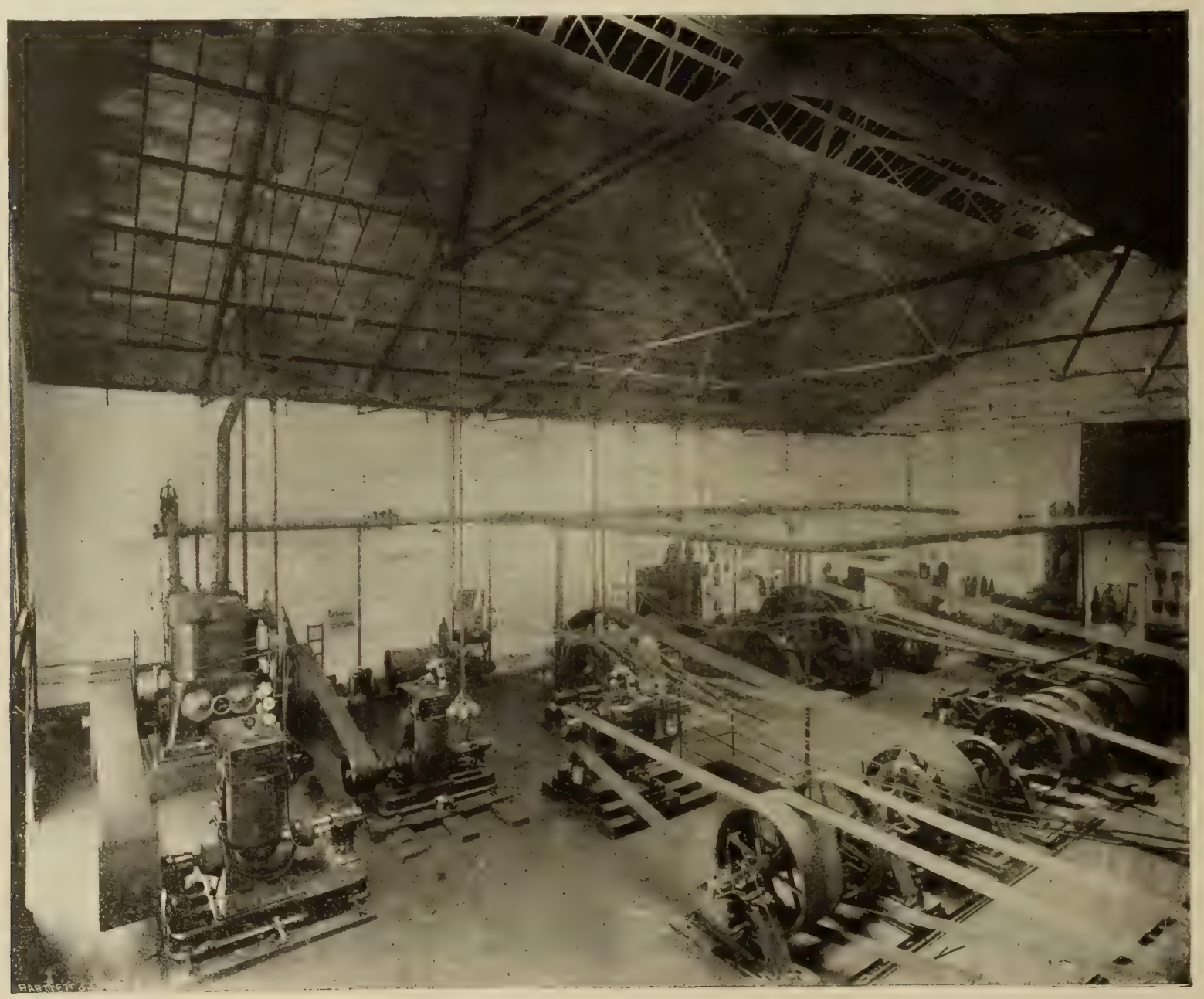
The stations will be arranged at points where the traffic is most dense—*i.e.*, at the intersections of the main streets and at the bridges over the canal. At each end of the line there will be a main station where carriages may be transferred from one track to the other, where they may be left over night and undergo any needful repairs.

The tracks will resemble in general those of the elevated railways of New York. As they are to be constructed with turn-tables they may be longer than those of the existing urban line. They are to be made in seven compartments holding 52 persons. American carriages cannot be used, as they cannot be emptied quickly enough at the stations.

The distance between the tracks is 3 metres, so that the minimum width of the permanent way will be 2.2 x 3=5.2 metres. Including the paths, 0.8 metres in width on each side outside the line, the total breadth will be 6.8 metres. Between any two carriages passing each other there remains—as the carriages have no steps—a free space of 0.8 metre.

The distance between the two tracks is such that passengers leaning out of the window cannot be injured, and that in case of need a workman may stand in safety between two carriages passing or meeting each other. The carriage doors are only 0.6 metre in breadth, so that a door left standing open cannot occasion any injury to the carriages on the opposite track. The carriage doors on the side turned away from the platform will also be kept locked, as they are on the London Metropolitan Railway.

The stations are arranged as simply as possible; no entrance hall, waiting-room and booking office. They consist merely of the stairs and platforms, which, like the rails, are covered with a light roof. The platform is not, as in the urban line, between the two tracks, but on the outside of each, thus keeping the traffic in each direction apart. The platforms are equal in length to three carriages. The tickets are supplied by an official who stands in an appendage to the entrance stairs. They are not stamped, but simply taken from a packet, as is done



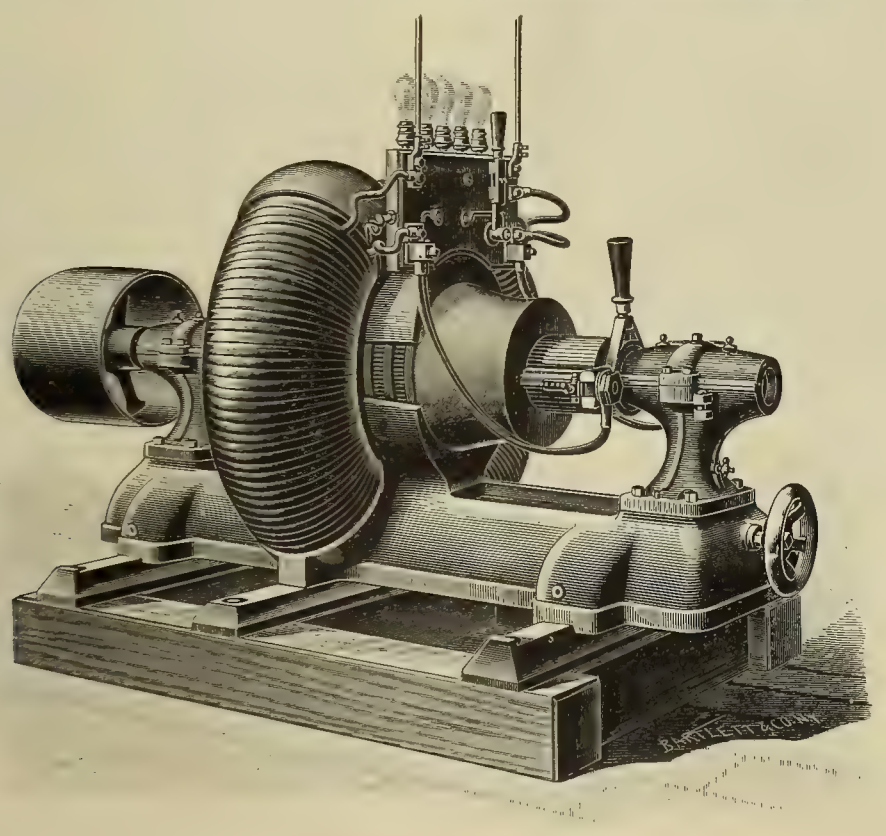
POWER-HOUSE OF FEDERAL STREET AND PLEASANT VALLEY RAILWAY CO.

in tram-cars. An official at the exit stairs takes the tickets from the passengers as they leave.

The platform is three metres in breadth. To prevent damage to persons waiting, by the doors being opened too soon, the doors of all the compartments are kept bolted until the carriage has come to a stand, when the bolts are simultaneously released by the conductor. The step from the platform into the carriage is only 0.32 metre.

A NEW TYPE DYNAMO.*

The accompanying illustration is taken from a photograph of a 50 H. P. "C. & C." dynamo of a type placed on the market during the past summer. The design is similar to that of the well-known circular field and consequent pole motor that has become so familiar to the public; in fact, there is not an electric light company in the country operating an incandescent circuit of any size that has not one or more of these motors connected to its wires. The machine represented in the cut is wound for 500 volts and specially designed for power circuits. For a long transmission of power this machine can be specially wound to give perfectly automatic regulation under the very greatest possible variation in load. A substantial terminal board is bolted to the



NEW TYPE DYNAMO.

upper pole-piece and is provided with a heavy knife-switch for opening the main circuit. This board also carries the field and armature connections, all of which are of solid metal and in plain view. The commutator is of the most substantial construction, being built up of heavy copper bars insulated with the best mica, and with proper care it will last for years. The mechanical construction is of the best throughout, skilled mechanics being employed with the most improved machine tools. The armature is wound to carry a much greater volume of current than the nominal capacity of the machine requires, thus making it practically impossible to burn it out by over-heating. The circular shape of the magnets give them the greatest possible development of power for least weight, and every part is so constructed as to make solidity and permanence the first consideration.

The 100 H. P. dynamo made by this company is of exactly the same form as the dynamo illustrated herewith, and is especially suitable to be used as a power generator for street-railway circuits, its high efficiency and mechanical excellence making it a favorite with station superintendents.

These dynamos are wound in standard sizes from 1 H. P. to 100 H. P. for electric lighting as well as for power transmission, and especially for isolated plants and for use in mills, office buildings, etc.

Although the "C. & C." Electric Motor Company has but recently entered upon this field, the long list of parties now using its dynamos for lighting purposes is the best possible indication of the success it is meeting with.

* "C. & C." Electric Motor Co., New York.

SOUVENIRS AT THE PITTSBURG CONVENTION.

The souvenirs distributed at the Pittsburg Convention of the American Street Railway Association last month were numerous and valuable. Among them we note the following:

The Short Electric Railway Co., of Cleveland, distributed an elegant pamphlet descriptive of the apparatus manufactured by the company. The pamphlet represented the highest degree of the printer's art. The cover was of rough white paper-board, finished off beautifully with two colored satin ribbons. In addition to this much other elegant literature was given out containing much valuable information. Another novelty was an elegantly-bound book containing the engraved cards of the various officers and others connected with the company. With each book came five tickets for as many free rides on the "Short" Gearless motor-car which was running on the lines.

The Calorific Ventilating Heater Co., of Chicago, distributed steel foot-rules incased in a neat leather receptacle. It also distributed a sheet of music, the words of which extolled the virtues of the Calorific Heater.

The Gould & Watson Co., of Boston, presented its friends with a pair of cuff-buttons made of moulded mica.

The Frost Veneer Seating Co., of New York, gave away samples of veneer ceiling.

The Brownell Car Co. gave a neat hard-rubber match-box.

The Westinghouse Electric and Manufacturing Co. gave away some aluminum models of the Westinghouse gearless motor. This was an elegant and unique souvenir, and was much sought after and highly prized by those who were fortunate enough to become possessor of one.

The Standard Paint Co., of New York, distributed pocket pin-cushions loaded with pins.

Post & Co., of Cincinnati, gave away artistic bronze turtle paper-weights.

The Standard Underground Cable Co. distributed button-hole bouquets, to each of which was tied a ribbon bow with the legend "Compliments of the S. U. C. Co." in gold letters.

Benedict & Burnham perpetuated their name by giving their friends Russia-leather cases containing samples of their wires.

Mr. P. C. Ackerman, representing the American Electrical Works, Providence, R. I., remembering that many of the delegates had a long ride before them to get home, presented them with a pack of playing cards, on the back of which was the name of the company above referred to.

The Electrical Supply Co., of Chicago, distributed handsome badges. It consisted of a button with a blue ribbon attached. The button had around the edge "American St. Rail'y Asso'n. The mule must go," and in the centre was the formula $H\ P = \frac{C \times E}{746}$ in antique letters. On the ribbon was stamped in gold, "Pittsburg, 1891."

The Solar Carbon & Mfg. Co., of Pittsburg, gave away souvenir medals made of carbon.

The Pittsburg street-railway companies, with commendable generosity, distributed among the delegates books of complimentary tickets good for rides on the various lines in the city.

CORRESPONDENCE.

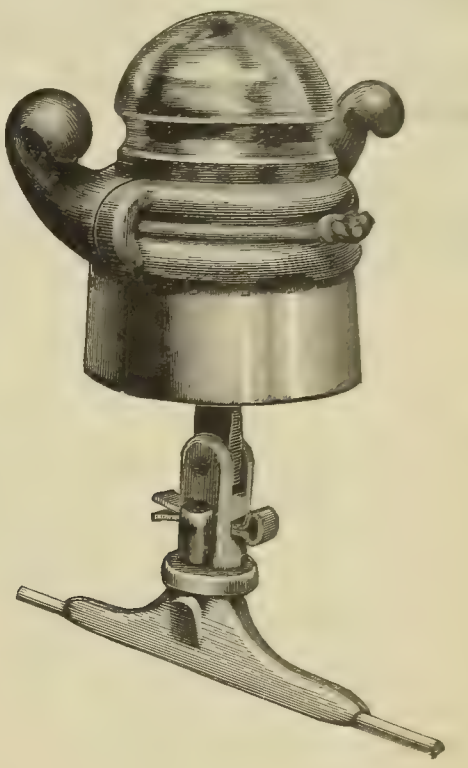
GLASS TROLLEY-LINE INSULATOR.

THE WIGHTMAN [illegible]
SCRANTON, PA., Oct. 22, 1891.

Street Railway News, World Building, New York:

GENTLEMEN: We note in your issue of Oct. 24 a description of a trolley-line insulator. The article states that glass, no doubt, on account of its superiority as an insulator, would have been earlier accepted for trolley-line insulation "had any one devised a practical plan of connection between the trolley wire and the span wire, in order to secure the glass insulator against breakage.

We do not question the superiority of glass as an insulator, as we have been making during the past two years a trolley-wire insulator in which glass is used, and we have found the same to meet all requirements. We are, however, very much surprised that any one should attempt to devise anything in a particular line without first becoming thoroughly posted on the state of the art. We desire, therefore, in this communication to commend the inventor of the insulator referred to upon his good judgment in choosing glass as an insulating material, and to call



GLASS TROLLEY-LINE INSULATOR.

his attention, and the attention of others who may be interested in the subject, to the trolley-wire insulator (we submit cut of our Straight-line Insulator) manufactured by us. This insulator has now been on the market for nearly two years, and many testimonials from street railways prove that "a practical plan" of protecting the glass against breakage has been secured. Very truly yours,

THE WIGHTMAN MFG. CO.
OSCAR URBAN, *Superintendent.*

ELECTRIC MOTORS.

Motors may be classified as—

1. Series motors, in which the field coils are connected in series with the armature.

2. Shunt motors, in which the field coils are connected in shunt or parallel with the armature.

3. Compound-wound motors, which have both the shunt and the series winding.

This latter class may again be subdivided into—

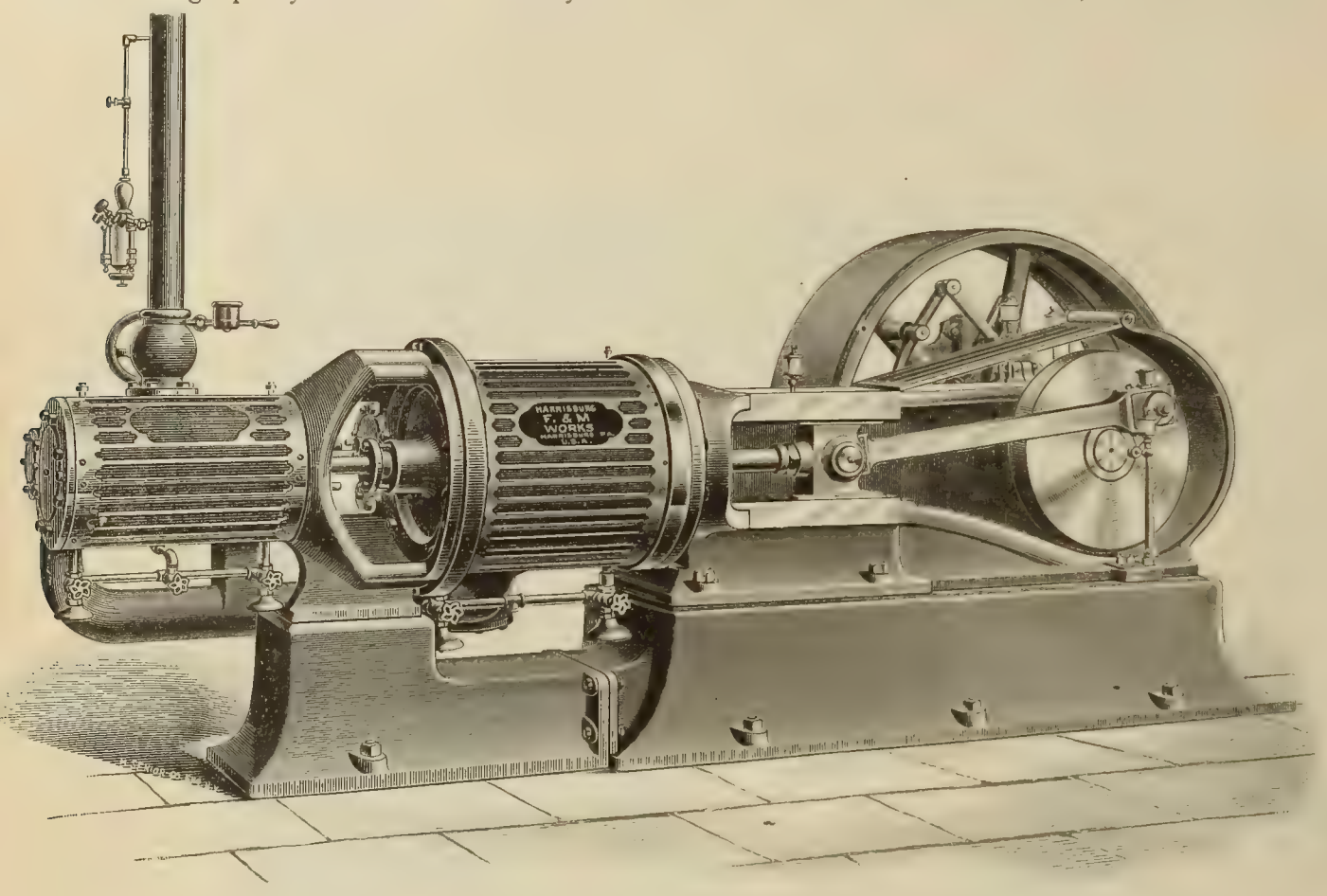
A. Differential motors, in which the series coil magnetizes the field magnets in opposite polarity to the shunt coil.

B. Cumulative motors, in which the series coil magnetizes the field magnets in the same polarity as the shunt coil.

TANDEM COMPOUND ENGINE.*

The Ide tandem compound engine, represented in the accompanying illustration, is substantial and compact in design, neat and attractive in appearance, and is made exceptionally large in all bearings and journals, with a view of comfortably transmitting the maximum power when run condensing.

It will be readily seen that this engine is extremely well adapted for the transmission of power in what is termed a "single drive." While for "double drive" it is also well adapted, provisions having been made in the length of the crank-shaft for the application of a second pulley, if desired. It is claimed by the most practical engineers that a centre-crank engine is not the best form for transmitting power from a single pulley. This would certainly seem to



TANDEM COMPOUND ENGINE.

be the case in such very severe service as is met with in electric-railway duty. The loads in this work are well known to be extremely vicious, throwing on and off large units of power which must necessarily be very hard upon the construction peculiar to the centre-crank engine. Where two generators are used or where the double-belt method to the line-shaft is employed, this strain would not be so great.

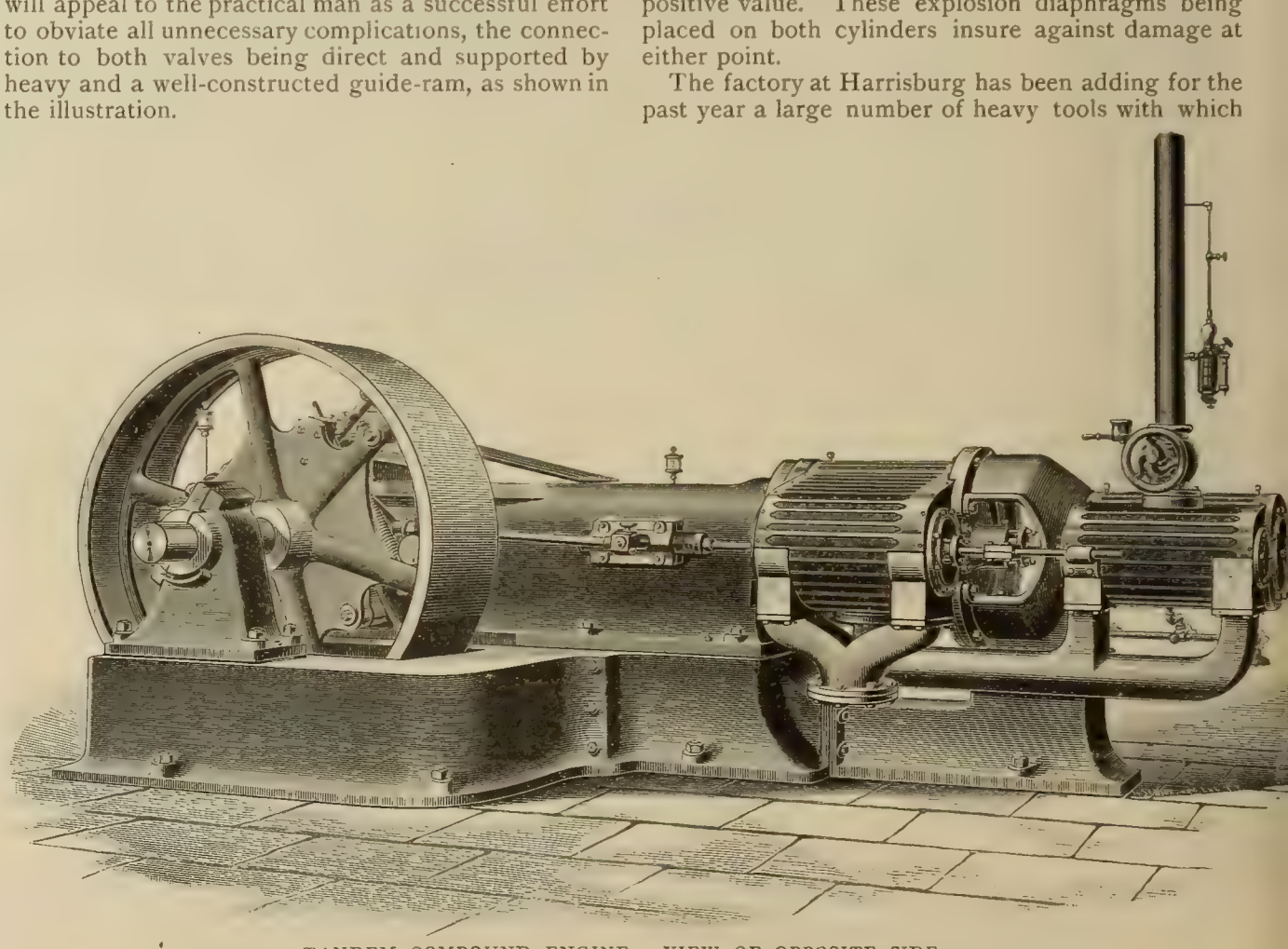
The engine above has several features which will appeal to the practical engineer at first sight. The very substantial and massive frame of the self-contained base used under the engine is claimed to be quite ahead of anything of the kind produced for the same purpose. At the point where the intermediate connection between the high and low pressure cylinders is supported on the self-contained base, a very wise precaution is taken, in that this support is constructed to rest in guides running parallel with the centre of the engine. The engraving cannot show plainly this construction, but it will be appreciated by the practical engineer, as by this means all expansion and contraction is amply provided for in a simple and substantial manner.

Particular attention is called to the intermediate connection between the cylinders. This is a special feature in the "Harrisburg" Ide Tandem Compound Engines. The head of the low pressure cylinder by this means can be slipped back inside of the connection, and the piston and cylinder may be examined with ease, entirely doing away with the most serious and annoying work connected with the disconnection of all steam, condenser, drip pipes, etc.

A great many engineers in charge of electric plants have been through an experience of this kind in the tandem compound automatic engines heretofore built, rigging up heavy tackle, tearing up floors, and disconnecting large and unwieldy pipes in the endeavor to get at and repair the low-pressure piston and examine the low-pressure cylinder of the engine. This is a most tedious and annoying job, and plants equipped with a narrow margin of power have been placed in positions where most serious expense and annoyance have been attached to the shutting down of the engine power from just such improvident construction. By the arrangement referred to it will be seen at a glance that this annoyance is entirely obviated.

This manner of supporting the high-pressure cylinder is very substantial, avoiding entirely the vibrations of the cylinders when working up to their fullest capacity. The advantages of this connection have been regarded so important that a patent has been applied for.

It will be noticed from a view given of the rear of the "Harrisburg" Ide Tandem Compound Engine that the valves to both cylinders are operated by a single eccentric. It is claimed that this is the first ever built of a wheel-governing type of tandem compound engine which was provided with this construction. Separate eccentrics, that of the high-pressure automatic and the low-pressure adjustable, had always previously been employed in engines of this type. The first engine built in this way was put in by this concern in a Massachusetts town, where the success of the single eccentric when used in connection with the original powerful and efficient Ide governor was demonstrated beyond all question. The absence of all "rock-arms" from the engine will be noticed, and will appeal to the practical man as a successful effort to obviate all unnecessary complications, the connection to both valves being direct and supported by heavy and a well-constructed guide-ram, as shown in the illustration.



TANDEM COMPOUND ENGINE. VIEW OF OPPOSITE SIDE.

A great many present owners of some of the tandem compound engines which have been sold have found the engine-frame, shafts and other running parts entirely too small for the amount of power driven through them. This has been due to the fact that in the eagerness to secure contracts at low prices the engine builders have been influenced more by the orders in sight than their good judgment should dictate. The simple single-expansion engine of a given rated power has had attached to it a tandem compound cylinder and a condensing apparatus, which would force through a frame and other parts a power which would be from 30 to 50 per cent. greater than that which the engine was originally designed for. In the "Harrisburg" Ide Tandem Compound Engines the engine-frames are employed of the single-expansion type, together, of course, with shafts, pins, cross-head and all other parts forward of the low-pressure cylinder of a size which were originally amply heavy for the single-expansion duty of the same capacity.

It is surprising to compare the weight of this engine of a given power with that of many tandem compound engines running in various plants, the "Harrisburg" Ide exceeding the most liberal of these by a large percentage.

The connections between the high-pressure and low-pressure cylinders are made of cast-iron, with finished flanged connections, and fitted up in first-class manner throughout. No wrought-iron pipes are used for this purpose, with their attending chances for leakage and annoyance, as well as difficulty in removing.

On examination of the drawings and details of the various sizes of these engines, it is found that they are constructed with the greatest care, and a special provision has been made throughout the entire design and construction for the interchangeability and renewal of wearing parts at light expense and without serious delays.

A most valuable feature is the placing upon the tandem engines, as well as the simple "Ide" and "Ideal" engines, of the Explosion Diaphragms, which are shown in the engravings. To those not familiar with this simple and effective device it would be well to say that these diaphragms, although covered by a strong patent, consist of simply a cast-iron "bulb" cored out so that the bottom will explode at whatever pressure it is desired, being constructed to suit the requirements. As the pressure in the cylinder may increase through condensation, priming of the boilers, or other causes which could not be provided for otherwise, the diaphragms, responding to the pressure subjected to the cylinders to which they are attached, explode immediately, and relieve at once the parts which otherwise, receiving the shock and breaking, would cause most serious damage and annoyance. This construction for the relief of cylinders relying upon the known strength of the metal of which they are made is never found in a condition where it will not promptly respond to undue pressure, which is not the case where poppet and relief valves are employed; corrosion or derangement in complicated relief valves often render them utterly useless when most needed and are therefore of no positive value. These explosion diaphragms being placed on both cylinders insure against damage at either point.

The factory at Harrisburg has been adding for the past year a large number of heavy tools with which to construct on a larger plan engines of this character, as well as to enable it to keep up with the orders on hand for Standard "Ide" and their later "Ideal" self-oiling engines.

There is considerable advantage gained by this company in furnishing and constructing complete steam plants, from the fact that it has a very large and complete equipment for the manufacture of high-pressure boilers of the horizontal tubular type, of

*Harrisburg Foundry and Machine Works, W. R. Fleming & Co., New York Agents.

THERE AND BACK.

[*Jottings from our Note-book at the recent Convention.*]

Part I.—"THERE."

PITTSBURG, THE SMOKY CITY STILL—THE WRETCHED DEPOT OF THE PENNSYLVANIA R. R. THERE—THE ALLEGED ATMOSPHERE—THE FIRST GUN—"ONLY WEEKLY STREET RAILWAY PUBLICATION IN THE WORLD"—THE ADVANCE GUARD—OLD CAMPAIGNERS.

It was nearly seven of the clock when the porter aroused us from our slumbers in one of the superb sleeping-cars of the Pennsylvania R. R., and, as he awoke us, he informed us of the hour, and our close proximity to the Smoky City. "What," you exclaim—"smoky city, when its furnaces are run by natural gas?" Do not be deceived—natural gas or no natural gas, Pittsburg now appears to be as smoky as ever. Within less than a half hour our train pulled into the Union Depot at Pittsburg, and our first wonder was how it came that a railroad having the immense wealth that the Pennsylvania R. R. has should own up to the possession of one of the dirtiest and most incommodious depots that any large city can acknowledge to. Just how Pittsburgers regulate their watches is not exactly clear to us, as the sun never thinks of rising there much before noon, and, more often than not, it has not time to find its way into Pittsburg through the fog before it is time for us to say "Good-night, thou glorious lamp of day."

In due time we managed to cut our way through the alleged atmosphere, and arrived at the Monongahela. Very quiet and still the well-known hostelry appeared in the early morning—and who, looking around at that time through its interior, where the bell-boys and clerks were still trying to wake up, could imagine that ere another moon had risen the entire aspect of the place would be changed—that the quiet and dignified-appearing rotunda would be converted into a phantasmagora of signs, advertisements, good, bad or indifferent as the case may be, more bewildering and confusing, and infinitely more hideous than anything yet inflicted upon the theatre-going public by the enterprising Kiralfys?

Breakfast is over, and as we stand at the head of the bandy-legged staircase opposite to the office, the well-known form of Payson K. Andrews, quickly followed by that of Sidney H. Short, flit across the rotunda—pickets of the army to follow. Time wears on, and the very first sign of the approaching convention—that of the STREET RAILWAY NEWS—is nailed up. As you stand with your back to the office and raise your eyes to the head of the staircase, it is utterly impossible to avoid seeing the characteristic sign of the only weekly street railway publication in the world—there it was—unique, original, characteristic.

LEAVE YOUR CARD AT
CONVENTION HEADQUARTERS OF
STREET RAILWAY NEWS
(PARLOR FLOOR, MONONGAHELA HOUSE.)
ONLY WEEKLY STREET RAILWAY PAPER
IN THE WORLD.
N. B.—WATCH FOR OUR
"CHROMATIC DAILY ISSUE."

Gradually these chromatic signs were followed by all kinds of printed matter; more than once an attempt was made to steal the space occupied by STREET RAILWAY NEWS; time and time again did [illegible] parties remove those signs, but

"Shot through the staff and the halyard,
Yet ever we hailed thee anew,
And still at our coign of vantage, there
The STREET RAILWAY NEWS had flew."

The first gun of the battle has been fired, the advance guard [illegible] ground. Here we see Garson Myers and his brother L. E. busy getting the exhibit ready for the Calorific Heater, in which company they are [illegible] terested; John C. Dolph, of the Short Co., active, energetic, courteous [illegible] are, indeed, all gentlemen connected with that company, is skurrying here and there bent upon leaving nothing undone to make the exhibit of his concern as great a success as its motors have proved. Here we notice the smiling face of Elmer P. Morris, of the supply department of the Thomson-Houston Co., while the sphinx-like countenance of Captain T. Okonite McCoubray is to be seen taking in all that is going on, and, like the proverbial tar-baby, "keeps on saying nothing." A moment later and the burly form of John Page makes its way towards the hotel office, presumably after mail matter; and as we pass towards the convention hall we notice Isaac Kinsey, President of Post & Co., with a look of determination and cold-blooded get-there ness on his face and a hammer in his hand pounding away at some big packing-cases which seem to have put up a job on him to prevent his getting his goods in place on time. But never fear, Post & Co. are always on time, and never more so than when the president of the company has his hand upon the tiller of the ship. Yet they adopted the peripatetic turtle as a souvenir. Returning through the corridor up on the first floor of the hotel, our hearing was almost destroyed by a blast from an infernal machine in the shape of an electric trumpet manipulated by Henry G. Issertel, of the A. B. & C. concern, who assured us that for demoniacal racket it rivalled the celebrated talking doll of Edison. And we believed him, for even Dante never permitted such a fiendish abomination—no, not even in his "Inferno"—nor could Poe, of "Raven" fame, even in his wildest flights of jim-jams, have lived for another five minutes under such pressure. But we are digressing. Crossing the dining-room we notice the classic yet adamantine features of H. L. Cargill, who for a long time has been the entertainer-in-chief for the T.-H. company, and who is never more in his element than when pursuing, for their delectation, the votaries of pleasure, and a royal entertainer he is, too.

The evening trains bring another large contingent, and the familar faces of President Hy. M. Watson, of Buffalo, and of Secretary Wm. J. Richardson are now to be seen, as also those of Edward Beadle, General Manager of the Railway Register Manufacturing Company, and who, by the way, is the inventor of the "EUREKA" folding mat—one of the best of those arrangements for street-car purposes. Then a group of old campaigners meets the eye—there they stand, known and respected by all, their faces as familiar as those of any present—Mr. Daniel Coolidge, Vice-President of the Johnson Company earnest as ever, guarding jealously the interests of his company; McLain, Secretary of the same company, quiet, observing, yet ever alert when the interests of his concern are involved; Littlefield, the Chicago Manager of the same enterprising company, always good-natured and full of quiet humor, and last of all Satan came also—no, no, we don't mean that, but we almost forget ourselves when the well-fed, hearty form of the bluff and genial Major H. C. Evans was very clearly discerned—even through the murky air of Pittsburg.

(*To be continued.*)

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improved design and construction. A number of orders are on hand at present for complete plants, placed on guarantees for economy and efficiency, and if any intimation of the success of a manufacturing concern is shown by the crowded condition of the work in the shops, the Harrisburg people must be getting more than their share of contract work in these lines.

One of these "Harrisburg" Tandem Compound Engines with cylinders 12″ and 18″ x 22″ may be seen running in the Edison plant at the Hackensack electric light station, Hackensack, N. J., where it has been found to give most satisfactory results. Another is driving the machinery at the exposition in Atlanta, Ga. Several of them are already running in New England and the Middle States, and contracts are on hand for several plants in New Jersey and New York, in all of which the Harrisburg Ide Tandem Compound Engine is to be placed.

To Mr. J. H. Gibson, Superintendent of Construction of the Short Electric Railway Company, is largely due the credit for the arrangement of the magnificent exhibit made by that enterprising company on the *Gusky* at the recent convention in Pittsburg. In spite of many set-backs, two breakdowns, and other troubles, Mr. Gibson managed to get the machine in position on time.

We inadvertently failed to acknowledge our indebtedness to our contemporary, the *American Machinist*, for the three outline cuts used in illustrating the article we published in our issue of Oct. 17 on the subject of a new compound engine made by the Phœnix Iron Works Co., of Meadville, Pa. These cuts were kindly loaned for the purpose.

OBITUARY.

LEWIS LYON.

Lewis Lyon, President of the Third Avenue Railroad Company, died at his residence, 739 Madison avenue, October 29, after a three-weeks' illness. Mr. Lyon was born in Birmingham, Eng., in 1830, and after studying in English schools he came to this country and completed his studies in the University of the City of New York. After graduating he engaged in railroading, and in December, 1876, was elected treasurer of the Third Avenue Railroad Company, and in February, 1879, was elected president, occupying that position until his death.

President Lyon was the first to introduce the cable system in New York State, fighting alone for a long time to accomplish his pet hobby. When he first agitated the subject to his colleagues on the Board of Directors they opposed him, and it required a two-years' struggle to induce them to permit him to try the system on the roads operated by the company. In 1885 he personally superintended the construction of the cable system on Tenth avenue, the success of which road induced the company to extend it to the 125th street lines. At the time of his death arrangements had been completed for the introduction of cable traction on the entire Third avenue system, and it was the fondest hope of Mr. Lyon to live to see the system installed.

Mr. Lyon married a niece of Mr. Henry Hart, vice-president of the road, and besides his wife he leaves five daughters. His brother, Edward, is superintendent of the Tenth avenue cable road. Mr. Lyon was a member of the City Lodge 408, F. & A. M., the Central Turn Verein, several Jewish charitable institutions, and the 19th Street Synagogue.

ROAD SOLD TO A SYNDICATE.

A despatch from Milwaukee, Wis., October 31, says: The West Side street railway of Washington Becker was sold to the Villard syndicate in New York to-day for $875,000. This gives a monopoly of the street-railway business to the syndicate. The property was purchased through the Central Trust Company, of New York, which will retain the title for one year.

THE WEEK'S RECORD OF STREET-RAILWAY NOTES.

ALABAMA.

BIRMINGHAM.—Trial trip Birmingham-Avondale electric line October 17.

CALIFORNIA.

OAKLAND.—October 12. Oakland Consolidated Railroad Company asks franchise 40th street to cemetery.

October 19. Consolidated Electric Railway Company was refused franchise 10th street.

Reported that franchise granted to ex-Governor Blasdel been assigned to 23d Avenue, Piedmont and Alameda Railway Company.

COLORADO.

DENVER.—Denver Tramway Company is erecting electric power-house.

CONNECTICUT.

MERIDEN.—Meriden Horse Railroad Company has erected extensive additions to its barns on Pratt street.

NEW HAVEN.—Mayor vetoed Council's ordinance giving one of street railways power to adopt trolley system.

GEORGIA.

SAVANNAH.—Reported Brush Electric Light and Power Company negotiating purchase City and Suburban Railway, Coast Line Railway and Thunder Bolt and Sandfly Railway.

ILLINOIS.

JOLIET.—Joliet-Lockport electric railway system completed October 23.

LYONS.—Ordinance granting right-of-way for electric road repealed.

IOWA.

DAVENPORT.—Allen line is to be connected with Perry street line.

MASSACHUSETTS.

LOWELL.—Lowell and Suburban Street Railway Company declared annual dividend 6 per cent.

PITTSFIELD.—The Pittsfield Electric Street Railway Company. Receipts for year, $17,064.16; expenses, $10,150.51.

QUINCY.—The Quincy and Boston Street Railway Company intends erecting large power-house here.

NEBRASKA.

OMAHA.—October 26. Office of Ames avenue barn of Omaha Street Railway Company robbed of $1,200.

NEW YORK.

ALBANY.—Albany Railway Company ordered ten new cars of Gilbert Car Manufacturing Company.

OHIO.

COLUMBUS.—Consolidated Street Railroad will double-track Oak street.

MIDDLETOWN.—Middletown and Madison Street Railway Company increased capital from $10,000 to $50,000.

PENNSYLVANIA.

DUBOIS.—The Dubois Traction Passenger Railway Company open October 17.

PITTSBURG.—October 26. Duquesne Traction Company's line to Wilkensburg in operation.

TEXAS.

AUSTIN.—Five new motors and three trailers added to Rapid Transit Company's lines. Construction of power-house being rapidly pushed.

WASHINGTON.

FAIR HAVEN.—The Fair Haven Street Railway Company installed new generator October 13.

WISCONSIN.

MILWAUKEE.—The National Avenue Line, Reed street to Soldiers' Home, opened October 16.

Mortgages.

ALLENTOWN, PA.—The Allentown and Bethlehem Rapid Transit Company to Old Colony Trust Company, Boston, Mass., trustee, for $200,000.

Bethlehem and Allentown Passenger Railway Company to Old Colony Trust Company, trustee, Boston, Mass., for $100,000.

Franchises.

ALBANY, N. Y.—Albany Railway Company granted right of-way through Greenbush.

ALEXANDRIA, VA.—Franchise granted A. H. Truax, Hastings, Minn., and J. R. Howes, Duluth, Minn., for street railway here.

FARGO, N. D.—October 19, Finney and Smith given franchise for electric street railway.

LOS ANGELES, CAL.—Franchise been granted Consolidated Electric Railway.

MONTGOMERY, ALA.—A. W. Le Bron, representing syndicate, has petitioned for franchise for electric street railway here.

Election of Officers.

DETROIT, MICH.—General Manager Mulliken, of Detroit Street Railway Company, removed, and management placed with a committee of six; W. C. Coleburn Secretary, George R. Russell Treasurer and John R. Sterling Assistant Secretary and Treasurer.

LAFAYETTE, IND.—October 15. Lafayette Street Railway Company. Directors: T. J. Levering, G. S. Brown and G. E. C. Johnson. Officers: T. J. Levering President and J. T. Henderson Secretary.

LOWELL, MASS.—October 22. Lowell and Suburban Street Railway Company. Directors: Edward M. Tucke, August Fels, Walter M. Sawyer, Percy Parker, Frank W. Howe, Thomas Costello, Ethan A. Smith, Stephen B. Puffer, Miles F. Brennan, Solomon Bachman, John Lennon and P. F. Sullivan. President, Edward M. Tucke.

PITTSFIELD, MASS.—October 21. Pittsfield Electric Street Railway Company. Directors: Joseph Tucker, Alexander Kennedy, James W. Hull, Charles E. Merrill and P. A. Chase, of Lynn. President, Joseph Tucker; Treasurer, C. E. Merrill, and Clerk, J. W. Stevenson.

Change of Power.

SAN FRANCISCO, CAL.—The North Beach and Mission Street Railway Company asks privilege converting Folsom street part of cable system into electric road.

ST. LOUIS, MO.—Benton-Bellefontaine Horse Car line is being changed to an electric-motor road.

Track Extensions.

AUSTIN, TEX.—Austin Rapid Transit Railway Company (electric) will extend its tracks in the near future.

DENVER, COL.—It is reported that the track on South Broadway is to be extended to Littleton, a distance of a little less than 7 miles.

DUQUESNE, PA.—White's Electric Traction Railway Company will extend to Homestead, connecting there with Second avenue line to Pittsburg.

TRENTON, N. J.—City Railway Company will extend from Olden avenue to Brunswick avenue.

WACO, TEX.—Waco Electric Railway and Light Company asked permission to extend lines.

New Roads.

CENTRALIA, WASH.—Street railway will be constructed here shortly.

DECHERD, TENN.—The municipality wants bids for complete electric light and street railway plant. Address M. M. Bright.

LARAMIE, WYOMING.—Laramie Tramway Company will construct an eight-mile electric railway here.

MONONGAHELA CITY, PA. Street railway to be constructed here.

PATERSON, N. J.—The Central Electric Railway Company (see Incorporations) will construct two miles at once.

SALEM, OHIO.—Electric Street Railway will be constructed between this place and Washingtonville.

SAVANNAH, GA.—Street railway will be constructed to Southover Junction immediately.

Incorporations.

LANCASTER, PA.—October 20. Lancaster and Strasburg Electric Railway Company. Capital stock, $125,000. Incorporators: John A. Coyle, Jacob B. Long, J. W. B. Bausman, Robert D. Steward and Wa ter M. Franklin, Lancaster.

MILWAUKEE, WIS.—October 24. Gothenburg Water-Power and Investment Company (incorporated in Nebraska), to construct electric street railways, etc. Capital stock, $2,500,000. Incorporators: A. H. Hadfield, M. H. Brand and Charles Quarles.

OMAHA, NEB.—October 19. Omaha and Florence Street Railway Company. Incorporators: Hugh G. Clark, F. C. Smith and F. L. McCoy.

PATERSON, N. J.—October 24. Central Electric Railway Company. Capital stock, $30,000. Incorporators: E. Stevenson, W. Pennington, A. H. Post, J. A. Morrisse, J. R. Beam, F. C. Van Dyke, J. Wadsworth, F. H Crossens, A. A. Van Voorhies, G. C. Mason, Paterson, N. J.

SAN BERNANDINO, CAL.—October 24. San Bernandino Street Railway Company. Capital stock, $10,000. Incorporators: Henry M. Willis, J. R. Brunn. James Fleming, William A. Harris and W. S. Hooper, San Bernandino, Cal.

SAVANNAH, GA.—October 9. Southover Street Railway Company. Capital stock, $15,000. Incorporators: J. L. Whatley, C. H. Holmstead, C. H. Dorsett and others.

TYLERVILLE, ILL.—Christian County Electric Railway Company. Capital stock, $100,000. Incorporators: W. W. Anderson, F. P. Drennan, Charles Cheney and others.

Legal.

JERSEY CITY, N. J.—October 19, Jersey City and Bergen Railroad Company applied for injunction to restrain Street and Water Board from interfering with extension of its motor system to ferry on Montgomery street.

MCKEESPORT, PA.—Reported McKeesport Street Railway Company to be sued by Common Council for $25,000 for failing to have cars running October 1.

MILWAUKEE, WIS.—Verdict for defendant in Fred Will *vs.* West Side Railway Company for damages sustained in collision.

October 16. Injunction served on Wauwatosa Rapid Transit Company restraining it from laying tracks over those of St. Paul Railroad Company's at Walnut street crossing.

MINNEAPOLIS, MINN.—Kate D. Jones *vs.* the Minneapolis Street Railway Company. Complainant awarded $5,000 damages for injuries received and her husband $500 for loss of services.

MUSKEGON, MICH.—In F. Page *vs.* Muskegon Railway Company for $20,000; verdict of $1,500 for complainant.

NEW CASTLE, PA.—Preliminary injunction by county of Lawrence restraining New Castle Street Railway Company from constructing track upon and running cars over Pittsburgh street bridge, dissolved.

PHILADELPHIA, PA.—Mary A. Cousley *vs.* Peoples Passenger Railway Company for $5,000 damages for personal injuries.

The City *vs.* Germantown Passenger Railway Company to recover $33.75, with interest from December 17, 1888, for work done on the street occupied by the company's tracks. First suit since recent Supreme Court decision.

PORTLAND, ORE.—J. R. Bailey *vs.* Metropolitan Street Railway Company. $60,000 damages. Thrown to the ground and injured by the sudden starting of a car before he could properly alight.

SAN FRANCISCO, CAL.—The Market Street Cable Railway Company *vs.* National Indicator Company and H. B. Berryman, to recover $919.21 damages for removing indicators from street cars.

Omnibus Cable Company *vs.* San Francisco and San Mateo Railway Company, to compel it to al ow plaintiff to operate cable road over defendant's tracks.

ST. PAUL, MINN.—Permanent injunction restraining Duluth Street Railway Company from condemning private property for street-railway purposes refused.

STILLWATER, MINN.—C. D. Elfelt *vs.* Electric Street Railway Company for $500 damages for trespass. Decision for defendant.

TOLEDO, OHIO.—Fred Sorge *vs.* Toledo Consolidated Street Railway Company for $5,000 damages for having his leg run over by street car.

Col. C. H. Voute *vs.* Toledo Electric Street Car Company for $75,000 damages for false arrest and imprisonment while tearing down wires when manager of Consolidated Street Railway Company's lines.

October 24. Consolidated Street Railway Company permitted (by decision of court) to string wires over its own tracks, and have as full use of its tracks as the opposition company which has been utilizing them for several months.

VICKSBURG, MISS.—City *vs.* Vicksburg Street Railway Company for forfeiture of franchise for failing to maintain track in proper condition.

WASHINGTON, D. C.—Marian L. Gitt *vs.* Metropolitan Railroad Company for $20,000 damages for injuries received by being thrown to ground by sudden starting of street car.

ZANESVILLE, OHIO.—Walter S. Madden *vs.* Electric Street Railway Company for $5,000 damages for injuries received in collision.

Casualties.

ALLENTOWN, PA.—October 26. Several passengers seriously injured by collision of two electric cars on Catasauqua and Allentown line.

BALTIMORE, MD.—On October 7 an electric car jumped the track and dashed into a building, killing the motorneer almost instantly.

October 23. Boy of 15 ran over by car of Baltimore Traction Company and seriously injured.

BRISTOL, PA.—While a 15-year-old boy was crossing Washington street, October 8, he was run over by a street car and badly mangled.

BROOKLYN, N. Y.—On October 12 a man was seriously injured by falling over the dash-board of a street car, on Fifteenth street, on which he was riding.

On October 11 a man was either knocked or fell from a street car on the North Second Street and Middle Village line, in the Eastern District, receiving injuries from which it is expected he will not recover.

CHICAGO, ILL.—On October 7 a man fell from the front end of a crowded trailer in the Lasalle street tunnel and was crushed to death. On the same date an electric car and a cable train collided at the entrance of the tunnel, seriously injuring several passengers.

A man was crushed to death recently by being caught between a telegraph pole and a car of the West Division Railroad Company. The company was censured by the coroner's jury for laying its tracks too near the poles.

October 14. Several people seriously injured by collision of two cable cars at Desplaines street viaduct.

COLUMBUS, O.—A lady, 51 years of age, while crossing High street, October 13, was run over by an electric motor car and badly injured.

October 14. Lady run over by electric car and killed.

October 21. Judge J. S. Friesner severely injured by motor car colliding with his carriage.

EVANSVILLE, IND.—October 27. The West End barn of Evansville Street Car Company destroyed by fire; loss $75,000.

FLUSHING, N. Y.—On October 12 a portion of a freight train on the Long Island Railroad ran into an electric car, entirely demolishing it and seriously injuring two lady passengers.

GRAND RAPIDS, MICH.—On October 7 two cable trains collided with terrific force, breaking one of the grip cars and severely injuring a number of passengers.

October 8. Man thrown under a moving car on which he attempted to jump and severely injured.

KANKAKEE, ILL.—October 2. Horse killed by being struck on neck just over spine by falling telephone wire which came in contact with trolley wire.

KANSAS CITY, MO.—On October 7 a cable car on Tenth street became unmanageable and crashed into a passing procession, severely injuring a large number of people.

October 16. Man killed on Twelfth street incline by Metropolitan cable car.

October 19. Man run over by cable car and seriously injured.

MINNEAPOLIS, MINN.—October 21. Boy of 3 ran over and killed by electric car.

October 21. Man fell beneath electric car and dragged several blocks; seriously injured.

NEW YORK, N. Y.—October 17. Man knocked down and seriously injured by Third avenue horse car.

PITTSBURG, PA.—On October 8 a five-year-old boy dropped from a wagon, on which he was riding, immediately in front of an approaching electric car, which ran over him, killing him almost instantly.

October 21. Three people injured by collisions between electric cars and carriages.

October 23. Boy of 12 knocked down and severely injured by Citizens Traction Company's car.

READING, PA.—October 11. Alderman Wickel knocked off the side steps of electric car and severely injured by coming in contact with one of the poles.

ST. JOSEPH, MO.—A passenger coach on the B. & M. Railway was set on fire by a fallen trolley wire, which came in contact with the car stove chimney, *making the stove and the pipe, which were of less resistance than the wire and had no connection with the earth, red hot.*

ST. PAUL, MINN.—October 21. Girl of 7 ran over and killed by car on Mississippi street.

SCRANTON, PA.—October 25. Two electric cars collided on Adams avenue.

TORONTO, ONT.—Total receipts of street railways May 16 to August 31, $291,642; expenses, $229,778. After paying interest on the capital, net profit to city, $45,444.

In the suit of Angus *vs.* Toronto Street Railway Company for $10,000 damages for injuries received by being thrown from a street car in a collision with an ice wagon, the plaintiff was awarded $2,500.

UTICA, N. Y.—October 23. Man ran over by electric car on Genesee street, receiving injuries which will cause death.

VENICE, ILL.—October 23. Man seriously injured at Madison Car Works by accidentally stepping on a running belt which pulled him under the pulley.

WILLIAMSPORT, PA.—October 24. Electric car jumped track and ran through switchman's watch-box of Philadelphia and Erie Railroad.

Foreign.

J. A. McClure, late Secretary of the Thomas Murray Company, sailed for Aspinwall, C. A., on Saturday, *en route* for Colima, Mexico, where he has the contract for the track work on the Colima R. R., which is being built by an English syndicate.

[*Bon voyage* to you, Mac.]

BUSINESS NOTES.

The following letter explains itself :

EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN,
BROOKLYN, Oct. 28, 1891.

Messrs. H. Ward Leonard & Co.,

Electrical Exchange Bldg., New York City.

GENTLEMEN : We have just permanently equipped our passenger elevator with your new system of operating electric motors, and are greatly pleased with the results. The arrangement is perfect in its absolute control of the elevator car, and requires a minimum of attention in its operation. The current taken by the elevator motor is dependent upon the weight in the elevator only, and for any given weight the current is constant and is entirely independent of the speed of the elevator.

The neutral point upon the armature of the motor is fixed and the brushes require no adjustment whatever, and there is absolutely no sparking when operating at any speed in either direction.

The elevator motor operates at its highest efficiency at all speeds, and no rheostat or other power-absorbing device is used in the armature circuit. The control of the elevator is effected in the elevator car itself, and the movement of the elevator is extremely smooth, both in stopping and in starting and in accelerating the speed. We are able to instantly reverse the motor and the elevator car at any speed without any jar whatever, and the motion of the elevator is as perfect as that of the best hydraulic elevator. The control is instantaneous and perfect, so that it is an extremely simple matter to make a perfect landing ; and there is no chance of the elevator's moving when it is supposed to remain at rest, as is frequently the case with the hydraulic elevator.

A point of the greatest importance is that the power required from the central station line is the least when the motor is started up, and the current from the line is gradually increased as the speed of the elevator is increased. The hand rope is entirely dispensed with.

Should any one desire to investigate this system they can see it in successful practical operation at this station at any time. Yours truly,

(Signed) W. S. BARTON, Gen'l Supt.

The Electric Merchandise Company reports shipments of Burton Electric Heaters during the past week to the following places : Salem, Ohio ; Williamsport, Pa. ; Toronto, Ontario, Canada ; Owego, N. Y. ; Ottumwa, Iowa ; Canton, Ohio ; Akron, Ohio ; Pottsville, Pa. ; Troy, N. Y. Numerous orders received from points widely separated testify to the general eagerness of street railway men to adopt this most desirable method of car heating.

The Edison General Electric Company has secured the contract for an electric street railway plant in Port Arthur, Ont.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued October 20 and 27, 1891.

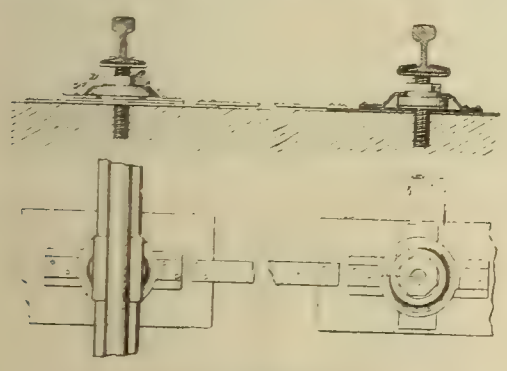
461,680. Car-Truck. Charles W. Hunt, West New Brighton, N. Y. Filed Feb. 16, 1891.

The combination, with car-wheels and their axles and boxes, of links connected with the boxes and a lever or levers pivoted upon the truck or car frame and to which the links are connected for allowing the boxes to move equally in opposite directions.

461,685. Electric Railway. Frank Mansfield, New York, N. Y. Filed Nov. 18, 1890.

In an electric railway, the combination, with a car provided with a contact device, of an insulated main conductor provided with normally-disconnected branch conductors, each having a movable contact, a switch in each branch conductor, adapted to close and connect the same with the main when the contact thereof is moved into engagement with the device on the car, an operating-lever for each branch pivoted in the road-bed and adapted to have its free end raised above the road-bed, the lever mechanically connected with the contact and the switch, whereby the raising of the lever may project the contact into engagement with the device on the car and connect the branch with the main, and a pick-up plough carried by the car for engaging and raising the operating-levers as the car moves by them.

461,690. Electric Railway. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed April 24, 1890.



461,741.—RAIL-SUPPORT.

In combination with two supply-conductors, a car or vehicle and a motor on the car for propelling the same, two independent pole trolleys or travellers on the car, comprising each its individual pole and its individual hinge and swivel-spring mounting, and each having its contact independently pressed by the spring against one of the conductors and electrically connected with a corresponding pole of the motor.

461,703. Car-Coupling. Marion F. Ely, John B. Funk and Frederick H. Ely, Clifton, W. Va., assignors of one-fourth to William R. H. Ely, same place. Filed May 29, 1891.

The combination, with a draw-bar, of a plate pivoted to the under side of the draw-bar, a laterally and vertically swinging link-lifter pivoted to the plate and provided with a stirrup projecting in front of the draw-bar to engage and support a link in advance of the draw-bar mouth, and a separate pivotally-supported and longitudinally-movable crank-rod having a bail portion, the sides of which engage and serve to move the link-lifter laterally.

461,717. Railway-Rail Fastening. Lewis Scofield, Sr., Chattanooga, Tenn. Filed Jan. 27, 1891.

In a railway-rail fastening, the combination, with a rest and rail of a clamp having a shoulder, a clamp having an inclined part and shoulder, and bolts having inclined sections arranged on a square to fit into correspondingly-shaped recesses in the rest and locked nuts.

461,729. Chair Plate for Compound Railway-Rails. Peter Bargion, Oakland, Cal. Filed July 7, 1891.

A chair plate upon which the lower rail of a compound railway-rail bears, the plate extending upward on each side of the rail so as to provide side pockets, into which the securing-bolts of the rails extend.

461,741. Rail-Support. Charles M. Dyer, Cloverdale, Ind. Filed July 20, 1891.

A rail-support comprising a nut mounted to turn on the tie and a screw-rod screwing in the nut and carrying a clip engaging the base of the rail.

461,764. Car for Single-Rail Railways. John B. Mahana, Freewater, Ore. Filed Jan. 24, 1891.

In cars for single-rail railways, a truck, and two vertical wheels journalled one before the other in the truck and adapted to run on the single rail, combined with a saddle-frame suspended from the truck over the rail and between the two wheels, the frame having a slight pivotal movement relative to the truck, a car-body, and plate-springs whose thick ends are rigidly secured to the car-body and their other ends attached to the saddle-frame by a universal-joint connection.

461,746. Elevated Railway. John B. Mahana, Freewater, Ore. Filed Jan. 24, 1891.

In a single-rail elevated railway, a trestle having a base-support and two inclined posts sustained by the base, their upper ends approaching but not touching each other, combined with a yoke-clamp uniting the upper ends and a rail-bed resting in the clamp.

461,775. Metallic Railroad-Tie and Rail-Fastening. Enoch L. Taylor, Philadelphia, Pa. Filed Feb. 16, 1891.

A metallic railroad-tie having a tongue formed integral therewith and elevated above the plane of the tie and an aperture adjacent to the tongue, in combination with a binding-strap or fastening device for securing a rail to the tie, hooked at one end to engage a portion of the base of the rail beneath the tongue and be re-enforced thereby, its other end screw-threaded and bent to an angle relatively to its main body portion, and its main body portion adapted to receive and hug the intervening portion of the tie between its tongue and the aperture beneath the rail and abut against the under surface of the rail each side thereof, and means for the threaded end for effecting union and rigidity of parts.

461,773. Railway-Rail Chair. Frank Pelton, Des Moines, Iowa. Filed Jan. 31, 1891.

A railway-chair consisting of two mating parts, each having a base adapted to be fixed on a railway-tie by means of spikes, a raised central portion that has a flat top to engage the flat bottom of a rail, and a lug at one edge of the flat top, adapted to overlap the edge of the flange of a rail, and a perpendicular face on one side of the raised portion, adapting the two parts of the chair to be placed in contact with each other and in right-angled position to a rail and track.

461,785. Trolley-Wire Support. Leroy S. Pfouts, Canton, Ohio, assignor of one-half to William J. Piero and Fred W. Bond, same place. Filed July 8, 1891.

The combination of trolley-wire brackets formed in pairs or sections and provided with recesses, cross-wire brackets formed in pairs or sections and pivotally connected to the first-mentioned brackets and a binding-sheet.

461,786. Street-Railway Switch. William H. Snyder, Akron, Ohio, assignor of one-half to Isaac W. Hewitt. Filed April 6, 1891.

The combination, in a railway switch, of a supporting-bed having diverging rails, a tongue pivotally mounted on the bed between the divergent ends of the rails, with its free end arranged to wing toward either, and a coiled spring surrounding the tongue-pivot, its opposite ends arranged to engage the bed and tongue.

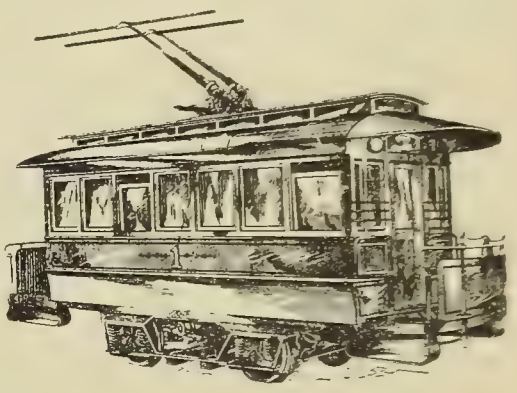
461,808. Electric Car-Brake. La Motte C. Atwood, St. Louis, Mo., assignor to the Atwood Electric Company, East St. Louis, Ill. Filed Jan. 10, 1891.

The combination of brake-shoes, a track-brake, an electric motor, a connection between the brake-shoes and the motor, and an independent connection between the track-brake and the motor, whereby the brake-shoes alone can be applied or the brake-shoes and the track-brake both applied at will.

461,840. Trolley for Electric Cars. Charles A. Lieb, New York, N. Y. Filed March 23, 1891.

A wheel in electrical connection with its shaft, and a contact-piece supported on the frame engaging with the end of the shaft.

461,851. System of Distribution for Electric Railways. Sidney H. Short, Cleveland, Ohio, assignor to the Short Electric Railway Company, same place. Filed Jan. 4, 1890.



461,690.—ELECTRIC RAILWAY.

A trolley-line consisting of a series of insulated sections, an individual conductor connecting each section with the generator, and an automatic cut-out for opening the circuit on the passage of an abnormally-heavy current included in each one of the connecting conductors.

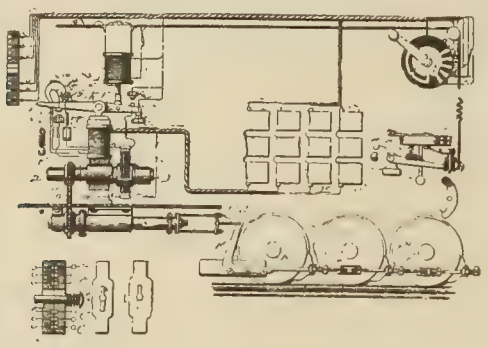
461,895. Means for Supplying Motive Power to Cars or other Vehicles. Leon O. Dion, Natick, Mass. Filed Jan. 19, 1891.

The combination of a series of motive-power-supply stations or conduits arranged at suitable points along a railway or other track, each having an automatically-closing valve which normally prevents the escape of motive power, and each having a terminal yieldingly held in its normal position, a car having a motive-power-storage receptacle, a motor connected with the receptacle, a flexible spring-supported conduit connected with the receptacle and having its outer end formed and arranged to connect with the terminal of each supply-station and establish communication between such station and the storage-receptacle while the car is passing the station, the outer end of the movable conduit being adapted to yield or move backwardly lengthwise of the car while in contact with each station, the terminal of each station yielding when the movable conduit has reached the end of its backward movement and then separating therefrom, means for automatically moving the conduit forward after it has separated from each station, means for automatically moving each terminal to its normal position after it has separated from the movable conduit, and a device on the car adapted to open the valve of the station and hold the same open so long as the movable conduit on the car remains in communication therewith.

STREET RAILWAY NEWS' PATENTS—Continued.

461,969. Electric Railway. William B. Vansize, Plainfield, N. J. Filed Sept. 1, 1890.

The combination, in an electric railway, of a moving car or vehicle, an electric motor located thereon, by means of which the car is propelled, a working conductor electrically divided into a series of sections, current-collecting devices in the car, connected to the terminals of the motor-circuit and moving in contact with the working conductor, a switch or circuit-changer in the motor-circuit on the car, a series of cells of secondary battery divided into groups, one group being located in proximity to each section of the working conductor, but normally electrically disconnected therefrom, a series of automatic switches, one for each section of conductor, for automatically connecting and disconnecting the section with the adjacent group of battery-cells during the passage of a car over the section only, a central station containing a dynamo-electric generator, and an insulated electrical conductor for connecting the several groups of battery with the dynamo.



461,770.—ELECTRIC RAILWAY BRAKE.

462,014. Electric Railway. George W. McNear, Oakland, Cal. Filed Oct. 11, 1889.

A flexible sack or tube carrying an electric conductor, and contacts diametrically opposite to the conductor and arranged to be maintained normally out of contact with the conductor by gravity.

462,022. Electric-Railway Switch. Hollon C. Spaulding, Boston, Mass. Filed Sept. 26, 1890.

In an electric-railway switch, the combination, with a line conductor and pivoted switch-tongue, of a guide extending along the tongue, and a contact-trolley having a projection adapted to engage the guide and thereby throw the tongue into the desired position.

462,031. Fish-Joint for Railways or Tramways. George T. Stevens and William R. Carruthers, Wellington, New Zealand. Filed April 23, 1891.

The combination, in a fish-joint for railways and tramways, of fish-plates having slot-holes with transverse wedge-pieces sliding on the inclined surfaces and actuated by the wedges.

462,045. Railroad-Spike. Daniel A. Hegarty, Philadelphia, Pa. Filed May 6, 1891.

A railroad-spike having a head with a brace-arm having a depending tooth on the side, the arm being arranged obliquely to the rail.

462,062. Metallic Cross-Tie. James M. Price, Philadelphia, Pa., assignor to the Price Railway Appliance Company, of Pennsylvania. Filed July 24, 1890.

A metallic cross-tie having oblique ends formed by bending the same downward outside of the rail-seat, and then horizontally from the downward bend parallel with the body of the tie to form stable rests or feet, downwardly-bent edge flanges and parallel under flanges extending throughout the length of the tie as thus formed, and top central flanges or ridges having their ends separated on the body of the tie to form rail-seats.

462,063. Tramway. James M. Price, Philadelphia, Pa. Filed Dec. 10, 1890.

A street or tramway rail having depending flanges at its sides with openings therein, a channel-bar with depending flanges at its sides having openings therein, a support for the channel-bar, and fastening means passing through the openings in the flanges of the rail and channel-bar into the support.

462,078. Car-Coupling. James B. Granger, Delhi, N. Y. Filed April 1, 1891.

A draw-head of a twin coupling, having pivoted jaws and a longitudinally-divided shank, one of the jaws being pivoted to one shank only and the other jaw pivoted to both shanks.

462,080. Fastening and Support for Railway-Rails. Johannes Grimme, Bochum, Germany, assignor to the Bochumer Verein fur Bergbau und Gusstahl-Fabrikation, same place. Filed June 5, 1891.

The combination, with a rail, of a trough-shaped base-plate having outwardly-inclined sides extended laterally to form hollow bridges and fastening-flanges on each side of the central trough, angle-shaped fish-plates bearing against the sides of the trough, and bolts clamping the fish-plates and base-plates together, a clear space being left between the bottom of the rail and the base-plate.

462,135. Covering for Cable-Conduits. Harry Hughes, Abilene, Kan. Filed April 23, 1891.

A covering for cable-conduits, provided with a series of plates fitted to slide in angular bearings across the conduit-slot, the plates being opened and closed by a pilot held on the car.

462,152. Car-Replacer. John McQuillan, Hecker, Ill. Filed June 30, 1891.

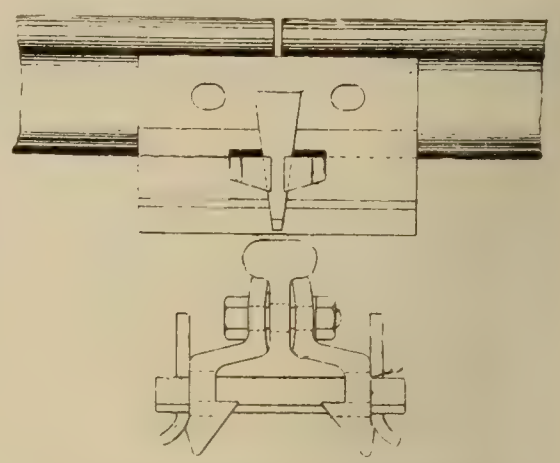
A car-replacer consisting of a clamping-bar bevelled at one end and terminating in a perforated tenon at the opposite end, temporary tracks inclined from and pivoted to the tenon, clamping devices mounted in the clamping-bar, and a chain connected to the lower end of the temporary rail and terminating in a hook.

462,153. Underground System for Electric Railways. Samuel D. Nesmith, Cleveland, Ohio. Filed Aug. 4, 1890. Renewed Aug. 29, 1891.

The combination, with a conduit, of a sleeve supported therein in slanting position by rods or equivalent means and provided with an electric conductor suspended by suitably-insulated hangers.

462,177. Electric Railway. Charles W. Thomas, New York, N. Y., assignor of part to Phillip Van Volkenburgh, same place, and John H. Pendleton, Brooklyn, N. Y. Filed May 6, 1890.

The combination of a series of insulated contact-plates in or parallel with the track, a car-motor circuit whose brushes have sliding contact with and bridge the consecutive plates, a dynamo-rheophore which connects through a pair of electro-magnets with every alternate plate and keepers, of which each consecutive two operate by their closure, the one to complete the motor-dynamo circuit through one of the intermediate plates and the other to enable such completion through the next in advance intermediate plate.



462,031.—FISH-JOINT FOR RAILWAYS.

462,196. Foot-Guard for Railroad-Tracks. Stephen R. Blizzard, Lincoln, Neb. Filed May 20, 1891.

The combination, with the divergent ends of the rails of a railway-frog or guard-rail, of one or more rods placed across the divergent space, a series of rollers placed on the rod, and springs for holding the rollers in a central position.

462,219. Electric-Railway Trolley. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 1, 1891.

In a current-collecting device for an electric car, the combination of a frame pivoted on a transverse axis, a socket-piece pivoted to the frame on an axis in the plane of travel of the vehicle, an upwardly-extending current-collecting arm carried by the socket-piece and provided at the top with a contact, and a spring connecting with the socket-piece at a point below its pivotal connection with the frame, whereby the spring normally tends to move the frame about its transverse axis and hold the socket-piece against lateral movement upon its pivotal point.

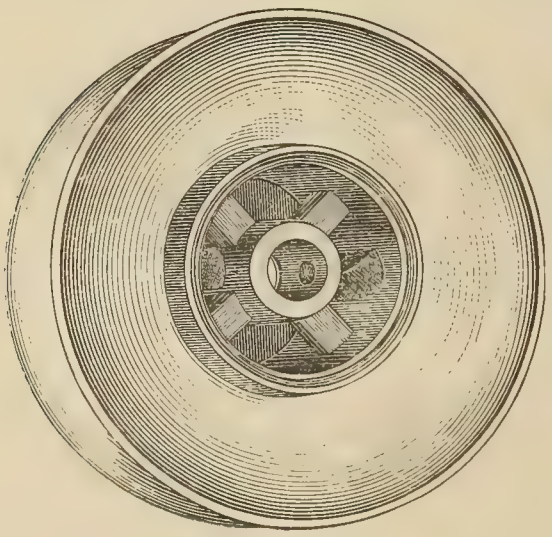
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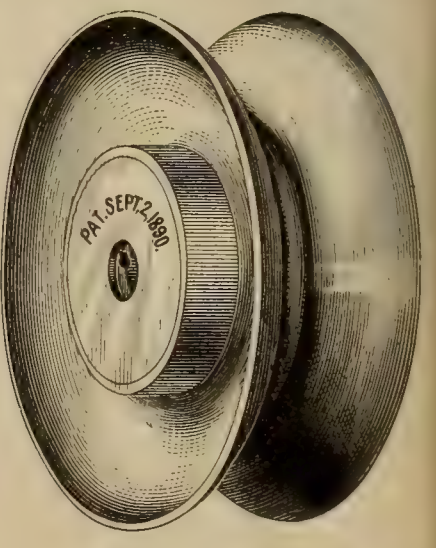
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SELF-OILING TROLLEY WHEEL,
For Electric Railways.

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Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

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VOL. I. NEW YORK, NOVEMBER 14, 1891. No. 19.

STREET RAILWAY NEWS.

(WEEKLY.)

Entered at New York P.O. as second-class matter.

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J. B. TALTAVALL, *President.* T. R. TALTAVALL, *Sec. and Treas.*
W. T. HUNT, *Vice-President.* E. V. CAVELL, *General Manager.*

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SUFFOCATION, NOT ELECTRICITY.

Only a short time ago a report reached us from a Michigan town that a truck-driver had met his death by reason of the team which he was driving at the time having bolted and fouled the telephone pole, in consequence of which a severed telephone wire falling across the trolley entwined itself around his neck and shocked him into eternity.

When any intelligent man, or rather intelligent men, having the faintest possible knowledge of electrical matters, alleges that the standardized voltage of electrical railways (500 volts) is dangerous to human life, the party making such assertion lays himself open to the charge of abnormal ignorance of the subject.

Upon more than one occasion we have ourselves taken the full current of 500 volts direct, and beyond being sent flying for a few feet, we are entirely unaware that our anatomy ever experienced any especial inconvenience.

Following our established custom, we investigated this accident and ascertained that the man undoubtedly died—not from an electric shock, but from asphyxia; not only that, but one of his horses fell upon him, which latter alone was sufficient to knock life out of any one.

When we think of this last "fatality due to the trolley wire," it brings vividly to mind the time when the Sprague Company was operating its line down in Chattanooga. A report came from that city that a colored man had been burned up by the trolley wire. They said smoke and flame had been seen emitting from his body, etc., etc., etc. The facts of the latter case were that one of the sons of Ham, anxious to secure a realization of his highest ambition, viz., to go to sleep, entered the power-house of the Electric Railway Company soon after midnight, and, being caught by the man then in charge, was put to work in the pit cleaning motors two or three hours after current had been shut off. He went to sleep while trying to earn his night's lodging, knocked the kerosene lamp over, and was consequently duly cremated; and yet his death was ascribed to the "deadly trolley wire."

Once more—and we are almost tired of repeating the challenge—we will defy any one to produce legal evidence that the loss of a human life has ever been ascribed directly to shock from a trolley wire of an electric railway, when the voltage has been in the neighborhood of 500, more or less.

ELECTION RECEPTION.

Pursuant to the invitation extended by STREET RAILWAY NEWS October 27, about 300 of its friends and acquaintances visited its rooms on the evening of the 3d—Election Day—and enjoyed the hospitality proffered, as well as the election returns, for the purpose of securing which the NEWS had a special Western Union wire run into one of its rooms, in addition to having its own private wires and a private operator from that company to take immediate charge of the returns. A very substantial and appetizing lunch was enjoyed by its guests, while the enthusiasm displayed by its visitors upon the receipt of each return showed very plainly that there were not only Democrats in the crowd.

A most delightful and enjoyable time was had, and STREET RAILWAY NEWS enjoyed the fun quite as much as its guests did.

YET THEY HOWL FOR RAPID TRANSIT.

In its issue of the 9th inst, the New York *World*, following the example of other great dailies so far as "soulless corporations" are concerned, took occasion to devote no less than nearly two columns and a half of its valuable space to a diatribe upon the fact [as alleged] that, with all the accidents which have occurred through the medium of horse cars in New York City for ten years, "not one of the twenty-nine drivers has been punished by the authorities."

In the recorded chapter of accidents which occurred between August 17 and October 21 of this year [as published by the same paper—28 in number] five proved fatal, and the balance more or less serious—eight of which did not amount to much, while the other fifteen were of a more critical nature. Of the death list of five, one man was at work on a sewer and failed to hear the warning whistle, and the other four were children all under ten years of age—the age when they, naturally enough, run riot from pure innocence and ignorance, and when their safety *should* be carefully looked after [but rarely is] by their parents. Of the list of casualties, outside of fatalities, a five-year child had its big toe broken, and no less than eight other children—none of them over ten years—were the other victims, proving conclusively that a large majority of the accidents were due to the carelessness of parents or the recklessness of ignorant children rather than from the negligence of car-drivers. A lad 16 years old and an old gentleman of 72 summers got injured—the latter by colliding with a "stick of timber, which was used as a guard by the Third Ave. Cable Company." [Injury inflicted through precautionary measures.]

One Dennis Hogan "missed his footing and fell" from the front platform, and sustained a fractured ankle.

The record is truly a serious one to contemplate; but while we admit the amount of injury sustained as alleged, it is very plain to us indeed that fully 95 per cent. of street-car accidents occur through the carelessness or ignorance of the parties injured.

Another very significant point to be remembered is, that the most reliable statistics demonstrate most clearly that the introduction of rapid transit as applied to the overhead system has materially reduced the number of accidents—in fact, to an almost incredible extent, by reason of the man in charge of the car having to depend solely upon the mechanism of the motive-power arrangements, and not upon the questionable ability of the horse or mule to stop quickly in case of emergency; and when we think how easily the electric motor can be and is used as a brake, it is clearly apparent that the number of casualties ascribed to street cars in New York could be materially lessened by the introduction of rapid transit as used in Boston, Minneapolis, St. Paul, Cleveland, St. Louis, Omaha, and other cities of equal importance.

ELECTRIC RAILWAYS AT THE FRANKFORT EXHIBITION.

The London *Electrician* publishes a communication from its Frankfort correspondent regarding electric trains that have been running during the past five months between the exhibition and the Opera Place, Frankfort.

The trucks used, as shown in the illustration, are primitive affairs as compared with the highly-developed American trucks, and from an American point of view are incomparable with the latter.

The chain gearing which is used for the transmission of power and motion from the motor to the axle will also strike the American street-railway manager as rather old-fashioned, and in Fig. 3, which shows the type used on the Budapest line, a strong resemblance will be noticed to the Bentley-Knight system, in use in this country some years ago but now abandoned in favor of the overhead trolley-wire system.

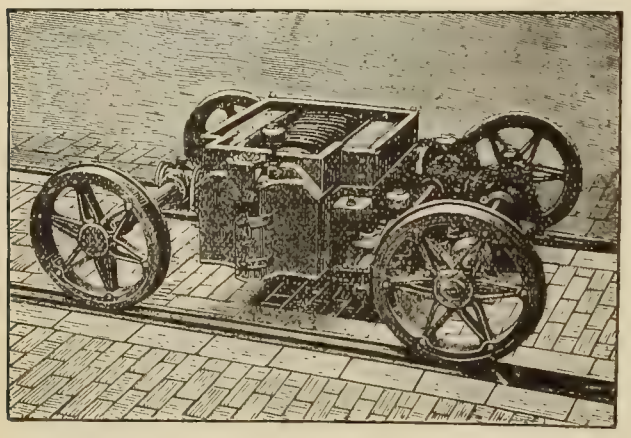


FIG. 2.—SIEMENS & HALSKE'S MOTOR-TRUCK.

It was arranged that the line should be constructed and equipped by Siemens & Halske, and this firm arranged with the Frankfort Tramway Company to lend and lay down the rails, while they themselves undertook the remainder of the work.

The line is 1,440 yards long, and is fairly level, there being only one sharp curve of about 13 yards radius. The overhead-wire system is employed, the wires being carried on iron poles 18 feet high. The current is supplied at a pressure of 800 volts from the Machinery Hall by two cables of 70 sq. mm. cross-section (.11 sq. in. nearly). One of these is attached to the rails at the exhibition end, and wherever two rails join they are connected electrically by a copper wire sunk beneath the surface.

The other cable runs by the side of the line close to the posts, 1 ft. 8 in. below the surface for a distance of 650 yards. Through every alternate post an 18 sq. mm. (.028 sq. in.) sectional wire is drawn, one end being connected with the cable, and the other with the trolley wire. The far end of this underground cable is brought out and connected with a 50 sq. mm. (.08 sq. in.) bare cable, which runs from here along the top of the insulators of the poles on the left side of the line to the end. At every pole this cable is electrically connected with the long working wire. There are three sidings on the line, dividing the line up into five fairly equal parts. The points shut automatically by means of springs, no pointsmen being required, the wheels wedging the points apart or being led by them to the siding, where the tram has to wait till the one coming in the opposite direction has passed.

Means are provided by which the driver can communicate with the engineer, and summon help in the event of a break-down. Both the long working wire and the wires which support it are of galvanized iron, and are 6 sq. mm. (.01 sq. in.) in cross-section.

The chief feature about the line is undoubtedly the simple and convenient system hit upon for making the contact with the overhead wires. Contact is made by means of a steel arm of T shape. The breadth of the arm is about the same as that of the tram, and the arrangement has a very neat appearance. The tram runs with the upper part of the arm lagging a little behind and pressing up on to the wire. When the tram reaches a terminus, the arm will therefore be leaning towards the direction in which the tram is going next; and at starting, the friction against the wire tends to keep the arm back, and the car gliding under the arm, forces the wire upwards for a moment until the arm is in the right direction for the return journey. The arm is kept pressed against the wire by the action of two spiral springs fixed on the axis of the T piece, and also by the weight of the rod frame, the centre of gravity of which is below the horizontal axis. The arm occasionally jumps for an instant away from the wire at the joints. But, as the greatest current used is not more than 40 ampères, the sparking is not very formidable, and could have been cured almost entirely by the use of two arms such as were used on the cars made by this firm for the tramway at Lichterfelde, an illustration of one of which is here given (Fig. 1). The arms in this case, however, though similar in principle, are of a different and perhaps less elegant form.

It may possibly be thought that the contact cross bar of the arm here described would soon wear away; but this has not been found to be the case. It is found that sidings do not offer the least trouble as far as the overhead contact is concerned.

The motor used is a 16 H. P. series wound drum machine; it drives one of the wheel axes by means of endless chains and toothed wheels (Fig. 2). The case containing the motor rests entirely on bearings on the two axes. There are two bearings for the motor on the driven axis, so that this cannot turn in a horizontal direction without carrying the motor with it; on the other axis, however, there is only one bearing for the motor, but that allows the axis to turn in all directions with the motor, and therefore with the other axis, thus allowing the cars to round sharp curves. The motor and chains are cased in to keep out the dust and dirt, but the commutator and oil cups are easily accessible. The brushes used are dense coppered carbons, and are pressed perpendicularly against the commutator by spiral springs. The commutator has steel segments. The brushes are very broad, and a little thicker than the usual copper brushes, and require changing about every three days.

Resistance coils, to allow of the current being gradually switched on and off, are provided. The total weight of each of the cars is about 3 tons 3 cwt., and they will carry 30 persons. The 1,440 yards journey occupies about six minutes, an average speed of $8\frac{8}{11}$ miles an hour; the car is, however, always slowed down at sidings and at the sharp curve.

In addition to the two cars working with the current from overhead, there is also a larger car driven by accumulators. This is built to carry 40 passengers, including three standing on either platform. The car is provided with two motors of 10 H. P. each.

The accumulator battery consists of 162 cells of the Tudor type. Hardened India-rubber boxes are used. While being charged the cells are arranged in frames, which can be raised to any height required, and the substitution of the discharged for the charged cells is accomplished in a very short space of time. The speed is regulated by varying the grouping of the cells. At the station there is a turn-table driven by an electric motor. The fly-wheel from the motor transmits the power on to a friction wheel placed at right angles to it, and thence to the turn-table wheels, or to a rope, to pull the car on to the turn-table according to the wish of the driver.

The firm of Siemens and Halske, in addition to the overhead wire and accumulator traction exhibits, also shows 25 yards of the type of track used for the street railway at Budapest. Fig. 3 shows the trench for the two insulated cables. This line was begun in 1889, and the projected length is 24 miles, of which nearly six miles are in operation at the present time. The number of cars running is 29, with eight as reserve. It may be mentioned that the total distance run by the trams on this line from Jan. 1 to Oct. 31, 1890, slightly exceeded 365,000 miles.

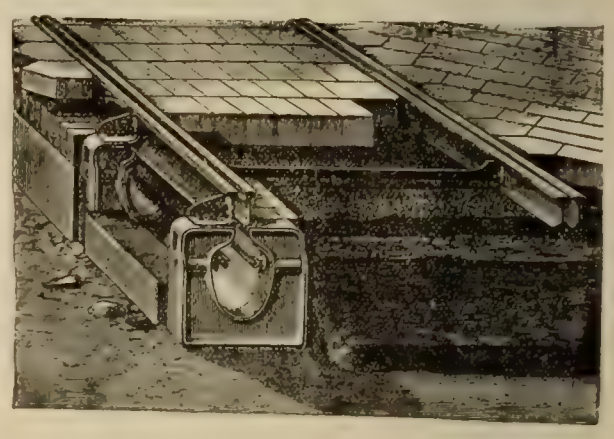


FIG. 3.—TYPE OF TRACK IN BUDAPEST.

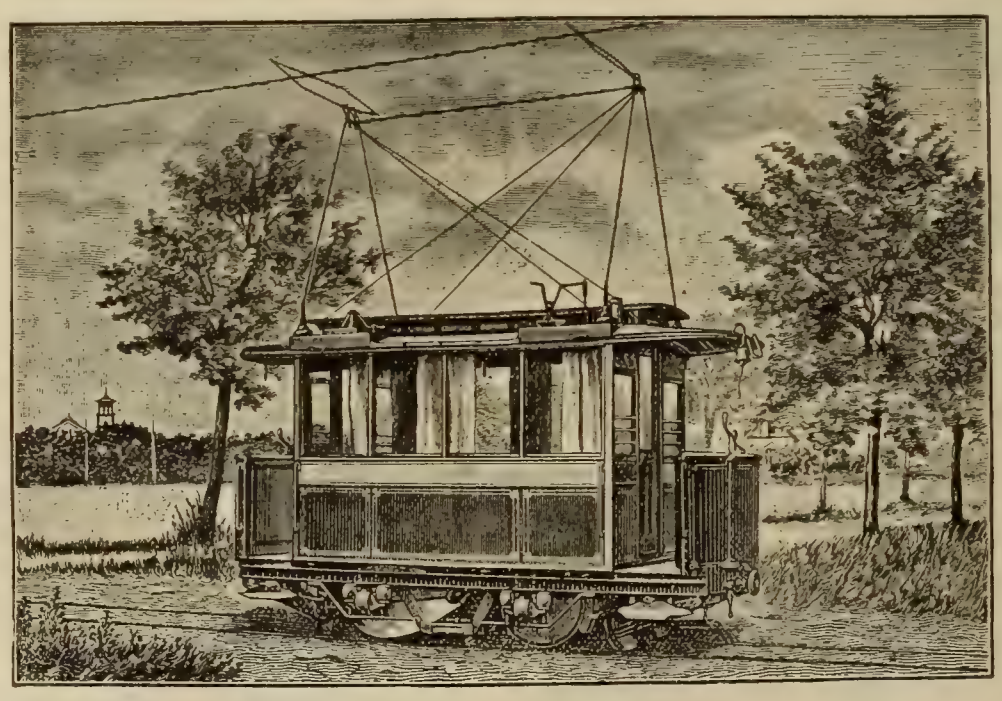


FIG. 1.—CAR ON LICHTERFELDE LINE.

The Engineering Equipment Company has transferred its New York offices from the second floor of the Central Building, 143 Liberty street, to the handsome store premises on the ground floor next the main entrance in the same building. The company now has advantageous locations in both New York and Boston, in which latter city its offices and salesrooms occupy the ground floor and basement of 126 Pearl street, in the heart of the steam and electric equipment trade. No better location in New York than Liberty street could be found for the same trade. The officers of the company are: F. L. Perine, General Manager; A. L. Tinker, Secretary and Treasurer; C. J. Field, M.E., Consulting Engineer; Albert C. Hale, Ph.D., Chemist to the Company; F. A. Magee, M.E., Manager of the Boston Branch; W. F. D. Crane, M.E., in charge of the Railway Department, at New York; C. S. Merrill, representing the Underwood belting and others.

WELL-KNOWN FACES.

JOS. R. ELLICOTT.

Mr. Joseph R. Ellicott, whose features are displayed in the accompanying cut, made from a photograph, is well known in the car-wheel and kindred trades.

He is a man of brilliant personality and one who is by nature fitted to manage large undertakings.



JOS. R. ELLICOTT.

Mr. Ellicott has been with the Griffin Wheel & Foundry Co. and Ajax Forge Co., of Chicago, for a great many years. He came to New York a year ago last May, opened his New York office and added the agency for the New York Car Wheel Works, to his already large duties. The much-increased business of the New York Car Wheel Works, however, compelled him to give up the other two concerns, and since May he has been with the former concern as general agent.

Mr. Ellicott's ability as an agent is well known, and no doubt his personal efforts helped the increase of his company's business. With his large experience a trade that will be the envy of others will no doubt be built up.

FRANK R. CHINNOCK.

Frank R. Chinnock, State Agent for New York for the Edison General Electric Company, whose picture is shown herein, was born in Harlem, N. Y., September 21, 1861.

His earlier education was obtained in Brooklyn, which place he left in 1873, going to Halifax, N. S., with his parents, where he lived for four years. During 1878 he took a course in the St. Romeo Institute of that city, and from 1881 until 1883 was a telegraph operator for the Intercolonial Railway Company. After 1883 Mr. Chinnock came to New York and became Chief Inspector for the Metropolitan Telephone & Telegraph Company, filling some important positions with it.

In 1885 he took charge of the New York and New Jersey Telephone Exchange, remaining with it until 1887. In February, 1887, he became State Agent for the United Edison Manufacturing Company covering Long Island and New Jersey, which position he filled until August, 1890, when he succeeded Mr. Charles T. Hughes, the late District Manager for New York State.

Probably no agent in the Edison Company is better known than Mr. Chinnock. Mr. Chinnock is the brother of Mr. C. E. Chinnock, the late Vice-President and General Manager of the United Edison Manufacturing Company.

According to the report of the Berlin Electrical Works, covering the period from June 30, 1890, to July 1, 1891, the increase in the number of consumers of electric light was from 872 to 1,314, or about 44 per cent. The increase in the number of lamp connections was from 74,959 to 104,100, and between 25,000 and 30,000 additional lamps have been called for during this winter.

FINANCIAL DEPARTMENT.

On application of the stockholders, Mr. W. G. Curtis has been appointed receiver of the Fond du Lac (Wis.) Street Railway Company, of which H. Burkholder is President. It was mortgaged to the Holland Trust Company of this city for $50,000 to secure the bonds on that amount. The indebtedness is principally for construction, and the bonds are nearly all held in New York and vicinity. If the electric bondholders in New York and New England will notify me oftener of their holdings, I can be of greater service to them. The Weekly STREET RAILWAY NEWS has attained a position which it is not judicious for you to ignore. STREET RAILWAY NEWS is fast becoming the recognized organ of all corporations connected with street railways or their equipment, and if you are interesting yourself in this line, the sooner your focus gets in close contact with headquarters the safer your investment will be. Do not be so modest. We will impart our choicest bits of information, from the signing of the municipal contract to the completion of the complete line earning and paying its dividends, with all modern improvements included.

The commissioners have agreed on the route and the details of construction, including electric light and power, for underground rapid transit for suffering New Yorkers and their guests. Their report after careful consideration has been signed by the Mayor, and now it is, or soon will be, in order for our daily contemporaries to fill column after column with peppery articles on jobs of all illegitimate natures; mechanical and engineering stupidity. Meantime from $50,000,000 up to—well, the limit of extras must be raised. We cannot receive subscriptions on it because it is not, strictly speaking, a street railway, but we shall watch its financial advancement and discuss that feature frequently. We are most decidedly in favor of rapid transit for this city, and this system being decided on, we cordially and heartily recommend its securities to all investors in or out of the metropolis.



FRANK R. CHINNOCK.

At the annual meeting of the South Brooklyn and Terminal Company, F. K. Hain, Clarence Stephens, J. A. Murray, Edward T. Hunt, John W. Ambrose, W. B. Cutting and Joseph Richardson were elected directors. The board organized by electing John W. Ambrose, President; Joseph Richardson, Vice-President; W. B. Cutting, Treasurer, and Francis H. Bergen, Secretary.

NEW INSULATING MATERIALS.

An improved insulating medium for electrical purposes in general consists of a mixture of sulphur, pipeclay, slate-dust, wax, and some metallic oxide, the latter being added on account of its cohesive action, whereby it assists the wax in binding the other ingredients together, and also on account of its coloring properties.

The proportions in which these ingredients are used are as follows:

Sulphur	7 lbs.
Pipeclay	1½ "
Slate-dust	1½ "
Paraffin wax	2 oz.
Oxide	variable.

The quantity of oxide added chiefly depends upon the color which it is desired to give to the mixture; it may vary from one-half to one-fourth of the total weight of the other ingredients.

In working up this mixture the clay and the slate-dust are first thoroughly mixed together by grinding, the materials being heated. The paraffin wax is then added and the mixture incorporated into a paste.

After exposure for some time, during which it becomes dry and hard, the mixture is ground to a powder and then mixed with the proper quantities of sulphur and metallic oxide. There is, apparently, no information available respecting the relative power of insulating possessed by this new medium.

Another invention has for its object the economy of gutta-percha, and similar expensive materials, in the manufacture of insulating compositions for electrical purposes.

Wood fibre, hemp, flax, jute, cotton, silk, woollen, or other suitable materials, are saturated with some drying oil—*e.g.*, linseed oil—which has been previously heated up to a temperature of 350° F. with litharge or some other oxidizing agent. The fibre thus treated is then dried and again saturated with oil, the process being repeated again and again until the fibre has increased in weight by at least 50 to 100 per cent. The dry fibre is now worked up into a homogeneous mass by the action of rollers running at a high speed, and then about 25 per cent. of gutta-percha or India-rubber is added, and so amalgamated with the fibre that the latter can afterwards be formed into blocks or rolled out into sheets, etc.

In another new insulating medium the chief features are as follows: Very finely powdered quartz is dried and made into a plastic mass with a solution of crude potassium or sodium silicate, coloring substances being added for appearance sake. The mass is moulded to any required shape, and may have pieces of metal imbedded in it for lamp-holders. It is then slowly dried and finally brought to a red heat. A glazing mixture gives a finish to the surface. This composition is stated to be very useful for insulation between commutator segments, for lamp fittings, etc.

OUR PATENT DEPARTMENT.

We desire to call the attention of our friends to the Patent Department of STREET RAILWAY NEWS. This department is in charge of Mr. John Henry Hull, a patent attorney of well-known ability and large experience, and in his hands this branch of the business has developed into a very important and successful one.

Any one desiring to obtain a patent on an invention cannot do better than by procuring it through the STREET RAILWAY NEWS Patent Department. The greatest of care is bestowed in drawing up the specifications, and owing to the large technical experience of Mr. Hull every point is fully developed.

Our terms are as low as any one's, and the service is of the first class.

UNION INTERNATIONALE PERMANENTE DE TRAMWAYS.

OFFICERS.

President, G. Michelet, rue Pascale, 6, Bruxelles ; Vice-Président, J. Fischer-Dick Berlin. Directors: Culin, Hamburg; Géron, Cöln; Hamelink, Heerenveen; Kessels, Milan; Schadd, Amsterdam; Turba von Dravenau, Wien; Secrétaire général, F. Nonnenberg, rue de Merode, 149, Bruxelles.

ORDINARY MEMBERS.

(CONSISTING OF TRAMWAY COMPANIES AND THEIR OFFICERS.)

GERMANY.

AACHEN. Aachener und Burtscheider Pferdebahn-Gesellschaft.

ALTONA. Hamburg-Altona and North Western Tramways Company, Limited.

AUGSBURG. Augsburger Trambahn.

BERLIN. Deutsche Local- und Strassenbahn-Gesellschaft, Mecklenburger Local- und Secundärbahnen (Bachstein & Cie), Neue Berliner Pferdebahn-Gesellschaft, Königsberger Pferde-Eisenbahn-Gesellschaft.

BOCKENHEIM. Fiankfurter Trambahn-Gesellschaft.

BRESLAU. Frankfurter Güter-Eisenbahn-Gesellschaft, Breslauer Strassen-Eisenbahn-Gesellschaft.

BRUXELLES. La Société anonyme des Tramways de Barmen-Elberfeld.

CASSEL. Casseler Stadt-Eisenbahn-Actien-Gesellschaft, Casseler Strassenbahn.

CHARLOTTENBURG. Berliner Pferde-Eisenbahn-Gesellschaft.

CÖLN. Cölnische Strassenbahn-Gesellschaft.

CREFELD. Crefeld-Uerdinger Localbahn-Gesellschaft.

DRESDEN. Dresdener Strassenbahn.

DÜSSELDORF. Düsseldorfer Pferde-Eisenbahn-Gesellschaft.

ERFURT. Erfuter Strassenbahn-Actien-Gesellschaft.

HALLE. Hallesche Strassenbahn-Gesellschaft.

HAMBURG. Strassen-Eisenbahn-Gesellschaft in Hamburg, Grosse Hamburg-Altonaer Strassenbahn-Gesellschaft.

HANNOVER. Hannoversche Strassenbahn, Localbahn-Bau- und Betriebs-Gesellschaft.

HEIDELBERG. Heidelberger Strassen- und Bergbahn-Gesellschaft.

INGOLSTADT. Ingolstädter Trambahn.

LANGFUHR. Danziger Strassen-Eisenbahn-Gesellschaft.

LEHE. Bremerhavener Strassenbahn.

LEIPZIG. Leipziger Pferde-Eisenbahn-Gesellschaft.

LÜBECK. Lübecker Pferde-Eisenbahn-Gesellschaft.

MADGEBURG. Madgeburger Strassen-Eisenbahn-Gesellschaft, Madgeburger Trambahn-Actien-Gesellschaft, Halberstädter Strassenbahn-Gesellschaft.

MANNHEIM. Pferdeeisenbahn-Gesellschaft Mannheim-Ludwigshafen.

METZ. Trambahn Metz.

MÜNCHEN. Münchener Trambahn-Actien-Gesellschaft.

NÜRNBERG. Nürnberg-Fürther Strassenbahn-Gesellschaft.

OBERRAD. Frankfurt-Offenbacher Trambahn-Gesellschaft.

POTSDAM. Potsdamer Strassenbahn-Gesellschaft.

ROSTOCK. Mecklenburger Strassenbahnen.

STETTIN. Stettiner Strassen-Eisenbahn-Gesellschaft.

STRASSBURG. Strassburger Strassenbahn-Gesellschaft.

STUTTGART. Stuttgarter Strassenbahnen.

AUSTRIA-HUNGARY.

BRUXELLES. La Société anonyme des Tramways Autrichiens de Cracovie et extensions.

BRÜNN. Brünner Local-Eisenbahn-Gesellschaft.

BUDAPEST. Budapester Strassen-Eisenbahn-Gesellschaft.

DEBRECZIN. Debrecziner Local-Eisenbahn-Actien-Gesellschaft.

PRAGUE. La Société anonyme des Tramways de Prague.

TEMESWAR. Temeswarer Strassen-Eisenbahn-Gesellschaft.

TRIEST. Triestina Tramway-Gesellschaft.

VIENNA. Kolomeaer-Local-Bahnen, The General Vienna Omnibus Company, Neue Wiener Tramway-Gesellschaft, Wiener Tramway-Gesellschaft.

BELGIUM.

ANVERS. La Société des Tramways Maritimes, La Société des Tramways du Sud.

BRUXELLES. La Société anonyme: Les Tramways Bruxellois, La Société Générale des chemins de fer économiques, La Compagnie Générale des chemins de fer secondaires, Société Nationale des chemins de fer vicinaux, La Société pour l'Exploitation de voies ferrées en Belgique.

EVERE-BRUXELLES. La Société anonyme "Les Tramways de l'Est de Bruxelles."

GAND. La Société des Tramways de Gand.

IXELLES. La Société du chemin de fer à voie étroite de Bruxelles à Ixelles-Boendael.

LIÉGE. La Société des Railways économiques Liége-Seraing et extensions.

DENMARK.

FREDERIKSBERG. Frederiksberg Sporveisselskab.

HELLERUP. Strandvejens Dampsporveisselskab.

SPAIN.

BILBAO. Compania del Tramvia de Bilbao a Santurce.

LONDON. The Barcelona Tramways Company, Limited.

MADRID. Sociedad Tramvia del Este de Madrid, Tramvia del Norte de Madrid.

SAINT-SÉBASTIEN. Compania del Tramvia de San Sebastian.

FRANCE.

BRUXELLES. La Société Nouvelle des Tramways de Nice.

PARIS. Les Tramways de Paris et du Dép't de la Seine.

REIMS. La Société des Tramways de Reims.

GREECE.

MONS. Les Tramways d'Athènes et extensions.

ITALY.

BARI. La Société anonyme des chemins de fer économiques de Bari-Barletta.

BRESCIA. La Société anonyme des Tramways à vapeur de la province de Brescia.

BRUSSELLS. La Société anonyme des Tramways et Chemins de fer économiques Rome, Milan, Bologne, etc., La Societa per le Ferrovie del Appenino Central, La Societa per le Ferrovie del Ticino, Société des Tramways de Vérone et Vicence, Compagnie générale des Tramways Piémontais.

FLORENCE. Les Tramways Florentins.

MILAN. La Société des Tramways Interprovinciaux de Milan-Bergame-Crémone, The Lombardy road railways Cy., Societa anonima degli Omnibus de Milano.

NAPLES. La Société des Tramways Provinciaux de Naples, La Société anonyme des Tramways Napolitains.

TURIN. La Société anonyme des Tramways de Turin, Societa dei Tramways a vapore nella provincia di Torino, Société du chemin de fer de Turin-Cirie-Lanzo.

VICENCE. The province of Vicenza Steam Tramways Cy.

JAPAN.

TOKIO. Compagnie générale des Omnibus de Tokio.

NETHERLANDS.

AMSTERDAM. Amsterdamsche Omnibus-Maatschappij, Hollandsche Ijzeren Spoorweg-Mattschappij, Noord-Hollandsche Tramweg-Maatschappij.

ARNHEM. Arnhemsche Tramweg-Maatschappij.

BRÉDA. Zuider Stoomtramweg-Maatschappij.

BRUXELLES. Haagsche Tramweg-Maatschappij.

DOETICHEM. Geldersche Stoomtramweg-Maatschappij.

DRIEBERGEN. Stoomtramweg Oldambt-Pekela.

NORWAY.

CHRISTIANA. Kristiania Sporveisselskab.

RUSSIA.

BRUXELLES. La Société des Tramways de Rostoff. La Société des Tramways de Tiflis.

KHARKOFF. La Société des Tramways de Kharkoff.

MOSCOU. La Société des Tramways de Moscou, 2e réseau.

ODESSA. La Société des Tramways d'Odessa.

RÉVAL. La Société des Tramways de Réval.

RIGA. La Société des Tramways de Riga

ST.-PÉTERSBOURG. La 1re Compagnie de Tramways de St.-Pétersbourg. La Société des Tramways de St. Pétersbourg.

TIFLIS. Radelet, Directeur des Tramways de Tiflis.

VARSOVIE. Chorazy, Directeur des Tramways de Varsovie. La Société anonyme des Tramways de Varsovie.

SWEDEN.

STOCKHOLM. Stockholms Nya Sparvägsactiebolag.

SWITZERLAND.

BÂLE. W. Rowan, Ingénieur.

BASEL. Tram-Omnibus.

GENÈVE. Compagnie générale des Tramways Suisses.

ZÜRICH. Zürcher Strassenbahn-Gesellschaft.

PERSONAL MEMBERS (*i.e.*, OFFICERS OF TRAMWAY COMPANIES).

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CHEMNITZ. Th. Fromm, Betriebsdirector der Deutschen Local und Strassenbahn-Gesellschaft.

CÖLN. Dräger, Betriebsdirector der Cölnischen Strassenbahn. Géron, Director der Cölnischen Strassenbahn. E. Hardt, Aufsichtsrath der Strassenbahn in Wiesbaden.

DARMSTADT. Rötelmann, Ober-Ingenieur der Hessischen Nebenbahnen in Privatbetrieb.

DORTMUND. H. Fromm, Betriebsdirector der Deutschen Local- und Strassenbahn-Gesellschaft.

DUISBURG. Waas, Betriebsdirector der Deutschen Local- und Strassenbahn-Gesellschaft.

ELBERFELD. Von Pirsch, Director des Tramway von Barmen-Elberfeld.

HAMBURG. Avé-Lallemand, Director der Grossen Hamburg-Altonaer Strassenbahn. Culin, Oberingenieur der Strassenbahn-Gesellschaft. Röhl, Director der Strassen-Eisenbahn-Gesellschaft. Schneider, Director der Strassen-Eisenbahn-Gesellschaft.

MAINZ. Altenfeld, Director der Mainzer Strassenbahn.

MÜNCHEN. G. Hippe, Director der Münchener Trambahn.

AUSTRIA-HUNGARY.

ARAD. Fenner, Director der Arader Strassenbahn.

BUDAPEST. Jellinek, General director der Budapester Strassenbahn. David Lebenstein, Ober-Ingenieur der Budapester Strassenbahn.

VIENNA. Franz Haffel, Ingenieur. Dr. Kopp, Präsident der Wiener Tramway-Gesellschaft. E. von Lindheim, Verwaltungsraths-Mitglied der Debrecziner Tramway-Gesellschaft. W. von Lindheim, Verwaltungsraths Mitglied verschiedener Strassenbahn-Gesellschaften. Dr. Percival, Director der Vienna Omnibus Company. Baron Pirquet, Präsident der Vienna Omnibus Company. Regierungsrath Morawitz, Verwaltungsraths-Mitglied der Wiener Tramway-Gesellschaft. J. Stern, Ingenieur. Wetzler, Verwaltungsraths-Mitglied der Neuen Wiener Tramway-Gesellschaft.

BELGIUM.

BRUSSELS. Becquét, Administrateur des Tramways Bruxellois. Dapsens, Administrateur des Tramways de Dusseldorf. De Burlet, Directeur général de la Société nationale de Chemins de fer Vicinaux. G. De Laveleye, Administrateur délégué de la Société des Tramways de Francfort. Demolder, Directeur de l'exploitation des Tramways Bruxellois. Despret, Administrateur de la Società per le Ferrovie del Ticino. Dugniolle, Ingénieur aux Tramways Bruxellois. Dupuich, Administrateur des Tramways Bruxellois. Guillon, Administrateur délégué des chemens de fer et Tramways de Perse. Hammelrath, Administrateur des Tramways d'Odessa. Janssen, Directeur général des Tramways Bruxellois. Lebon, Administrateur des Tramways de Dusseldorf. Limauge, Administrateur des Tramways Bruxellois. Lorge, Professeur à l'École vétérinaire. Marx, Secrétaire des Tramways de Francfort. Michelet, Administrateur délégué de la Compagnie des Chemins de fer secondaires. Moyaux, Administrateur de diverses Sociétés de chemins de fer en Italie. Nonnenberg, Ingénieur. Renty, Ingénieur à la Société Nationale des chemins de fer Vicinaux. Schaar, Alfred, Ingénieur. Stoclet, Administ. de la Società per le Ferrovie del Ticino. Tellier, Contrôleur à la Société Nationale des chemins de fer Vicinaux. Van Overstraeten, Chef des services techniques aux Chemins de fer économiques. Van Vloten, Ingénieur.

HEERENVEEN. Nederlandsche Tramweg-Maatschappij.

HILLEGOM. Noord-Zuid-Hollandsche Stoomtramweg-Maatschappij Harlem-Leide

LIÉGE. Ad. Dupont, Administrateur délégué de la Société des Railways économ. Liége-Seraing & extensions. Nyst, Concessionnaire du Tramway Est-Ouest à.

LOOSDUINEN. Westlandsche Stoomtramweg-Maatschappij.

MONS. Fauconnier, Administrateur des Tramways d'Athènes.

NAMUR. Leclercq, Inspecteur de la Cie du chemin de fer du Nord.

PÉRUWELZ. De Lattre, Concessionnaire du Tramway de Péruwelz.

ROTTERDAM. Rotterdamsche Tramweg-Maatschappij.

UTRECHT. Ooster Stoomtramweg-Maatschappij, Stichtsche Tramweg-Maatschappij, Utrechtsche Tram-Maatschappij.

SWITZERLAND.

GENÈVE. T. Laval, Directeur de la Cie générale des Tramways suisses.

FRANCE.

DIJON. Chassin, Directeur des Tramways de la Côte-d'Or.

LILLE Clément, Inspecteur de l'exploitation de la Cie des Tramways du département du Nord.

NICE. Thiebaut, Directeur des Tramways de Nice.

PARIS. Billema, Directeur de la Cie de chemins de fer sur routes de Paris à Arpajon. Delonchant, Ingénieur chef du service de la voie à la Compagnie générale des Omnibus. L. Francq, Ingénieur-conseil de la Cie des Tramways du Département du Nord. Lavalard, Administrateur de la Cie générale des Omnibus. Mauclère, Directeur des Ateliers de la Cie générale des Omnibus.

TOULOUSE. Pons, Concessionnaire des Tramways de Toulouse.

ITALY.

IVREA. Borel, Ingénieur chef d'exploitation du Tramway à vapeur d'Ivrea-Santhia.

NAPLES. O. Folinéa, Chef de bureau aux Tramways Napolitains.

MESSINE. A. Galimberti, Ingénieur.

MILAN. Grandmoulin, Chef de service aux Tramways interprovinciaux de Milan-Bergame-Crémone. G. Sève, Chef du service de l'exploitation des Tramways interprovinciaux de Milan-Bergame-Crémone.

SAMPIERDARENA. Piacani, Ingénieur des Tramways de Gênes.

NETHERLANDS.

AMSTERDAM. Perk, Secrétaire de l'Union Néerlandaise de Tramways. Ramann, Commissaire de l'Amsterdamsche Omnibus-Maatschappij. H.-G. Van der Vies, Commissaire de l'Amsterdamsche Omnibus-Maatschappij. Van Reigersberg-Versluys, Membre de la Direction de l'Union néerlandaise de Tramways.

ARNHEM. H. Erdbrink, Membre de la Direction de "l' Union Néerlandaise de Tramways."

DOETINCHEM. Heuff, Directeur de la Geldersche Stoomtramweg-Maatschappij.

GROEDE. Gerritsen, Commissaire du chemin de fer de Breskens à Maldeghem.

LA HAYE. J.-J. Van Kerkwijk, Membre de la 2e Chambre des États-Généraux.

OOSTERHOUT. Hamilton, Président-Commissaire du Zuider Stoom-Tramweg-Maatschappij.

PRINSENHAGE-LEZ-BRÉDA. Julien Pirau, Ingénieur-Directeur technique de la Zuid Nederlandsche Stoomtramweg-Maatschappij.

ROTTERDAM. Schotel, Ingénieur.

PHILIPPINE ISLANDS.

MANILLE. Zobel de Zangroniz, Administrateur de la Compania de los Tramvias de Filipina.

TURKEY.

CONSTANTINOPLE. Comte Graziadei.

ASSOCIATE MEMBERS—FIRMS CONNECTED WITH TRAMWAY INTERESTS.

GERMANY.

BERLIN. Borsig, Siemens & Halske.

BOCHUM. Bochumer Verein für Bergbau und Gussstahlfabrication, Gesellschaft für Stahl-Industrie.

BRESLAU. Hoffmann & Cie.

BUCKAU-MAGDEBURG. Grusonwerk.

CASSEL. Henschel & Sohn.

DORTMUND. Union.

DUSSELDORF-GRAFENBURG. Baessler und Jorissen.

EHRENFELD. Herbrand & Cie.
ESSEN. Friedrich Krupp.
HOERDE. Hoerder Bergwerks- und Hütten-Verein.
KÖLN-DEUTZ. Van der Zypen & Charlier, Gebrüder van der Zypen.
LAAR BEI RUHRORT. Phönix.
LUDWIGSHAFEN. Ludwigshafener Waggonfabrik.
OSNABRÜCK. Georgs-Marien-Hütten- und Bergswerks-Verein.
REMSCHEID. Bergische Stahl-Industrie-Gesellschaft.
RUHRORT. Kampf und Hollender.
ZITTAU. L. Entel.

AUSTRIA-HUNGARY.

GRAZ (Steyermark.) Joh. Weitzer.
WIEN, Wipplingerstrasse, 23. M. Frisch.

BELGIUM.

BRUXELLES. L'Electrique, L'Industrie, La Metallurgique. Société Emile et Jules Halot & Cie., Société internationale de construction de matériel de chemins de fer.
CHARLEROI. Philippot et Wilmet, Victor Gilleaux.
COURT-SAINT-ETIENNE. Henricot.
LAEKEN. La Visserie Belge.
LIÉGE. De Marneffe & Cie., Fétu-Defize & Cie.
LOUVAIN. Dyle-Bacalan.
MALINES. La Société anonyme des Ateliers de construction de.
MONTIGNY-SUR-SAMBRE. J. et S. Piérard frères & Cie.
OUGRÉE. Société des Aciéries d'Angleur.
SCLESSIN. Dejaer Mullenders & Cie.
THY-LE-CHÂTEAU. Caramin & Cie.

ENGLAND.

EDINBURGH. Miller and Co.
SHEFFIELD. Ibbotson Brothers.

FRANCE.

PARIS. Société anonyme de Travaux Dyle & Bacalan.
RAISMES. La Société anonyme Franco-Belge pour la construction de matériel de chemin de fer.

NETHERLANDS.

HAARLEM. A. J. Beynes.

SWEDEN.

ARBOGA. Arboga Mekaniska Werkstad.

PERSONAL ASSOCIATE MEMBERS.

BERLIN. Brehm, Dietrich, Donath, Engelmann, Freese, Grengel, Hanke, Karl Meyer, Peine, Quitmann, Schelbach, F. F. A. Schulze, Sterken, Wernigh.
BREMEN. Davin.
BOCHUM. Diefenbach.
CHARLOTTENBURG. Damke.
FRANKFURT. Gallenkamp.
HALLE. Ferber, Reinitz.
HAMBURG. Huber, Paul Knacke
HANNOVER. Bartling.
KÖLN-DEUTZ. Eugen van der Zypen.

AUSTRALIA.

MELBOURNE. Capt. F. C. Rowan.

AUSTRIA-HUNGARY.

VIENNA. Joseph Tauber.

BELGIUM.

ANGLEUR. De Groulart.
BRACQUEGNIES. Noulet.
BRUGES. Feldhaus, In.
BRUXELLES. Boty, Mommens, Moreau, Thomas, Vissoul.
HAINE-ST.-PIERRE. Moyaux.
LA LOUVIÈRE. Delcuve, Tabutaut.
LIÉGE. Dohmen-Leblanc.
MARCINELLE-COUILLET. Alf. Maroquin.
OUGRÉE. Raze.
WILLEBROECK. L. De Nayer.

ENGLAND.

LONDON. A. H. Rowan, Druitt Halpin, von Buch.

FRANCE.

LYON. Emile Hanquet, Petrequin.
PARIS. Lucien Demolon, Paul Jullien.

NETHERLANDS.

ROTTERDAM. Chabot, Dikema.

SWITZERLAND.

BÂLE. Riggenbach.
WINTERTHUR. F. Marti.
ZÜRICH. Gerlich.

CORRESPONDENCE.

IMPOSITIONS.

EDITOR STREET RAILWAY NEWS: In your issue of October 31 I read with interest the short note from your correspondent, "INVENTOR," and also the very proper editorial note.

I would suggest that the duty of exposing such impositions upon the public rests principally upon those that "know better" and thus protect their readers and the general public. Lesser "humbugs" have been mercilessly dealt with by some journals; now let them show their "honest impartiality" by making such an exposure of this the most outrageous attempt to destroy others and dupe the "uninstructed" public. Yours, etc.,

"INTEGRITY."

NEW YORK, Nov. 6, 1891.

THE WEEK'S RECORD OF STREET-RAILWAY NOTES.

ALABAMA.

BIRMINGHAM.—It is probable Birmingham Railway and Electric Company will abandon its present line from Sixth avenue to Twenty-sixth street and Eighth avenue to Twenty-seventh street, and construct road from Sixth avenue out Twenty-fourth street to city limits.

MONTGOMERY.—Reported efforts being made to forfeit street-railway franchise for failure to construct tracks according to ordinance.

CALIFORNIA.

OAKLAND.—Construction of electric road to East Oakland being rapidly pushed. Storage-battery system will be used.

SAN DIÉGO.—October 29. Property of San Diégo Street Car Company purchased for $115,000 by Myrick & Deering, San Francisco, solicitors for Farmers' Loan & Trust Co., who hold bonds of street-car company. It is rumored that purchaser is A. B. Spreckles, son of Claus Spreckles, the sugar king, but nothing definite known.

SAN FRANCISCO.—October 24. The 27,000 feet extension of the Ferries and Cliff House Railway system in operation.

SAN JOSÉ.—Half interest in the Hoskins motor sold to R. H. Quincey, of this place.

DELAWARE.

WILMINGTON.—Westchester Electric Street Railway Co. expects Lenape branch road ready for traffic November 16.

GEORGIA.

ATLANTA.—October 28. Consolidated Street Railway Company starts 1,000 additional horse power at its new plant.

October 30. Reported consolidation Atlanta, West End and McPherson's Barracks and the Grant Park electric lines under the name of Atlanta Traction Company. (See Election of Officers,)

ILLINOIS.

CHICAGO.—Cicero and Proviso Electric Street Railroad is operating its Desplaines avenue loop.

ELGIN.—Elgin Street Railway Company increased capital to $250,000.

INDIANA.

EVANSVILLE.—The Evansville Street Railway Co. will rebuild its stable and power-plant (recently destroyed by fire) on the old site at once.

MARYLAND.

BALTIMORE.—Reported that Edison General Electric Company has given electrical department Johns Hopkins University two 15-horse-power street-car motors.

MASSACHUSETTS.

PEABODY.—Essex Electric Street Railway ordered more Rae motors.

QUINCY.—Quincy & Boston Street Railway Co. has declared dividend of 5 %.

MICHIGAN.

DETROIT.—Detroit Electric Battery Company granted privilege running storage-battery cars on any line in the city.

SAGINAW.—Saginaw Union Street Railway Co. will use vestibule cars.

MINNESOTA.

MINNEAPOLIS.—October 26. Electric street railway to Fort Snelling in operation.

President H. M. Whitney and Chief Engineer E. J. Pearson, of West End system, Boston, in this city October 24.

Reported that Minneapolis Street Railway Co. has ordered one hundred 200-horse-power combined engines and generators of the Westinghouse Co.

Minneapolis Street Railway Company will convert the cable car-house on 31st street into electric plant; fitting it with ten 250-horse-power generators and necessary engines, at cost of over $50,000.

ST. CLOUD.—Electric street railway expected to be in operation Nov. 15.

ST. PAUL.—On account numerous collisions between street cars and fire apparatus on way to fires, ordinance passed giving fire department right-of-way.

MISSOURI.

ST. LOUIS.—St. Louis Unicycle Railroad Company is making surveys and measurements for its electric railroad in western part of city.

The St. Louis and Suburban Railway Co. will construct one-story brick power-house, 31 x 400 feet, on Maple street near Rosedale, at cost of $26,000.

NEW JERSEY.

ELIZABETH.—Prospective consolidation Elizabeth & Newark Horse Railway Co. and Orange, Cross Town & Bloomfield Street Railway Co.

PATERSON.—It is stated that Central Railway Company will build lines through State street instead of Ellison street and Fifteenth avenue.

NEW YORK.

BINGHAMTON.—October 31. Reported Binghamton and Port Dickinson Street Railroad sold to John Evans for $75,000.

CHATHAM.—October 23. Gibson Storage-Battery Works destroyed by fire. Loss about $15,000. Partially insured.

NEW YORK.—October 29. Successful trial trip on Broadway cable line.

UTICA.—October 17. Belt Line completed work of relaying tracks on Columbia street.

OHIO.

EAST LIVERPOOL.—November 1. Track laying commenced on Franklin street.

SPRINGFIELD.—Time-limit for construction of street railway extended one year.

TOLEDO.—October 29. Consolidated Street Railway Company's car-house on Buckeye street destroyed by fire. Estimated loss, $2,500; insurance, $1,600.

Toledo Electric Street Railway Co. offers use portion of track jointly with Consolidated Street Railway Co. on disputed streets and furnish power to that company on principal thoroughfares at rate of 4 cents per car mile.

OREGON.

PORTLAND.—East Side Railway Company's power-house will be located at the saw-mill of Inman, Kalson & Co.

PENNSYLVANIA.

MIDDLETOWN.—Steelton and Middletown Street Railway Company purchased Middletown Turnpike for $16,500.

PITTSBURG.—Rumored negotiations pending for consolidation Duquesne Traction Co. and Fifth Avenue Cable Co.

The Westinghouse Co. is now manufacturing combined engines and generators for street-railway service from 100 to 500 horse-power.

MEMPHIS.—November 1. Electric cars running on four of six street-car lines here. East End Dummy line will change to electric power soon.

TEXAS.

Beaumont.—October 29. Track-laying on new street railway commenced.

San Antonio.—To avoid further trouble regarding occupancy of Austin street, San Antonio Rapid Transit Co. agreed to put down track of its own to occupy space between curb and tracks of San Antonio Street Railway Co.

WASHINGTON.

Seattle.—Grant street electric road nearly completed.

Tacoma.—Reported purchase Point Defiance street railway by Tacoma Street Railway and Motor Co.

WISCONSIN.

Fond du Lac.—October 26. W. G. Curtis appointed receiver for Fond du Lac Street Railway Co.

Janesville.—Reported that street-railway tracks are to be torn up, road proving a failure.

Milwaukee.—The Villard syndicate now controls all street railways here.

November 4. Reported strike of 700 laborers on the Villard electric railway system against reduction of 25 cents in wages.

Superior.—The Douglas County Street Railway Co. will erect a car-house to cost about $20,000.

Possible Purchases.

Ashland, Pa.—Shenandoah, Mahanoy City, Girardville and Ashland Electric Co. requires electric construction material.

Boston, Mass.—The Norfolk and Suffolk Street Railway Co. needs material for a street railway from this place to Dedham.

Braddock, Pa.—The Braddock Electric Railway Co. requires construction material.

Cincinnati, Ohio.—The Cincinnati, Lebanon and Northern Railway Co. requires electric construction material. (See Change of Power.)

Duluth, Minn.—The Minnesota Point Street Railway Co. needs material for a track extension of two miles.

Harrisburg, Pa.—Latrobe and Derry Electric Street Railway requires construction material.

Holyoke, Mass.—The Holyoke Street Railway Co. may require material for a track extension.

Hot Springs, Ark.—Hot Springs Street Railway Co. (horse) requires electric construction material. Address S. W. Fordyce, President.

Nebraska City, Neb.—The Nebraska City Street Railway Co. requires material for track extension. Address H. H. Bartling, President.

Oakland, Cal.—Oakland Consolidated Railway Co. will require material for a track extension.

Walla Walla, Wash.—The Walla Walla Street Car Co. requires electric construction material.

Incorporations.

Chicago, Ill.—October 25. United States Rapid Transit Company. Capital stock, $5,000,000. Incorporators: John Irvine, Isaac T. Dyer and Frank A. Anderson.

Harrisburg, Pa.—October 26. Latrobe and Derry Electric Street Railway Co. Capital stock, $40,000. Incorporators: John W. Hughes, John B. Nieller, James E. Heck, David J. Bush and Clate O. Slater, all of Latrobe.

Minneapolis, Minn.—November 2. The Northern Car Co. Capital Stock, $250,000. To manufacture street and railway cars, electric motors, etc. Incorporators: C. P. Jones, D. M. Gilmore, W. E. Steele, S. S. Thorpe, all of Minneapolis, Minn.

Sacramento, Cal.—October 29. San Bernandino Street Railway Co. Capital stock, $10,000. Incorporators: H. M. Willis, S. R. Brunn, James Fleming, William A. Harris and W. S. Hooper.

St. Louis, Mo.—October 28. Clay and Forest Park Railway Co. Capital stock, $50,300. Incorporators: T. K. Skinner, J. L. Boland, B. F. Thomas, V. B. S. Buchanan, R. E. Carr.

Foreign.

Commencing November 3, the street railways of Toronto, Ont., are owned by the municipality, and will be operated by private persons under the terms of a lease. City said to receive $800 a year per mile of track and 8 per cent. of gross earnings.

An electrical tramway is being built in Rio Janeiro, Brazil.

Statistics.

Mechanicville, N. Y.—Quarterly report Stillwater and Mechanicville Street Railroad Company: Gross earnings, $1,811.85; operating expenses, $1,012.79; fixed charges, $370; net income, $429.06; profit and loss surplus, $922.58.

Oneonta, N. Y.—Oneonta Street Railway Co., for quarter ending September 30: Gross earnings: $1,186.61; operating expenses, $1,605.63; loss from operation, $419.02.

Philadelphia, Pa.,—The Lombard and South Streets Passenger Railway Co. Net earnings, for the year $88,849.52; of which $1,349.52 were carried to surplus. Dividends were paid amounting to $87,500. Passengers carried, 7,281,414.

Change of Power.

Biddeford, Me.—Street railroad company transformed from animal to electric power.

Cincinnati, Ohio.—Reported Cincinnati, Lebanon and Northern Railway Co. (narrow-gauge, steam) to propel its trains by electricity.

Hot Springs, Ark.—Street railway to use electric power in the near future.

Sacramento, Cal.—Probable replacing of horse by electric power on street railway before Christmas.

Walla Walla, Wash.—The Walla Walla Street Car Co. is to replace horse cars with electric system.

New Roads.

Bar Harbor, Me.—Electric street railway is to be constructed to Westbrook.

Columbus, Ind.—Electric street railway from this place to Nashville, Brown county, distance of 20 miles, being agitated.

Harrisburg, Pa.—Electric street railway three miles in length to be constructed here in the near future. (See Incorporations.)

Track Extensions.

Duluth, Minn.—The Minnesota Point Street Railway Company has asked for franchise to extend from Ship Canal to northern city limits.

Fall River, Mass.—Globe Street Railway Co. will extend to Bowenville.

Holyoke, Mass.—The Holyoke Street Railway Co. is considering advisability of extending to Oakdale and Springfield.

Milwaukee, Wis.—October 26. Ordinance passed authorizing Milwaukee Street Railway Co. to extend tracks.

Nebraska City, Neb.—Nebraska City Street Railway Company will extend shortly. Address H. H. Bartling, President.

Oakland, Cal.—Oakland Consolidated Electric Railway Co. will extend to Mountain View Cemetery.

St. Paul, Minn.—Branch lines are to be constructed to Como Park and St. Anthony Park.

Franchises.

Ashland, Pa.—October 19. Shenandoah, Mahanoy City, Girardville and Ashland Electric Company granted franchise for electric street railway.

Boston, Mass.—November 2. Norfolk and Suffolk Street Railway Co. granted franchise from Boston to the Dedham line.

Braddock, Pa.—Braddock Electric Railway Co., to construct street railway on number of streets within limits of the borough of Braddock.

Fonda, N. Y.—Reported that Edison General Electric Company has secured right-of-way for electric street railway from this place to Gloversville.

Kansas City, Mo.—October 20. Thayer-Enright street railway company, franchise for electric street railway from the north city limits to Armourdale.

Los Gatos, Cal.—October 19. Board of Trustees granted F. Chappellet and others franchise to construct and operate electric railway through this place.

New Orleans, La.—Right-of-way over certain streets for street railway for sale by city.

San José, Cal.—Felix Chappellet is after franchise for electric road to Alviso.

St. Louis, Mo.—St. Louis Electric Railroad Company wants 50-year franchise for two routes to Calvary Cemetery.

Casualties.

Baltimore, Md.—November 2.—Cable car on Ann street ran into runaway horse and carriage, throwing driver of rig out and seriously injuring him.

Boston, Mass.—October 28. Boy of 7 run over and seriously injured by electric car on Hampden street.

Buffalo, N. Y.—November 3. Electric car on Niagara street burned.

Chicago, Ill.—October 27. Lady struck by electric car on Prairie avenue, receiving severe fracture of skull.

Cincinnati, Ohio.—October 31. Man received broken ankle by jumping backwards from electric train.

November 1. Lady thrown from crowded electric car and killed. Man severely injured through carelessness in boarding cable car.

Denver, Col.—November 30. Collision of motor car and trailer, in switching, resulting in severe injuries to Chief of Health Department.

Grand Rapids, Mich.—October 31. Inmate of Soldiers' Home thrown under trailer and killed in attempt to get off moving motor car.

Milwaukee, Wis.—October 26. Man knocked down by electric car and seriously injured.

Newark, N. J.—November 1. Several people severely injured by collisions between electric cars.

November 4.—Car house of Rapid Transit Railway Co. on Bergen street destroyed by fire. Estimated loss $125,000; fully insured.

Peoria, Ill.—October 25. Lady struck by motor car and seriously injured.

St. Louis, Mo.—October 25. Man knocked down by grip car on Broadway line and badly bruised.

Boy of 16 while trying to board motor car on Mound City line fell under trailer, receiving serious injuries.

Lady in stepping off car on Second street slipped and fell, breaking right leg.

Wilmington, Del.—October 31. Three-year old boy run over by electric car and killed.

Election of Officers.

Atlanta, Ga.—Atlantic Traction Company. President, George E. Hoppie; Vice-President and General Manager, J. H. Mountain; Treasurer, Henry Lanier; Secretary, Harry Woodard.

Haverhill, Mass.—October 28. Haverhill and Groveland Street Railway Co. Directors: Ira O. Sawyer, J. A. Colly, James D. White, Ira A. Abbott, P. C. Swett, William H. Smiley and John B. Nichols. Auditors: E. G. Frothingham, E. O. Bullock and G. L. Sleeper. President, Ira A. Abbott; Clerk, Treasurer and General Manager, John A. Colly.

New Bedford, Mass.—November 4. The Union Street Railway Co. Directors: S. C. Hart, A. G. Pierce, W. W. Crapo, Weston Howland, J. A. Beauvais, Abbott P. Smith, C. H. Gifford, C. E. Cook and James E. Dwight.

Pawtucket, R. I.—November 2. Pawtucket Street Railway Co. President, Arnold B. Chace; Vice-President, A. H. Littlefield; Treasurer, E. N. Littlefield; Secretary and General Manager, Charles F. Luther; Auditor, Darius L. Goff.

Philadelphia, Pa.—November 3. West Philadelphia Passenger Railway Co. Directors: P. A. B. Widener, W. L. Elkins, J. E. Gillingham, G. D. Widener, Thomas Dolan, James McManes, J. B. Altemus, T. J. Yarrow and G. W. Elkins.

November 3. Lombard and South Streets Passenger Railway Co. Directors: W. H. Shelmerdine, W. R. Wister, Edward Samuel, E. J. Moore and T. C. Barr.

Seabrook, N. H.—November 2. Black Rocks and Salisbury Beach Railway Co. Directors: E. P. Shaw, Capt. J. Frank Tilton, C. H. Brown, George Tilton, A. P. Shaw and David Sanborn. President, E. P. Shaw; Treasurer, George Tilton; Secretary, C. H. Brown.

THERE AND BACK.

(*Continued from page* 161.)

Not long after this our eyes rest upon a tall, slender, earnest man, talking with a friend: it is Sidney Short, and well may he look pleased, for his splendid exhibit, though, possibly, equalled by some, is, certainly, exceeded by none. And as we look at that gentleman, we cannot refrain from taking our minds back, retrospective of the days when matters were not quite as bright for his system as they are to-day—when he was grinding away with his patents, and at last succeeded in installing a short line in Columbus; but how well we remember the wonderful confidence he had in his (then) theories, and it makes the heart feel good to realize that most of them have now become, not merely theories, not even problems, but facts, cold facts, and facts substantiated by figures. He is talking to one of his first lieutenants—Rogers, a good salesman and a capital fellow withal. A moment later and the thoughtful face of another Short Co. man is seen—that of Mr. C. C. Curtis, its Confidential Agent, whose long experience in the electrical field has fitted him most admirably for that important office. In the evening we continue our observations, and in the reception-rooms of the T.-H. Company (where a Cargill punch is being served) we meet such well-known men as Charley Benton, of the Detroit Electrical Works, a capital good fellow and splendid horseman; Frank B. Rae, the inventor of the Rae System; Alex. Lewis, whose powers of mimicry are proverbial, and others equally well known in the electric-railway field. Then to the Press Club, where, under the guidance of Electrician Morris Mead, we spend a pleasant hour, and then to bed, to gain a few hours' rest before the excitement of the morrow shall commence.

(*To be continued.*)

Legal.

BAY CITY, MICH.—In the suit of R. B. Taylor *et al. vs.* Bay City Street Railway Co., verdict of $537.74 for plaintiffs. The railway company will appeal to Supreme Court.

CLEVELAND, OHIO.—Yale & Town Manufacturing Co. *vs.* Cleveland City Railway Co. for infringement of letters patent upon improvements in clutch mechanism.

DENVER, COL.—John Green *vs.* Denver Tramway Company for $5,100 damages for injuries received by son in a collision.

MINNEAPOLIS, MINN.—Sarah Sundstrum *vs.* Minneapolis Street Railway Company for $3,017 damages for injuries received.

NEW YORK, N. Y.—October 28. In Supreme Court Judge Truax gave verdict of $37,928.80 against Forty-second Street and Grand Street Ferry Railroad Company, favor of Fifth Avenue Bank. Suit was to recover value of two fraudulently issued certificates, which banking company had made good.

PITTSBURG, PA.—James Bugsman *vs.* Central Traction Company for $1,000 damages for injuries to horse and destruction of vehicle.

SACRAMENTO, CAL.—Mollie V. Griffith *vs.* Market Street Cable Co. to recover $150,000 damages for death of E. J. Griffith, who was run over by one of company's cars.

SAN FRANCISCO, CAL.—Mrs. A. M. Nicoll *vs.* City Railroad Co. and a local brewery for $10,000 damages for injuries to herself and five children received in collision of car and brewery wagon.

ST. PAUL, MINN.—Elizabeth H. Jacobs *vs.* St. Paul City Railway Co. to recover $5,000 account personal injuries received at hands of some of company's employés.

WORCESTER, MASS. George A. Lord *vs.* Consolidated Street Railway Company for $3,000 damages for injuries received by being accidentally thrown from an open car.

Clarissa Harrington *vs.* Worcester, Leicester and Spencer Street Railway Co., for injuries received by being struck by an electric car.

PERSONAL.

Mr. Daniel Coolidge and Major H. C. Evans, of Johnson Company, Johnstown, Penn., dropped in at our office this week.

Messrs. Cline and Hanna, of J. G. Brill Co., were callers at the office of STREET RAILWAY NEWS since its last issue.

The deputation of the Glasgow Town Council, who visited the Frankfort Exhibition, has reported in favor of the adoption at an early date of the cable or electric system on the Glasgow tramway.

The glass or porcelain insulators which are now in common use are very good insulators only when they are perfectly clean and when the atmosphere is dry. In the moist atmosphere the insulator will be covered with a film of moisture outside and inside, and the current will pass through the film to earth via the pole, and cause what is called "surface leakage."

AN OPINION OF THE "ELECTRICAL AGE AND STREET RAILWAY NEWS."

Mr. B. J. Wheelock, of 18 East 18th street, New York City, inventor of the Wheelock Primary Battery, says in regard to the ELECTRICAL AGE AND STREET RAILWAY NEWS: "I note the steady improvement of your paper and begin to feel that I cannot 'keep house' without it."

BUSINESS NOTES.

The Electric Merchandise Company, 11 Adams street, Chicago, is still engaged with the same rush of business that has occupied its attention during the summer and begins to wonder if the customary cessation is really to be experienced this winter. Present indications are against it. For its standard line material, station and car equipment, an ever-increasing demand is reported, while repeated large orders for Pratt's Portable Conductor's Register and the Burton Electric Heater are being filled.

The Electric Merchandise Co., Chicago, reports large sales of the Burton Heater, and says that they are giving satisfaction wherever used. The company is in constant receipt of large numbers of letters in regard to them, the tenor of which is similar to the following:

ESCANABA, MICH., October 27, 1891.

Electric Merchandise Co., 11 Adams St., Chicago.

GENTLEMEN: The Burton Electric Heaters you sent to the Escanaba Electric Street Railway Company have been put to a good thorough test and have been found equal to the emergency. We have have had some cold weather and quite a fall of snow, but the cars have been as warm as toast. Your heaters are the simplest, cleanest and most efficient of any heating apparatus in the market.

You may use this in any manner you wish or refer to me at any time.

Respectfully yours,
(Signed) GEORGE W. FINCH,
Elec. Eng.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued November 3, 1891.

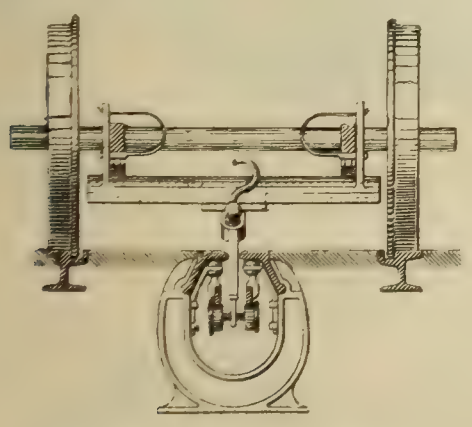
462,227. Car-Coupling. Edwin G. Adams, Cohoes, N. Y. Filed March 24, 1891.

In a car-coupling the combination, with a draw-head, a frame hinged to the top of the draw-head, and a pin having a sliding pivotal connection with the outer free end of the frame, of a coupling-link having a depending rib or projection on one surface to form a pivotal bearing on which the link can rock.

462,231. Electric Railway. Edward M. Bentley, New York, N. Y. Filed Nov. 23, 1888. Renewed Aug. 8, 1891.

The combination of a slotted conduit and a supply-conductor therein with a transverse guide supported from the vehicle on yielding supports, and a current-collector moving transversely in the guide and in contact with the conductor.

462,296. Spring-Rail Railway-Frog. Nathaniel W. Boyd, Carlisle, Pa. Filed March 24, 1891.



462,231.—ELECTRIC RAILWAY.

A spring-rail railway-frog having its point bevelled or inclined on the upper surface thereof, the spring-rail having its upper surface lying in a different horizontal plane relatively to the upper surface of the body of the frog, and the re-enforce united rigidly to the web of the spring-rail below the head thereof, combined with detaining devices operating in conjunction with the spring-rail and a base-plate.

462,297. Railway-Frog. Nathaniel W. Boyd, Carlisle, Pa. Filed July 3, 1891.

In a railway-frog, the combination, with the rails, the filling-blocks, and a binder or clamp, of a single through-bolt having its head countersunk in the clamp, and a slotted key which receives the bolt within itself.

462,332. Car-Coupling. Nicholas Sedon, Letellin, Canada. Filed Dec. 2, 1890.

In a car-coupling, a tongue having a squared hole in combination with a bail having on one of the outer arms a squared part which fits the tongue-hole and journals which turn in the sides of the draw-head.

462,359. Clamp for Trolley-Wires. Charles A. Lieb, New York, N. Y. Filed July 28, 1891.

The combination, in a clamp for trolley-wires, of two jaws or parts movable relative to each other and permanently attached together, and a spindle threaded into one of the parts which engages with the other part, whereby their clamping-surfaces may be adjusted toward or from each other.

462,378. Cable-Gripper. George S. Duncan, Melbourne, Victoria. Filed Aug. 25, 1890. Patented in Victoria, New South Wales, South Australia, Tasmania, England and Queensland.

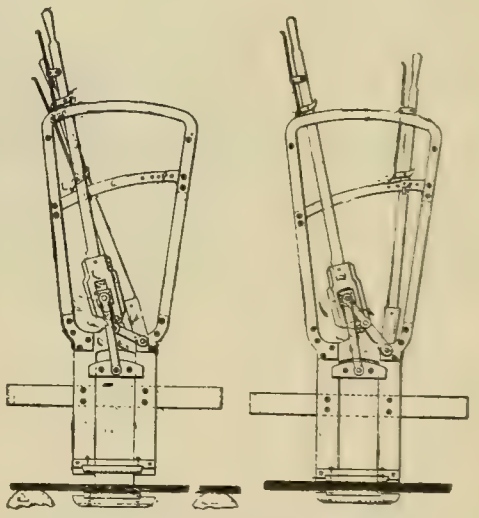
A cable-grip comprising a fixed gripping-jaw, a jaw having vertical motion toward and from the fixed jaw, a slide-block, a link connection between the block and the movable jaw, a lever and a crank-and-link connection between the lever and slide-block.

462,379. Cable-Pulley. George S. Duncan, Melbourne, Victoria. Filed Aug. 14, 1891. Patented in Victoria, New South Wales, South Australia, Tasmania, England and Queensland.

In a cable road, the combination, with the cable-conduit and chamber, of a cable-support consisting of a stand, a weighted lever journalled in it, the lever being forked at its outer end and having journal-bearings formed in the arms of the fork, and a cable-carrier sheave journalled in the arms, so that its carrying face will project slightly above the lowest point of the cable conduit.

462,399. Lock-Rail Joint. Preston C. Dockstader, Colorado Springs, Col. Filed Oct. 25, 1890.

The combination, with the track-rails, of a chair having a horizontal base supporting the adjacent ends of the rails and provided with two upwardly-projecting flanges embracing the bottom flanges of the rails and engaging at their upper edges with the webs of the rails, and tapered wedges inserted between the flanges upon the chair and the bottom flanges of the rails, the wedges being provided with transverse grooves, and keys or cotters adapted to be inserted in one of the grooves of each wedge and to engage the chair to prevent longitudinal movement of the wedges.



462,378.—CABLE GRIPPER.

462,401. Car-Coupling. John W. Elliott, Medora, assignor of one-half to Travis, Carter & Co., Seymour, Ind. Filed June 4, 1891.

The combination, with the draw-head having a chamber at its mouth end, of a vertically-movable mouth-piece within the chamber and provided with a longitudinal rib upon its lower wall.

462,413. Car-Coupling. Charles A. Pooley, Buffalo, N. Y., assignor to James F. Gluck, same place. Filed May 21, 1891.

STREET RAILWAY NEWS' PATENTS—Continued.

A car-coupler comprising a head, a swinging coupling-jaw, and a swinging pawl for locking the jaw, in combination with provisions on the head actuated by the parts and constructed when the pawl is swung out of the locking po-



462,578.—TROLLEY FOR ELECTRIC CARS.

sition to swing the jaw toward the open position, and when the jaw is swung closed to swing the pawl into engagement therewith.

462,496. Car-Step. Henry Lutz, Logan, O. Filed May 15, 1891.

In steps for railway-cars, the combination, with the fixed steps and their supporting frame work, of an upwardly, extending tube supported from the car-platform, a telescoping tube, internal spring-actuated rod within the tubes and connected with the recess and notch formed, respectively, in the rod, the shaft journalled at the back of the fixed steps, pivoted coupling-piece connecting the shaft and rod, shaft-arm, jointedly connecting therewith, step supporting rods movably supported at the back of the steps and a step supported on the lower ends thereof, the rods being jointedly connected with the arm.

462,578. Trolley for Electric Cars. Robert D. Nuttall, Allegheny, Pa. Filed June 19, 1891.

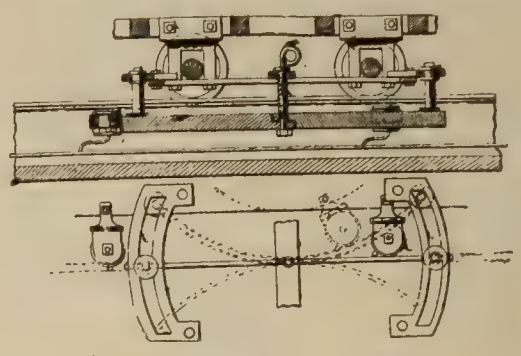
A pivoted yoke provided with a socket for the trolley-rod, a swivel-head upon which the yoke is pivoted, with a horizontal rod extending out from each side of the swivel-head, spiral springs surrounding the horizontal rod, cross-heads sliding on the same, and flexible connections attaching the cross-heads to the yoke.

462,595. Electric Railway. James B. Sheldon and Daniel J. Murnane, St. Louis, Mo., assignors to the Underground Electric Traction Company, of Missouri. Filed Feb. 12, 1891.

In an electric railway a series of yieldingly-secured rotating stationary switches located in the conduit and having connection with a source of electricity and devices on the motor-car adapted to conduct the current from the switches to the motor.

462,672. Conduit Electric Railway. Archibald J. Robertson, New York, N. Y. Filed Dec. 10, 1890.

In electric railways and cars, the combination, with the track-rails, an open receiver extending longitudinally thereof and provided with insulation for a main conductor, and the naked slack main conductor arranged in the receiver and extending lengthwise thereof, of a car-truck mounted on the track-rails, an insulated carrier-pulley mounted on the truck and arranged above the level of the receiver, the



762,595.—ELECTRIC RAILWAY.

elevated bight of the conductor taking over and resting on the pulley, an electric motor on the truck and the trolley of the motor, the trolley resting on the elevated portion of the conductor, whereby when the car-truck moves along the track the carrier-pulley underruns the conductor and keeps it in contact with the trolley, the main conductor rising out of and falling back into the receiver as the car moves along.

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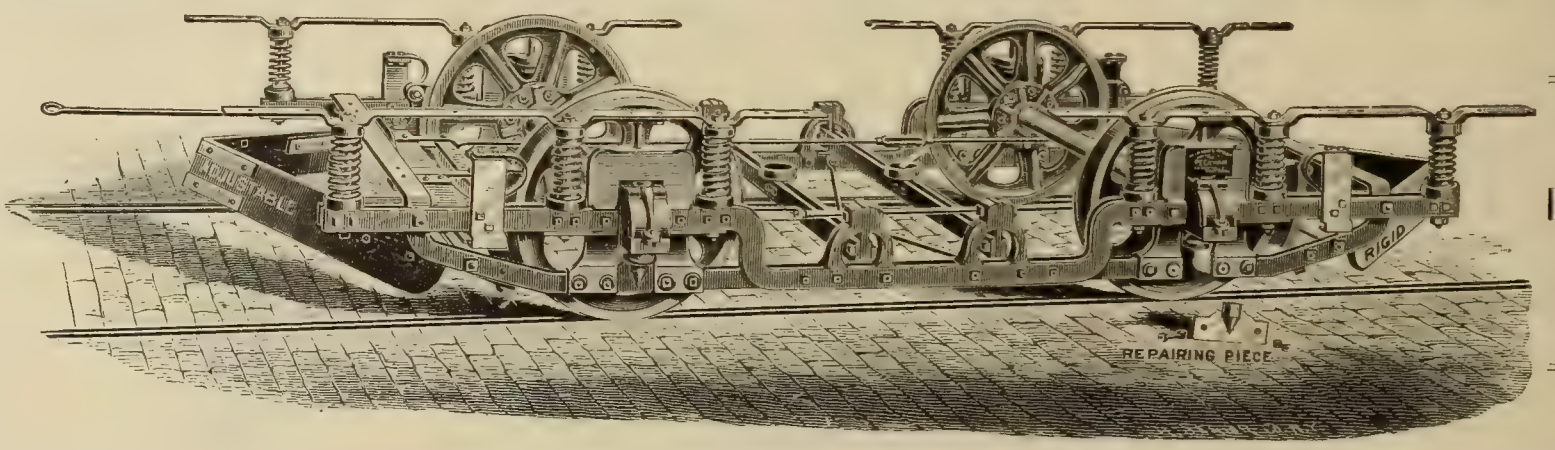
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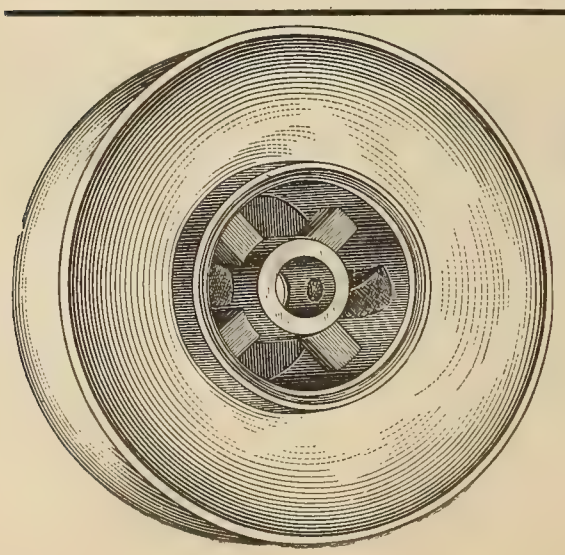
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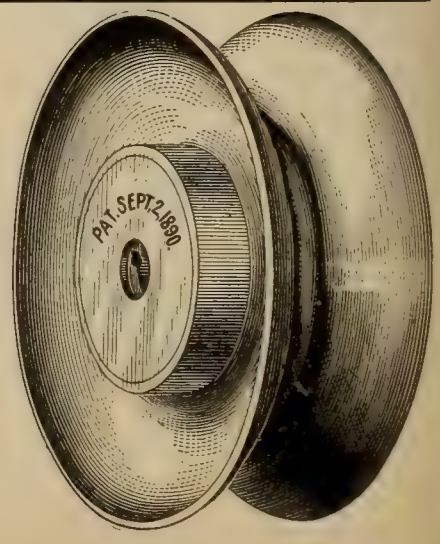


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VOL. I. NEW YORK, NOVEMBER 21, 1891. NO. 20.

STREET RAILWAY NEWS.

(WEEKLY.)

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O. S. T. A.

AKRON CONVENTION.

The Tenth Annual Convention of the O. S. T. A., which was held in Akron last week, is now a thing of the past, and, as we look back on it, we are free to admit that we cannot exactly see any extraordinary advantages resulting therefrom.

The only paper read was one on Car Building, prepared and read by a car-builder, in which he, naturally enough, put forward the advantage of the adoption of his own methods in that connection; no remarks were made by any one else in the same business, either before the Convention or at the midnight banquet, which succeeded it.

We acknowledge to a sense of disappointment at the lack of papers prepared, as we had been given to understand, upon the highest authority, that quite a number of well-known supply-men would either have papers prepared or would speak extemporaneously regarding their different systems.

In the absence of this, coupled with that of the absence of a great many of the members' delegates, the Convention undoubtedly lacked a good deal of interest which has been one of its chief characteristics in the past, and unless it manages, by some means or other, to keep well ahead of itself during the next few years, we cannot predict for the Association quite such a brilliant future as its past impelled us to believe was before it.

In the selection of its officers, the Nominating Committee undoubtedly did wisely; for as "a bird in the hand is worth two in the bush," so likewise are officers, tried and true, worthy two others who have not been through the mill.

The re-election of Mr. John N. Stewart as President—although he is but the president of a corduroy road, with a big fight on hand at that—was a particularly wise choice, inasmuch as he is in a position to devote considerable time to the interest of the Association, and the growth that it has attained during the first year of his administration is evidence sufficient that his heart is thoroughly in the work, and that nothing will be left undone by him to bring the Association up to the very highest pinnacle of recognition, importance and influence. In his efforts to accomplish this he is constantly supported by Mr. J. B. Hanna, who has once more been elected Secretary and Treasurer of the Association, and whose strength in his official capacity has been thoroughly demonstrated by many years of practical experience.

The presence of the supply-men saved the Convention, as indeed it did last year, from having a somewhat slim attendance, but everything passed off pleasantly and without a hitch.

The O. S. T. A. has our best wishes for its future, and our assurance that STREET RAILWAY NEWS will always be in the van when it can in any way aid the meritorious objects for the accomplishment of which the Association lives and has its being.

CROWDED OUT.

We have been compelled to carry over until next week some interesting matter intended for this issue, owing to the lack of space.

A. S. R. A. CONVENTION OF '92.

Pursuant to the suggestions made by STREET RAILWAY NEWS in its issues shortly preceding the holding of the Pittsburg Convention, the question of the adoption of any particular city as the next place of meeting, also that of the whereabouts of the holding of the exhibits of next year, was left to the Executive Committee of the A. S. R. A., which committee, acting in harmony with the Nominating Committee appointed at the Pittsburg Convention, and also with the Local Committee in the city, designating as the next place of meeting the city of Cleveland, O., has about decided that the Convention of October, 1892, will be held at the Hollenden Hotel, in Cleveland.

In the course of conversation with the manager of that splendid hostelry, a day or two ago, we were informed that the management had bound itself by an agreement with the Local Committee—of which the officers of the East Cleveland Street Railway Company are probably the most prominent members—not to permit any exhibits whatsoever to be held in any of the rooms, and not to raise the rates of the hotel.

In view of the manner in which guests of the recent Convention headquarters at Pittsburg had their fleeces removed, and in view of the complete lack of system with regard to the display of exhibits there, this news must assuredly come to all interested, even as a rift in a cloudy sky.

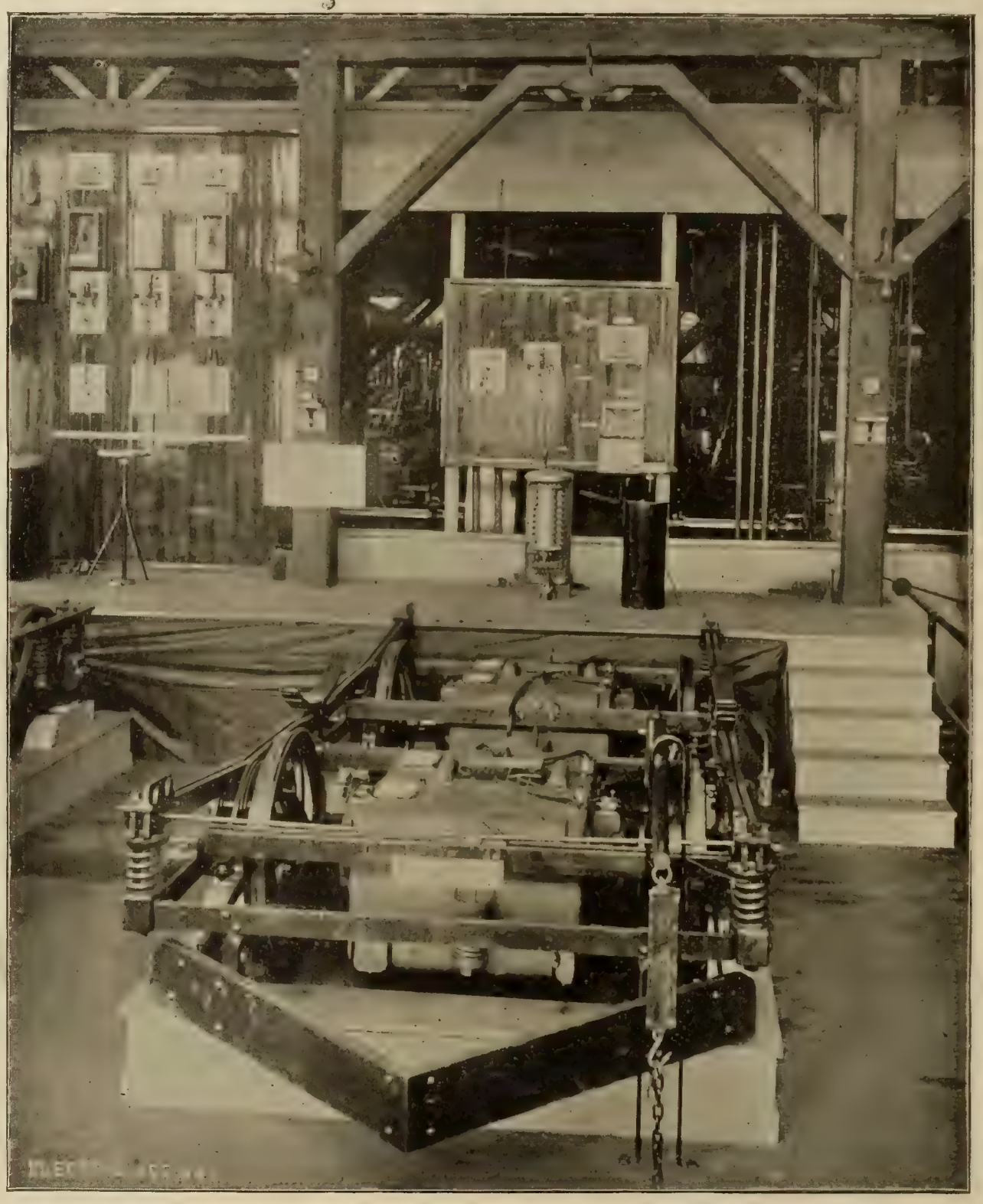
It is the intention of the Local Committee of Cleveland to secure space adequate to the demands of all possible exhibitors for the Convention of 1892—exactly in accordance with the suggestions made in STREET RAILWAY NEWS of Oct. 24 and 31, and to "assess each exhibitor in proportion to the amount of space occupied."

Just where the Exhibit Hall will be is as yet undecided, but in any case exhibitors had better make up their minds right now that they will either have their exhibits in the hall engaged for that purpose or take chances of their goods not being seen at all, as it is clearly understood that under no circumstances whatsoever will exhibitors be permitted to show their goods in their rooms at the hotel.

Of all the hotels in the State, the Hollenden is, perhaps, the best, and with its accommodations for seven hundred guests, its splendid cuisine and its liberal management, backed up by the proverbial hospitality of the citizens of the Forest City of Ohio, it will be passing strange if the grandest laurels of unqualified success do not rest lightly upon the head of the managers of the American Street Railway Association's Convention of 1892.

THE WESTINGHOUSE EXHIBITS AT THE PITTSBURG CONVENTION.

During the Tenth Convention of the American Street Railway Association, which was recently held in the city of Pittsburg, Pa., many of the electrical companies made most complete and interesting displays of electric-railway apparatus on the exhibition boat. One of the most instructive to railway men was that of the Westinghouse Electric and Manufacturing Company, illustrating the great advances which have been made by that company in the comparatively short time during which it has been engaged in the manufacture of apparatus for the equipment of electric roads. The boat exhibit of the Westinghouse Company included trucks equipped with gearless and single-reduction motors in operation, an ornamental station switch-board intended to accommodate one generator and one feeder and fitted up with the most improved forms of switches, rheostats, lightning arresters, automatic circuit-breakers, ammeters and voltmeters. The marble bases and polished brass-work of these instruments gave to the board an exceedingly handsome appearance. As an evidence of the care with which the insulation of the Westinghouse motors is effected a single-reduction motor was shown in operation completely submerged in a tank of water. This motor was operated with current from one of the electric lines in the city, and, although no attempt was made to enclose the commutator, brushes or any other part of the motor, no trouble was experienced in the operation of this motor during the three days of the Convention. A large table at one end of the space allotted to the Westinghouse Company was completely covered with detail parts of the car equipment, such as controlling stands, lightning arresters, gears, pinions, field and armature coils, etc.



VIEW OF TRUCK EQUIPPED WITH WESTINGHOUSE GEARLESS MOTOR, SHOWING FRICTION BRAKE AND SPRING BALANCE.

Taking advantage of the location of its factory in the heart of the city where it is easy of access, the Westinghouse Company prepared here in one of the departments a display which, owing to the great amount of space and the steam-power available, was most complete. We present herewith some views of this exhibition-room. The whole ground floor of the Westinghouse plant was thrown open to the delegates, and that the courtesy was appreciated was shown by the numbers who took advantage of the opportunity to personally inspect the works of one of the largest electric companies in this country. The exhibit covered the whole range of the company's work in the manufacture of electric-railway apparatus as well as a complete display of the method of incandescent lighting by the alternating current. A most important feature, and one which was of the greatest interest in view of the doubts which are entertained by some practical railway men regarding the efficiency of the gearless motor, was the comparative test made between similar motors of the double-reduction, single-reduction and gearless types. Side by side were three street-car trucks blocked up to allow free motion of the wheels. A friction-brake applied to the one wheel of each truck was fitted with a spring-balance which indicated the pull on the brake. The motors were started and the brakes adjusted until each motor took exactly the same current. The pull on the spring-balances were then noted and found to be as follows:

Double-reduction, 78 lbs.; single-reduction, 88 lbs.; gearless, 110 lbs.

As all of the conditions of speed, voltage, etc., were the same in each case, no more conclusive evidence of the superior efficiency of the gearless type could be given. These results were verified by a number of prominent electrical engineers and practical railway men, each of whom expressed his conviction of their reliability. Other tests to show the great starting torque of the Westinghouse gearless motor were also made, and the ability of this machine to operate successfully and economically under the conditions of actual service was demonstrated beyond question. In addition to these shop tests cars equipped with Westinghouse gearless motors were in continuous operation under the ordinary conditions of practical service on two of the Pittsburg lines, and, even the most sceptical were convinced, after an inspection of their operation upon grades as well as under the conditions of a heavy city traffic where frequent stops and starts are necessary, that with a properly-designed motor the use of gearing is not at all essential to the successful and efficient operation of a street-railway motor.

In another portion of the shop was shown in operation a 300 H. P. generator of the new Westinghouse multipolar type which, apart from the beauty of its mechanical design, was remarkable for its excellent operation electrically. The heaviest available load, which was 38⅓ per cent. above the rated capacity of the machine, failed to produce any noticeable sparking at the commutator, and the brushes, having been once set, required no adjustment for any load from zero up to the highest current output reached. This load was thrown off and on suddenly, and an observer standing by the generator could not distinguish whether it was loaded or not except by the change in the noise made by the engine and belt. A number of machines of this type were seen in process of construction, among them being one of 700 H. P. Large switch-boards were arranged to show the operation of all the various devices for the equipment of a railway generating station.

Another portion of the exhibition-room was devoted to a display of the dynamos, converters, switches, measuring instruments, lamps, wiring, etc., used in the alternating system of incandescent lighting. Here were shown some of the curious inductive effects which are possible with the alternating current only.

The display as a whole was well calculated to give the visitor an excellent idea of the quality and quantity of the work which the Westinghouse Company is turning out both for railway and lighting purposes, and visitors went away expressing themselves as well pleased with the attention shown them by the officers and representatives of this company.

FINANCIAL DEPARTMENT.

The event in street-railway finance of far greater importance even than the consolidation of the Detroit corporations by Governor Waller, is the annual meeting of the West End Street Railway Co., of Boston. President Whitney accepts the issue, so often set forth in the Financial Department of the STREET RAILWAY NEWS, that the public have a right to know of the financial condition of a public company, whether personally interested or not; and so far as he could he published the annual report, including an exhaustive statement, and issued it to the press and the shareholders, coupled with a request that the fiscal year should close January 1 and the annual meeting to receive, discuss and accept the report be held on March 1. This will give all interested time to digest the statements and act intelligently at the meeting; it will also enable intending investors to eliminate from their minds the always possible contingencies involved in the declaration of dividends. By such proceedings alone can the investor decide on the security or the amount desirable.

One of the peculiar items was that of accident losses which, of course, reduce the dividends, and it is shown by figures that it is less by electric than by horse service. The receipts from passengers for the past year were $5,889,179.98. The real estate account figures for the year at $445,499.75. Credits of horse cars converted into electric, old cars destroyed and depreciation aggregated $73,602. The electric-car equipment has been charged with a total of $432,788.18, and the net charge $204,881.24. In the earnings of the lines operated by electricity there has been a steady and in some cases a most surprising increase. The company is now in a stronger financial position than ever before, and will soon have for sale a large lot of real estate, as electric motors occupy much less space than horses.

DISCUSSION OF RAPID TRANSIT FOR NEW YORK AT THE COMMONWEALTH CLUB.

The Commonwealth Club dined at Morello's Friday evening, Nov. 13, and discussed rapid transit very thoroughly. Among the guests were President W. J. Coombs, of Brooklyn; Abram S. Hewitt, Dorman B. Eaton, Carl Schurz, Burton N. Harrison, Col. Rowland Hazard, Edward P. Steers, President of the Twelfth Ward Bank; Charles G. Cronin, Francis Collingwood, Secretary of the American Civil Engineers' Association; John Bogart, Engineer of the Pennsylvania Railroad; Henry R. Beekman, John E. Fitzgerald, Rapid Transit Commissioner of Massachusetts, and three railroad engineers, Walter Katte, J. M. Wilson and O. F. Nichols; W. G. Hamilton, George W. McNulty, W. R. Hudson, Theodore Cooper and many others.



GENERAL VIEW OF EXHIBIT AT WESTINGHOUSE COMPANY'S FACTORY.

President Coombs, in opening the discussion, said that the subject of rapid transit had been discussed by the Club in 1888, when ex-Mayor Hewitt's message thereon was made public, but the question was still unsettled.

The first speaker, J. G. R. Croes, a well-known engineer connected with the Suburban Rapid Transit Railroad, said:

"Into half a square mile of territory to the south of the Park, around which are grouped the City Hall, the newspapers and Post-Office, there are brought down-town by the present elevated roads every morning and carried up-town every evening about one hundred and thirty thousand people, or about fifty per cent. more than the entire population of Albany. To the north of this we see first a strip of land a mile long, and from one to two miles wide, occupied by enormous business establishments. Into this strip of one and a half square miles area there are brought down every morning and from it carried up every evening about sixty-five thousand people. Looking still further north, we see a strip of land two miles wide and one mile long, containing the great retail houses of New York, and into this there are brought every morning and taken away every evening about sixty-five thousand people. Beyond this is the residence quarter, two miles wide and six miles long, up to the Harlem River.

"The dividing line of the up and down long distance travel appears to be about Forty-second street, and every day there are about 350,000 people gathered up above that line and brought down to their daily work, and taken back in the evening and distributed to their homes. Besides this there is a large short distance traffic. About 80 per cent. of these people in the busy hours manage to obtain seats.

". . . In the case of an underground road, as compared with an elevated road in a street, the cost of structures would be about the same; the damages to be paid to abutting property-owners, including the underpinning of buildings and vaults, would probably be about the same, but there would be the additional cost of excavating and removing the material displaced to make room for the road. The lowest estimates for this extra work is $1,200,000 per mile for a four-track road.

"Judging from the experience of the elevated roads in the lower part of the city, the damages to abutting owners amount to about $1,000,000 a mile, so that of the amount which the underground road in the street would cost, about $2,200,000 per mile would be applicable to the purchase of right-of-way over private property in case of a different location. This would go far toward paying for the right-of-way, particularly if the style of structure be modified in proportion to the value of land, building perhaps a one-story four-track viaduct where land is of less value, a two-story two-track viaduct where the land is more valuable, or a four-story single-track structure where land is dearest.

"But, whether it cost more or less, the sanitary conditions connected with an underground road are sufficient to make one undesirable and dangerous in New York. Each passenger would be underground from fifteen to forty-five minutes, according to the length of his trip. Three-fourths of them would go through that experience twice a day. That is to say, every traveller would do what is equivalent to going down into his sub-cellar and sitting there from fifteen to forty-five minutes morning and evening, which no one could do without great danger to health. Out of 200,000 people who should do this, at least 2,000 cases of pneumonia would result."

Henry G. Prout, editor of the *Railroad Gazette*, said:

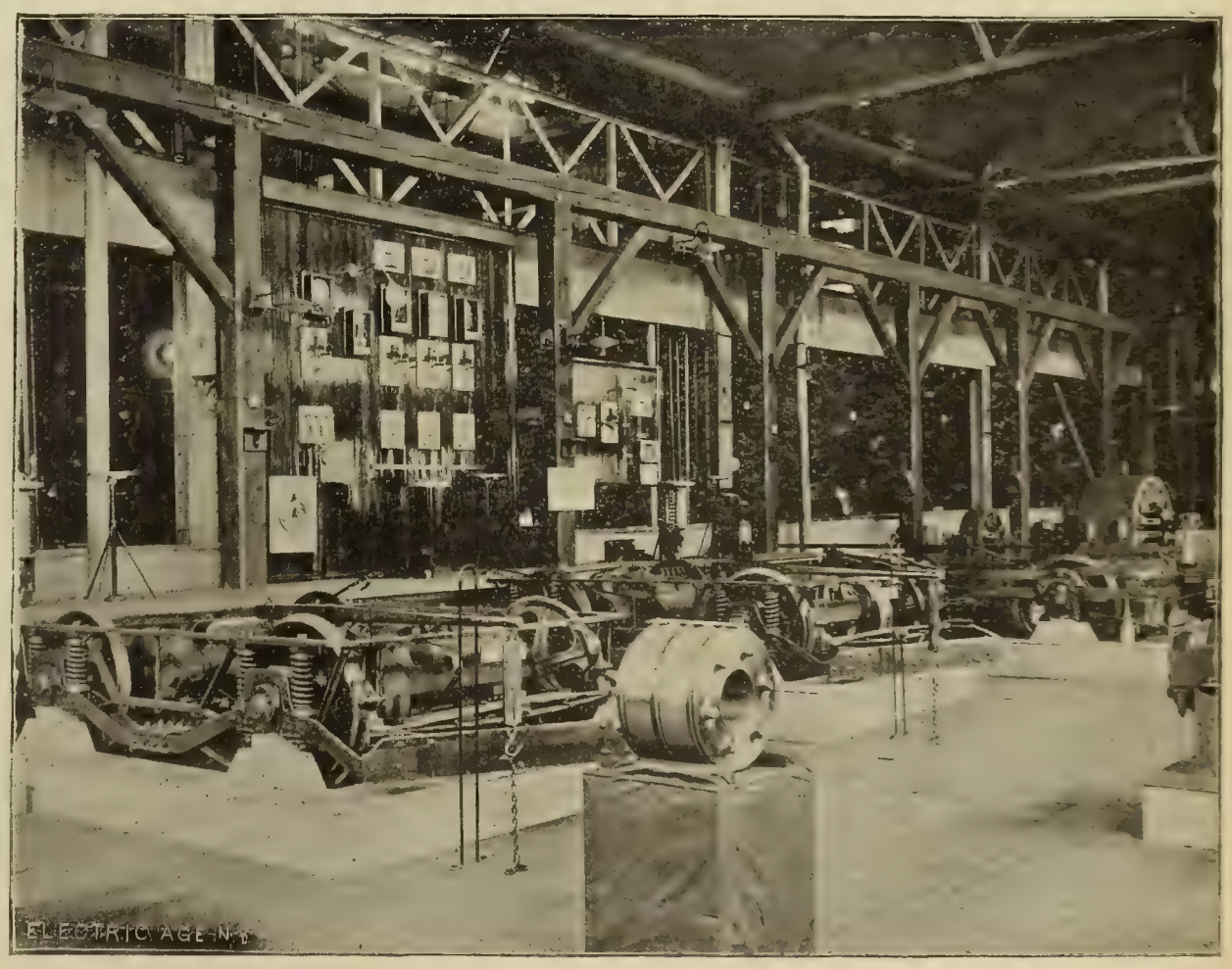
"An analysis of the traffic shows that 55 per cent. of the passengers are taken on in the first two miles, 20 per cent. in the next mile, 11 per cent. in the fourth mile, and 7 per cent. in the fifth and sixth miles. That is, 96 per cent. of the up-traffic is taken on in the first six miles and 90 per cent. in four miles. If these figures mean anything they mean that a very important part of the revenue of the elevated roads is from comparatively short trips. They mean that if the new rapid transit system is to pay operating expenses and a fair profit on the investment, it must be such as to pick up a large number of those people who are going comparatively short distances all through the day.

"The system proposed by the commissioners has been estimated to cost anywhere from $70,000,000 to $100,000,000. To earn 6 per cent. on the lowest of these sums it must carry as many passengers as the elevated roads now carry. To do this it must compete with the elevated roads for short and long distance travel, and with the cable roads, horse cars, and probably with trolley or other electric roads for short-distance business. It must begin at once to draw from these lines their present business, for although it will, of course, create new business, it will be many years before there will be half a million new passengers a day to be carried.

"It follows that the new system must be not only quick and comfortable, but accessible. The conditions of attractiveness and comfort are against even a shallow tunnel. The problem of tunnel ventilation is not solved. Whether or not the tunnel accepted by the commissioners can be ventilated so as to be wholesome and agreeable is not certain.

"The dimensions of the tunnel require lower cars than are used on surface or elevated roads. Logically these cars should be higher, so as to give more cubic feet of air per passenger than is provided on roads running in the fresh air and sunlight. That is, economy of first cost is secured in building a low tunnel, but at a constant tax on the operating expenses for all time to come.

"The new rapid-transit system must carry about 200,000,000 passengers a year to earn interest on an estimated cost of $70,000,000. This is on the ratio of operating expenses and net earnings of the Manhattan system. That this traffic can be counted on ten years from now is about as certain as anything can be. That it might be developed in five years is probable, but that it can be had from the start is extremely doubtful. Supposing that 30 per cent. is taken from the elevated roads and 20 per cent. from the surface lines up and down the island, there would still be over 100,000,000 of new passenger trips to create. I conclude, then, that with every advantage that can be given to the new system, the profit is so remote that the investor must be prepared to wait and to speculate on the future."



VIEW OF TRUCKS EQUIPPED WITH WESTINGHOUSE MOTORS AT WESTINGHOUSE FACTORY EXHIBIT.

"It is proposed to spend money enough to build 1,500 miles of single-track railroad, equip it with rolling stock, shops, stations and all the material necessary to make it a first-class line. It is proposed to spend an amount equal to the entire capital of the Chesapeake and Ohio. There are less than twenty-five railroads in the United States that have a capital equal to the probable cost of the rapid transit system as laid out by the Commissioners. You see, therefore, that there is a chance for unparalleled waste of money. . . .

Mr. Prout concluded by saying that it would not pay private capitalists to build a rapid transit system except close to the surface of the ground.

Francis Collingwood said that in the early days of the rapid-transit problem he happened to be placed

on a committee of the American Society of Civil Engineers, which undertook to examine the subject and make a report. The particular portion of the work he did was to take up the question of the cost of the movement of freight to and from the city, as at that time there was an idea that tracks prepared more especially for this purpose should be built around the shores of the island. One of the startling figures worked out was that at that time every ton of freight brought to the city and again taken away paid terminal costs of about $3 per ton. . . .

Ex-Corporation Counsel Henry R. Beekman said: "I am not in favor of an elevated system, but I am in favor of an underground system, although I have no charter for an underground road in my pocket. The difficulties surrounding an elevated road are insuperable. It is practically impossible to build an elevated system here now. The cost will be too much. No one can tell what the present system will be compelled to pay to property-owners before the litigation now before the courts will be concluded."

Mr. Beekman said that rapid transit involved quick passage between the extremes of the city. There would not be the expense of paying damages for abutting property-owners. He gave the history of the various rapid-transit schemes proposed since 1875, and animadverted somewhat severely upon the Legislature.

Ex-Mayor Hewitt was called for and applauded when he rose.

"The best rapid-transit scheme," began Mr. Hewitt, "that was ever presented was the one offered by Tweed twenty years ago, and it was a pity Tweed did not live to see it carried out, no matter whose money he stole."

Mr. Hewitt spoke of the proposition of A. T. Stewart to provide New York with rapid transit, and of the plan of Commodore Vanderbilt, who became disgusted by the cry of "Grab." The plan proposed by Mr. Hewitt himself was referred to, and its history given.

"We must have better rapid-transit facilities," he said, "but the city must take charge of the work. Let the city give bonds and let private capital do the work. It would be suicidal to place the control of the expenditure of the enormous sum of money necessary in the hands of a few officers elected by politicians. I want to say here that while I want better rapid transit, it is a monstrous folly to refuse to the existing systems the facilities they need until some plan is decided upon. It is utter nonsense to talk about depriving the people of Battery Park. The only bill I succeeded in getting through the Legislature was the one providing for small parks. I want to give the people parks all over the city, but I think the elevated roads ought to be given the space they need in Battery Park.

"A new system of rapid transit can be constructed only by municipal capital; private capital cannot see how it will pay, and I don't believe you will ever get it except that way. We have spent something like $50,000,000 for our aqueducts, and the city is better able to spend $100,000,000 now than it could $20,000,000 when the first aqueduct was built. I would not object to the expenditure provided it was done through an agency and the money of the taxpayers was not squandered."

After a number of other speeches of a like tenor by other gentlemen present the meeting, which was one of the most successful and enjoyable in the existence of the club, adjourned.

AN EFFICIENT LIGHTNING ARRESTER.*

There are but three causes which are liable to injure a street-railway generator, and a great majority of accidents which have happened to dynamos of this class may be traced to one of them. These causes are lightning discharges, overloads or short circuits on the line, and neglect or inattention on the part of the station attendant. The last cause may be entirely removed by employing only competent and experienced men to take care of the generators, and by requiring them to make regular reports on the condition of the station and machines. The first two causes can only be removed by protecting the generator by efficient and reliable lightning arresters and circuit-breakers.

A lightning arrester, to fulfil the purpose for which it is designed, must have a very small air-space across which the discharge has to jump in order to present as little resistance as possible; it must be free from any inductive resistance, such as is offered by a coil of wire surrounding the iron core; it must be automatic in its action, adjusting itself after each discharge; the mechanism must be very simple; it must provide means for surely and quickly destroying the arc which follows the discharge. It is seldom that one instrument is so constructed as to cover all these points, but we think each point is fully met in the arrester which we describe and illustrate herewith.

The operation of the instrument does not depend upon magnetic action. The air-space is adjustable, and may be made as small as necessary, and the arrester is entirely automatic. To meet the last of the above-named conditions, a very simple principle is utilized. The heat of the arc is made to expand the air in a closed chamber, the only outlets from which are closed by two movable arms. The sudden expansion of the air drives these two arms outward, and the arc is at the same time drawn out and blown out. The arms fall back into place by gravity, and the arrester is ready for a second discharge. So rapidly is this done that the entire action requires only a small fraction of a second.

Fig. 1 is a view of the lightning arrester as constructed for use on the switch-board at the power-station. A triangular iron box, having for two of its sides marble slabs, is mounted on a marble base; near the upper end of each of these slabs is fastened a small brass casting, part of which serves as a bind-



FIG. 1

ing-post for making connection with the trolley or ground wires. From each of the castings hangs by a hinge a light metal arm which carries at its lower end a carbon point. This point makes a contact with a carbon block inside the chamber by passing through a circular hole in the marble. The discharge takes place between two "saw-teeth" carbons inside the chamber, and the arc is first formed at this point, but the air instantly expands, and drives out both of the movable arms. The circuit is thus broken in two more places, and the rupturing of the arc takes place instantly. By removing the triangular plate of brass on the front of the arrester the carbon points may be examined and adjusted. The "T"-shaped arm, which projects from the top of the iron box, carries two insulated bumpers against which the hinged arms strike when blown out.

Fig. 2 shows an arrester for use on electric cars to protect the motors. The form of this instrument is similar to the one described above, the only difference being that the arrester proper is placed inside of an asbestos-lined iron box, which thoroughly protects it. As the car arrester requires no attention, further than an occasional inspection, it may be placed out of sight under the platform of the car.

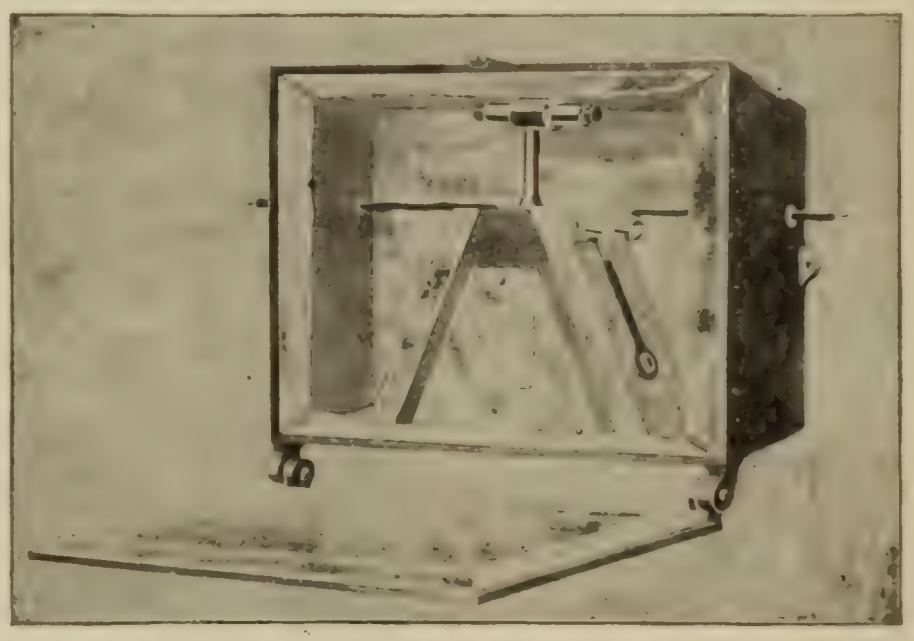


FIG. 2.

* Westinghouse Electric and Manufacturing Co., Pittsburg, Pa.

THE WEST END COMPANY'S ANNUAL MEETING.

The West End Street Railway Company, of Boston, held its annual meeting Thursday, November 12, at which the principal business transacted was the election of fifteen directors and the presentation of the annual report.

At the meeting President Henry M. Whitney reiterated his belief in the advantage of electricity as a motive power, and stated that the sum paid out on account of accidents last year was smaller than the amount the year before, the claims for September, 1890, being 61, while for the same month this year there were but 44. He believed from what he had seen that the number of accidents to the electric cars will be proportionately less than by the horse cars. He advises increasing the capital stock and paying off the floating debts, of which nothing now remains but some long time notes held by the savings banks, amounting to about $1 [illegible]. He stated that the streets of Boston were getting so overcrowded that unless some action was taken shortly the cars must stop near Kneeland street on the south side of the city, and at Scollay Square on the north side.

The company introduced a large number of long cars during the year, and is now thoroughly convinced that the cost of running them is about the same as that for the short cars, while the increased earning capacity, as well as the increased accommodation to the public, is considerably greater. The increase in the earnings during the past year has been mainly in the places where the electric system is in operation. The lines which have heretofore been electrically equipped have been mainly the long and unprofitable horse car lines, while the lines now being equipped are the shorter and more profitable lines. The company intends to change its entire system to electric traction as rapidly as possible. By the 1st of January 175 more long cars which have been ordered are expected to be added to the electric system.

The annual report, which is as follows, is very gratifying to the company:

Receipts from [illegible]	[illegible]
Receipts from [illegible]	[illegible]
Receipts from passengers carried	[illegible]
Total receipts	[illegible]
Average receipts per passenger	[illegible]
Charges to and credits against the account for the year, including property lost or destroyed, etc.	[illegible]
Central and East Cambridge power stations, new car houses and additions to old ones, rebuilt	[illegible]
Net additions to real estate for the year	[illegible]
During the year property has been changed with reference to the equipment, as follows:	
[illegible]	[illegible]
Credits by horse cars converted into electric cars, old cars destroyed, and depreciation charged off	[illegible]
Net reduction of horse-car accounts	[illegible]
The electric car equipment account has been charged with the horse cars converted, and with 16 new long open cars, 2 short and 2 long box cars, total	432,755.13
Credits by cars sold, converted to horse, and depreciation charged off	227,650.94
Net charge to electric car equipment account for the year	204,551.24
General equipment account increased, net	34,078.62
Power-station account increased, net	104,743.40
Total charge to electric line equipment for the year	160,404.95

After the reading of the annual report the business of electing directors was proceeded with.

The directors whose names had been dropped

from the ticket were those of Asa P. Potter, Col. Jonas H. French, Elisha S. Converse, Charles O. Foster and Nelson Bartlett. To take their places the names of the following-named gentlemen were presented: William Powell Mason, T. Jefferson Coolidge, Theophilus Parsons, Walter Hunnewell and Nathaniel Thayer.

The full ticket as elected is as follows: G. T. W. Braman, Isaac T. Barr, T. Jefferson Coolidge, Joseph S. Fay, Jr., Eustace C. Fitz, Henry D. Hyde, Walter Hunnewell, E. D. Jordan, Samuel Little, William Powell Mason, Theophilus Parsons, Dexter N. Richards, Nathaniel Thayer, Walter S. Swan. Henry M. Whitney.

The number of shares voting was 134,372.

As reorganized the company has upon its board men whose wealth, stability and business ability are known and respected all over the country, giving the street-railway business, and especially that of Boston, a dignity it never had before in any city.

O. S. T. A.

AKRON CONVENTION.

The 10th annual Convention of the Ohio State Tramway Association was called to order in the ladies' parlor of the Hotel Buchtel, Akron, O., on Wednesday, Nov. 11, at about 10.50 A.M., President John N. Stewart being in the chair. On account of there being so few members' delegates present the President deferred reading his annual address until the afternoon session, when a number of other gentlemen were expected to arrive from the South.

Soon after the Convention was called to order the report of the Executive Committee was read and its recommendations adopted, after which a Nominating Committee consisting of Dr. Everett, of Cleveland, John Metlin, of Akron, and John Harris, of Cincinnati, was appointed to select the officers for the ensuing year, and the place in which the next Convention should be held. Upon its appointment, the committee retired for consultation, and the Convention went at once into executive session.

About 2 o'clock the Convention met again, pursuant to adjournment, when the President delivered his annual address, which was as follows:

GENTLEMEN OF THE OHIO STATE TRAMWAY ASSOCIATION: It is my duty, as it is my pleasure, to open the proceedings of this the tenth annual meeting of this Association.

At our meeting last year in Columbus it was decided that as meetings had been held in all of the larger cities of the State, that some one of the many smaller ones which were making rapid strides in the advancement of their street-railroad accommodations and population, one following the other in the order I have named, should be visited by us, and it was decided to come to this beautiful and thriving city of Akron, where the merry buzz of commercial activity is heard all around and about us, and where, as in larger cities, the population depends upon transportation by its street railroads. But Akron, nor Akron people, needs no eulogy at my hands. I am told that they some time since assented to unconditional surrender, as the inevitable when street-railroad men show up, and that on this occasion they have thrown the latch-string out, and hold "hands up." I have, however, attempted to allay their anxiety by assuring them that the Association was pledged simply and solely to the promulgation of the idea of the "greatest good to the greatest number," and not, as perhaps many suppose, by oath or obligation to the annihilation of some of the oldest industries on the face of the earth, by the substitution of electric generators for hay and grain consumers; and while we must acknowledge that most of our members during the past year appear to have had an unusual "fellow feeling" for electrical promotion, it is not to be taken as an indication of conspiracy against the "Farmers' Alliance."

During the last year we have added several new companies to our list of members, and now nearly all of the street railroads of the State are connected with the Association. A kind Providence has so favored us that we have to report no diminution in our ranks, and "all present or accounted for."

It has been the custom heretofore at our annual gatherings to have papers submitted only by our members. From this stereotyped method I have taken the liberty of departing, and you will be instructively entertained by several gentlemen who have kindly consented to submit their practical ideas on matters of great interest to us all.

At our last meeting I called your attention to matters of legislation then, as now, pending. I much desire at this time to thoroughly impress upon you the importance of co-operation in the support of all legislation calculated to enhance the interests represented by us, as well as the united defence against all "piratical and tyrannical" measures attempted in the name of the public by some selfish and mercenary malcontent temporarily elevated to the dignity and importance of a statesman. Against all such methods the smaller roads are equally interested with the larger, and should not expect to do less than co-operate when called upon to do so. I allude in all seriousness to the growing evils menacing personal and corporate rights, and the attempts being made to make corporations bear more than a just proportion of their legitimate duties to the State and to the people. Let justice and equity towards all be resolutely insisted upon.

When reviewing our stewardship and taking into consideration the many millions of dollars in street-railroad industries in our State, we ought to feel that a great and sacred trust has been reposed in us, and that we must afford it all the safeguard and protection that can be made to surround such a trust. Our bonds and securities are owned by all classes of people, and held in trust for minors and indigents, and upon the earnings of such investments the "weal and woe" of many a household depends. The employment furnished our operators is of a much higher grade and better pay than was formerly the case, and proportionately as the march of progress goes on so does all elements of the street-railroad service. Our managers and operators are in closer touch with the public than are those of any other class of transportation, and contemplating the hustle and bustle of our crowded thoroughfares and the pell-mell confusion consequent upon the loading and unloading of our cars, both stockholders, employés and the public are to be congratulated that so few accidents occur.

Several "Employers' Indemnity Companies" are of late seeking your earnest consideration for their business methods, but how well and satisfactory they may be able to protect your interests must depend upon your experience with them, as perhaps few conditions are equal, and little reliable data exists upon which to base any calculations, though the impression appears to be general that in selecting companies in which to entrust your interests it may be well to remember that real good things cannot be bought the cheapest.

Franchises—that much misunderstood and abused word—might as well be dropped from the vocabulary and plainer "contract" substituted. The change might disabuse the public mind, which now appears to cherish the idea that when a contract is made and it appears christened in the name of franchise, every symptom of a large-sized wolf in sheep's clothing is contained therein—a clear case that the fragrance of a rose depends upon the name it bears. Contracts are as old as the ages. Even the great book indicates, when it says "One may be taken unto the other for better or for worse," that the inevitable solution of a contract is that one or the other contracting party gets the best of the trade. Street-railroad contracts are made in accordance with the prescribed dictates and mandatory provisions of the laws of the State, made operative by and through the delegates and concurrent acts of a municipality. Rights to operate street railroads under these acts are unquestionably contracts, and sanctioned by legislative power higher than that of a municipality, and not alone are the beneficiaries thereunder confined to the narrow domain of a city or town, but even the stranger within the gates temporarily enjoys the benefits thereof.

The joint interest between street railroads and the public cannot be gainsaid, yet the rampant wailings of a hungry horde of malcontents would disconnect any and all affinity between the two and condemn the former for ever having dared to earn an honest penny or enter the great race of the survival of the fittest. The grantor or grantee or both may try the patience and put the claims of Job to shame; nevertheless everybody joins in the refrain that street railroads have come to stay, and no interest seems quite so allied to the people; the pittance contributed is doubly, yes trebly, returned in unequalled and unprecedented service.

The value of the bonds of street railroads should not be less than that of the cities in which they are located. Often they are the more desirable of the two, for the reason that private management develops greater business judgment, while the increasing debt and liability of State and municipal management do not commend its business methods—an argument prejudicial to the theorist who argues for public ownership at the expense of the individual or corporation. "Take it," he says, "by confiscation, and condemnation afterwards, at any cost of principle and equity, personal rights or financial loss; and with perhaps a single exception cooler and calmer judgment has prevented such incendiary acts, and such dogmas have been made to slumber in the brains of the inventors. I can congratulate the members of this Association that to-day witnesses a remarkable progress in methods and systems for propulsion of street cars, the initiative step towards which was taken within the borders of this State but a very few years ago. The daily progress in this direction is indeed phenomenal, and our people are unhesitatingly acquiescing in and adopting all advanced theories and ideas, thus showing conclusively that capital stands forth ever ready as a golden reward for brain energy and devotion. In passing I cannot omit mentioning the valuable service rendered this Association by its secretary and treasurer, Mr. J. B. Hanna, whose activity and devotion has during all these years added so much to its success.

Gentlemen of the Association, may you gather knowledge and wisdom from your associates and co-laborers here assembled; may the interchange of thought and inquiry prove a source of mutual advantage, and may you each as you depart to your various fields of labor carry with you the kind remembrance of these annual gatherings and the satisfaction that they have proven beneficial and instructive.

After some discussion a paper on Car Building was read by Mr. Brownell, of St. Louis.

At the close of the reading of the paper, considerable discussion was indulged in, after which the Nominating Committee recommended the re-election of the old officers, which recommendation was adopted, likewise that of Zanesville, O., as the selection for the place of meeting for the next Convention.

The Convention adjourned at about 5 P.M.

BANQUETED.

At 10 o'clock in the evening a banquet was given at the Buchtel Hotel, in which about twenty-five to thirty guests participated.

The menu was a very tempting one and fully carried out. After the soup had been served, and soon after claret had reddened each glass, Toastmaster Stewart proposed the health of Dr. Everett and J. B. Hanna, of Cleveland, each of whom was absent, on account of family bereavements.

When the punch came on, STREET RAILWAY NEWS, with its usual enterprise, took several flashlight pictures of the banqueters, but as one of the waiters tried to execute a double-shuffle when the brilliancy of the magnesium obscured his remaining senses for the nonce, just at the wrong time, the picture looked as if the community—including that son of Ham—had been struck by lightning, and we, consequently, refuse to give the Ethiopian the benefit of such a glorious free advertisement as he would have by the publication of the picture we refer to. In it we notice he is working in no less than seven shirts, seven vests, seven dress-coats, seven noses, etc., and there were no snakes around either.

Judge Marvin, attorney for the Akron Street Railway Company, responded to the toast of the "City of Akron," and complimented the city upon the number and variety of its industries, made a special reference to the immense improvements in street railways in general, and closed by eulogizing the management of the Akron Street Railway Company.

Mr. Miller, of Akron, responded to "Street Railways of the Past" by passing the response, whereupon John Harris, of Cincinnati, came to time with "Street Railways of the Present," after which Mr. Wilcox, a resident of Akron, but one of the directors of the street railways in Zanesville, made a very neat speech.

Mr. Slavbaugh, of Akron, responded to the "Legal Fraternity."

Quite a number of other speeches were made, and the company adjourned about 1 o'clock, having passed a most enjoyable evening.

LIST OF ATTENDANTS.

Andrews, Horace E., President Broadway and Newburg Street Railway Co., Cleveland, Ohio.
Baker, J. L., *Western Electrician*, Chicago, Ill.
Banman, A., Manager Lancaster Street Railroad, Lancaster, Ohio.
Benton, C. A., Detroit Electrical Works, Detroit, Mich.
Boughton, W. E., Johnson Co., Cincinnati, Ohio.
Brownell, F. B., Brownell Car Co., St. Louis, Mo.
Bulkley, M. J., *Electrical Review*, Chicago, Ill.
Byam, N. H., Charles Munson Belting Co., Chicago, Ill.
Carpenter, Reid, Treasurer Citizens' Electric Railway, Light and Power Co., Mansfield, Ohio.
Carter, E. J., Fremont Street Railway Co., Fremont, Ohio.
Cavell, E. V., STREET RAILWAY NEWS, New York, N. Y.
Christy, W., Cleveland Construction Co., Cleveland, Ohio.
Collins, L. W., *Electricity*, Chicago, Ill.
Coolidge, Daniel, Vice-President Johnson Co., Johnstown, Pa.
Dean, D. B., Electric Merchandise Co, Chicago, Ill.
Dorner, H. A., Dorner & Dutton, Cleveland, Ohio.
Elliott, W. S., Edison General Electric Co., Chicago, Ill.
Goodhue, Wells, The Electrical Supply Co., Chicago, Ill.
Hanna, J. A., J. G. Brill Co., Philadelphia, Pa.
Hanna, J. B., Woodward Avenue and W. S. Street Railway Co., Cleveland, Ohio.
Harris, John, Cincinnati Street Railway Co., Cincinnati, Ohio.
Hazzard, W. W., Cleveland, Ohio.
Kenfield, F. S., Chicago,
Leonard, S. S., Hill Clutch Works, Cleveland,
Lewis, A. H., Thomson-Houston Electric Co., Cincinnati, Ohio.
Littell, H. M., General Manager Cincinnati Inclined Plane Railway Co., Cincinnati, Ohio.
Mark, C. E., Mark & Sterling, Cleveland, Ohio.
Metlin, J. E., Superintendent Akron Street Railroad Co., Akron, Ohio.
Monroe, P. G., *Street Railway Gazette*, Chicago, Ill.
Morgan, H. B., Munson Belting Co., Chicago, Ill.
Myers, Garson, Calorific Ventilating Heater Co., Chicago, Ill.
Packer, Eldridge, Rochester Car Wheel Works, New York, N. Y.
Rodgers, A. D., President Columbus Consolidated Street Railroad Co., Columbus, Ohio.
Rogers, Frank A., The Short Electric Railway Co., Cleveland, Ohio.
Rude, Clark, President Citizens' Electric Railway, Light and Power Co., Mansfield, Ohio.
Seiberling, F. A., J. F. Seiberling & Co., Akron,
Siersdorfer, M., Post & Co., Cincinnati, Ohio.
Stewart, John N., President Ohio Tramway Association, Cleveland, Ohio.
Strieby, F. H., Central Thomson-Houston Co., Cincinnati, Ohio.
Stump, C. E., Street Railway Pub. Co., New York, N Y.
Taltavall, T. R., STREET RAILWAY NEWS, New York, N. Y.
Wagner, F. B., Typograph Co., Cleveland, Ohio.

EXHIBITS.

A few exhibits were displayed in the main corridor of the Hotel Buchtel.

Post & Co., of Cincinnati, had an attractive display of headlights for electric cars, gongs, etc. They also showed a double-pole switch, electric portables of all kinds, and trolley-wire fixtures. Mr. M. Siersdorfer represented the company and gave away some bronze turtles for paper-weights.

The Calorific Ventilating Heater Co., of Chicago, was represented by Mr. Garson Myers. Mr. Myers exhibited No. 1 Calorific Ventilating Heater, style A, with straight pipe, also style B, which calls for a goose-neck to bring the hot-air pipe to the front of the seat. This style is used on cars with upholstered seats. Mr. Myers distributed steel rules in leather cases as souvenirs. A display card showed that in 1889 one calorific heater was in use, while in 1891 there were 1,037. Hard coal is used in these heaters.

The Electric Merchandise Co., of Chicago, was ably represented by Mr. D. B. Dean, who displayed a sample of the Chicago trolley-clamp, and a few railway specialties. Mr. Dean also distributed some literature concerning the many goods handled by this well-known house, including Pratt's Portable Fare Registers, and Brand's steel-wire track brooms for street railways.

The Electrical Supply Co., of Chicago, had a display of trolley clips, a Wirt dynamo brush, Wirt

steam insulator and a pole ratchet. The company was represented by Mr. Wells Goodhue.

The Rochester Car Wheel Works, of New York, was represented by Mr. E. Packer, of the street-car department. Mr. Packer showed some sections of cast-iron wheels for horse and electric cars.

Mark & Sterling, of Cleveland, Ohio, had a display of a model of their rail chairs and joint bridges. Mr. C. E. Mark represented the firm.

Literature in various forms was distributed by the following-named companies by the gentlemen representing them, viz.:

The Hill Clutch Works, of Cleveland, Ohio, by S. S. Leonard.

The Charles Munson Belting Co., of Chicago, by H. B. Morgan and N. H. Byam.

The railway department of the Central Thomson-Houston Co., Cincinnati, by F. H. Strieby.

The Edison General Electric Co., by Mr. Wm. S. Elliott, special agent, Chicago.

NOTES.

Snyder's Automatic Tongue Switch attracted considerable attention in Akron during the Convention of the Ohio Tramway Association last week. This switch is the invention of Mr. W. H. Snyder, of Akron, and sets itself automatically. A strong spiral spring is placed in the tongue around the pivot in such a way that the tension of the spring keeps the tongue pressed firmly against the rail. One of these automatic tongues is now being tried on the Akron electric line, and the street-railway men who examined it seemed to be favorably impressed with its simplicity and efficiency.

Mr. Daniel Coolidge, Vice-President of the Johnson Co., Johnstown, Pa., and Mr. Boughton, manager of the company's Cincinnati office, were in Akron during the Convention, looking after the interests of their company.

After the adjournment of the Convention a party of the delegates visited the factory of J. F. Sieberling & Co., to see an electric motor and truck being constructed there by Mr. F. A. Sieberling. The motor and the method of application are of Mr. Sieberling's own design. The motor is supported on the side frames of the truck, and the armature and its shaft are placed at right angles with the axles or parallel with the track. The motor is of the single-reduction type, and the power is transmitted to the axles by bevel gearing. The motor is hung between the axles, and the armature shaft is geared at both ends, so that the power is applied to both axles.

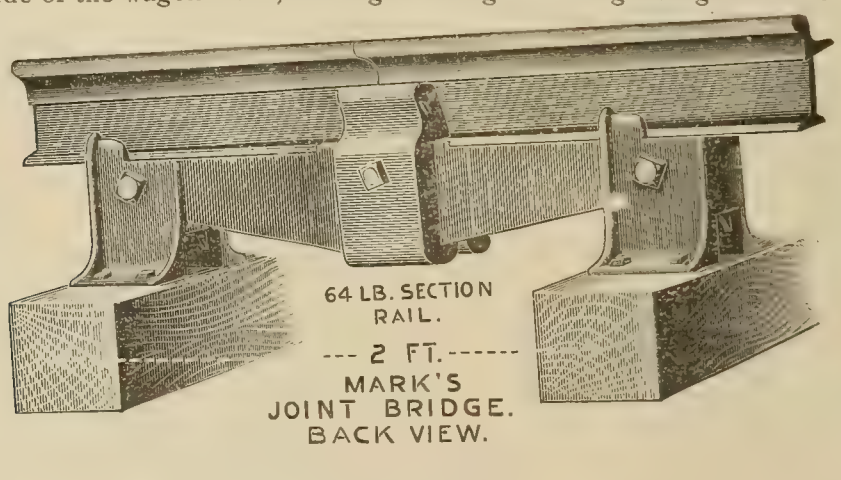
JOINT BRIDGE AND RAIL CHAIR.*

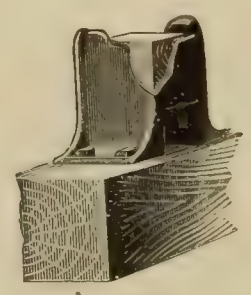
The development of electric railways has necessitated a corresponding improvement in track construction. Many inventions have been brought out with the view to securing a more solid road-bed and more perfect joints of the rails, as it is well known poor joints are a serious defect on street railway lines where electric cars are operated.

One of the most efficient methods of track-laying and joint connections is that described and illustrated below.

The joint is supported by an annealed cast-steel bridge or truss; two chairs, made especially for the purpose, supporting the truss. In order that the truss and chairs may retain their relative positions they are bolted together loosely. There are two side clips, one on each side, at the centre of the bridge, made to conform with the shape of the rail. The inside clip is so made that it engages with the under edge of the bridge, and also with the base of the rail. The upper portion engages with the under side of the wagon-tread, making a strong and perfect support of the joint for ordinary street travel, such as wagons, trucks, etc. The outside clip is made to engage with the lower edge of the bridge and the upper side of the base of the rail, also to fit the web of the rail under the curved edge of the rail-head. In this way a perfect support for the rail as far as its alignment is concerned is secured.

Since the ends of the rail are supported by the solid bridge or truss, a perfect and straight joint that will stand the most severe usage is the result, and the effect is that of a practically continuous rail. There is no sag at the ends of the rails as is common in poorly constructed roads, and which has been one of the most difficult things to avoid heretofore.





MARK'S RAIL CHAIR.

*Marks & Sterling, Cleveland, Ohio.

The spaces between the ties are the same throughout the whole grade, whether the joints are broken in the centres of opposite rails or are even.

The chairs are made of malleable iron and will withstand years of service without deterioration. The accompanying cut will give a clear idea of its construction. It will be noticed that the body of the chair is box-shaped, having a very strong and solid bottom. Wood filling is compressed into this box at a pressure of about 10 tons. The upper surface of the wood is $\frac{3}{16}$ of an inch above the edge of the iron box, in this way forming a wooden seat for the base of the rail. The use of wood insures a minimum amount of noise, and at the same time gives a certain amount of elasticity, which renders the motion of the cars very easy; thus two very important features in road-bed construction are attained.

The lips of the chair are cut at diagonally opposite corners, with curved edges, so that the chairs can be adjusted to the base of the rail, and when it is turned at right angles to the rail it makes a perfect support for the latter.

The firm claims to have in this chair and bridge joint the *ne plus ultra* of perfection, and will be glad to give further information and estimates to those interested.

LARGE RAILWAY GENERATORS.

A representative of STREET RAILWAY NEWS visited the Short Electric Railway Company's works in Cleveland last week, and found each machine in every department at work. Motors and generators without number, in all stages of construction, were seen.

One of the claims the Short company makes is that it does its work well, and a visit to the immense works, where every detail in the construction of motors and generators can be seen and inspected, convinces one of the substantiality of the claim. Every part of the work in the construction of these machines is most carefully and thoroughly done. The materials used are of the very best, and the employés have the appearance of possessing extraordinary intelligence. Intelligence is an essential factor in the construction of electrical apparatus, and this, combined with the best material, cannot result otherwise than in the production of superior goods.

The process of armature winding and insulation—most difficult work at the best—was also seen in every detail. The greatest care is taken to insure perfect insulation, and the winding is most carefully accomplished and finished.

The testing of the brake-power of motors is an interesting process. A test for efficiency was made a few days ago with a Short Gearless Motor, and the results were most excellent. The curves, which we saw, showed that the machine gave 94 per cent. efficiency.

The Short Electric Railway Company is now getting out twenty-three 150 H. P. multipolar railway generators. Fourteen of these immense machines are for the Rochester Railway Company, and the others are to go to Johnstown, Pa., East Liverpool, O., and Trenton, N. J. The iron in the base and field-magnet yokes of each machine—all in one casting—weighs four tons.

THE WEEK'S RECORD OF STREET-RAILWAY NOTES.

COLORADO.

DENVER.—November 4. Train on Denver, Texas & Gulf Railroad caught fallen trolley wire of South Broadway electric street railway and tore wire down for distance of ten blocks.

DELAWARE.

WILMINGTON.—Wilmington City Passenger Railway Co. making arrangements with county relative to crossing Third street bridge.

GEORGIA.

COLUMBUS.—The electric street railway nearly completed.

SAVANNAH.—Savannah Street & Rural Resort Railway Co. has nearly completed its track extension. It has just received two more cars from the J. G. Brill Co., of Philadelphia.

ILLINOIS.

CHICAGO.—Reported Mayor Washburne will not veto ordinance for extension South Chicago Street Railway Company's lines.

November 9. Mayor Washburne signed Torrence Electric Terminal Railroad ordinance, on condition that company pays same mileage tax that surface roads pay, if it ever competes with such roads for local passenger business.

EDWARDSVILLE.—On October 22 Steel Trust Car-Wheel Co. commenced manufacture car-wheels, which are said to be much stronger and more elastic than ordinary wheels. Officers of company are: President and Superintendent, Jacob Dunstedter; Vice-President and Treasurer, G. Cramer; Secretary, August Lindenmuth.

KENTUCKY.

LOUISVILLE.—November 6. Motorman on Green street electric line robbed of money-box containing $25 by negro.

November 8. Attempt made to wreck electric car near Jacob Park by placing rails across track.

MARYLAND.

BALTIMORE.—The Baltimore City Passenger Railway Co. has purchased property 93 x 180 feet on East Baltimore street near Exeter, for $37,500, on which it intends erecting power-house.

MASSACHUSETTS.

BEAVER BROOK.—First street-car constructed at Hollingsworth's new car-factory to be shipped to Newton (Mass.) Street Railway Co.

MALDEN.—November 11. East Middlesex Horse Railway Company asked permission double-track lines.

NEWTONVILLE.—Project of building storage battery street-railway system to Newton Centre revived.

Incorporations.

BELLEFONTE, PA.—November 5. Bellefonte Electric Street Railway Co. Capital stock, $18,000. Incorporators: L. A. Schaefer, W. F. Reeder and James H. Potter, all of Bellefonte, Pa.

CHICAGO, ILL.—November 7. Chicago Electric Carriage Co. Capital stock, $100,000. Incorporators: W. O. Worth, L. J. Pearson and Hugh McIndoe. (World's Fair enterprise.)

November 9. United States Rapid Transit Company of Chicago, Ill., to construct and operate mechanical and electrical devices for rapid transit of United States mail, passengers and merchandise. Capital stock, $5,000,000. Incorporators: John Irvine, Isaac T. Dyer and Frank O. Anderson.

November 9. International Electric Railway Co. Capital stock $2,500,000. Incorporators: J. T. Hanna, M. M. Wood and Demas L. Coe.

LANCASTER, PA.—Lancaster and Strasburg Railway Co. Capital stock, $125,000. Incorporators: Jacob B. Long, J. W. B. Bausman and Walter M. Franklin, all of Lancaster, Pa.

LATROBE, PA.—Latrobe and Derry Electric Street Railway Co. Capital stock, $40,000. Incorporators: J. W. Hughes, John B. Miller, Clate O. Slater, David J. Bush and Jas. E. Heck, all of Latrobe, Pa.

NEW YORK, N. Y.—Mitchell Electrical Railway Cable Co. (Incorporated in W. Va.) Capital stock, $5,000,000. Incorporators: W. A. Taylor, J. A. Lindsay, J. W. Forrest, all of New York, N. Y.

PRINCETON, ILL.—The Princeton City Street Railway Co. Capital stock, $20,000. Incorporators: M. C. Clarke, M. T. W. Lathrop and F. W. Clarke.

TAMAQUA, PA.—November 2. Tamaqua and Lansford Street Railway Co. Capital stock, $50,000. Incorporators: D. D. Philips, Gordon, Pa.; Robert Harris, Tamaqua, Pa.; C. R. Eberle, Philadelphia, Pa.

New Roads.

IONIA, MICH.—Electric street railway to be constructed here at once.

NAPA, CAL.—Electric street railway between Napa City and Calistoga to be constructed in near future.

OAKLAND, CAL.—Consolidated Street Railway Co. will construct street railway to cemetery in near future.

SAN FRANCISCO, CAL.—Projected electric road in Golden Gate Park.

SEATTLE, WASH.—Prospective motor line from Admiralty to Coupeville.

Change of Power.

ELMIRA, N. Y.—Elmira and Horseheads Street Railway Co. will use electric power on its entire system in near future.

JACKSONVILLE, FLA.—Jacksonville Street Railway Co. will change from animal to electric power.

SAN FRANCISCO, CAL.—North Beach and Mission Street Railway Co. desires to run its system by electric power.

BUSINESS NOTES,

The Electric Merchandise Company received a few days since the following dispatch, the latter part of it referring to a duplicate order for four additional sets just ordered by mail:

OTTUMWA, IA., Nov. 14, 1891.

Heaters working satisfactorily. Hurry the others along as soon as possible OTTUMWA ELECTRIC RAILWAY.

The Duplex Street Railway Track Co., 51 Wall street, city, commenced laying its duplex track on Fourth avenue near Eighth street, Wednesday, November 11. The mechanical principle of under and overlapping at joint connections is something new in its application to street-railway tracks, and it is said that the system in a simple and natural way overcomes the inherent weakness at joints. This principle of construction, as supplied by this company in its renewal of track for the New York and Harlem Railway Co. on Fourth avenue, will be watched with interest by street-railway men and engineers.

The New York Equipment Company reports great activity in its business of supplying electric street railways with equipment, having made sales recently in the States of North Carolina, South Carolina, Indiana, New York, Ohio and Virginia. There is a special demand for large lots of second hand cars which have seen but [illegible] service and which, when put in action, a good condition as [illegible] cars is customary with this company, [illegible] able condition in price.

Owing to the demand for [illegible] railroad span wire, the [illegible] Bridgeport, Conn., has put on the [illegible] possessing all the high [illegible] silicon bronze wire, but at the [illegible] for span-wire, the company [illegible] of wire at a considerably lower figure. It is [illegible] silicon bronze is safer and more suitable than galvanized iron for overhead construction, and that it [illegible]

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued November 10, 1891.

462,688. Electric-Railway System. Henry C. Camp, St. Paul, Minn. Filed June 30, 1890.

The combination, in a conduit for the conductors of electric railways, of the side walls of the conduit at a greater distance apart than the proposed width of the slot, inwardly-extending lugs formed at the upper edge of the side walls, angular cap-plates having one wing adjustably secured to the lugs and forming chambers upon each side of the upper interior of the conduit, and current-conductors suspended from the lugs in such manner as to lie above the plane of the lower edges of the depending wings.

462,716. Railway-Tie and Rail-Securing Device. Orville M. Knox, Oneida, N. Y. Filed July 15, 1891.

A metal railway-tie having a surface plate and a downwardly-projecting central flange formed integral therewith, and having the corner or angle between the surface plate and flange filled and rounded, and a centrally-located web or plate for preventing longitudinal movement of the tie, and also having the angle between the web and surface plate filled and rounded.

462,717. Railway-Tie. James H. Lynch, Addison, N. Y. Filed April 16, 1891.

The combination, with a railway-tie provided in its upper face with a seat for the rail and the rail-chair and the rail seated therein, of a sectional chair seated in the seat on each side of the rail and lapping onto the flanges of the rail and provided with arms straddling the tie on top and an inverted saddle straddling the lower face of the tie, and means to secure the chair sections and saddle together.

462,728. Track-Clearer. George Nevens, Brunswick, Me. Filed March 7, 1891.

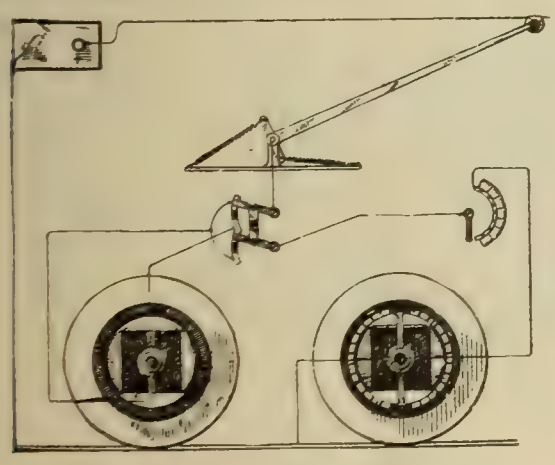
A cutter-bar suspended from a car by means of links, cutters secured to the bar, and a handle or lever for moving the bar laterally.

462,751. Electric-Railway Motor. Charles J. Van Depoele, Lynn, Mass. Filed Dec. 20, 1890.

An armature fixed upon and carried by the axle, a circular field-magnet surrounding the armature, also carried by the axle and journaled thereon, and means carried by the armature for shifting the polarity of the field in advance of the poles of the armature.

462,769. Combined Car Step and Gate. William E. Ludlow, Toledo, Ohio. Filed March 25, 1891.

The combination, with an ordinary platform, of an outwardly-moving and upwardly-folding car-step.



462,751.—ELECTRIC RAILWAY MOTOR.

462,793. Electric Car-Brake. James D. Collier and James K. P. Miller, Woodville, Tex., assignors of one-third to John H. Kirby, same place. Filed Feb. 4, 1891.

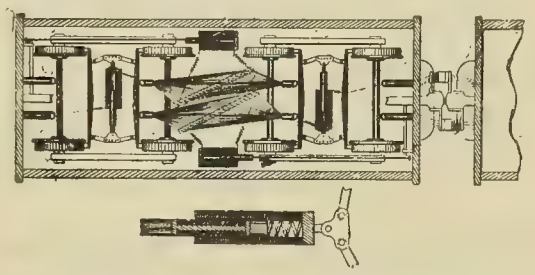
An electric brake for railway-cars, consisting of an electro-magnet and armature placed between the wheels of a car-truck, the magnet being connected to a toggle-joint connecting the brake-beams at one end, and the armature being connected to a toggle-joint connecting the brake-beams at the other end.

462,794. Electrical Connection and Signal for Railway-Cars. James D. Collier and James K. P. Miller, Woodville, Tex., assignors of one-third to John H. Kirby, same place. Filed March 25, 1891.

In a railway-train, the combination, with a source or sources of electricity, of two main wires connected to opposite poles of the source of electricity leading throughout the train and electrically connected from car to car by circuit-couplers on either side of the drawhead, a series of secondary wires branching at either end of the car and symmetrically connected from car to car by the circuit-couplers, each of the wires being connected to one of the mains and to a device operating by electricity, and a series of circuit-closers attached to the opposite main and capable of connecting the secondary wires therewith.

462,807. Electric Car-Coupling. James D. Collier and James K. P. Miller, Woodville, Tex., assignors of one-third to John H. Kirby, same place. Filed Feb. 18, 1891.

In a system of car-couplings actuated by electricity, the combination, with the source of electricity, of a conductor leading from one pole thereof connected from car to car, a second conductor leading from the opposite pole of the source of electricity and also connected from car to car, an electro-magnet and circuit-closer between the conductors, and an armature adapted to be drawn to the magnet, a link connected to the draw-head and having an arm protruding therefrom, a rod or rods connecting the arm and the armature to raise the link, and means for engaging the link in the opposite draw-head.



462,793.—ELECTRIC CAR-BRAKE.

462,832. Car-Coupling. Joseph J. Wisda, Defiance, Ohio, assignor of one-half to John Wisda, same place. Filed June 1, 1891.

In a car-coupler, the combination, with a slotted draw-head and a coupling-pin, of a lever having a vertical branch provided with a shoulder or rest on its forward edge and the notch in its forward edge below the shoulder or rest and also having a lower rearwardly-extended weighted branch.

462,850. Electric Circuit Closing and Breaking Device for Railway-Tracks. Thomas H. Patenall, Rahway, N. J. Filed Feb. 20, 1891.

The combination, with a reciprocating plunger under the control of a railway-rail, of a receptacle for a fluent electric conductor, the receptacle having separated branches, one of which is in communication with an air-chamber at the end of the plunger through an inclosed channel, and contact-points located in position to engage the fluent conductor.

462,900. Metallic Railway-Tie. William P. Hall, Piqua, Ohio. Filed April 27, 1891.

The combination of a tie, rail-clips bolted thereto and provided with bars or fish-plates adapted to fit against the flanges of the rails, and ears adapted to clamp down on the fish-plates.

462,911. Draw-Gear for Railway-Cars. George L. Harvey, Chicago, Ill. Filed Aug. 6, 1891.

In a draw-gear, the combination, with plates having lateral offsets between their ends to provide abutments for the follower-blocks, of filling-pieces adapted to the openings behind the offsets.

462,915. Car-Coupling. Dyer Williams, Cedar Rapids, Iowa, assignor to Carlotta B. Williams, same place. Filed Feb. 6, 1891.

In a car-coupler, the combination, with a draw-head, of a pivoted jaw having a shoulder on the inward arm, behind which the pin drops to lock the jaw, the face of the jaw contiguous to the shoulder and which moves the pin in locking being eccentric to the pivot or cam-shaped in the plane of the jaw's movement and bevelled so as to have a greater diameter on the under side, and a locking-pin staggered in outline, the inclination of the middle portion corresponding to the bevel of the jaw and the parallel terminal portions inclining in the opposite direction and adapted to slide in bearings in the upper and lower parts of the draw-head.

462,926. Heating and Lighting System. Rudolph M. Hunter, Philadelphia, Pa., assignor to The Electric Car Company of America, same place. Original application filed Jan. 12, 1887. Divided and this application filed Sept. 27, 1887.

In an electric railway, the combination of a line working conductor arranged along the track, an electrically-propelled vehicle, a motor on the vehicle, two [illegible] batteries also on the vehicle, a current-collector carried by the vehicle to receive current from the line working [illegible], a motor-circuit, a secondary-battery circuit in electrical connection with the motor-circuit, and switches to cut either battery out of circuit and disconnect it from the line-circuit, a local circuit carried by the vehicle, a switch to couple the circuit with either of the batteries, and translating or current-consuming devices in the local circuit.

462,967. Rail-Joint. Joseph A. Ino, Newark, N. J. Filed Nov. 12, 1890.

In a railway-joint, the combination, with the rails, of a chair provided with upwardly-turned and perforated flanges, angle-plates the lower legs of which are curved and provided at their margins with hooks extending through the perforations in the chair and adapted to be struck or bent up by the hammer without removal of the plate to take up wear, and bolts securing the plates to the rails.

462,989. Car-Brake. Augustus J. O'Neill, Butte City, Mont. Filed April 14, 1891.

In a car-brake, the combination, with a plate adapted to extend into the slot of the cable-conduit and provided with brake-shoes adapted to engage the cable-conduit, of an arm pivoted on the car-brake and carrying the pivot of the plate, the arm being under the control of the operator, bell-crank levers pivotally connected with the arm, and links pivotally connected with the bell-crank levers and the plate.

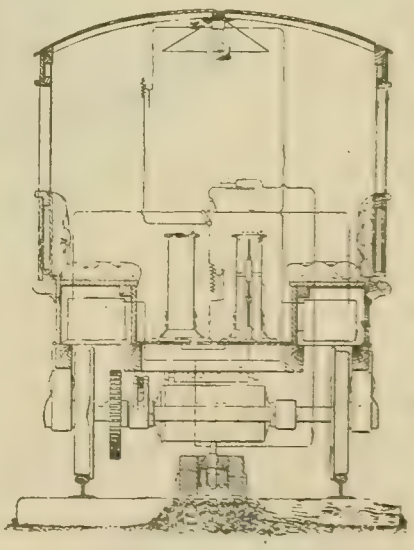
462,999. Car-Coupling. William B. Seal, Baltimore, Md., assignor to William S. Reins, same place. Filed Jan. 15, 1891.

The combination, with a draw-head containing a cavity and having flanges at the top and bottom, of a bell-crank-shaped hook pivoted in the cavity and adapted to co-operate with a similar hook in a corresponding draw-head and rest between the flanges of the opposing draw-head.

463,005. Track-Brake for Railways. John Story, Lonaconing, Md. Filed March 13, 1891.

A track-brake for cars, consisting of one or more horizontal brake-bars arranged beside the rail and just above the same, and means for throwing it against the sides of the car-wheels.

463,020. Electric-Railway System. Granville T. Woods, New York, N. Y., assignor to the American Engineering Company, same place. Filed Aug. 31, 1891.



462,926.—HEATING AND LIGHTING SYSTEM.

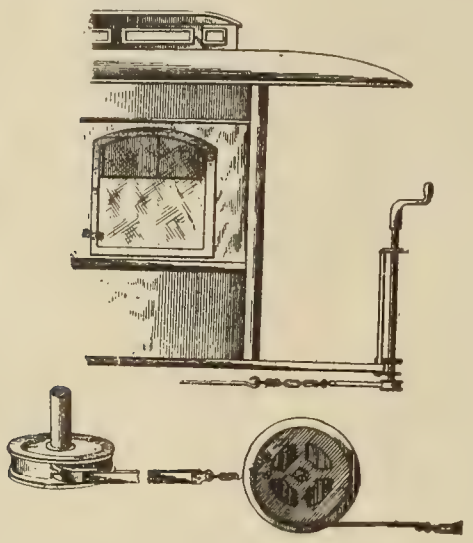
A system of electrical distribution composed of a group of electro-magnetically-controlled contacts outside of the road-bed and accessible, each contact being electrically connected with one exposed terminal head in the road-bed.

463,024. Reversible Electric Trolley. Joseph W. Bates and Carolstine E. Blake, Minneapolis, Minn. Filed Dec. 22, 1890.

The combination, with the trolley-wheel, of an oscillating reversing-frame provided with laterally-flared guides, the outer ends of which are made to converge and form a bearing or point of contact for the trolley-wire, the guides serving as directors of the trolley upon the trolley-wire both on the right and left hand sides of the axis of the trolley.

STREET RAILWAY NEWS' PATENTS—Continued.

463,046. Railway-Tie and Fastening. Charles P. Hammond, Atlanta, Ga. Filed April 11, 1890. Renewed Sept. 17, 1891.



462,993.—CAR-BRAKE.

The combination, with a metal tie having communicating slots located at right angles to each other, of a clip in one slot having a lip for engaging the rail flange and a wedge in the other slot for engaging the outer end of the clip.

463,071. Car Construction. George W. McNear, Oakland, Cal. Filed July 8, 1891.

A car comprising a central compartment with an open dummy at each end and having transverse side entrances for passengers, the flooring of the side passages and central compartment being depressed below the level of that of the dummies.

463,082. Railway-Rail Joint. Solomon F. Stever, Fairfield, Iowa. Filed Dec. 14, 1889.

The combination, with rails and with angle-bars the outer edges of the flanges of which project over or outward beyond the flange of the rail in use, of a jaw or clamp to be on each side of the rail at the joint in use, holding the flanges of rail and angle-bar and bearing against the projecting flange of the angle-bar when in position, and means for connecting the jaws.

463,087. Car-Coupling. Wesley W. Windham, Atlanta, Ga. Filed Feb. 24, 1891.

The combination of a draw-head, a box seated within the draw-head having its lower portion hollowed out and its upper part cut by a recess extending upwardly and rearwardly from a lower recess and recesses cut in the sides, a lip separating the upper and lower recesses, a gravity-block having trunnions registering with the recesses in the sides of the box, a rear extension registering with the upper recess and a downwardly-projecting lip at its front lower end, a pin and a link.

H. WARD LEONARD & CO.



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NEW YORK CITY.

THE SHORT ELECTRIC RAILWAY CO.

Short Electric Railway Motors are not "Innovations." They are "EVOLUTIONS" **along a clearly marked line, and the same thoroughly tested forms.**

THE RING ARMATURE,

MULTIPLE FIELDS,

LARGE COMMUTATORS,

Complete Ventilation of Parts and Spring Suspension of the Entire Machine

Characterize ALL THREE TYPES. The records made by these motors are unsurpassed, and place the motors EASILY in the LEAD of ALL OTHERS for Economy and Efficiency.

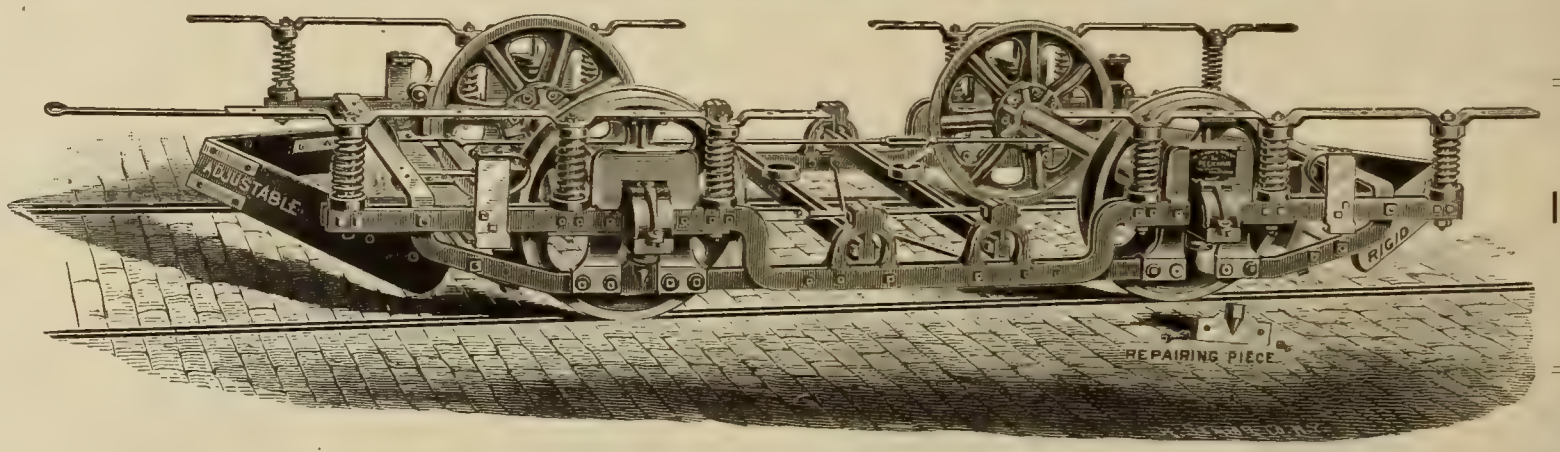
SEE THE ROCHESTER (N. Y.) RAILWAY COMPANY'S OFFICIAL REPORT FOR 1890-91.

THE SHORT ELECTRIC RAILWAY COMPANY, Cleveland, O.

Peckham's Patent Cantilever Motor Truck.

GUARANTEED TO PREVENT BOTH END AND SIDE OSCILLATION OF ELECTRIC CARS RUNNING TWENTY MILES AN HOUR.

ADAPTED TO ANY STYLE OF MOTOR.



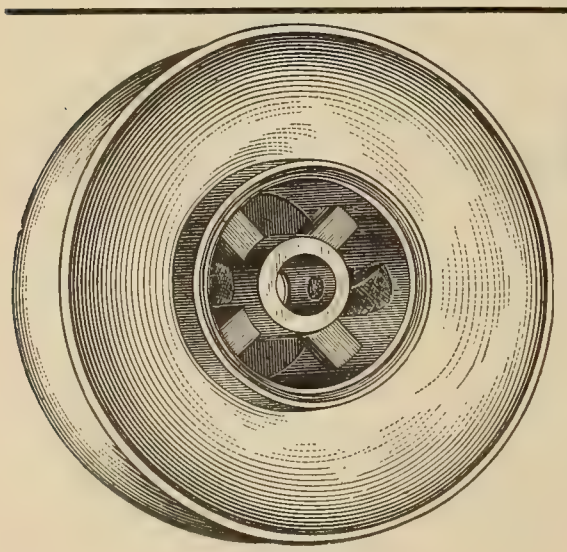
EQUIPPED WITH INTERCHANGEABLE OR RIGID WHEELS.

The Strongest, Most Economical, Easiest Riding and Easiest Repaired Motor Truck in Use. Equipped with "Peckham's Patent" Cantilever Extension Side Frames Radial Gear and Pendulum Motor Hangers. The Only Motor Truck with Flexible Journal Bearings. The Only Motor Truck with Flexible Motor Supports.

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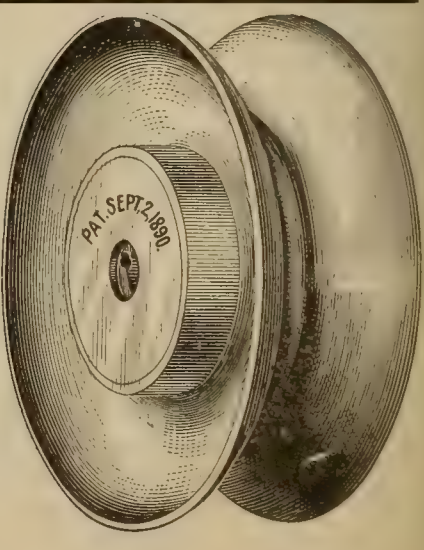
BADGER'S PATENT

SELF-OILING TROLLEY WHEEL,

For Electric Railways.

Smooth running; ways well oiled, prolongs the life of the wheel.
It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

BADGER BROTHERS, West Quincy, Mass.





VOL. I. NEW YORK, NOVEMBER 28, 1891. NO. 21.

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(WEEKLY.)

Entered at New York P. O. as second-class matter.

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LACK OF RAPID TRANSIT FACILITIES HANDICAPPED DETROIT.

Our Cleveland correspondent refers to a recent visit there of prominent street-railway men of Detroit for the purpose of looking into the rapid transit systems in operation in the Forest City. Their object was to gather all information and knowledge possible concerning these enterprises, so that it could be used in their efforts and plans to secure rapid transit for Detroit.

Detroit possesses every advantage for the full development of rapid transit, particularly for electric lines. Its streets are wide and, like most Western cities, its distances are magnificent. The enterprising people of that beautiful city might have been better off to-day, and the business of the place might have been greatly expanded, had there been ample facilities for handling large crowds on the street-car lines. The lack of rapid transit was significantly referred to in a dispatch from Washington a few days ago to a New York daily in regard to the selection of the place for the next National Republican Convention. Touching the comparative advantages of the various cities contending for the honor, the dispatch says that Detroit "has neither the necessary hall nor *street-car* facilities"—therefore it stood no show.

This is something for the enterprising people of Detroit to think about. Did the city possess rapid transit facilities it might possibly have had a chance of securing the prize, but the lack of such facilities put it entirely out of the question.

RAPID TRANSIT ABROAD.

The development of rapid transit in American cities is pretty fully chronicled in the journals devoted to the publication of matters pertaining to all classes of street-railway systems; but progress in this direction in foreign cities is little known in this country. For this reason the report of Osborne Howes, Jr., to the Boston Rapid Transit Committee on the various systems of urban transportation used in British and foreign cities—an abstract of which we give on another page—will no doubt be read with interest by American street railway men.

It will be noticed that the laws affecting the operation of transportation systems in most of the cities concerned are in many respects radically different from the practice in America.

In many of the cities of the Old World the rights which are granted to American companies are jealously guarded by the authorities. As a rule, in foreign cities the right to fix the rate of fare is reserved by either the municipal or national authorities. In like manner the number of trips to be made by the cars and the form of track to be used in the equipment of the road are decided. The authorities also reserve the right to determine how much of the streets through which the tracks run shall be kept clean by the company, and how much it shall pay for the paving of the same. The authorities also reserve the right to purchase street-car plants any time after the expiration of a certain period.

A law compelling street-car companies in America to provide seats for every passenger would no doubt be hailed with delight. Laws having for their object this very thing are in force in some English and European cities. In Birmingham, for instance, seats must be provided for all who ride, and it is the duty of the police to see that this law is enforced. In case of its violation the company concerned is subject to a fine.

In Berlin the authorities are in favor of electric roads operated by underground wires, but the principal street-car company in the city, which uses horse power entirely for the propulsion of its cars, is not willing to go to the expense of making the change, because all street constructions must, according to law, revert to the city after a certain number of years.

Compared with American practice, the taxation of street-railway property in foreign cities appears to be enormous. In Berlin, for instance, the street-car company above referred to pays for the privilege of using the streets 4 % on its gross income so long as it is within 6,000,000 marks; a taxation of 8 % is levied when the gross income is 15,000,000 marks or over. Besides this the company is required to pay taxes on real estate and an income tax on declared profits of 4 %. So much for taxes on the company itself. After the stockholder has received his dividends he also is taxed on the same as though they had not been previously taxed.

As in Birmingham, the Berlin street-railway company must provide seats for all passengers, and failure to do so establishes sufficient grounds for an official inquiry.

Mr. Howes does not entertain a very favorable opinion of the underground electric railroad in London. As far as the electrical equipment and its operation is concerned he finds no fault, and he says it is all right, but as for the appointments and provisions for the convenience and comfort of the passengers the system is wretched and unattractive. He says the cars are dingy, cheaply built and badly lighted.

While our English friends have the reputation of doing things well when they undertake a task of this sort, they could learn a great deal by studying American methods. No doubt if the English rapid transit officials could see some of our elegantly appointed electric cars they would open their eyes in astonishment.

New York is not alone in the matter of inferior rapid transit facilities; the great city of Paris is about as badly off—probably worse; and great dissatisfaction exists there on account of the difficulty experienced in going from one part of the city to the other. The Government is to be asked for a concession to construct a rapid transit line. Plans have been proposed by M. Eiffel for the construction of a circuit route through the central part of the city, two-thirds of which will be tunnel and the other third viaduct construction. The length of the road will be $7\frac{1}{2}$ miles, and it is stated that M. Eiffel has the support of capitalists and the steam railroads.

STEAM CONDENSERS.

Theoretically, the gain of pressure in a cylinder should increase with the ratio of expansion of the steam, but, as a matter of fact, this is true only within certain narrow limits, and an expansion which yields a mean effective pressure less than half the difference of the extreme pressures will result in a loss from the excessive initial condensation, which becomes greater as the limits are exceeded. Still, it is true that the economy does increase with the range of pressure and temperature in a cylinder if the expansion be not excessive, but this increase is so slight comparatively that the additional range through the vacuum is unimportant with a high initial pressure, particularly when it is remembered that the exhaust steam cannot be used for feed-water heating.

In the system of multiple expansion the conditions are again changed. Here the low pressure cylinder subjects its steam to the same influences that gained the economy in the case of the single cylinder working with low pressures. By a division of the fall of temperature between the cylinders the internal condensation is reduced, and the value of the condenser again becomes probable. Even with this construction, however, a total net gain is by no means certain, and circumstances may very easily cause a considerable loss in its use.

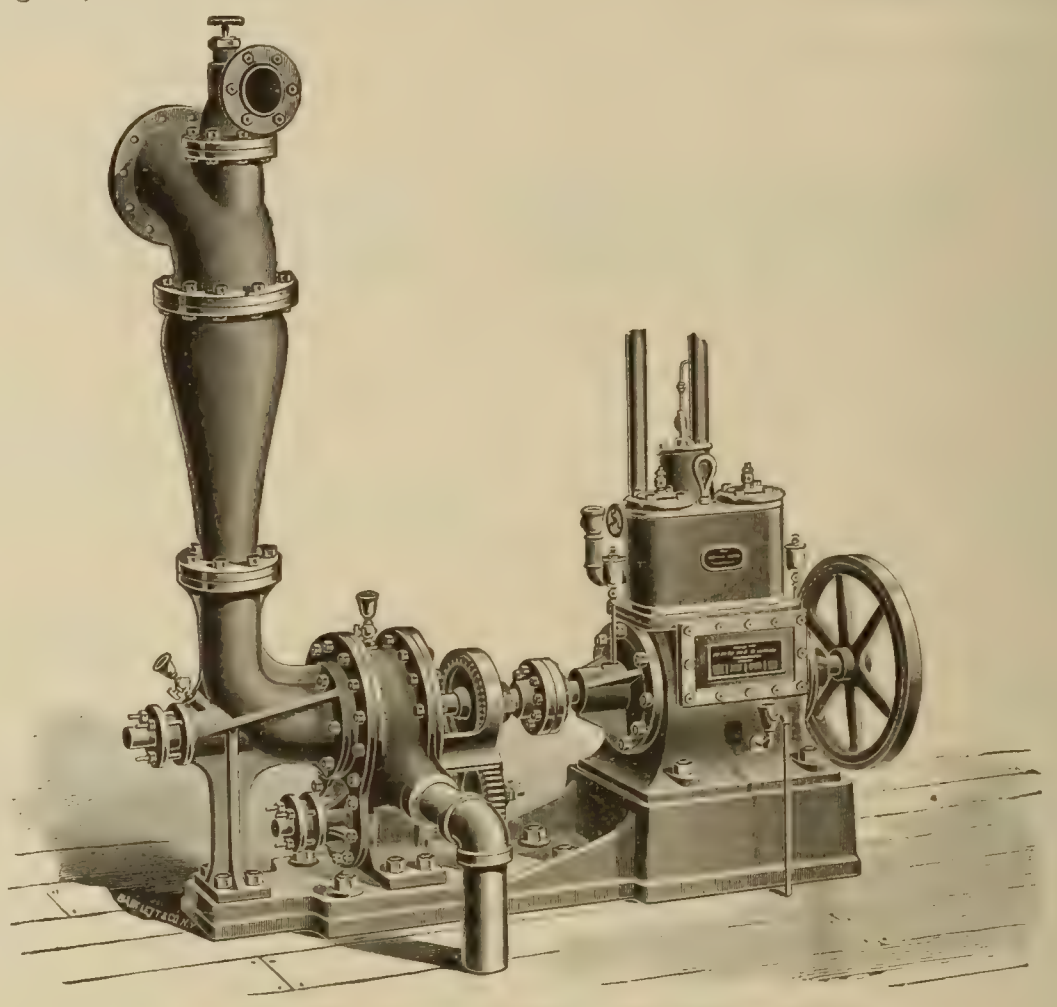
The greatest expense is the loss of heat for feed-water, which is constant, and in round numbers amounts to about two-thirds of the gain by condensing. The remaining third is the quantity subjected to varying conditions, which may easily make a vacuum a dead loss. For instance, the quality of the work done by the engine has a most important bearing in this connection. With a variable load—as in electric and similar industries—the capacity of the condenser must be sufficient for the greatest demand upon it, so that at the average load, when the expansion is already too great for economy and the steam consumed in forming the vacuum is the constant amount for the maximum power of the engine, then the net result is almost certain to be a considerable loss.

Then, again, with a condenser belted or otherwise operated from the engine the economy of the condenser is that of the engine with a consumption of less than 20 pounds of steam per horse-power per hour; and the range of conditions over which the condenser is valuable is much greater than in the case of the independent direct-acting pump taking steam full stroke with a water rate of probably 200, or more than ten times as great as in the former case.

In general it may be stated that only under the exceptionally favorable conditions of a properly proportioned condenser of an economical type; an engine not too large for the work, and a load variable to but a slight degree, is a condenser at all advisable. So seldom are these conditions realized in practice that probably not one plant in five could be run with this extra mechanism at a profit over and above what could be obtained without it and with a good form of feed-water heater. Repeated expert tests have shown this to be true, and a better proof is the general acceptance of the fact by those most interested—the manufacturers

In the few cases where it is undoubtedly commercially valuable the structural disadvantages of the independent condenser have been against it as much as the inefficiency of the independent system

Recently a combination which incorporates the advantages of both has been designed It consists of a Dow Positive Rotary Pump, coupled direct to a small Westinghouse engine, as shown in the accompanying illustration, and is briefly a high-speed independent condenser with all the economy of operation found in the belted form. With the results indicated by a practical test of this form of condenser in the New England States during the past year, many of the objections to such a plant are removed and the possibility of economy extended over a greater range of unfavorable conditions.



ROTARY PUMP AND HIGH-SPEED CONDENSING ENGINE.

RAPID TRANSIT IN FOREIGN CITIES.

Mr. Osborne Howes, Jr., of Boston, has been compiling statistics regarding rapid transit systems in various English and European cities, and has submitted his report to the Boston Rapid Transit Committee, for whom his investigations were undertaken. We give an abstract of his report, which will, no doubt, be of great interest to our readers.

It may be laid down, says Mr. Howes in his report, as a rule having few if any exceptions, that in the franchise granted to street railway companies in the cities of England and of the continent of Europe, the Government,either national or municipal, reserves to itself the right to fix the rates of fare and the number of trips which shall be run during the day and night; to decide the form of track that shall be used, and the part which the companies shall pay of the expense of paving, cleaning and watering the streets through which the tracks run, and, finally, to purchase the entire plant, either at any time or at the end of a fixed period. In other words, many of the rights which the American municipalities have surrendered to street railway companies, the municipalities of the Old World have jealously retained.

In Manchester, for example, the fares are based upon a sliding scale, graded by distance travelled, and run from 1d. to 6d. (2 cents to 12 cents), the latter applying to the longest route, which covers a distance of about six miles. The great majority of the fares collected are 1d. and 2d. fares. This method of grading fares, which has recently been adopted, is said to be satisfactory to the people and profitable to the company.

The tide of travel in Manchester, as in Boston, is inward from the suburbs in the morning and outward in the afternoon, though pleasant weather tends to equalize matters by sending excursionists out of town in the morning and suburban shoppers in and out of town during the middle of the day. The company regulates its trips by its patronage, putting on and pulling off cars as demand increases or slackens.

In Birmingham, the leases of the various roads have been given out, without competition, to the companies that now hold them, for a term of 21 years, these leases including such extensions as the municipality may from time to time construct. Under the terms of these contracts the companies agree for 14 years to pay annually, in addition to all parish, municipal and national taxes that may be regularly imposed, 4 per cent. of the gross cost of constructing the tracks, including in this cost the expense of paving or repairing between the tracks and for 21 inches on either side. For the succeeding seven years the rate of payment is 5 per cent. of the gross cost. The companies are also compelled to pay the entire cost of all repairs that the city officials consider it necessary to make on the tracks or the road surface in its immediate vicinity. There is no rule regulating the number of cars that the companies shall run. Seats must be provided for all who ride, and it is the duty of the police to enforce this law, and fines for violation are imposed with more or less frequency.

The street railways of Berlin have only a traction service of horses. It is the wish of municipal authorities to have electricity by the conduit system substituted, but the chief company, Der Grossen Berlin Pferde-Eisenbahn Action-Gesellschaft, is unwilling to incur this increased expense, for the reason that after a number of years the street constructions of all kinds revert to the city, and the company does not care to forfeit an unnecessary amount of property, by investing the fresh capital needed to make these improvements.

The company has to pay for its use of the public streets a tax upon its gross income of 4 per cent. when this income is but 6,000,000 marks or under, and ascending to 8 per cent. tax per annum when the gross income is 15,000,000 marks or over. The company paid of last year's receipts 7¾ per cent. to the Government,that is, a sum equivalent to $247,625. Besides this, the company has to pay a tax on all of its real estate, an income tax on its declared profits over 4 per cent., and in addition its stockholders have to pay an income tax on their dividends, as though the company had paid nothing.

The city authorities reserve to themselves the right to regulate the rates of fare and the time-table of trips. The company cannot carry in any car more than its seating capacity, and if it failed to provide a sufficient number of cars for ordinary demands, the municipal authorities would instantly cause the omission to be made a matter of official inquiry.

There is a strong competition going on between the street railway lines and the state steam railway lines. The policy of the latter to reduce their rates of fare and improve their facilities is forcing the street railways in self-defence to offer larger inducements in the way of fares and more frequent trips.

Buda-Pesth, a city of about 500,000 people, is the only city in Europe that has a direct working electric railway. There are three of these lines already in operation, and a fourth, on a new system, will probably be built next year. The price for a trip in the electric and horse cars is 6 kreutzers per stage, that is, about 2½ cents for an average distance of two miles. If the so-called Greathead tunnels of London, with their stations, trains, etc., were to be literally copied in Boston, they would not give general satisfaction. They do afford a reasonably speedy transit. The tracks are not evenly laid, unlike in this respect most English railroads; the cars are cheaply built, with poor springs and dingy furnishings, and are badly lighted, even though electricity is used, while the stations and their appointments are exceedingly unattractive.

There are a number of serious defects in the Greathead tunnel system, as it is exemplified in the London and Stockwell line. The question to consider is whether the merits of the system could be taken and its defects rejected in an American adaptation. It would be necessary to continue the single tunnel feature, for by means of this the expense is reduced, and a cheap, easy and tolerable fair method of ventilation is secured, and if the tunnels were made smooth on the inside, by filling up with cement the spaces between the flanges, it is probable that the noise now complained of would be very decidedly reduced. The stations, the elevators, the tracks and the cars could all be made so as to be much more sightly and comfortable—one or both; while if the tunnels could be run between stations in practically straight lines, not a little of the discomfort incident to travel in the London tunnels could be avoided. In other words, the Greatead system furnishes the suggestions, at least, of a method of urban rapid transit, which might be wisely adopted in Boston, if it is thought desirable to have a system of rapid transit entirely independent, though connecting, with existing systems of transit, either of steam or street railway.

The Central London tunnel will have a diameter of 11½ feet, and will cost, simply for tunnel construction, about £600 per yard. Mr. Greathead estimates that it will cost about 4 shillings per square

yard to remove the earth, and is of the opinion, from his experience as consulting engineer of the North River tunnel, that the expense would not be much more in the United States.

The underground steam railways of London are owned and worked by the Metropolitan and District Companies. The service begins at 4 A. M. and ends at midnight. The time required for making the circuit trip is one hour and ten minutes. The fares are, in substance, for short distances: per mile, first-class, about 4 cents; second-class, about 3 cents, and third-class, about 2 cents. The two roads carry in a year about 40,000,000 passengers each over their lines. They pay the interest on their bonded indebtedness, but give little or nothing to their stockholders. This financial result is due partly to the great cost of construction, averaging $4,000,000 per mile. The tunnel lines are only of use for urban and suburban travel. These underground roads are not financially successful, and it is questionable whether they can ever be made so.

In spite of the wide streets and boulevards, the numerous omnibus and tramway lines in Paris, and the system of circuit railroad, maintained by the railroad company of the West, the people of that city are greatly dissatisfied with their local methods of transportation.

There have been a number of projects prepared for meeting and overcoming this defect. The one which seems to have the best chances of success, because it has been prepared by a distinguished engineer, M. Eiffel, has the support of wealthy capitalists, and is to some extent approved by the great railway companies, consists of a circuit route through the central part of Paris of about 7½ miles in length. Nearly two-thirds of this would be by tunnel and one-third by viaduct.

M. Eiffel's first intention was simply to obtain a concession from the Government permitting him to form a company to build this road, under an agreement to divide with the Government all profits over 8 per cent.; but apparently, he has not yet succeeded in obtaining the approval of the Minister of Commerce, or winning the consent of the Municipal Council of Paris, and it is also intimated that, failing to obtain by private subscription the money needed, the next proposition will be for the State to guarantee interest and principal on the bonds that may be issued for the money needed to build this road, which may be undertaken either by one of the great railway companies, such as the North or West, or by a corporation formed for that purpose. The cost of the work proposed in the last plan was estimated at about 84,000,000 francs, or, say $2,400,000 per mile.

The new overhead railway in process of construction at Liverpool is owned and will be operated by a private company, which has acquired the concession from the Liverpool Dock Board for a period of 999 years. By the terms of this concession the railway company pays to the Dock Board a ground rent agreed upon for the land occupied by it, and agrees to divide its profits with the board after paying 5 per cent. per annum to its shareholders. The Dock Board reserves the right to terminate the lease at any time by the purchase of the structure and equipments at an agreed-upon valuation. The road will be put in service in about a year more. It will be operated by electricity, the cars taking it from a wire fastened to the structure. It is the first elevated railroad, so called, that has been built in Great Britain, and the estimated cost of construction and equipment is $400,000 per mile.

THE STEAM-LOOP.*

BY WALTER C. KERR.

The steam-loop is generally called an ingenious device, and, if so, the ingenuity certainly appears at once in the name, "steam-loop," a name which, though almost meaningless, seems very consistent with its simplicity. The name has the further merit of not portraying any of its functions or peculiarities, and hence cannot be an embarrassing restraint, as is so frequently the case with names attached to mechanical apparatus.

That so simple an application of nature's laws as is involved in the steam-loop should not have been turned to useful effect earlier is at first thought strange, but as one looks deeper into the subject, the reasons become more apparent. While no engineer is unfamiliar with the phenomena on which it depends, it has been interesting to note that even those best informed in practical steam engineering or theoretical research in thermo-dynamic science seldom understand its action on first acquaintance, though they soon recognize in it a new combination of functions.

Its mission is the simple and useful one of returning water of condensation to steam-boilers. Its chief characteristics are that its action is continuous, rapid and positive, and that it is a closed system operating under widely varying conditions, without valves or adjustments. Its construction is simply that of ordinary piping.

The principles on which its action depends are as follows:

Difference of pressure may be balanced by a water column.

Vapors or liquids tend to flow to the point of lowest pressure.

Rate of flow depends on difference of pressure and mass.

Decrease of static pressure in a steam pipe or chamber is proportioned to rate of condensation.

In a steam current water will be carried or swept along rapidly by friction.

To these simple statements there will probably be no dissent. We have all used them in many ways, and some of them have disagreeably used us in a manner quite unwelcome. But it remained for the steam-loop to collect a few of these erratic agents and from them create a useful system, combining the certainty of flow due to difference of pressure with the quiet uniformity with which steam condenses, and with the force we see uselessly expended in the hampering of our steam-heating apparatus.

It will be evident that the steam-loop, therefore, contains no mysterious factors, even though, like the steam-injector, it has been called a paradox.

We have here a working model (see Fig. 1), the steam-pipe passing from the boiler to a separator near the engine, which separates the water of condensation and entrainment from the steam. The drip from the separator is below the boiler, and evidently were a pipe run from this drip outlet directly to the boiler, we would not expect the water to re-

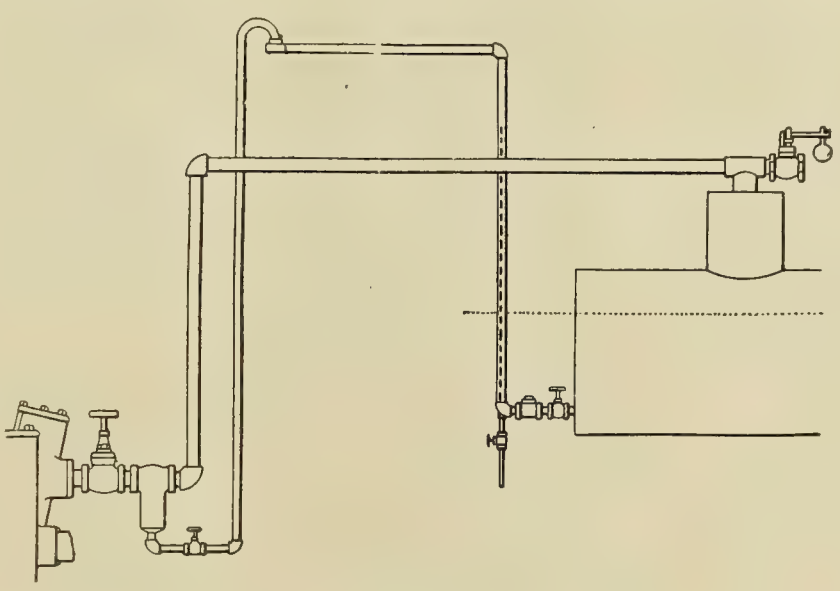


FIG 1.

turn up-hill. Moreover, the pressure in the boiler is (say) 100 pounds, while in the separator it is only 95 pounds, due to the decrease in pressure in the steam-pipe, by reason of which the steam flows to the engine. Thus the water must not only flow up-hill to the boiler, but also must overcome the difference in pressure. The device to return it must perform work, and in so doing heat must be lost. The loop, therefore, may be considered as a peculiar motor doing work, the heat expended being radiation from the upper or horizontal portion.

We are now prepared to examine its mechanical operation, which is best done with the model in action. The form of separator is immaterial, there being many kinds, differing more or less in construction and efficiency. The one in model is simply an elbow turned down into the body of the device (see Fig. 2), throwing the steam against a perforated plate above which the dry steam is removed by a pipe leading to engine, while the water collects below.

From the separator drain leads the pipe called the "riser," which at a suitable height empties into the "horizontal." This leads to the "drop-leg," connecting to the boiler anywhere under the water-line. The riser, horizontal and drop-leg form the loop, and usually consist of pipes varying in size from three-fourths inch to two inches, and are wholly free from valves, the loop being simply an open pipe giving free communication from separator to boiler. (For convenience stock and check valves are inserted, but they take no part in the loop's action.)

Suppose steam is passing, engine running, and separator collecting water. The pressure of 95 pounds at the separator extends (with even further reduction) back through the loop, but in the drop-leg meets a column of water (indicated by the heavy broken line), which has risen from the boiler, where the pressure is 100 pounds, to a height of about ten feet; that is, to the hydrostatic head equivalent to the five pounds difference in pressure. Thus the system is placed in equilibrium.

Now the steam in the horizontal condenses slightly, lowering the pressure to 94 pounds, and the column in drop-leg rises two feet to balance it, but meanwhile the riser contains a column of mixed vapor, spray and water, which also tends to rise to supply the horizontal as its steam condenses, and being lighter than the solid water of the drop-leg, it rises much faster. If the contents of the riser have a specific gravity of only .1 that of the water in the drop-leg, the rise will be ten times as rapid, and when the drop-leg column rises one foot the riser column will lift ten feet. By this process the riser will empty its contents into the horizontal, whence there is a free run to the drop-leg and thence into the boiler. In brief, the above may be summed into the statement that a decrease of pressure in the horizontal produces similar effects on contents of riser and drop-leg, but in degrees inversely proportional to their densities. When the condensation in horizontal is maintained at a constant rate sufficient to give the necessary difference in pressure, the drop-leg column reaches a height corresponding to this constant difference and rises no further. Thus the loop is in full action and will maintain circulation so long as steam is on the system and the differences of pressure and quantities of water are within the range for which the loop is constructed.

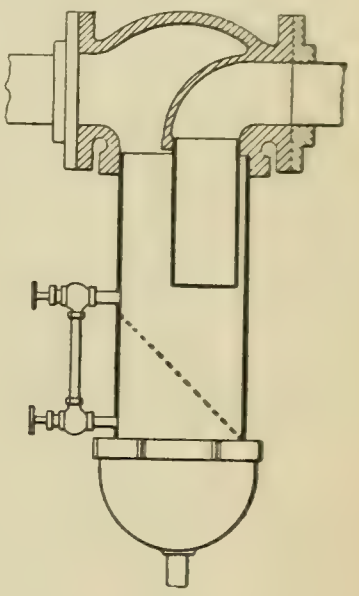


FIG 2.

* Abstract of lecture delivered before the Franklin Institute, Philadelphia, February 27, 1891.

THE PROPOSED UNDERGROUND ELECTRIC RAILWAY IN PARIS.

According to the vote of the Paris Municipality, says the London *Electrical Review*, the Administration has opened an inquiry into the scheme for the construction of underground electric railways in that city. This project, which is due to M. Bertier, provides for a line between the Bois de Boulogne and the Bois de Vincennes, the railway passing under the Avenues d'Eylau, Victor Hugo and Champs Elysées, Place de la Concorde, Rues de Rivoli and Saint Antoine, Place de la Bastille, Rue de Lyon, Boulevard Diderot, Avenue Daumesnil, Rue Rambouillet, Rue Erard, Boulevard Diderot, Place de la Nation, and the Cours de Vincennes.

It is to be 6.82 miles in length, and comprise a single tunnel made of iron instead of masonry. The joints of the plates are to be made water-tight, and prevent any percolation of water into the tunnel. Efficient ventilation is to be provided by the construction of a number of shafts along the route of the line, and the tunnel itself is to be lighted by electricity. The carriages are also to be illuminated by electricity, the platforms being level with the floors of the coaches, in order to reduce to a minimum the time of stoppage at each station. It is proposed to adopt a speed of from 22 to 25 miles per hour, and a fare the same as by omnibus, namely, 30 centimes (6 cts.) for first, and 15 centimes (3 cents) for second class. It is believed that the result of the inquiry will be favorable to the construction of the line, which would be built without breaking open the public thoroughfares.

THE TROLLEY IN BROOKLYN.

The commission which was appointed by the Supreme Court to determine whether the application of the Coney Island and Brooklyn Railroad Company for permission to extend its trolley system to certain parts of its route in Brooklyn should be granted, has presented its official report. The report favors the single trolley overhead system for that portion of the road extending from the extreme

northerly side of the circle at the southwesterly entrance of Prospect Park, in the town of Flatbush, to Ninth Street at the junction of Ninth Avenue. No poles or supports are to be erected within the roadway. The circles at the intersection of 15th Street and Coney Island Avenue and at the intersection of 15th Street and Ninth Avenue are to be spanned in a proper manner, but no support is to be erected in the roadway. The circle at the southwesterly entrance to the Park is not to be traversed by the trolley system, only horse cars being permitted to cross it. The report prohibits the erection of poles or supports within the extreme circumference of that circle, and no suspended wires can cross it; underground conductors must be used.

OBITUARY.

J. H. BONN.

J. H. Bonn, President of the North Hudson County Railway Company, Hoboken, N. J., died at his home in Bonnsville, N. J., on Sunday night, November 15. Mr. Bonn was born in Norden, Germany, and was 62 years old at the time of his death. He came to this country at an early age, and settled in that part of Hoboken which is now known as Bonnsville; the place was named in honor of Mr. Bonn. His death was caused by the rupture of a blood-vessel in the head.

RAPID TRANSIT IN DETROIT.

Messrs. D. M. Ferry, George H. Russell, E. W. Cottrell and John H. Fry, of Detroit, representing the syndicate which recently purchased and consolidated all the street railways of that city, were in Cleveland a few days ago for the purpose of examining the electric cable systems in the latter place. It is their intention to give the people of Detroit rapid transit if the Council of that city will permit them to make the necessary changes and improvements. "There was a great deal of hard feeling towards the old companies which," Mr. Russell says, "has been inherited by the syndicate." But what the result of the effort to improve the transportation facilities in Detroit will be cannot yet be definitely predicted. The syndicate now owns fifteen lines of railways in Detroit, aggregating sixty miles of track, and it requires more than 2,000 horses to operate the lines at present. If the City Council will give the necessary permission rapid transit for Detroit will soon be realized.

STREET CARS.*

Some points in car-building. In building street cars three important things must be considered: First, the design; second, the material; third, the workmanship.

In regard to the first point, design, the importance of this is too often overlooked, and while many railroad operators do not stop to consider all the points involved, their importance exists all the same. The form of street car in general use is an evolution from a coach or carriage up to the street car, by the way of an omnibus, and not from a steam car down, the main object being to get the greatest amount of strength with the least amount of weight. Most of the older car-builders were formerly makers of coaches, wagons and omnibuses, to be hauled by horses, consequently they studied the problem of how to get the greatest strength by least weight, more than some of those who have gone into the business later. Well do I remember one of the old-time successful circus managers saying, after urging the reduction in weight of some parts of his vehicles, then in construction, "I would rather buy wagons than kill horses."

Of course this idea could be carried to extremes, and strength sacrificed to weight; but a few break-downs soon established safe limits. After the questions of strength and durability come symmetry and form. Cars should be graceful in appearance as well as strong and capacious. We often realize this when we are away from home, and have a chance to see the other fellow's geese, while thinking of the beautiful swans we have left behind. It is well for railway managers to put themselves in the place of would-be passengers occasionally in order to appreciate the wants and feelings of the latter. Who has not arrived in a strange city, and on emerging from the dark and smoky depot, been depressed by the appearance of a lot of antediluvian hacks and broken-down horses that might have seen duty when Adam was a boy; or beheld an old-time street car, unpainted, weather-beaten, dusty and dirty, and not have wished for something better, and finally in his hurry to reach a hotel concluded it would be safer and speedier to walk?

I remember a man telling me once of his conversation with a railroad president from whom my friend had just bought the line. He said after the transfer of stock was concluded the old president asked him how he was going to run the road. He replied by saying that he was going to put on new and better cars, which he described in detail, when the former broke in and said: "Well, if you do you will make a mistake; you don't understand the people of this city; why, they will ride in a dry-goods box if you only put it on wheels." My friend replied, "All right, you have tried your way, I am going to try mine." He did, with the result that his first year's receipts were nearly 60 % greater than the year before with the same number of cars running. This was eight years before the advent of cable and electric cars and rapid transit.

* Paper read by F. B. Brownell at the annual meeting of the Ohio Tramway Association, Akron, O., November 11, 1891.

Cars should be light and attractive in appearance, cheerful and inviting to ladies and children, and comfortable for all, so as to induce the greatest number to patronize them. I sometimes think that it takes some companies a long time to learn that they make no money from the people who walk. In these days of mechanical motors, either cable or electrical, the idea seems to be growing that the question of weight was not so much of an object as heretofore. One party, who wanted to buy cars, expressed himself to me as not caring for weight: he was not going to run a horse road; in fact, he wanted the cars as different in appearance from horse cars as he could get. I thought then, and do now, that he was mistaken, and that it would take as much coal, and would cost as much money to make steam to carry 10,000 pounds of street cars as the same weight of passengers.

The design of cars also includes the manner of getting in and getting out, so as to make both safe, convenient and speedy. The amount of money it costs in wages and interest when cars are standing still aggregates more than is often considered. I presume it is not unreasonable to assume that in a round trip of 75 minutes at least twenty are devoted to stops. What does this mean in wages to a car making 15 trips per day? A reasonable calculation gives us 300 minutes, or 5 hours per day, for conductor and driver, which, at 20 cents per hour each, would make $2 per day, or $730 per year, to say nothing of interest and other expenses that are going on all the time. Now, if this lost time could be reduced one-half, the company would be the richer by $365 per year per car, which is 6 % interest on $6,000, and is just as acceptable in way of dividends as if the result of increased earnings instead of decreased expenses.

Besides this there is the question of safety and accidents. Whatever style of car the passengers can get into or out of the quickest will generally have the least number of accidents. Surely there is much in the matter of design of cars for consideration. After the design is settled then comes the question of material.

Many buyers think there is no difference in material that enters into the construction of cars; such are mistaken. There is not only difference in the kinds of woods best adapted for certain purposes, but difference in qualities of the same wood. I have myself weighed side pillars of the same size and pattern without particular selection, and found a variation of 30 % between the lightest and heaviest and 13 % between lightest and average. It is a fact that the strength and weight of ash increases in the same proportion—and the heavier it is the stronger it is. Builders do not always agree on the question of the kind of timber best suited for certain purposes. It sometimes, if not often, happens that one kind of timber is better for certain things than another, but if the former is not as well seasoned as the latter, then the latter may give better results. The care and seasoning of green lumber until it is fit to use in work is great and requires long experience and much expense. It makes a difference in the cost of a car if it is made of lumber that has been carried from one to four years, is air dried and seasoned so as to retain all its strength and lasting qualities, as well as a difference in its life of usefulness, for if made from kiln-dried or only partially dried material the former will be found to have but little strength, while the latter will soon rot and go to pieces. A railroad superintendent told me once in speaking of some new cars that when his men bored into the sills to put in some bolts the sap in the wood ran down the bit. It is only a question of time, and a very short time at that, when those sills will be rotted out and require replacing. Even though a car is new and nicely painted, and there are no defects visible, it does not follow that none exist.

A few weeks since, in talking with a lumber salesman, he asked how long we thought certain kinds of material should be kept before using. I replied about four years: three at least. He laughed at the idea, and said he could prove he had sold lumber of the same size, that in less than six months from the time it was loaded at the mill went out of the shop in street cars. Now what does such saving in time mean to a manufacturer? Only a difference of 20 % from interest charges alone.

The foregoing only applies to lumber, but there is not a thing we buy for cars, from nails and glue up to paints, varnishes, carpets, bronze trimmings, etc., in which there is not a difference of 10 % to 33⅓ %, and while preparing this article I was interrupted by a salesman who offered me supplies for cars 40 % cheaper than we had been buying, and, as he said, equal to the best. He stated he had sold one firm two lots of trimmings, but in answer to my inquiry as to whether they were copper or brass, silver or nickel-plated, he did not know, as he had only been representing the firm since October 1. We have built cars for railroad companies who in giving directions for color have taken their ideas from an elegantly gotten up sample-book by one of the largest firms in the country. The sample looked well, and so they selected it, but the price was only 22 cts. a pound. If left to our own selection, however, we would have used the color costing anywhere from $2 to $6 per pound. It would take an expert to note any difference when new, but a blind man could see a great change in a year or two hence; one would be bright as ever, as long as any color was left, the other—well, it would not be long before it all did leave.

After material is chosen, then comes the workmanship, as the vital parts of the work are mostly concealed from view. The man who buys a car by its outward appearance only is apt to be as badly deceived as those who have bought gilded nickels thinking them $5 gold pieces.

At the present time the framing of the woodwork—that is, the tenoning, mortising, etc.—is all done by machinery, and one might reasonably ask how is it possible to put the work together wrong. It will be difficult to explain how, in all its details; besides it would tax your patience quite a little if I were to undertake to do it. But if a man is fortunate and careful enough to set his machine right the work coming through it will probably be right, but if he is not, then the trouble commences, and instead of tenons driving into mortises so the shoulders make a tight, close joint, the latter will gape open like the mouth of a hungry fish, and make a lodging-place for dirt, and moisture, and dampness to settle which will soon rot out the tenons, and your car commences to wear and creak like an old-fashioned rope bedstead. But supposing the mill-work is well done, and it goes to the body-builder to be set up, here again are many opportunities for slighting the work. The builder may fail to get lead in all the joints, or in order to deceive his foreman he may get lots of it where it was easy to put it and would be seen but not needed, but none where it was more difficult to place and would do the most good. Instead of drawboring his stuff and putting in close-fitting wood pins that would not rust or rot off, he drives in a nail or screw that perhaps splits the timber and only partly fills the hole bored for it in the mortise: or, in his haste, if he is a piece workman, he may drive home a tenon too big for a mortise, and split the latter open in an effort to make two wrongs right. When he comes to put on his panels he may use white lead or glue. If the former, the probabilities are he will get more where it is not needed and will do more harm than good, and if panels are glued on it may be done on surfaces imperfectly heated, so that the glue is chilled before contact is made, and the result is no adhesion: but after it is all done and the panel strips are put on, who can see it?

It would not take many months' use to develop bad results that any one could see. After a car is built and painted and finished, who can tell whether it is well made and will be durable? The only test that I know of is that applied by jewellers in purchasing gold or silver ware, viz, who is the maker?

As to the care of cars, so as to prolong their attractiveness and usefulness, more can be said than time will permit. It is too often the case that a company will go to great expense of time and money in getting cars that will be beautiful and all that the most exacting could wish for, and take great interest in them for a few brief weeks, but soon the novelty is gone and the cars are left to the tender mercies of the conductor and foreman. The manager forgets that it was a necessity for the cars to look well when first put on the road. That same necessity exists as long as it is expected to carry passengers, and as the car begins to look dull in using, the varnish is allowed to perish, as perish it will, even if the best is used. When the varnish is gone the paint soon follows, and who wants to ride in such a looking tub? The people walk, and the company loses money; no dividends are paid: the road is sold out and falls into hands who believe in keeping things up, and there is a change for the better.

In a few words I would say: A new car, if well painted, ought not to require repainting in ten years, but it should be varnished at the end of the first year and every six months thereafter.

The inside of the car should be cleaned well at least once a week, using as little water as possible: the more water put on the floor of a car and around the bottom of the pillars and on sills the worse it is. It is apt to cause quick rotting.

The seats and backs and wheel-houses should be taken out at the end of the first year and once every six months thereafter, and the covers and inside work well painted with good oil paint. The roofs should be painted every six months with one coat of white lead or oil, or tint to suit.

The manufacturer and buyer should bear in mind that it is not the first cost of a car that should be considered of most importance, but the principal and interest cost of maintenance for ten or twelve years and the condition of the car at that time.

A small interest charge is quickly overbalanced by a large expense for maintenance.

CLEVELAND NOTES.

Hathaway & Robinson, Cleveland, O., dealers in electric railway supplies, report a good business.

The Hill Clutch Works, of Cleveland, are at work filling a large order for the West End Electric Railway power-station in Boston, for clutches, shafting, etc.

The Walker Manufacturing Co., Cleveland, O., is celebrated for the cable-driving machinery which it manufactures. The Walker Patent Differential Cable Drum is said to be the only proper method of driving a cable. The company makes drums and all the machinery necessary in the operation of a cable railway.

The Van Dorn Iron Works, of Cleveland, makes all kinds of iron goods, including poles, brackets, cross-arms, etc., for electric railway and electric light uses.

Mr. Eldridge Packer, representative of the Rochester Car Wheel Works, New York, was in Cleveland after the Akron Convention, and secured orders for several car-loads of wheels to be used on Cleveland cars.

Mr. J. A. Hanna, of the J. G. Brill Co., Philadelphia, was also in Cleveland, and did some good work in the interest of his company. There is no doubt that some good orders will be received from him at headquarters.

WILLIAMSPORT PASSENGER RAILWAY COMPANY.

The Williamsport Passenger Railway Company, of Williamsport, Pa., commenced in May last to change its motive-power from animal to electric power. The road had 5½ miles of centre-bearing rail and 9 one-horse cars in operation. Four miles have been replaced and two miles of double track laid with 60-pound Wharton girder rails. The equipment consists of ten 16-foot cars with McGuire trucks and Westinghouse Single-Reduction Motors, the power being furnished by the same company's make of generators. The overhead construction was carefully done, regardless of cost, to remove any municipal objection that might be made. Four cars were put in operation the 6th of August, and four additional cars on the 15th of November. The road will be extended 1½ miles further to a suburb

THERE AND BACK.

(*Continued from page* 171.)

Morning again, although it would take a Pittsburger to believe it—for the tobacco-hued climate, although of a fashionable tint, is not conducive to the ambition of the devotees of early rising, but, somehow or other, after lighting the gas we manage to get dressed and soon find ourselves in the breakfast-hall, in which, seated at divers tables, lots of familiar faces meet our view. Here we notice the well-known face of Vice-President John A. Brill, of the J. G. Brill Company, talking with another capital good fellow, Hanna, of the same concern, while at an adjacent table W. R. Mason, the well-known and popular President, A. H. England, Secretary, and D. B. Dean, of the Electric Merchandise Company of Chicago, are holding counsel with Dr. Burton, the inventor of the Burton system of electric heating—by long odds the most perfect system of electric heating upon the market. Sitting down to enjoy our grapes, our note-book records the fact that John Geeghan, of J. H. Bunnell & Co., of New York, Wm. H. Gordon, of the same city, and Theodore P. Bailey, of the Thomson-Houston Company of Chicago, and Elmer P. Morris, of the same company, are present with many others whose names it is impossible for us to know of. Soon after leaving the dining-room the smiling face of Judge John W. McNamara, of Albany, crosses our vision, and, almost immediately afterwards, we find ourselves talking to Mr. E. H. Oswald, of the well-known firm of Benedict & Burnham Manufacturing Company of New York, with whom we just parted company; President Partridge, of the Partridge Carbon Company of Sandusky, O., accompanied by a number of friends, accosted us. It is a little too early in the day, so we contented ourselves with an agreement to meet him later on; now we are shaking hands with Mr. J. Winfield Peugh, of the Robinson Electric Truck Company, whose new truck is most admirably adapted for gearless motors; from him we learned that the prospects for his trucks are all that he had expected. Strangely enough, the next man encountered is Mr. Albert Hay, a quiet, thoughtful and earnest exponent of his company's goods, whom we had not seen since the Washington Convention, when he represented the Cambria Iron Company, but has now joined forces with the Bellwood concern. Mr. Hay possesses the faculty of popularizing himself by his very earnestness, and the charm of his manner, which wins him friends wherever he goes.

The work of arranging the exhibits both on the boats and in the rooms and hotel corridors goes on merrily; so likewise does the festive tack hammer, [illegible] totally effacing all semblance of dado, paper or frieze on the walls of the hotel rotunda.

Towards noon no less than thirty or forty have inscribed their names upon the official register of STREET RAILWAY NEWS. Every train that reaches the city brings its complement of delegates, supply-men, visitors, hangers-on, and others, indicating that the number of visitors will far exceed the accommodation provided. The evening trains bring in a tremendously heavy contingent, and now the ringing of the tack-hammer is heard with a vengeance, and the rotunda of the hotel has assumed the appearance of a crazy quilt, fresh from the asylum. In front of the hotel office can now be seen the well known faces of B. G. Hann, of the New York Car Wheel Works, H. McL. Harding, C. B. Osgood and J. L. Barclay, also Stewart and Atkinson, of the Westinghouse Electric Manufacturing Company, while John N. Stewart, President of the Ohio State Tramway Association, is seen flying hither and thither working for Cleveland as the next camping-ground of the Association. A group of Edison men are now to the right of the hotel office—Shain, Chinnock, Muir, Green, Silsby, Kelley and Silverman—and, as we follow them into Parlor A, where their magnificent exhibit is displayed, we cannot help feeling that "it is good for us to be here." And so it goes on until the last train is in—the last contingent of the day has arrived, and the myrmidons, for the nonce, cease to come—then it is that the Brill Company makes its record as one of the princes of reception—for if any gentleman visiting its headquarters on that eventful night fails to meet with a "reception" it is certainly neither the fault of either Messrs. Andrews nor Hanna, and the air of "Where did you get that hat?" makes the welkin ring.

Practical jokes and undeniable good-fellowship reign supreme, and it is in the wee sma' hours of the morning that we creep into our beds, glad of at least a few hours' surcease from the excitement and hospitality incident to such an occasion.

(*To be continued.*)

this winter, and some three or four miles additional track laid early in the spring.

The officers are: H. R. Rhoads, President; John Lawshe, Treasurer; J. F. Starr, Secretary; H. C. Young, Superintendent. Directors: H. C. Parsons, C. L. Munson, Jno. R. T. Ryan, Wm. Emery, H. W. White.

THE WEEK'S RECORD OF STREET-RAILWAY NOTES.

CALIFORNIA.

OAKLAND.—Oakland, San Leandro and Haywards Electric Railroad Company will erect car and motor house.

COLORADO.

BOULDER.—Street railway suspended operations.

CONNECTICUT.

NEW HAVEN.—Israel Kelsey, President, and Wallis W. Ward, Superintendent, West Haven Horse Railroad, thrown from carriage November 14 and severely injured.

GEORGIA.

ATLANTA.—Street-railway employés formed organization Atlanta Street Railway Employés' Union.

INDIANA.

FORT WAYNE.—November 11. Successful trial trip Slattery's storage-battery car.

LOGANSPORT.—Electric street railway running November 15.

IOWA.

CEDAR RAPIDS.—November 12. Successful trial trip new electric street railway.

DUBUQUE.—Reported Dubuque Street Railway Co. and Electric Railway, Light and Power Co. to be consolidated.

OTTUMWA.—Reported electric streets railways here consolidated.

MARYLAND.

BALTIMORE.—Bonds issued by Baltimore City Passenger Railway Co., aggregating $2,000,000, purpose cabling parts of system, on market.

MASSACHUSETTS.

BEVERLY.—Naumkeag Street Railway Co. made another petition, permission erect trolley system on number streets here.

BOSTON.—Efforts being made have West End Street Railway Co. equip cars with fenders.

BROCKTON.—Brockton Street Railway Co. granted permission increase capital stock $100,000.

LOWELL.—Lowell and Suburban Street Railway Company ordered three 500-horse-power condensing Corliss engines.

MALDEN.—East Middlesex Street Railway Co. asked permission double track Pleasant, Main and Ferry streets.

SOMERVILLE.—West End Street Railway Co. (Boston) granted permission construct electric lines through this place.

MICHIGAN.

DETROIT.—John M. Brewer and Emil Stroh granted street-railway franchise by Hamtramack township on Gratiot from old city limits to Leesville, been notified by Board Public Works, this place, not tear up street purpose constructing street railway until receive permission from city, as part route been annexed to city since franchise granted.

November 4. Standard Storage Battery Company's car running on Jefferson avenue line of Citizens' Street Railway Co.

NEGAUNEE.—Negaunee and Ishpeming Electric Railway will begin operations about December 15.

RED JACKET.—Franchise granted E. D. Ryan, November 2, said to be valueless, as Calumet & Hecla Railway Co. refuses right-of-way across company's property.

SAGINAW.—Saginaw Union Street Railway Co. will erect power-house costing about $25,000, equipped with four 150-horse-power engines, three Babcock boilers and an additional 150 horse-power dynamo.

WEST BAY CITY.—Council trying to force West Bay City Railway Co. to replace conductors, company having substituted metal boxes for collection of fares.

MINNESOTA.

DULUTH.—Duluth Street Railway Co. will have its inclined road on Seventh avenue in operation December 1.

MINNEAPOLIS.—Minneapolis Street Railway Co. will make one-story brick addition to power-house, at Nicollet avenue and Thirty-first street, to cost about $3,000.

MONTANA.

HELENA.—Reported New York syndicate purchased Steam Motor and Union Electric Railway Companies' lines.

NEW JERSEY.

CAMDEN.—Camden Electric Railway Co. been petitioned to extend tracks to Merchantville.

NEW YORK.

ALBANY.—Electric street railway to Greenbush nearly completed.

OSWEGO.—Street cars heated by electricity.

ROCHESTER.—Exchange street electric cars running from Clarissa street bridge to Bay railroad station, November 9.

OHIO.

CINCINNATI.—Reported that some miscreant been placing obstructions on track of Mt. Auburn electric railway.

COLUMBUS.—Glenwood and Greenlawn Street Railway Co. will erect one-story car-shed.

TOLEDO.—Reported Toledo Electric Railway Co. just closed contract for 36 new motor-cars and two 300-horse-power generators.

OREGON.

PORTLAND.—November 2. East Side railway on Eleventh street opened.

PENNSYLVANIA.

ALTOONA.—November 7. City Passenger Railway Co. commenced operating Broad street extension.

BETHLEHEM.—November 12. Allentown and Bethlehem Rapid Transit Co. entertained friends with excursion, and dinner at Hotel Allen, Allentown.

ERIE.—Reported Erie Electric Motor Co. will erect power-house on corner Peach and Front streets, facing the bay.

MCKEESPORT.—McKeesport and Reynoldton passenger railway in operation.

Reported McKeesport Electric Railway Co. erected trolley-wires on Fifth avenue so that many electric lamps cannot be lowered to be trimmed, causing war between railway and electric light company.

PHILADELPHIA.—Philadelphia Belt Line Railroad Co. filed bonds aggregating $250,000 as surety for construction road.

Street railways decide pay their bills for street paving to city in accordance with recent decision of Supreme Court.

PITTSBURG.—Cars of Citizens' Traction Co. to be steam-heated, steam being forced in reservoir under cars at power-house.

Right of way granted Pittsburg, Homestead and Munhall Street Railway Co. for street railway to Homestead.

Second Avenue Passenger Railway Co. made $33,000 worth improvements during past year.

Citizens' Traction Co. announces that Sharpsburg electric line be opened December 1.

F. W. Fawcett, receiver Pittsburg Knoxville and St. Clare Railway Co., will sell franchise and property company public auction December 1.

Changing motive-power to electricity Union line branch Pittsburg, Allegheny and Manchester Railway nearly completed.

On November 12 Baltimore and Ohio Railroad Co.'s employés tore up crossing Braddock and Turtle Creek Street Railway Co.'s line Rankton station, but by November 16 street railway had it relaid.

SHENANDOAH.—Efforts being made have track of street railway made 52½ inches instead of 62½ inches.

WESTCHESTER.—Numerous attempts been made wreck street railway cars.

November 10. Lenape branch of Westchester Street Railway Co. opened for travel.

Westchester Street Railway Co. borrowed $30,000 for purpose completing Lenape branch of road, and given mortgage for amount.

TEXAS.

HOUSTON.—Incendiaries set car-barns of Houston City Street Railway Co. on fire recently.

WASHINGTON.

SEATTLE.—James Street cable and electric street railroad completed to Lake Washington and Manhattan Beach.

SPOKANE FALLS.—Lidgerwood Electric Street Railway Co. has line on Sprague street nearly completed.

WHATCOMB.—Lake Whatcomb electric road running by January 1.

WEST VIRGINIA.

WHEELING.—November 10. Successful trial trip of electric street railway to Martin's Ferry.

Electric street railway erecting handsome brick buildings, including model car-barn, offices and shops.

Election of Officers.

ANNISTON, ALA.—W. F. Cook succeeded S. L. Niolon as superintendent Anniston City Railway Co.

BOSTON, MASS.—November 12. Lynn and Boston Street Railroad Co. re-elected old board of officers.

November 17. West End Street Railway Co. President Whitney and Treasurer Goodspeed re-elected.

November 12. West End Street Railway Co. Directors. G. T. W. Braman, I. T. Barr, T. J. Coolidge, J. S. Fay, Jr., E. C. Fitz, H. D. Hyde, Walter Hunnewell, E. D. Jordan, Samuel Little, W. P. Mason, Theophilus Parsons, D. N. Richards, Nathaniel Thayer, W. S. Swan and H. M. Whitney.

MARLBOROUGH, MASS.—Marlborough Electric Street Railway Co. President, Samuel Boyd; Clerk, Samuel C. Darling; Treasurer, A. C. Weeks; Superintendent, H. E. Bradford.

NEW BEDFORD, MASS.—November 10. Union Street Railway Co. Officers: President, Weston Howland; Clerk and Treasurer, William H. Allen; Superintendent, Franklin Woodman; Assistant Superintendent, Mortimer McCarthy.

NEW YORK, N. Y.—November 11. Third Avenue Railroad Co. Directors: Henry Hart, William Remsen, S. S. Riker, R. G. Remsen, R. W. Taylor, J. E. Parsons, Edward Lauterbach, Solomon Mehrbach, A. S. Rosenbaum, A. J. Elias, Alexandre Nones, S. M. Ehrlich and Abraham Ayres. Officers: President, Albert J. Elias; Vice-President, Henry Hart; Secretary, Alfred Lazarus; Assistant Secretary, John Brolles; Treasurer, John Beaver, and Superintendent, John H. Robertson.

OAKLAND, CAL.—October 30. Oakland Consolidated Street Railway Co. Board of Directors not changed. H. L. Coleman, Superintendent; Mr. Biggs, Secretary.

OGDEN, UTAH.—Capt. R. M. Spivy appointed Superintendent Ogden Street Railway Co.

PITTSBURG, PA.—November 16. Pittsburg Traction Co. Directors: W. L. Elkins, P. A. B. Widener, G. L. Elkins, Philadelphia; G. W. Elkins, T. S. Bigelow, J. Z. Wainwright and G. C. Wilson, Pittsburg. Officers: President, G. W. Elkins; Vice-President, T. S. Bigelow; Secretary and Treasurer, J. G. Traggardh.

Second Avenue Passenger Railway Co. Directors: J. C. Reilly, J. D. Callery, W. J. Burns and W. B. Callery. Officers: President, J. D. Callery; Secretary, J. C. Reilly; General Manager, W. J. Burns.

Citizens' Traction Co. Directors: James Verner, J. G. Holmes, J. J. Donnell, J. B. Jackson, C. L. Magee, H. S. A. Stewart and John Gripp. Officers: President, J. G. Holmes, Vice-President, H. S. A. Stewart; Treasurer, N. Holmes.

Citizens' Passenger Railway Co. Directors: James Verner, J. S. Browne, J. J. Donnell, C. L. Magee and H. S. A. Stewart.

STILLWATER, N. Y.—November 15. Stillwater and Mechanicsville Street Railway Co. Old Board of Directors re-elected. President, W. L. Denison; Secretary, H. O. Bailey; Treasurer, E. I. Wood.

Possible Purchases.

AUBURN, N. Y.—Auburn Electric Railway Co. desires construction material. Address T. B. Gould, President.

BRADFORD, PA.—Citizens desire electric street railway.

BROOKLYN, N. Y.—Coney Island and Brooklyn Railway Co. may require material for track extension.

CHATTANOOGA, TENN.—Chattanooga Belt Railroad Company may desire electrical equipment. (See Change of Power.)

COLUMBUS, MISS.—Local company may desire equipment street railway to be constructed here. Address Mayor for information.

DENVER, COL.—Metropolitan Electric Street Railway Company needs construction material for track extension.

GALVESTON, TEX.—Extensive electric street railway system to be constructed here. Promoters, a Denver (Col.) syndicate. Names of members unknown.

GRAND RAPIDS, MICH.—Grand Rapids Electric Street Railway Company desires construction material.

IONIA, MICH.—Citizens here just formed company for construction of electric street railway. Address the Mayor for information.

JACKSONVILLE, FLA.—Jacksonville Street Railway Co. desires electrical equipment.

Panama Rapid Transit Company will need construction material for five miles of track.

NEWCASTLE, PA.—Newcastle Street Railway Company requires material for track extension.

OAKLAND, CAL.—Consolidated Street Railway Co. may require construction material.

RICHMOND, VA.—Richmond Railway and Electric Company needs construction material.

SALEM, ORE.—Capitol City Street Railway Company needs track material for twelve-mile extension.

SAN FRANCISCO, CAL.—Some electrical engineering company may close contracts with Park Commissioners for electric road in Golden Gate Park.

SAVANNAH, GA.—City & Suburban Railroad Co. needs construction material. Address J. H. Johnson, President.

WILLIAMSPORT, PA.—Williamsport Passenger Railway Company probably requires construction material one and one-half mile track extension at once. (See Track Extensions.)

New Roads.

ASHLEY, PA.—Electric street railway to be constructed here.

BALTIMORE, MD.—South Baltimore and Curtis Bay Railroad Co. will commence construction work on its electric line at once.

BRADFORD, PA.—Expected that electric street railway constructed here next spring.

CARROLLTON, MO.—Scheme on foot for street railway.

COLUMBUS, MASS.—Local company will construct street railway here.

CLEVELAND, OHIO.—"Dummy" line to be constructed on Ansel avenue.

GALVESTON, TEX.—Reported syndicate Denver (Col.) capitalists construct electric street-railway system here.

GRAND RAPIDS, MICH.—Grand Rapids Electric Street Railway Co. after franchise for electric street railway here.

JACKSONVILLE, FLA.—Panama Rapid Transit Co. will construct a street railway to Panama Park, distance five miles.

JANESVILLE, WIS.—Chicago capitalists made proposition that if citizens this place will take $12,000 stock they will construct electric street railway here costing $40,000.

PITTSBURG, PA.—Electric street railway to be constructed on principal streets Duquesne Heights.

PEN MAR, PA.—Reported that electric street railway to be constructed this place to Germantown.

SNOHOMISA, WASH.—Electric line to be constructed to Port Gardner, distance twelve miles.

TAMAQUA, PA.—Electric street railway to be constructed to Lansford.

WESTPORT, CONN.—Prospective street railway to Norwalk.

Incorporations.

AKRON, OHIO.—November 7. Akron Transfer Railroad Co. Capital stock $30,000. Incorporators: C. W. Risley, John T. Powell, Charles S. Miller, J. W. Holloway and John T. Eaton.

ASTORIA, N. Y.—Astoria Street Railroad Company incorporated November 17. Capital stock of $100,000.

AUSTIN, TEX.—Austin Dam Street Railway Co. Capital stock $100,000. Incorporators: William Metzger, Clinton Snell and others.

CLEVELAND, OHIO.—November 11. East Liverpool and Wellsville Street Railroad Co. Capital stock $300 000. Incorporators: Albert L. Johnson, Sidney H. Short, C. E. Grover, L. A. Russell and William B. Bolton.

JACKSONVILLE, FLA.—Panama Rapid Transit Company, to construct and operate street railway to Panama Park. Capital stock $100,000. Incorporators: T. T. Stockton, J. S. Bell, H. W. Clark, C. D. Mills, M. L. Broward, G. W. Arnold and J. M. Elkins.

PORTLAND, ORE.—November 10. Portland and Hillsboro Railway Co. Capital stock $200,000. Incorporators: Thomas H. Tongue, Richard Morton and Eugene G. White.

Track Extensions.

AUBURN, N. Y.—Auburn Electric Railway Co. will make extensive track extensions in the near future. Address T. B. Gould, President.

BALTIMORE, MD.—North Avenue Railway Company to extend electric street-railway system.

BROOKLYN, N. Y.—Coney Island and Brooklyn Railway Co. will extend to Norton's Point.

CHICAGO, ILL.—Cicero and Proviso Electric Railroad Company contemplates extensive track extensions.

Cable line on Milwaukee avenue to be extended to Lawrence avenue.

DENVER, COL.—Metropolitan Electric Street Railway Co. to extend to Fairmont Cemetery.

ELMIRA, N. Y.—Elmira and Horseheads Railway Co. constructing an extension along State street.

NEWCASTLE, PA.—Newcastle Street Railway Company's lines to be extended.

RICHMOND, VA.—Richmond Railway and Electric Company asked permission extend road.

SALEM, ORE.—Capitol City Street Railway Company to extend about twelve miles.

SAVANNAH, GA.—City and Suburban R. R. Co. will make extensive additions to its tracks in near future. Address J. H. Johnson, President.

WESTFIELD, MASS.—Street railway company will extend to cemetery.

WILLIAMSPORT, PA.—Williamsport Passenger Railway Company will extend one and one-half miles this winter, and lay three or four miles additional track early in spring.

Change of Power.

CHATTANOOGA, TENN.—Chattanooga Belt Railroad Co. probably change street railway steam to electric power, using storage-battery system.

KANSAS CITY, MO.—Interstate Consolidated Rapid Transit Railway Co. probably change cable line 8th street to electric traction.

PITTSBURG, PA.—Pittsburg and Birmingham Traction Co. will change Short Line road into electric line.

Franchises.

BUCYRUS, OHIO.—November 13. Crawford County Commissioners granted franchise construction electric railway Bucyrus to Galion.

COLUMBUS, MISS.—Franchise granted local company construct street railway, work to be completed in five months.

FLORENCE, NEB.—Omaha and Florence Street Railway Co. granted franchise for street railway here.

GALVESTON, TEXAS.—November 13. Franchise granted syndicate Denver capitalists construction electric street-railway system in this city.

GLOVERSVILLE, N. Y.—Reported Charles M. Gibson secured right-of-way six rods wide through private lands between this place and Fonda, and will construct boulevard upon which to run his electric street railway.

GRAND RAPIDS, MICH.—Valley City Street Railway Co. has asked for franchise to construct and operate electric street railway on number streets here.

KANKAKEE, ILL.—Kankakee Electric Street Railway asked franchise for street railway to city limits.

SAN JOSÉ, CAL.—W. B. King has asked for 49-year franchise for single-track electric or steam street railway from northern to western city limits.

SARATOGA SPRINGS, N. Y.—Saratoga Electric Street Railway Co., franchise construct and operate street railway Congress and Front streets and Union avenue to race-track grounds.

ST. CLOUD, MINN.—Thomson-Houston Electric Street Railway Co. granted right of way to Great Northern shops.

Legal.

ANSONIA, CONN.—Members of committee appointed to hear suit of receiver for Ansonia Horse Railroad Co. *vs.* Borough of Ansonia regarding assessment of $1,500 for paving streets, unable to agree on report, and have so reported to litigants.

BATTLE CREEK, MICH.—November 9. Battle Creek Electric Railway Co. served with injunction restraining it from crossing tracks of Michigan Central.

BAY CITY, MICH.—Merritt A. Rose *vs.* Bay City Street Railway Co. for $5,000 damages caused by construction of street railway on Third street.

COVINGTON, KY.—South Covington and Cincinnati Street Railroad Co. *vs.* City of Covington: to restrain city from selling franchise of street railway company.

DENVER, COL.—Ruth L. Oakes *vs.* Denver City Cable Railway Co. for $750 for loss of valuable dog, run over by one of company's cars.

KANSAS CITY, MO.—John Costello *vs.* Kansas City Cable Railroad Co. for $10,000 damages for injuries received by being thrown to ground in attempt to alight from car.

MINNEAPOLIS, MINN.—In William Salomon *vs.* Minneapolis Street Railway Co. for $5,000 damages for being insulted on one of company's cars; a verdict of $600 was rendered plaintiff.

NEW YORK, N. Y.—Deputy Sheriff Murphy received two executions aggregating $500,643.38 against New York Cable Railway Co., favor Josiah B. Shaw, but it was said the company had no property in this city.

ST. LOUIS, MO.—Louise Bischoff *vs.* People's Street Railway Co. for $10,000 damages for injuries received in collision.

TOLEDO, OHIO.—Jacob Gurzler *vs.* Consolidated Street Railway Co. for $5,000 for being pushed from one of company's cars by conductor.

WASHINGTON, D. C.—Sarah Hardmond *vs.* Capitol, North O Street and South Washington Railway Co., for $10,000 damages for injuries received by sudden starting of car from which she was stepping.

Statistics.

CHICAGO, ILL.—Receipts of City Collector's Office from street-car companies for licenses for cars for quarter ending October 31: West Chicago Street Railway Co., $4,672.44; Chicago City Railway Co. (South Side), $4,355; North Chicago Street Railway Co., $2,626.25.

NEW YORK, N. Y.—November 11. Third Avenue Railroad Co. Total receipts for the year, $1,808,643.68; total expenditures, $1,691,741.32. Nearly 35,000,000 passengers were carried.

PITTSBURG, PA.—Pittsburg Traction Co. For year ending October 31: Net earnings, $84,000; passengers carried, 9,479,994.

Citizens' Traction Co. Passengers carried, 12,508,969, gain of 836,437 over 1890; total receipts, $962,223.31; total expense, $905,741.74; cash balance, $56,481.57.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company. Annual report: Receipts, $273,000; expenses, $223,000. Passengers carried, 6,071,000.

Foreign.

A report from St. Catherine's, Ont., says that a receiver and manager has been asked for the St. Catharine's, Merritton and Thorold Electric Railway, by bondholders who are interested to the extent of $35,000.

It is probable that the city of Hamilton, Ont., will follow the leadership of Toronto and in 1893 assume the ownership of all street railways in that city, which it has a right to do according to the reading of the street-railway franchises.

At a recent meeting of the directors of the Montreal Street Railway Company, Montreal, Que., the secretary's report for the year ending September 30 showed a net balance of $60,261.77, out of which dividends had been declared amounting to 8 %, and $2,487 placed at the credit of contingent account.

A GOOD SHOWING.

The directors of the Grand View Beach Railway, running between Ontario Beach and Manitou Beach, N. Y., held their annual meeting recently. The statement of the earnings and expenses during the year are made public as follows: Earnings, $17,976.08; operating expenses, $8,500.60; surplus, $9,475.48; interest and taxes, $4,010.34; net surplus, $5,465.14.

The company feels greatly pleased with the showing and expects to make a greater one next year. Mr. E. A. Roworth, who has up to the present time filled the position of general ticket agent of the road,

has been appointed general superintendent. Mr. Roworth is very popular, and his promotion gives his friends great pleasure.

A fully illustrated description of this road, which involved some extraordinary engineering work in its construction, was published in our issue of July 11 last.

PERSONAL.

Mr. H. H. Littell, General Manager of the Buffalo Railway Co., brother of Mr. H. M. Littell, Manager of the Mount Auburn Electric line, Cincinnati, was in the latter city a few days ago.

The Brooklyn Supply Co., of 123 Chamber St., New York, is busily engaged in the manufacture of a new and improved track-sweeper, which, judging from the model, bids fair to meet with success. Among its valuable points is a contrivance consisting of a knife or blade which will cut and remove ice that may form on the rails. The sweeper can be either pushed or drawn by any power used in propelling surface cars, electric, cable or horse.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued November 17, 1891.

463,130. Rail-Joint for Use on Railroads. James J. Anderson, Chicago, Ill., assignor to the Anderson Rail Joint Company, of Illinois, and Noel Brosseau and Eben D. Norton, all of same place. Filed Feb. 13, 1891.

In a rail-joint, the combination of two like sections grooved to receive the flanges of rails, a bolt securing the sections against the rails, feet extending laterally from the ends of each section across the railroad tie, having notches for the passage of spikes, and ribs integral with the sections and feet extending from the top of the former to the bottom of the latter.

463,136. Device for operating Railway Switches. Watson A. Brown, Rochester, N. Y. Filed Nov. 12, 1890.

An electro-magnet attached to the car and capable of being shifted from one side of the rail to the other, electric connections attached to the magnet, and means for opening and closing the circuit.

463,145. Railway-Spike Puller or Extractor. Philip Fowler, Wayne, Neb. Filed May 18, 1891.

A spike-puller or extractor, comprising a lever, two depending links pivotally secured thereto and having lower slotted ends, dogs or jaws pivotally connected together and having slots in their upper ends, nutted bolts projected through the slots and coincident holes or apertures of the links, and a main operating-lever connected to the former lever.

463,177. Car-Coupling. William R. Teeguarden, Bristol, Tenn. Filed April 4, 1891.

The combination, with a draw-head having the two jaws forming a continuous cylindrically-shaped opening, of a coupling-link constituted of two cylindrically-shaped heads connected by a web, one of these heads being shouldered.

463,187. Car-Brake. Robert R. Gairing, Cleveland, Ohio. Filed April 27, 1891.

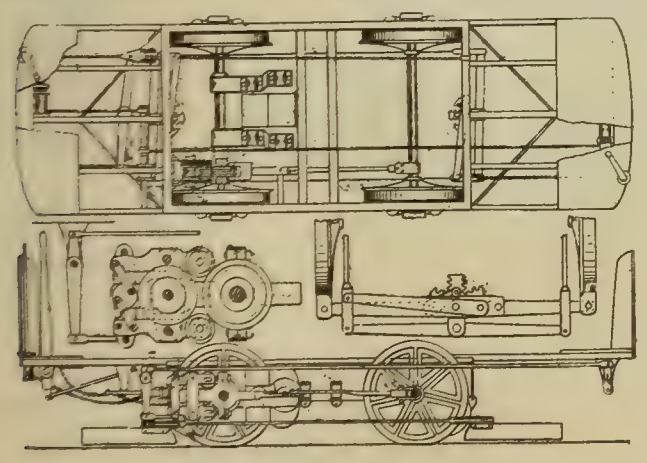
The combination, with the axle of a motor-car, of a grooved friction-wheel, yoke, drum, levers, grooved rollers, pivoted levers, discs, links, and means for operating the same from either end of the car.

463,197. Electrical Conduit. John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. Filed Feb. 10, 1891.

The combination, with the side walls of a conduit provided with rigid inwardly-extending brackets, of slot-rails provided with depending flanges on both margins and adapted to extend over the upper edges of the side walls, with their outer flanges engaging the outer surfaces of the side walls and their inner flanges engaging the brackets.

463,257. Ice-Breaker and Electric-Current Transmitter. Charles Smith, Wilkesbarre, Pa. Filed Jan. 31, 1891.

A current-transmitter and ice-breaker, consisting of a revoluble disc having a cutting-edge connected to the frame of the car, and means for adjusting the disc vertically.



463,187.—CAR-BRAKE.

463,258. Railway-Rail-Joint Coupling. George Weeks, East Oakland, Cal. Filed May 7, 1890. Renewed April 14, 1891.

In a railway-rail-joint coupling, the combination of rails having the webs provided with apertures, a fish-plate formed or provided with inwardly-extending slotted arms, a chair having its side piece provided with apertures registering with the apertures in the rails, the registering apertures adapted to receive the ends of the arms, and a longitudinal bar provided on one end with an inwardly-extending lug passing into a recess in the side of the chair and upon its opposite end with a downwardly-extending lug bearing against the inwardly-extending arm to which it is adjacent.

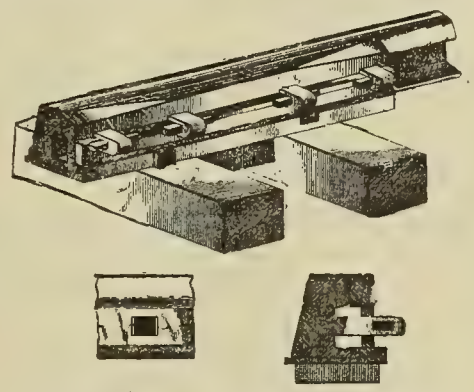
463,296. Buffer for Railway Cars. Stephen H. Springer, Des Moines, Iowa, assignor to the Springer Automatic Car Coupler Company, same place. Filed Dec. 5, 1890.

A metal-bearing for car-buffers, consisting of an elongated plate having a transverse projection on its back and centre, forming an open chamber adapted to receive and retain the end of a cross-bar or plate, flanges at the end portion of its front or inside face to produce chambers adapted to receive ends of sliding cross-heads, and perforations in its ends to admit the passage of bolts.

463,310. Crossing for Electric-Railway Conductors. William J. Silver, Salt Lake City, Utah. Filed Feb. 12, 1891.

The combination, in a wire-crossing for the wires of intersecting systems of electric railways, of an insulating hanger consisting of bars of insulating material supporting each wire and insulating one from the other, and guides, two for each wire, having downward inclinations toward the centre of the hanger.

463,315. Power-Storing Mechanism for Electric Locomotives. James A. Hockett, Stirling, Kas. Filed Oct. 22, 1890.



463,258.—RAIL-JOINT COUPLING.

The combination, with an electric locomotive, of an electric motor having a tubular armature-shaft journalled on the axle of the car, the car-wheel loosely fitted on the axle, a clutch device, and a yielding device or spring connecting the loose wheel and clutch, whereby the power of the motor may be gradually applied to the wheel for the purpose of propelling the car.

463,356. Electric Locomotive. Sidney H. Short, Cleveland, Ohio. Filed April 8, 1891.

Bevel-gearing connected with each axle and insulated therefrom, castings mounted on the axles for supporting and protecting the bevel-gearing, and flexible connections between each end of the motor shaft and the shafts of the bevel-gearing.

463,357. Car-Coupling. James Timms, Columbus, Ohio, assignor to the Buckeye Car-Coupler Company, same place. Filed July 25, 1891.

In an automatic hook car-coupler, the combination, with a knuckle having a locking-arm, the latter having an inclined lower edge, of a tilting locking-plate bearing a sliding link, the latter having a toe or projecting member in position to engage the incline of the knuckle-arm, by which engagement the knuckle is opened in tilting the locking-plate upward.

463,358. Operating Device for Car-Couplings. James Timms, Columbus, Ohio, assignor to the Buckeye Car-Coupler Company, same place. Filed July 25, 1891.

In adjunct mechanism for car-couplers, a rock-shaft bearing a rock arm and hand-lever at the opposite extremes thereof, boxes for supporting such rock-shaft, the box next the hand-lever having a vertically-elongated opening, and a recess connected with the upper section of such opening, such box having an overhanging section provided internally with a square socket adapted to receive the square section of the rock-shaft.

463,359. Motor-Car for Electric Railways. Thomas E. Adams, Cleveland, Ohio, assignor to the Brush Electric Company. Filed May 28, 1890.

An electrically-propelled car provided with a trolley or trolleys for an overhead electric line, and with glazed sight-openings in the roof of the car for observing the line.

463,419. Fish-Plate Connection for Rail-Joints. George W. Eddy, Waterford, N. Y. Filed Jan. 25, 1889.

In a fish-plate connection for rail-joints, the combination of a shoe made with elastic flanges, the fish-plate proper made with bolt-passages in lateral alignment with bolt-passages made in the rail ends, and each having an upper bevelled edge and a lower bevelled edge and arranged within the opposite sides of the rail-waists, a supplemental fish-plate made with bolt passages in lateral alignment with bolt-passages in the rails and constructed with a key-plate and a pivoted key, and bolts having heads and provided with nuts and threaded ends.

463,426. Chilled Car-Wheel. William W. Lobdell, Wilmington, Del., assignor to the Lobdell Car-Wheel Company, same place. Filed Feb. 24, 1891.

A cast-iron car-wheel having a chilled surface at the tread and at the throat of the flange, but unchilled at the outer portion or point of the flange, which also has an internally-projecting rib.

463,430. Head-Chair for Stub-Switches for Railways. Robert C. Schenck, Dayton, Ohio. Filed May 4, 1891.

A metallic head-chair made of one piece throughout and having the base-plate cored, whereby the whole may be thoroughly annealed.

463,433. Actuating Device for Car-Brakes. Victor Angerer, Philadelphia, Pa. Filed April 15, 1891.

In a brake-operating device, the combination of a main lever, a supplemental lever, both levers having a mutual fulcrum, a segmental rack on the supplemental lever, a stop on the supplemental lever, whereby the lever may be operated to apply the brakes, a controlling-pawl pivotally secured to engage with the segmental rack, another pawl for holding the rack in a given position, and a device for withdrawing the controlling-pawl from the rack.

463,438. Fender for Cars. Leopold Bertsche and Alexander Ortner, Pittsburg, Pa. Filed July 13, 1891.

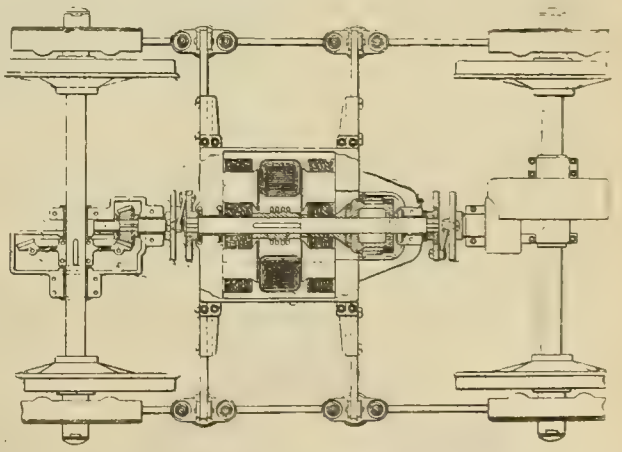
A car-fender consisting of longitudinal curved bars which are rigidly united at their ends by suitable transverse means, an axle carried by the fender near its lower end, and wheels journalled on the axle.

463,443. Rope or Cable Coupling. Charles Davidson, Guelph, Canada. Filed Oct. 14, 1890.

A coupling for travelling power-transmitting cables consisting of two members, one provided with a hook and the other with an eye, each member formed integral with a solid end terminating in the hook or eye and having the tubular shank of the same external diameter as the cable and split longitudinally on two sides, and having internal transverse serrations formed to bite into the wire wrapping on the cable ends, and pins passing through the opposite sides of the shank and the cable ends.

463,456. Metallic Railroad-Tie. Ellison Saunders, Austin, Tex. Filed June 8, 1891.

In a metallic railroad tie, the combination, with the base-plate, the blocks riveted or bolted to the base-plate with their lower faces resting on top, rail-receiving recesses in the top faces of the blocks, and spike-receiving apertures at opposite sides of the recesses, of an headed tension-rod extending through the blocks above the base-plate and provided with an adjusting-nut.



463,356.—ELECTRIC LOCOMOTIVE.

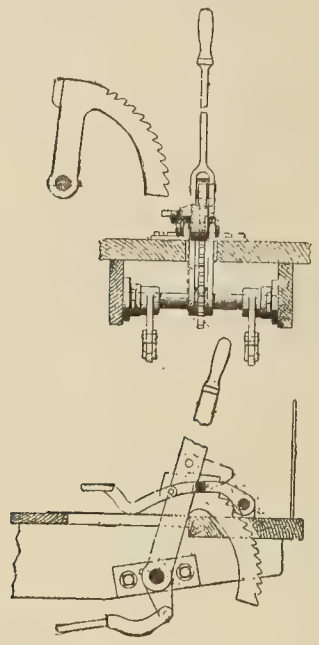
463,513. Car-Coupling. Henry W. Hoss, Gamma, assignor of one-half to John H. Ingram, George B. Aydelott, Samuel T. Aydelott, Edward Cope and John W. Delventhal, all or Truxton, Mo. Filed March 24, 1891.

In a car-coupling, the combination, with spring-pressed plates arranged longitudinally in the draw-head and opposite each other, of a coupling-link having arrow-shaped heads adapted to pass between the plates and engage them at the inner ends.

463,543. Railway Switch and Lock Apparatus.

STREET RAILWAY NEWS' PATENTS—Continued.

Henry S. Pfeil, Philadelphia, Pa. Filed Aug. 3, 1891.



463,433.—ACTUATING DEVICE FOR CAR-BRAKES.

The combination of the base, a wide-mouth-jaw bell-crank lever for throwing the switch-points, a slide moving in guideways in the base and provided with a stud or roller to operate the lever and with locking-dogs on its under side, and a lock-bar contained in a guideway beneath and crosswise of the slide and provided with notches to receive the locking-dogs on the slide.

463,579. Railroad Switch. Martin Hynes, Hamilton Station, Minn. Filed April 23, 1891.

Stationary rails of the main and side tracks, combined with movable rails, a switch-rod or lever provided with wheels, rack-bars connected to the free ends of the switch-rails, shafts provided with wheels, and rack-bars.

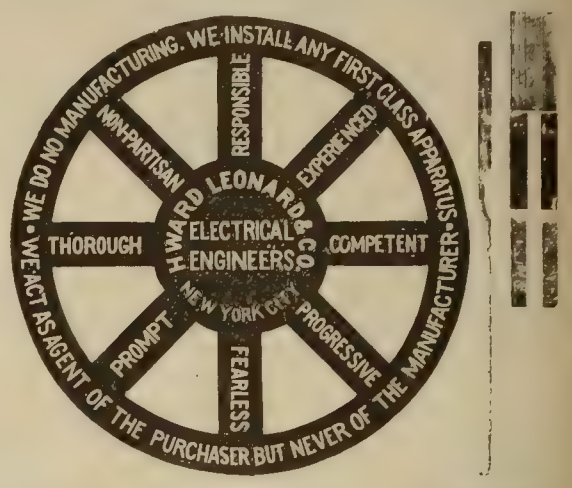
463,580. Switch-Operating Device. Nelson Newman, Springfield, Ill., assignor of two-thirds to George A. Sanders and Samuel J. Willett, both of same place. Filed July 22, 1891.

In a switch-operating device, the combination of a pivoted adjusting-bar, a lever for moving the same, a vertically-adjustable standard carried by the adjusting-bar, and a shoe on the standard.

463,598. Car-Brake. Charles W. Duncan, St. Louis, Mo., assignor of eleven-twentieths to James A. Baumgartner, same place. Filed July 2, 1891.

In a car-brake, a brake-hanger, in combination with a removable brake-shoe rigidly secured directly thereto, the brake-hanger being formed with a laterally-projecting lug portion adapted to be fitted into a recess formed in the rear side of the brake-shoe.

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MULTIPLE FIELDS,
LARGE COMMUTATORS,

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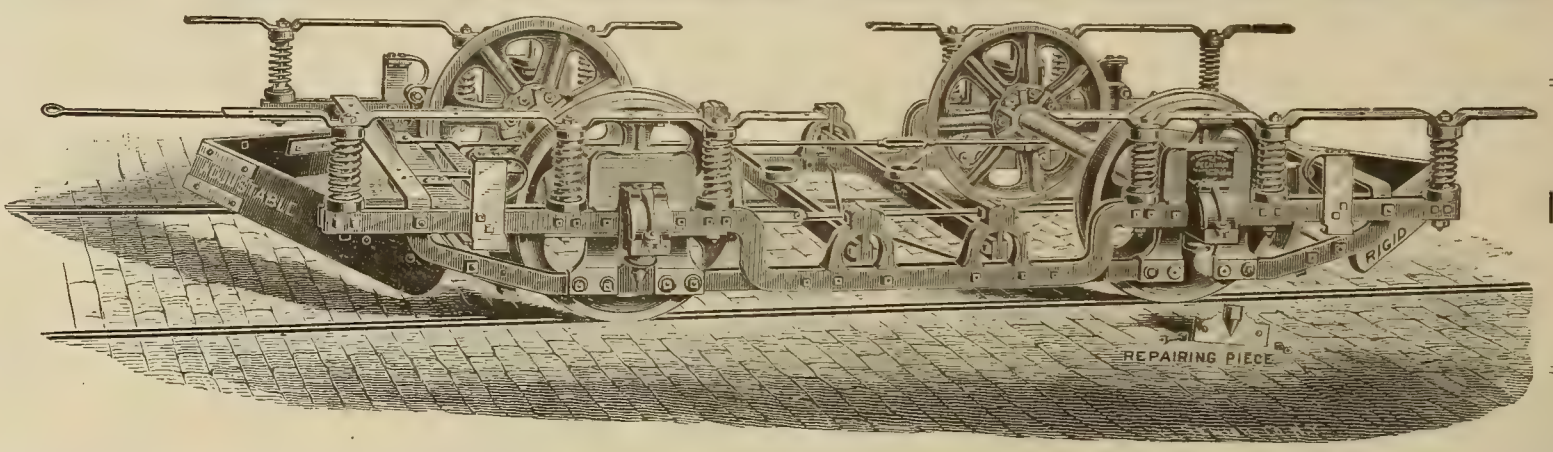
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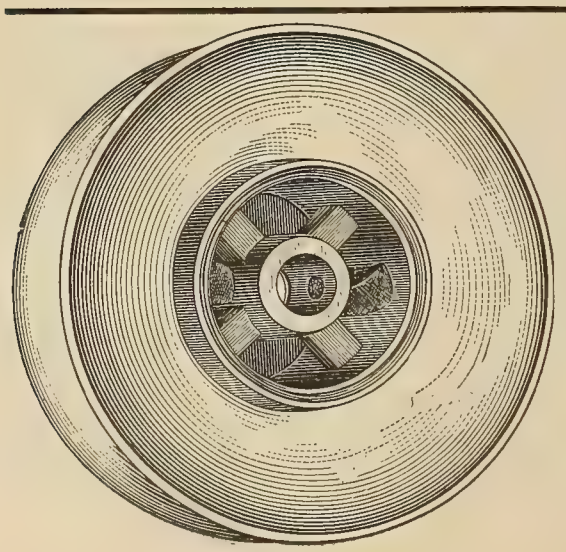
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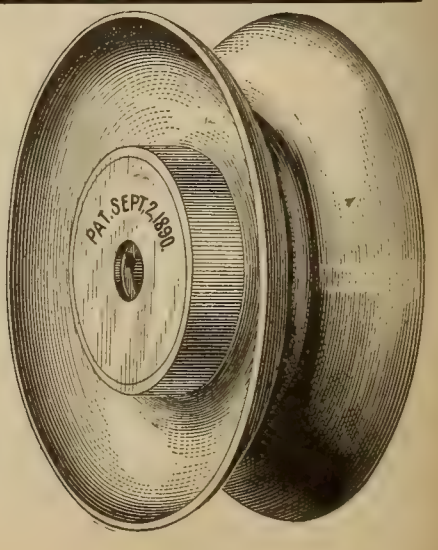
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For Electric Railways.

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It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

BADGER BROTHERS, West Quincy, Mass.





VOL. I. NEW YORK, DECEMBER 5, 1891. No. 22.

STREET RAILWAY NEWS.

(WEEKLY.)

Entered at New York P. O. as second-class matter.

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"JUGGERNAUTS."

THE "DEADLY (?) TROLLEY"—HOWL OF THE DAILIES—HORSE CARS KILL MORE PEOPLE THAN CABLE OR ELECTRIC—THE REASON WHY—RIDING ON THE FRONT PLATFORM—SAFETY APPLIANCES—"ACCIDENTS WILL HAPPEN," ETC.—RAPID TRANSIT IN NEW YORK CITY, ETC., ETC.

After being sated with the howl against the alleged "deadly trolley wire" made by daily papers the country over, it is really almost refreshing to learn that within a period of sixty days no less than twenty-nine people were either killed or suffered injuries more or less serious by horse cars in New York City alone. Truly a cruel record—a death or an accident for almost every forty-eight hours.

Experienced street-railway men and those operating rapid transit in some form or other—cable, electric, etc.—state that the records show that fewer accidents occur when cars are operated at a high rate of speed than when the old five-miles-an-hour rate was maintained.

Actual statistics show that the record of accidents where electricity has been adopted as the motive power is marvellously lower than when cars are hauled by horses. And when we come to look into the facts of the case, the reasons why are not very difficult to find. In the first place, it is an acknowledged fact among street-railway men that the permitting of passengers to ride on the front platform is highly conducive to the swelling of the accident record, as, if a passenger happens to fall off the front platform, the odds of his escaping the wheels entirely are terribly great; whereas, if he falls off the rear platform, the chances are that he will pick himself up with no injury other than that done to his clothing, and a big able-bodied ! ! ! ! Again, when passengers are allowed to ride on the front platform, they are almost certain to enter into conversation with the driver or motor man. In the operation of electric railways it is not considered good policy to allow any one on the front platform, and consequently the ratio of casualties is diminished to a phenomenal extent.

The advent of electricity as applied to the solution of the city transportation problem gave a fresh impetus to inventive genius, and the brains of that much maligned, but, nevertheless, indispensable fraternity have been and are still working on new safety appliances designed for no other purpose than the protection of human life and property.

In the construction of street cars for electrical motive-power, the builders are very keenly alive to the fact that it is to their interest to surround the people who will ride in their cars with every imaginable safeguard, and the result is that all cars now being made are equipped with better brakes and other similar appliances than the old horse cars—and how many horse cars are being built to-day—a very, very few.

About a year ago we were informed by the contracting agent of one of the largest horse-car building companies west of New York that during the year which was then about to close his concern had not built over five or ten horse cars, but that the factory had been running steadily all through the year, building cars for electric service.

In spite of all precautions it is as impossible for accidents not to happen as it would be for H_2O to walk up-hill; but this is a progressive age—an age of improvements, an age of tremendous advancements, and we feel assured that when New York City has true rapid transit—even though it be the much libelled "trolley" system—that accidents will occur far less frequently, and that the sensational and lurid dailies will then reluctantly admit that horse and not electrical railways constitute the mythical "juggernauts."

IMPROVEMENTS IN ELECTRICAL EQUIPMENT.

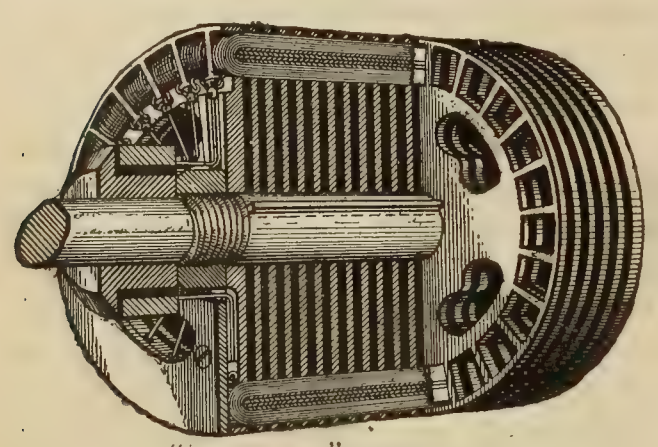
It is a very significant fact that the number of break-downs in the apparatus of electric roads is constantly diminishing. This is due to two things—greater experience and better construction. The overhead construction is now much more substantial and reliable, and the breaking of trolley wires and other parts is comparatively rare. Other portions of the electrical equipment, particularly the motors, have also been greatly improved, and it would seem that perfection had about been attained in this direction; but it is hardly in the nature of things to suppose that the limit has been reached. Our experience of one day suggests improvements to be made the next, and so it goes all along the line. The fact that electrical engineers are giving so much time and attention to the improvement of the equipment of electric railways is a healthy sign in itself, and the results of this application of energy and thought are seen in the model electric roads of to-day. First-class material and intelligence are essential factors in a successful electric road. The best is the cheapest, but the cheapest is not the best.

THE BROOKLYN BRIDGE CABLE'S ENFORCED REST.

It is very rarely indeed that a railroad depending upon steam power for its operation is knocked out through the lack of water to supply the boilers, yet this very thing happened last week on one of the greatest highways in the country, the Brooklyn Bridge. A break in the main water-pipe in Brooklyn necessitated the shutting off of the water supply to the dwellings and every concern operating steam plants excepting gas and electric-light establishments. The result was that for a whole day the cable on the bridge was motionless and idle. The cars were run over by locomotives, for which a sufficient supply of water was obtained from a private source near the Brooklyn station. The Brooklynites realized the value of the cable system on the big bridge when they were deprived of the facilities it affords them.

"UNIVERSAL" ARMATURE AND CLUTCH.*

As a science becomes better developed the instruments and mechanism used in it become simpler in construction, more efficient and better adapted for the purpose for which they are made. This has been the case with every branch of mechanical science, some of which have been so simplified that improvement seems impossible. This seemed to be the case with electric motors for street railway purposes—first the motor with its unnecessary amount of gearing, which put as much work on the motive-power as the car itself, then the double reduction motor and single reduction motor, until it looked as if a gearless motor was the limit; but mechanics know no limit, for where they reach the end of their



"UNIVERSAL" ARMATURE.

tether in one direction, they try to improve in some other, or to improve the individual parts which make up the whole of the last complete success.

Numerous attempts have been made to make the armature of motors easy of access, so as to enable rapid repairing in case of an accidental break-down, and there are numerous methods of constructing this part of the motor, all designed with the same object in view and reaching the same end, but by different means. One of these improved armatures, that known as the "Universal," is a radical departure from the ordinary construction. It is very simple in form and is said to be very efficient. It certainly should be as efficient as any other "ring" armature, and at least as handy if not handier to repair, on account of the unique method of its construction.

As will be seen in our illustration the coils, the form of which is readily seen, are wound separately and mounted on a core having a drum shape, in such a way that any coil may be removed, repaired and replaced without dismantling the whole armature or moving any other coil. The method of construction is so evident from the illustration that no extended description is necessary. As the coils are imbedded in the armature on all sides they are protected from mechanical injury. Over-heating is reduced to a minimum, as spaces are cut in the centre in the body of the armature which afford ventilating channels; this construction also has the effect of reducing the weight of the armature.

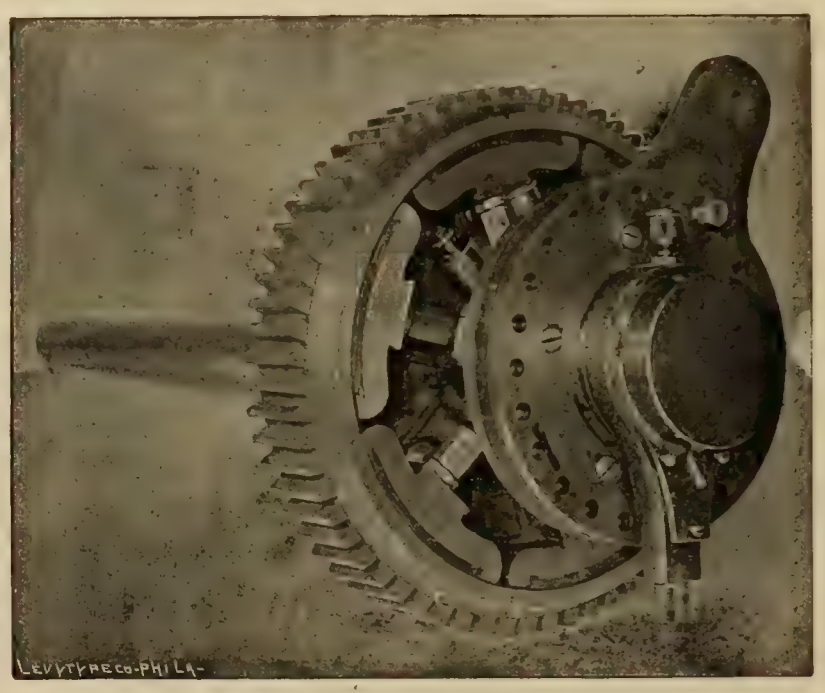
The company that manufactures this armature also makes a clutch which it is said if used in connection with the armature reduces the shock sustained in starting to such an appreciable extent that the life of the armature is prolonged indefinitely, as a car can be started so gradually with the application of less than one-fourth of the electrical energy otherwise required, that the transition to full speed is accomplished without jar. Usually it requires so much current in overcoming the inertia of a loaded car that unless some method is applied to obviate it the armature coils are always in danger of burning out, and severe strains are often thrown on the machinery at the generating station, the effect of which is seriously felt upon connecting machinery—keyboards, switches, cut-outs, etc.—making a good deal of expense which might be avoided by proper appliances.

The "Universal" clutch was designed to remedy this fault in street railway operations, and, it is said, fulfils the most sanguine expectations of its inventors. The clutch is used between the armature and its work, and permits the armature to continue revolving after the car is stopped; placing the load on the armature so gradually when starting the car that the strains are entirely obviated.

In starting a car, when the lever is pushed forward, the wheels of the car are released from the hold of the brakes, and with the same motion of the lever the clutch-shoes are pressed up against the inside rim of the gear-wheel of the clutch, and the whole clutch and the armature revolve together as if made of one piece. In stopping a car it is only necessary to pull the lever back as quickly as it may be desired, thus drawing the shoes from their respective positions sufficiently to permit the gear-wheel to revolve free with the armature, while at the same time a direct connection is made in the operation of the car brake. The armature continues in operation and the car is stopped without checking the electrical energy or touching the switch. It is said that a car can be made to stop as suddenly as desired without throwing the passengers from their seats. The armature may be brought to a standstill while descending a short or a long grade, preventing the ordinary wear and tear, and the lever is so constructed that the motorneer must start the car gradually.

Oiling is required about once a week, and the adjustment of shoes but two or three times a year. The clutch while in active use is said to be absolutely noiseless, and, being mounted on the inside of the large gear-wheel, takes up no more room on the car than the wheel. It can be made to suit any style of motor, either gearless, single or double reduction.

Clutches of this make are in use on the cars of the Atlantic City Electric Street Railway, Atlantic City, N. J., the Duquesne Traction Company and the Valley Passenger Railway Company, of Pittsburg, Pa., besides on cars at a number of other places.



"UNIVERSAL" CLUTCH.

* The Universal Electric Railway Construction Company, Philadelphia.

IT LOOKS THAT WAY.

The New York *Sun*, in its issue of November 23, printed a two-column article under the heading, "Must the Car Horse Go?"

It considers in a general way the three principal systems of street-car traction, namely, horse, electric and cable, and gives many statistics and other data, showing the rapid development of the electric system and the correspondingly rapid disappearance of the horse. The article shows that the cable system is also coming in favor on account of its adaptability to certain classes of traffic.

"The development of cable and electric railway construction," continues the article, "has been so remarkable in the past few years, and the decrease in the use of animal power has been so great, that the conservative street railway men acknowledge that they realize that the days of the horse are almost numbered."

As an evidence of this fact it is noted that the number of horses employed on the 1,003 street railway lines in the United States and Canada in November, 1890, has decreased from 116,795 to 88,114, or 28,681 in one year.

It is scarcely five years ago since one of the largest electrical manufacturing concerns asked a prominent electrical engineer if he thought electric traction would ever be successful, and whether it would pay to manufacture motors of electric railways. Whether the reply was favorable or unfavorable to the idea is not known to us, but the fact of electric traction tells its own story.

The article refers to the fact that the entire time of the delegates to the recent convention in Pittsburg of the American Street Railway Association was occupied in the consideration of electric traction.

Concerning the comparative cost of operating electric and horse railways the article says:

"The operating expenses of one electric road in Pittsburgh last year were 12.74 cents per car mile. The cost of operating a horse line was 10 cents per car mile. In the latter instance the company paid only one man on a car where it now pays four, or 3 cents a mile against 6.8 cents now. The increased cost per mile for conductors and motor men is considered a necessary adjunct of rapid transit, and is not peculiar to the system. Allowing for that, a difference of 1.04 cents per car mile was figured in favor of electricity as against animal power. In Boston the expense of operation with horses is about 25 cents per car mile. The cost of operating with motors up to the present time has been about 20 cents per car mile. Cars from twenty-six to twenty-eight feet in length of body and thirty-five feet over all are more profitable in Boston than sixteen-foot cars.

"With the extensions now in process of construction about 700 miles of cable railways are in operation in the United States. It was thought at first that cable traction was applicable only on straight lines with heavy grades in favorable climates, but the operation of the cable railway in Chicago on level lines, with sharp and difficult curves, during all kinds of weather, changed that view. The first line was opened in San Francisco in 1873. That city has now nearly 100 miles of cable railway. The first cable road in Chicago was opened in 1886. Most of the cable railways have the cables in underground conduits, but the elevated road in Hoboken, the Brooklyn Bridge, and some viaduct lines in Los Angeles have cables on the roadbeds. Kansas City has 70 miles of cable railway; Denver, 58; Cincinnati, 24; St. Louis, 48; Chicago, 35; Philadelphia, 23; Pittsburgh, 26; Cleveland, 20; Seattle, 22, and Washington, 16. The Tenth avenue cable railway in this city is eleven miles and a half in length. A specialty in its construction was the introduction of duplicate cables for securing constant service during the greater part of the day. The first line in Europe was the Highgate Hill road in London, which was opened in 1884. The Brixton section of the London Tramways Company is having a cable road constructed, and about sixty miles of different lines in London are to be changed to cable railways. The construction of cable railways in a part of the southern division of the Paris tramways is under consideration. Melbourne, Australia, has eighty-five miles of cable railway. Single cables of 35,000 and 39,000 feet in length have been operated, but 25,000 feet is considered a safer limit. The cable generally used is one inch and a quarter in diameter. A cable may be run through crowded thoroughfares and around ordinary curves at a speed of eight miles an hour, but in suburban districts the speed may be increased to fourteen miles an hour. The average life of a cable is about fourteen months, giving from 70,000 to 80,000 miles of service. On short, straight and level roads the cables last longest. One cable in Los Angeles lasted thirty-eight months, running 120,681 miles. In Kansas City a cable 18,000 feet in length gave a constant service of twenty-two months at a speed of fourteen miles an hour. To propel a cable without injuring it, and with the least loss of power to the operating machinery, both drums of the winding machinery are driven with as few wraps as possible. Differential ring-drums, for reducing the wear on a cable, are used generally now. For carrying large numbers of passengers in several large cities many single cars instead of trains are employed, but in other cities the problem has been solved by reducing the number of cars and increasing their carrying capacities, and experience has taught that trains are more efficient in relieving congested traffic. The average working cost is estimated at thirteen cents per mile. In Chicago the cost is 9.65 cents. The advantages claimed for cable traction are low operating cost and depreciation, high earning capacity, independence of climatic conditions, facilities for connecting districts with steep grades, convenience, and certain sanitary effects.

REGULATING SPEED.

It is proposed by the Boston City Council to amend chap. 6 of the revised regulations of 1891 so that a street-railway electric car shall not run in any part of the city at a rate of speed faster than seven miles an hour until the car shall have been equipped with proper and suitable fenders or guards for the protection of the public against accident; nor in turning a corner in any part of the city at a rate of speed faster than four miles an hour.

Edward Keliver, 55 years old, managed to get under the horse's hoofs of a Third avenue [New York] car at 117th street at 8 P.M. Sunday the 22d inst., and suffered contusions of his head and right arm, together with the breaking of several ribs. No blame could be attached to the driver.

DUPLEX CAR-HEATER.*

The development of the heating of street cars has been at a stand-still for some time, excepting on electric street railway lines where the current used as the motive-power is also utilized for heating the car which it runs. All other cars, and even the majority of electric cars, are still warmed by the old method of the coal stove at one end, rendering the atmosphere torrid in its immediate vicinity and frigid at the other end. Scarcely any method now in use is satisfactory to all passengers, some of whom prefer to walk rather than ride in a car in which they will be either too warm or too cold.

The majority of car-stoves are far too heavy, and the room they require can be better utilized in some other way. The Duplex car-heater, which we illustrate and describe herewith, is one of the latest developments in this field, and as will be seen by the illustrations it is based on a common-sense principle —that adopted in the ordinary house furnaces.

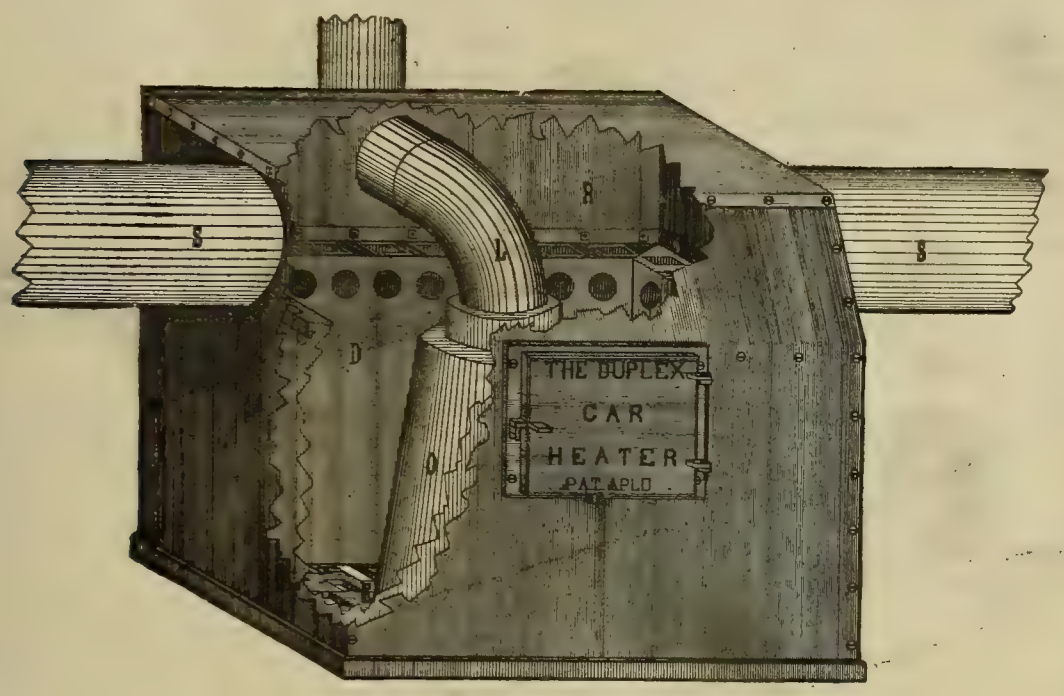


FIG. 1.—DUPLEX CAR HEATER.

Fig. 1 shows its construction, and Fig. 2 its application and position in the car. As will be seen the heater takes up but a very small space, and all parts of the car are heated alike. As the bottom of the car is heated first the upper portion will also be heated, as the heat, of course, rises. Fresh air is admitted through holes in base E (Fig. 1) into the heating-chamber R, in which there is concealed a fire-pot O, with the smoke-stack L running through the back. Fresh air is also used for the insulation, entering between the lining D and the outside of the heater and discharging into the car at each end through the hot-air pipes S S, which branch each way from the heating-chamber underneath the seat. These pipes radiate heat through their entire length.

It is claimed that the "Duplex" warms the car from end to end, keeps a constant circulation of fresh air, takes up no room whatever, as it is placed entirely under the seat, weighs less than a half-fare person, and utilizes every particle of fuel, of which very little is required. The size of the heater is but 14½ x 18 inches. It is the invention of Mr. A. J. Long, of Chicago, formerly a well-known telegrapher.

The company has a number of these car-heaters on exhibition in the salesrooms of William Hood, the well-known dealer in electrical specialties, 239 Lasalle street, Chicago, where they attract considerable attention from street railway men.

AN ELEGANT NEW CAR.

The Newton (Mass.) Street Railway Company is proud of a new electric car which it has just added to the equipment of its line. The car, which is No. 22, was built by George H. Hollingsworth, of Beaver Brook, Waltham, and possesses some novel features not usually found in cars of this class. Mr. F. G. L. Henderson, the superintendent of the line, gave special attention to its construction, and it was built largely after his own ideas. The car is of the standard length—16 feet—with platforms of extra width (60 x 41 inches). The interior finish of the car is very pleasing, and is of oak throughout, and the aisle is of extraordinary width—46 inches—which gives the car a very roomy and airy appearance. Polished brass trimmings inside and out of the latest pattern are used, and were furnished by the Lewis and Fowler Company, of Brooklyn. The seat backs and cushions are upholstered in dark-green leather, which color forms a pleasing and artistic contrast with that of the oak wood-work. In the centre of the monitor roof a very handsome combination lamp is hung. This contains an oil lamp and a cluster of three incandescent lamps, with shades of special design. In addition to these electric lamps others are placed at each end of the car, the interior of which is very brilliantly illuminated at night.

One of the most important features of this new car is the method adopted for heating it. Four Burton electric heaters are used for this purpose, and are placed under the seats, two on each side. In front of each heater is an opening in the panels, covered with a handsomely designed brass register, through which the heat is admitted to the car.

The car is mounted on one of the latest trucks manufactured by the Bemis Car Box Company, Springfield, Mass. The truck carries two 15-horse-power Thomson-Houston motors, with which all of the cars of this company are equipped.

Patent raw-hide gearing is used on these motors, which renders the operation of the machinery noiseless.

The car is handsomely painted and finished and is very attractive. It reflects great credit upon Mr. Hollingsworth, who has recently established a car-building industry in Waltham, and this is the first vehicle he has turned out. He has many other orders to fill. Mr. Hollingsworth is about to build a patent combination car adapted to winter or summer use.

* Chicago Street-Car Heating Company, Chicago, Ill.

THE WEST END'S DOUBLE-DECKED CAR.

The double-decked Pullman car recently added to the equipment of the West End Railway Company, Boston, was run out of the Bartlett-street shops on the night of Nov. 23 for a trial trip. There was a party of invited guests to the number of 30 or more, representing the Pullman Company, the West End mechanical and electrical departments and the press. Among those present were Messrs. F. A. Pullman, of Chicago, and J. W. Stockton, superintendent of the New England division of the Pullman Company, and L. S. Pearson, chief engineer of the electrical department; R. Hapgood, division superintendent; L. S. Doumalin, superintendent of the electrical department, and F. H. Houghton, all of the West End road.

The trip was from the Bartlett-street shops, by Shawmut avenue to Tremont street, Bowdoin square, Green and Chambers street, across the West Boston bridge, and through Harvard square to North Cambridge.

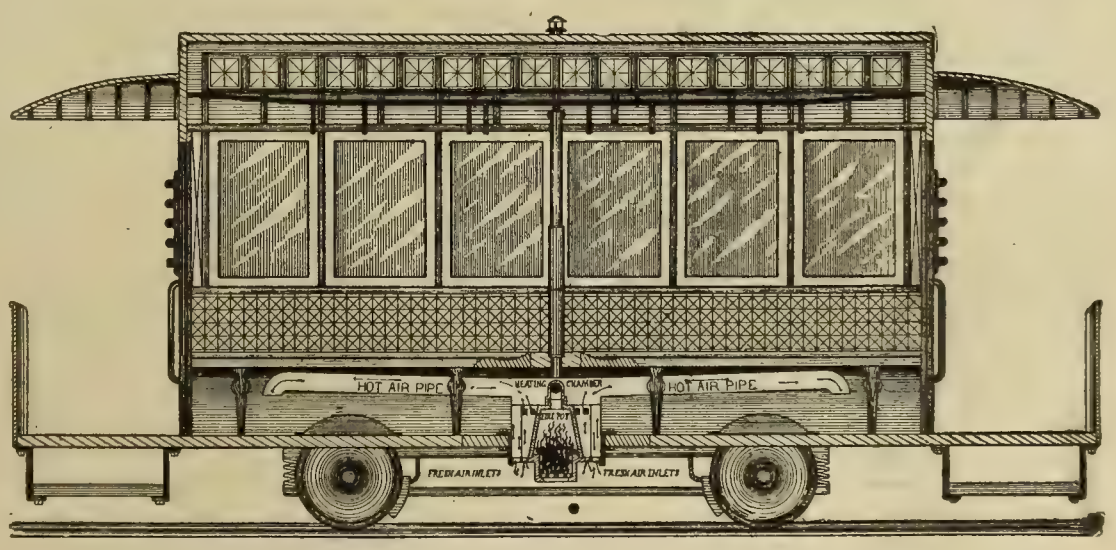


FIG. 2.—CAR EQUIPPED WITH DUPLEX HEATER.

The trip was made easily and pleasantly, with several stops to inspect the behavior of the car on sharp curves, heavy grades, etc., and it proved itself equal to every emergency. The running time from Bartlett street to the North Cambridge stables was 80 minutes.

The experts in the party were unanimous in their approval of the new car, and expressed themselves as sanguine of its success.

The new car will be further tested within a few days by the West End president and directors, and will then go into regular service. There is no little ambition on the various divisions of the road to secure the double-decker. Its assignment is not yet made, but it will probably be put either on the Cambridge line or on that to Chestnut Hill.

NEW ROAD FOR UPPER NEW YORK.

The Williamsbridge, Woodlawn and Westchester Railroad Company has been organized with a capital stock of $240,000. The company proposes to build a new line from Yonkers to that portion of New York City known as Fordham. It will pass through Mount Vernon, South Mount Vernon, Williamsbridge and the town of Westchester, and will be about 24 miles in length. It is likely that the road will be operated by electricity. The principal office of the company is in New York City and the directors are: George A. Humphreys, Clarence R. Dean, Herbert N. Curtis, Schuyler C. Strock, A. A. Alling, Thomas Binness, William J. Dieter and Francis A. Bates, all of New York.

HOW TROLLEY LINES ARE RUN OVER DRAWBRIDGES.*

One of the most unusual problems met with in the equipment of the West End road in Boston was in connection with the drawbridge over which the cars were obliged to pass. Arrangements had to be made so that the cars could be operated on either side of the drawbridge, whether it was open or closed, and also upon the drawbridge itself, when closed. This was done by making the short stretch of overhead wire upon the draw independent of the shore wires, and supplying current to it through an auxiliary submarine cable, which is brought up to the centre pier on which the drawbridge turns. This cable is connected to a switch, the lower part of which is stationary on the pier.

On the revolving part of the bridge is suspended the other part of the switch, which in turn is connected to the short strip of wire on the draw itself. When the draw is open the connection of this switch is broken; this does not interrupt the operation of the road, however, the current to operate the cars on the further side of the drawbridge being carried by a second submarine cable, independent of the other, and connected to the ends of the overhead wires on each side of the drawbridge. The rails on the draw are connected in the same manner as those on the street, and grounded.

Four poles, two at each end of the draw, hold the trolley-wire in position. The overhead construction at each end of the draw, and upon the ends of the main bridge adjacent to the draw, is of special design. At each end of the conductors a length of iron gas-pipe is attached to an iron truss; to this pipe are attached the ears which hold the trolley-wire in position. At the ends of the wire are placed tapering frogs or switches, so that when the draw is closed the trolley cannot leave the wire in passing from the conductor on the main bridge to that on the drawbridge.

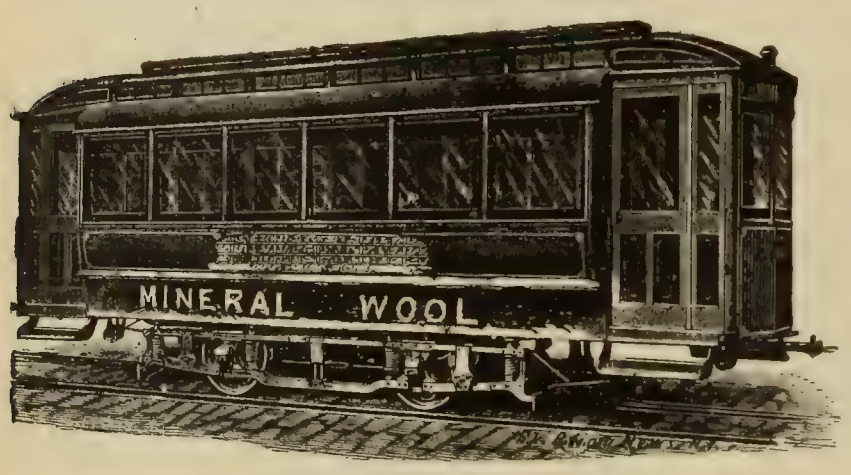
* Thomson-Houston Electric Co., Boston.

CAR-LINING.*

In the case of cars, heat is lost both by radiation and contact of cold air, but the cooling by the first process is inconsiderable in comparison with the last. The motion of the car is an important factor, for by reason of it the second process is going on much more actively than in the case of a stationary structure. With great differences of temperature it has been shown that the loss of heat increases in a much higher ratio than that difference—in other words, the colder the weather, or the greater the difference between external and internal air, the more rapid the extraction of the heat; and furthermore, as the speed of the car increases the loss of the heat increases, because of the contact of a greater amount of cold air in a given time. The proper ventilation of the cars becomes a difficult matter only when they are in motion, because then the penetrating force of the exterior air is increased, and it is not possible to confine the inflow to the openings intended for it; but, on the contrary, the cold air is rushing through the cracks on all sides in quantity increasing with the speed.

To make travel luxurious or even comfortable, all discomforts—such as exposure to draught and rapidly changing temperature—must be provided against. For a long time it was the practice to use shop shavings and sawdust for the filling between street-car walls, because they were on hand and cost nothing, but the articles that cost least are not by any means always the cheapest in the end. To keep the cars at an even temperature and comfortable, a lining of some kind is necessary, and the better the lining and the greater the results accomplished by its use, the better the car is fitted to accommodate the travelling public.

Within the last few years the leading car-builders



ELECTRIC CAR LINED WITH MINERAL WOOL.

have adopted mineral wool for car lining, principally because it accomplishes all the objects required of the lining and because it is a non-conducting substance of both heat and sound. As a deadening substance it makes the cars practically noiseless, and its moderate weight adjusts the centre of gravity of the car and gives stability to the whole structure. Where the floor, the sides and ends of the car are lined with mineral wool as high as the windows the lower part is always warm, and but very little fuel is required in the car stove to keep the car at a comfortable temperature in winter.

Insulation of sound is particularly necessary in electric and cable cars, and the value of the wool, not only for deafening noise but for the other purpose named, is acknowledged, and this knowledge is acted upon by many builders constructing such cars. It is a splendid protection against both cold and heat, and may be applied without altering the construction of the car. It has been customary to use the ordinary grade of slag-wool, but the manufacturing company now furnishes rock-wool, a much lighter article, and preferable for this reason.

ARMATURE BUSHINGS.

It is essential that the bushing for the armatures of electrical machines be of the best material, as much depends upon their quality. Superior bushings for armatures are manufactured by E. A. Hewitt & Co., Cleveland, Ohio, for No. 6 Sprague motors, and they have the advantage of being interchangeable with the ones now in use. They consist of cast-iron shells filled with babbitt metal, and babbited on mandrils to fit any size armature-shaft. They are durable and wear much longer than brass or bronze, and in addition to this they do not wear the armature-shaft to any appreciable extent. They require less lubrication than brass or bronze bushings, and they run much cooler. No injury to the shaft results in case they do run warm for any reason, and they can be made for about the same original cost as the others. As to the question of renewal, the cost including material and labor is about one-eighth of the original. When this concern furnishes an electric road with these bushings it sells at a small cost a device whereby the work of renewal can be accomplished with greater facility and at the cost above named.

* United States Mineral Wool Company, New York.

NEW IRON POLE.

Superintendent Davids, of the Canton, Ohio, Street Railway Company, has invented an iron pole for electrical wires of all classes, including railway wires, which is said to be the lightest and strongest made. The metal is distributed in such a manner as to give the best results in practice. The new poles are artistic in design and present a handsome appearance.

GALVESTON'S STREET-RAILWAY LITIGATION.

For several months past the Galveston City Railroad Company and the city of Galveston, which is a large shareholder in the street railroad company, have been at war over the latter's financial condition and the class of service it rendered the city, ending during September last, as noted in our issue of September 26, with a threatened institution of proceedings with a view of placing the road in the hands of a receiver, and the appointment of two experts to look into the matter and report thereon.

The city needed rapid transit, and to secure it granted the street-railway company the right to substitute electric power for its horse system, but the trouble above referred to delayed the work to such an extent that the city on November 13 granted a syndicate, said to be composed mainly of Denver (Col.) capitalists, a franchise to construct and operate an extensive electric street-railway system in and about the city. It is said that the new road will be between thirteen and fifteen miles in length, and include the Beach Hotel on its route, which the Galveston City Railroad Company projected and constructed.

This called forth from the Board of Directors of the Galveston City Railroad Company a long and bitter letter showing its position, abstracts from which follow. The Board of Aldermen discussed the document on November 16, finally referring it to the committee of two appointed to consider the subject, making it, with its consent, a committee of four by the addition of the City Auditor and the City Clerk. It is difficult to foresee how the litigation will terminate, but our readers can draw their own conclusions from the following abstracts from the letter:

"GALVESTON, TEX., November 16.

"*To the Honorable Mayor and Board of Aldermen:*

"Replying to the several communications of the special committee appointed under date of September 9, 1891, the Galveston City Railroad Company beg leave respectfully to state that on September 17, 1891, the president of the Galveston City Railroad Company addressed a communication to the special committee on investigation of the city's interest in the Galveston City Railroad Company, in which he stated that he was compelled to leave the city for a few days on important business, and requested the committee not to take any action or make a report until his return. He left the city on September 17, 1891, for the North, for the purpose of perfecting financial arrangements to complete the electrical system of the Galveston City Railroad Company. The committee was fully informed of the object of his visit to the North. Notwithstanding the request that no report be made or action taken by the committee before his return, the committee made an *ex-parte*, unfair, and, in important respects, an erroneous report to your honorable body on September 21, 1891, four days after he had left the city for the purposes above stated, and the substance of the report of the committee was telegraphed over the United States.

"In that report the committee stated that the bonded and mortgaged debt of the Galveston City Railroad Company was $600,000, when the truth is and was (and the committee was so informed before the report was made) that the bonded and mortgaged debt was only $400,000. The different members of that committee knew these facts from two sources. The City Attorney, a member of the committee, was furnished with a statement prepared by Mr. A. J. Walker, showing the bonded debt to be $300,000; and, in addition to this information, the committee had before it the report of November, 1886, on this subject, made by the City Auditor, Mr. Wm. Selkirk, and Col. George P. Finley, who was at that time City Attorney, in which the bonded debt was explained to be $300,000. In fact, the report made by Col. Finley and William Selkirk was embodied in the report of your special committee. But the committee says that the records of the County Clerk's office show that there is a bonded debt of $500,000, instead of $300,000, as the company's records show. It was fully explained to the City Attorney, one of the committee, before he made the report of September 21, that $200,000 of the $300,000 bond issue was not used; it was held by the trustee and is still held by it to redeem and retire $200,000 of its former issue when the same should mature, and that the bonds so reserved could not be used for any other purpose under the terms of their issuance.

"With all these facts before it, strange as it may seem, the committee reported that the bonded debt of the company was nearly double what it actually is. This report, so variant from the truth, was also wired to the money markets of the world, and when the president of the company arrived in New York to arrange for placing the proposed new bonds to be issued to retire the old bonds and provide the funds necessary to equip the road electrically, he was confronted by this report. The result was that all negotations were temporarily suspended and remained so until such data and facts were forwarded from Galveston to New York as proved the falsity of the report. This caused a delay of several weeks and much expense and loss of time, which, it is needless to say, seriously impaired, at least for a time, and possibly permanently, the credit of the company, and greatly delayed its present work. But this is not all; the most remarkable thing connected with this report was a resolution introduced by Alderman Schmidt on Friday last to adopt the report, and thus commit the city, not only to the mistakes and misstatements in that report, which are apparent to every one, but to such responsibility as would result from that approval for the loss and damage sustained by the railroad company therefrom.

"The city council, by an ordinance of the last city council, authorized the Galveston City Railroad Company to change its motor power from mule to electricity. The mayor of the city of Galveston voted, in writing, its 693 shares in favor of the change and the outlay which it necessitated. A large majority of the stockholders did the same thing. Before a vote was taken and a change decided upon the cost was fully and freely discussed; it was known by every stockholder that the change would require an outlay of about $300,000 or $400,000. The work was begun over a year ago and was pushed rapidly, and would have been completed in the early part of the year 1892 but for the ill-advised and unfounded action of your special committee.

"From the day of its incorporation the Galveston City Railroad Company has complied strictly with the laws and by-laws regulating and controlling its existence. It has had regular annual meetings of its stockholders, our records show regular meetings of the directors, and that their reports have been regularly acted upon and approved by the stockholders for the past twenty-four years, after thorough investigation each year by a stockholders' committee—not directors—as the by-laws provide. At all times have the directors furnished all the information desired, and we wish to add that after a complete and thorough investigation all parties interested were satisfied with the result of the researches made.

"The city attorney has seen fit, for reasons best known to himself, to deviate from the course of his predecessors. Instead of asking for full and accurate information, which we would gladly have furnished, and did offer to furnish, he makes a report to the city council in which he assails the personal honor and integrity of every director connected with the Galveston City Railroad Company. We do not wish to discuss matters which have been acted upon regularly by stockholders and directors of the company all these years; but, speaking for ourselves, we desire to say that we do not consider the present city attorney and special committee more competent, more devoted to the city's interests, more honest or better qualified to investigate our relations with the city and protect its interests than their predecessors. We are of the opinion, and leave the public to judge, that the city attorney's original communication to the city council on this matter, as well as the report of the special committee, bears the stamp of unfairness, and the erroneous and slanderous statements which bear his and their signatures could not have been made if he and they had asked the management of the Galveston City Railroad Company for correct data, or accepted their repeated proffers to furnish the same prior to making their several reports.

. . . . . .

"We are responsible alone to the stockholders of the company, and the city is one of them. Ever since the organization of this company the city has

had its representatives in the directory of the company, as provided by the contract between the city and the Galveston City Railroad Company, down to the present day." This section of the contract is then quoted, and the letter continues:

"In regard to the expenditures involved in the transformation of the lines of the company to electricity as a motive power, the authority for making the change was duly authorized by the City Council under and by virtue of an ordinance, and the assent of the city was not only indicated and ratified and confirmed by this ordinance, but was specifically authorized and approved by your honorable mayor, by his official signature.

This agreement was, at the last annual meeting of the stockholders, held on January 14, 1891, in all things duly ratified and confirmed, as can be verified by the minutes of said stockholders' meeting. It is by and with this action that the directory has proceeded to make the expenditures and improvements the City Attorney and said committee now complain about.

We claim that by the action of the City Council and Mayor, as well as by a large majority of the stockholders, it does not lie with your honorable body to complain of any acts of the directory done in conformity with the authorization expressly and specially conferred upon them.

We claim further, that in the matter of expenditures involved in the construction of the Beach Hotel, the city is estopped from complaining now, because said expenditures are in all respects ratified and approved by the stockholders of the company in manner and form as is provided by the by-laws of the company, as an examination of the records of the company and proceedings of its meetings will disclose.

We claim further, that if the amount expended in the construction of the Beach Hotel was a mistake, the city does not and has not suffered therefrom, because by reason of the construction thereof the additional taxes accruing to the city therefrom, which taxes are secured by a first lien under the laws of this State, as well as the increased taxes from the enhanced value of the surrounding property, largely exceed any dividend that could or would have accrued to the city had the same not been erected, the city thereby deriving in another way a much greater revenue than it could possibly have received in dividends had the hotel not been built. If all the other stockholders were and are willing to make the disbursements complained of, and have accepted the results that flow therefrom, surely under the circumstances it does not seem to us that the city should complain of such improvements in our city when no other stockholder has.

. . . . . .

Your special committee in its last report makes a point and lays great stress on the fact that in other cities a certain percentage of gross receipts are paid by the street railroad companies for the privileges they enjoy, namely, among others, the cities of Baltimore, St. Louis and St. Paul.

In answer to this we challenge the committee to point out any city of the size of Galveston that is now or has ever paid a percentage on gross earnings into the city treasury. When Galveston gets to be a city of 100,000 or more, which day we hope is not far distant, a street railroad could then afford and would gladly pay a percentage on earnings for the franchises they would enjoy. But in the language of Alderman Schmidt at the last meeting, when the question of making the South Galveston road pay a percentage of the gross receipts was up according to the Galveston *News'* report, he opposed such a tax as advocated by Mr. Goggan, and said that the imposing of such a tax upon the company was equivalent to withholding the franchise.

. . . . . .

The Galveston City Railroad Company paid the city of Galveston 25 years ago 600 shares of stock for the privileges they now enjoy. Our company has disbursed over $300,000 in the reconstruction of our lines electrically in order to furnish rapid transit to the public. Notwithstanding the fact that the stockholders have received no dividends for years, nevertheless your committee recommends additional taxes and burdens, and at the same time your honorable body grants privileges to a new company without any compensation whatever."

The letter, which is signed by Wm. H. Sinclair, President; A. J. Walker, Leon Blum, Julius Runge, Dave Freeman, Directors, ends with a certified copy of extracts from the minutes and records of the Galveston City Railroad Company, showing:

1. Certified copy of action of stockholders of the Galveston City Railroad Company authorizing the expenditures involved in the construction of the Beach Hotel.

2. A certified copy from the same records showing that the bonded indebtedness is only $300,000.

3. A certified copy from same records showing the authority from the stockholders to equip and operate the Galveston City Railroad Company by electricity and the expenditures thereby involved.

SHORT GEARLESS MOTORS.

At the recent convention in Akron of the Ohio Tramway Association, Mr. Frank A. Rogers, of the Short Electric Railway Company, Cleveland, Ohio, made some interesting remarks which have not heretofore been published.

Mr. Rogers stated that the Short Electric Railway Company now manufactures three types of motors, the single and double reduction and the gearless. All three have their advantages, but the gearless motor is most efficient in the performance of the work for which it is made. He thought the gearless was best adapted for roads where grades do not exceed 10 %. The company's gearless car in Pittsburg ran up 5½ % to 6 % grades without trailers. The gearless motor was regularly tested at Cleveland and showed the average current to be 24 ampères for motor and trailer car loaded with passengers.

There are only three wearing parts to the motor, and the electrical repairs would compare favorably with the double reduction motor and the mechanical repairs very much less; the gearless is, moreover, practically noiseless. In starting the gearless on grade and the double reduction on grade each starts at the same time, but the gearless takes a trifle less current. On a level the gearless takes 10 % less current, the motors being of the same capacity.

The armature of the double-reduction motor is 13½ inches in diameter, that of the single-reduction 18 inches and of the gearless 24 inches. There is a difference of 300 lbs. in weight in favor of the single as compared with double-reduction motor; and the difference is 700 lbs. between the gearless and the single reduction, the gearless being the heavier. This of course refers to motors of the same capacity.

RAPID TRANSIT IN BROOKLYN.

On November 28 the Railroad Committee of the Brooklyn Board of Aldermen heard arguments for and against the application by the various street railway companies in Brooklyn for permission to substitute electric for horse-power on their lines.

Ex-Alderman O'Connell opposed the system on the indefinite ground that it was dangerous to life and injurious to property. Mr. James F. Muncie's opposition was based on like reasons, and also because, as he said, a better electric motor system could be employed. What he meant is hard to say. Mr. Thomas C. Smith urged an objection to the electric system that has never been put forward before. He said it was "antiquated," besides being dangerous and unsightly. Mr. Daniel F. Lewis, president of the City Railroad Company, made a strong speech in favor of the system. He said that it would introduce handsomer and better-lighted cars. The roadbeds would have to be rebuilt, better and more satisfactory time would be made, the advantages in this respect being probably one-third, compared with the present rate of speed. At one stroke 10,000 horses would be removed from the streets, which would, therefore, be more cleanly. The removal of horses from the stables would also be a great advantage to the neighborhood adjoining. There would be a great increase in the value of suburban property. Mr. Lewis said that an experience of three years in other parts of the country had shown that the system was absolutely safe. The various companies did not propose this change for their own benefit, but for the benefit of the public. The mayors of sixty-nine cities in which the electric trolley system had been in use for some time have declared that the system is an entire success, and that they would not dispense with it on any account.

General Slocum thought that the change would be of great benefit to the people of Brooklyn, as well as to the outlying districts. He thought that he would attain greater celebrity through his efforts to get rid of horses than anything else he had ever done.

Owing to a break which occurred to one of the big water mains in Brooklyn, on the 21st inst., and the consequent loss of a considerable percentage of the city's water supply, the Fifth Avenue elevated railway was obliged to discontinue running its trains, temporarily, at about 9 A.M., on the Monday following, when an order was sent over the wires by the General Manager to the ticket-sellers to give all prospective passengers due warning to that effect.

An experimental trial with an electric railway took place recently at Singapore. The project is to build an electric railway to Johore, and the government is to be asked for the necessary concession.

ELECTRIC LOCOMOTIVE.

The first electric locomotive for freight purposes built in this country was exhibited by the Thomson-Houston Electric Company at its Lynn factory on Saturday, November 28, in the presence of quite a number of gentlemen who assembled to witness its capabilities.

It is not intended that this locomotive shall take the place of the regular freight locomotive on big lines, but the purpose of its designer is that it can be made a valuable auxiliary on short feeder lines, especially where some mill or factory is located a short distance from a railway and where the owners desire the use of their own locomotive.

A couple of freight cars, aggregating in weight 54 tons, were hitched on to the locomotive, which pulled them with ease up down a straight track and also up and down a 1.75 % grade and around curves at a speed of about five miles an hour, after which two more cars were coupled up, making the entire weight 96 tons, and later on another two were attached, giving a total of 163 tons, all of which the locomotive handled with apparent ease.

The test was quite a severe one, as the engine was built for the purpose of hauling only 60 tons up a 3 % grade at a speed of five miles per hour.

Power is communicated from the armature to the rear axle by means of a double-reduction gearing, and from the rear to the forward axle by parallel rods. The weight of the locomotive is 42,525 lbs.

The motor, which is of the "G" type, consists of wrought-iron field-magnets which are bolted to magnetic yokes of cast wrought iron, one of which carries the bearings which support that end of the motor on the axle, while the other is supported by a spring from the other axle, which arrangement, it is claimed, always keeps the gears in line, meshes them correctly with each other, and, at the same time, provides no little spring support for the motor. The weight of the motor is about 5,400 lbs.

The utmost care has been taken to make the motor absolutely waterproof, the field spools having their wire incased and entirely sewed up in canvas bags covered with a heavy coating of waterproof paint.

Cast wrought-iron gear-wheels with aluminum bronze pinions are used for gearing, which run in gear-cases well supplied with grease, thus decreasing the noise, friction and consequent wear of the gears.

Keyed on the intermediate shaft is a wrought-iron brake-drum covered with wood lagging. The shaft is embraced by two half-bands of steel tightened upon it by means of the brake drum lever situated in the operating stand.

The steel-tired driving-wheels have a diameter of forty-two inches and the frame consists of two heavy side-plates in which are located the axle-bearings.

Two heavy cast-iron end-plates, on which are cast the pilot or cowcatcher, are bolted to the side-plates by means of heavy bolts, which plates carry the heavy spring drawbars and bumpers.

At one end of the platform, inclosed in a railing and covered with a protecting roof, is the operating platform, upon which are located the levers for operating the brake, sand-boxes and controlling mechanism, while what is known as the universal trolley-bar—a diamond-shaped and very ingeniously constructed trolley wheel—extends upwards from the platform.

The operation of the locomotive is very simple, two large rheostats being so arranged with their contact-shoes that no reversing switching is needed, an arrangement by which the operator simply pushes the reversing lever forward when he wishes the train to go in that direction, and turns it back again when it is desired to back the locomotive.

A positive centre-lock is provided, so that in turning the current off, there is no danger of passing the neutral point of the rheostat and so reversing the locomotive with the current applied.

The current can be shut off instantaneously by the operator by means of a combined main switch, lightning-arrester and fuze-box which is placed within easy reach of his hand.

Five hundred volts were used, and it is intended to use the regular trolley when in active operation on the line of the Whitin Machine Company, of Whitinsville, Mass., for whom the machine is intended. It will be used by the company for carrying its merchandise between the railway station and its works, a distance of 1½ miles.

The speed reduction between the armature and axle runs from one to twenty-five, and the measured height of the locomotive above the rail platform is about 4 ft. 4 in.; the maximum length of the locomotive (at the pilot) is 15 ft. 9½ in., that of the platform being 12 ft. 7¼ in., width of platform being 7¼ ft.

Those who saw the exhibition were well pleased with the working of the locomotive, and after a light lunch tendered by the Thomson-Houston Company, the party dispersed.

THE WEEK'S RECORD OF STREET-RAILWAY NOTES.

CALIFORNIA.

SACRAMENTO.—Central Street Railway Company applied franchise electric street railway to city limits.

Reported Sacramento Street Railway Company (horse) and Central Street Railway Company (electrical) consolidated.

SAN FRANCISCO.—Metropolitan Electric Railway Company erecting $4,000 car-house.

COLORADO.

DENVER.—Mayor vetoed ordinance granting right-of-way Metropolitan Street Railway Company from present terminus to Harman.

GEORGIA.

ROME.—Reported sale property Rome Street Railway Company to Washington capitalists consummated.

ILLINOIS.

CHICAGO.—North Chicago Street Railway Company making exhaustive tests Connelly gas-motor for use on street cars.

INDIANA.

INDIANAPOLIS.—November 18. Successful trial Newhouse trolley.

LOGANSPORT.—November 19. Electric street railway in operation.

TERRE HAUTE.—November 21. Conductors and motorneers strike for increased wages.

IOWA.

SIOUX CITY.—November 14. People's Street Railway Company prepared half-mile Third street for construction of street railway during night. Two other street railway companies have franchises for street.

LOUISIANA.

NEW ORLEANS.—Ordinance establishing new street railway route passed and proposals for sale same invited.

MASSACHUSETTS.

CAMBRIDGE.—West End Street Railway Company (Boston) petitioned permission to establish trolley system number streets here.

WORCESTER.—Worcester Consolidated Street Railway Company. Year ending September 30: Surplus, $5,600; passengers carried, 6,071,948.

During first thirty days' operation Worcester, Leicester and Spencer Street Railway Company carried over 97,000 passengers, number running over 200,000 during second thirty days. Company says electrical railway financial success.

MINNESOTA.

MINNEAPOLIS.—November 20. Cross between trolley and telephone wires destroyed large number telephones.

ST. CLOUD.—Owing to snow and cold weather work on new street railway line stopped.

MONTANA.

BUTTE.—Street cars to be heated by electricity.

MISSISSIPPI.

VICKSBURG.—Tracks Vicksburg Street Railway Company ordered torn up account failure company keep them repaired.

NEW YORK.

BROOKLYN.—Reported that effort will be made during next session Legislature get law exempting Bedford avenue from railroad building repealed.

OSWEGO.—Extension street railway finished as far as Lawrence street.

OHIO.

DEFIANCE.—Street railway nearly completed.

SANDUSKY.—Street railway nearly completed.

PENNSYLVANIA.

PHILADELPHIA.—Philadelphia Traction Company will spend about $250,000 improving stables and car-houses.

PITTSBURG.—Duquesne Traction Company and Pittsburg Traction Company arranged system transfer checks taking effect December 1.

RHODE ISLAND.

LINCOLN.—Pawtucket Street Railway Company asks permission operate cars here by electricity and run line over proposed High Street route.

UTAH.

SALT LAKE CITY.—Salt Lake City Street Railway erected corrugated iron car-house 200 x 80 feet, with storage room for 45 cars, giving, with the old building, room for 75 cars.

VERMONT.

RUTLAND.—December 1 Rutland Street Railway Company will pay bonds amounting $1,000, being second thousand in two years. There still remain unpaid bonds to amount of $26,000.

WASHINGTON.

SPOKANE FALLS.—Spokane Street Railway Company asked permission transfer freight over lines.

Foreign.

Hamilton Street Railway Co., Hamilton, Ont., began operating Barton, James and Herkimer street lines November 14.

Reported that streets of Caracas, Venezuela, so narrow that street cars recently shipped there had to be sawed in two in order to allow them turn street corners.

Track Extensions.

ATLANTA, GA.—Atlanta, Hapeville and Manchester Street Railway Company asked permission extend through waterworks property.

BEAUMONT, TEX.—Street railway company will extend to city limits.

VINEYARD, MASS.—Cottage City Street Railway Company granted permission extend tracks Vineyard Haven.

Increase of Capital.

CHICAGO, ILL.—Belt Line Transfer and Storage Company to increase capital to $100,000.

WEBB CITY, MO.—Rapid Transit Company to increase from $150,000 to $500,000.

Incorporations.

ALBANY, N. Y.—November 21. Williamsbridge, Woodlawn and Westchester Railway Company. Capital stock, $240,000. Incorporators: O. A. Humphreys, C. R. Dean, H. N. Curtis, S. C. Strock, A. A. Alling, Thomas Binness, W. J. Dieter, F. A. Bates and A. H. Girard.

CHICAGO, ILL —November 18. Cross-town Railway Company. Capital stock, $500,000. Incorporators: Mark T. Leonard, W. R. Weever and A. B. Camp.

Change of Power.

NEW ORLEANS, LA.—November 17. New Orleans and Carrollton Railroad Company authorized use electric power.

NORWICH, CONN.—Norwich Street Railway Company applied for permission use electric power.

BROOKLYN, N. Y.—Every street-railway system here exception Broadway lines applied permission substitute overhead trolley system of propulsion for horses.

Election of Officers.

BUFFALO, N. Y.—Messrs. Watson and Littell, respectively President and Vice-President Buffalo Street Railway Company, re-elected.

HOLYOKE, MASS.—C. L. Chapman elected Superintendent Holyoke Street Railway Company, vice Mr. Loomis, resigned.

ROME, N. Y.—November 17.—Rome City Street Railway Company. President and Superintendent, W. P. Ratland; Vice-President, Charles W. Dayton; Secretary and Treasurer, William Moores.

New Roads.

DELAWARE, OHIO.—Electric street railway to be constructed here.

FINDLAY, OHIO.—Rumored electric street railway to be constructed to Fostoria.

STROUDSBURG, PA.—Talk of electric street railway to Bushkill, distance 18 miles.

Legal.

ATLANTA, GA.—W. H. Brotherton *vs.* Atlanta Consolidated Street Railroad Company, $15,000 for personal injuries.

M. J. Murphy *vs.* Atlanta Consolidated Street Railroad Company, $2,500 for personal injuries.

Mrs. Cora Williams *vs.* Atlanta Consolidated Street Railroad Company, $2,500 for personal injuries.

C. J. White *vs.* Atlanta Consolidated Street Railroad Company, $10,000 for injuries received.

W. Kennedy *vs.* Atlanta Consolidated Street Railroad Company, $10,000 for personal injuries.

Timothy Dricoll *vs.* Atlanta Consolidated Street Railroad Company, $5,000 for personal injuries.

G. F. Garreaux *vs.* Atlanta Consolidated Street Railroad Company, $2,500 for personal injuries.

A. J. Jordon *vs.* Atlanta Consolidated Street Railroad Company, $2,000 for personal injuries.

T. M. Donohue *vs.* Atlanta Street Railway Company, $5,000 damages injuries received.

ATLANTIC CITY, N. J.—City taken steps compel Camden and Atlantic City Railroad Company pay taxes on its street railway franchise.

BALTIMORE, MD.—Baltimore and Lehigh Railroad Co. asked injunction restraining North Avenue Railway Co. and Baltimore, Hampden and Lake Roland Railroad Co. from tresspassing upon or occupying certain of its property.

CHICAGO, ILL.—John E. Kane *vs.* Chicago City Railway Co. for $30,000 damages for injuries received collision on company's lines.

COLUMBUS, O.—Anticipating suit heavy damages by Mrs. Ida B. Rose, account death of husband, an employé of company, Consolidated Street Railway Company compromised by payment of $60.

DENVER, COL.—William Reid *vs.* Denver Tramway Co. for $21,000 damages injuries received while alighting from electric train.

DUBUQUE, IA.—In United States Court, Accumulator Co., Philadelphia, *vs.* Dubuque Street Railway Co. recover $48,586.89 for storage-battery equipment of line. Accumulator Company also filed mechanics' liens Dubuque District Court against street railway company same amount.

HORNELLSVILLE, N. Y.—Hornellsville street-railway franchise granted some time since recently sold by order attorney-general, company failing construct road.

JERSEY CITY, N. J.—November 24. City restrained interfering Jersey City and Bergen Street Railway Company construction trolley system Montgomery street.

LOWELL, MASS.—Vincenz Kern *vs.* Lowell and Draycut Railroad Company for amputation of foot by street car. Verdict $120,000 for plaintiff.

MARBLEHEAD, MASS.—Samuel Gale *vs.* Naumkeag Street Railway Co. for $3,000 damages injuries received in accident on company's line.

MINNEAPOLIS, MINN.—Hester J. Whitcher *vs.* Minneapolis Street Railway Company, $4,050 for injuries received.

NEWPORT, KY.—City of Newport *vs.* Cincinnati and South Covington Street Railway Co. compel it place conductors on street cars.

Charles Hartsfeldt *vs.* South Covington, Cincinnati Street Railway Co. for $10,000 damages ejected from company's car tendering transfer ticket dated day prior to use.

NEW YORK, N. Y.—Judge O'Brien Supreme Court trying suit reform lease made 1884 between Christopher and Tenth Street Railway Company and Twenty-third Street Railway Company, by which latter permitted run cars through Fourteenth street from Fourth to Ninth avenue. First company claims not understand Twenty-third Street Railway Company obtained use Fourteenth street tracks; latter corporation asserts other company fully aware provisions lease.

OAKLAND, CAL.—F. Gillett *vs.* Oakland and Berkeley Rapid Transit Company, $5,150 for injuries received.

OGDEN, UTAH.—Charles T. Nelson *vs.* Rapid Transit Co. for $5,000 damages ejected from car of company by conductor.

OLYMPIA, WASH.—November 13. Cars Olympia Street Railway Company seized on execution issued against North Olympia Land Company, owner of the street car line. Cars released on replevin bond.

ONSET BAY, MASS.—Stockholders Onset Street Railway Company petitioned Supreme Court dissolve that company, affirming corporation disposed property to East Wareham, Onset Bay and Point Independence Street Railway Company, paid debts and closed up all its concerns.

PHILADELPHIA, PA.—Isaac Guggenheimer *vs.* Citizens' Passenger Railway Co. for $10,000 damages injuries received by being pushed from crowded car.

SEATTLE, WASH.—Mrs. Annie Sears *vs.* Seattle Consolidated Street Railway Co. for $25,000 damages personal injuries caused by being thrown from car.

SPOKANE FALLS, WASH.—Been decided that City Park Transit Company has legal right of way Sprague street.

SPRINGFIELD, ILL.—F. Robinson *vs.* Springfield City Street Railway Co. for $5,000 damages for injuries received in accident on company's lines.

STILLWATER, MINN.—Henrietta St. Pierre *vs.* Stillwater Street Railway Company, $20,106 for internal injuries sustained starting street car when alighting.

TOLEDO, OHIO.—Constitutionality Toledo street railroad law to be contested Supreme Court.

Ellen Hayes *vs.* Toledo Electric Street Railway Company, for $750 damages for personal injuries. Verdict $125 for plaintiff.

UTICA.—Hearing of argument reference abandonment West Belt Street Railroad, before Railroad Commissioners, Albany, completed, decision not made public.

WACO, TEX.—A. S. Foster *vs.* City of Waco and Waco Dummy Street Railway Company, for $900 damages for injury done property plaintiff by negligent construction street railway. Judgment full amount rendered plaintiff.

WAUWATOSA, WIS.—Injunction restraining Wauwatosa Rapid Transit Co. from crossing track of Milwaukee and St. Paul Railroad dissolved.

Casualties.

BALTIMORE, MD.—October 30. Man slipped under trailer car on cable road and severely injured.

BUFFALO, N. Y.—November 3. Man run over and killed by electric car on Seneca street.

CHICAGO, ILL. November 12. Two ladies seriously injured, cable car collision LaSalle and Monroe sreets.

November 13. Lady thrown ftom street car, State and Adams streets, by its sudden starting, and severely injured.

November 26. Street car run into by switching-engine, Ashland and 40th streets, reducing car to kindling and severely injuring number passengers.

CINCINNATI, OHIO.—October 29. Eight-year-old boy knocked down, dragged 20 or 30 feet, and seriously injured by Mt. Auburn cable car.

DENVER, COL.—November 1. Electric car ran into carriage, completely destroying it, and severely injuring a lady and gentleman who were in it.

DUBUQUE, IA.—November 2. Man knocked down and legs badly crushed by electric car.

EASTON, PA.—November 11. Car on Pennsylvania Motor Company's line got beyond control of motorneer, on College Hill, owing to slippery track, and plunged over Third street Bushkill bridge, breaking motorneer's leg and seriously injuring two passengers.

HARRISBURG, PA.—November 11. Child run over by car on electric street railway and killed.

November 15. Three-year old child run over by motor car and killed.

INDIANAPOLIS, IND.—November 5. Street-car driver squeezed to death between two cars while turning switch.

MARQUETTE, MICH.—A barn of Marquette City and Presque Isle Railway Co. recently destroyed by fire.

MILWAUKEE, WIS.—November 6. Man struck by electric car and severely injured.

MINNEAPOLIS, MINN.—November 7. Electric train ran into farmer's wagon on Washington avenue, seriously injuring driver.

PITTSBURG, PA.—November 6. Car on Pittsburg and Birmingham Traction Company's lines ran into empty hearse and seriously injured driver.

November 7. Six-year-old girl struck by car on Duquesne Traction Company's line and killed.

November 8. Several passengers severely hurt jumping from car Pleasant Valley line, which was running away account failure brake to hold.

ROCHESTER, N. Y.—November 7. Electric car collided with horse and wagon and severely injured driver.

November 12. Wagon struck by motor car and two men seriously injured.

SEATTLE, WASH.—November 30. Ten-year-old boy crushed to death beneath Madison street car.

BUSINESS NOTES.

Few roads are built in the winter months, but existing roads must be kept in good running order. The Electric Merchandise Company, Chicago, is doing a large business in specialties which many roads testify are necessary to a model system. The past week has seen roads in the following places equipped with Burton Electric Heaters: Ottumwa, Ia., Reading, Pa., McKeesport, Pa., Cleveland, O., Lincoln, Neb., Marquette, Mich., Wheeling, W. Va., Wilkes-Barre, Pa., Shamokin, Pa., Bloomington, Ill., Martinsburg, W. Va., Salt Lake City, Utah, Sioux City, Ia. Brand's Patent Track Brooms and Wardell's Track Broom-Holders are in use upon a large number of street lines doing excellent service. Orders for the same are received daily. An encouraging sale of Pratt's Portable Registers also is reported.

The Chicago Electric Motor Company, 205 and 207 South Canal Street, Chicago, manufactures motors for all kinds of stationary power work, and do a very large trade in the repairing of street railway generators. Their reputation in this class of work is very large, and they give perfect satisfaction. Mr. J. G. Hart of the company is now making some repairs on a large generator on one of the Ohio lines. The following copy of a letter received by the company shows that it does its work thoroughly:

OFFICE OF THE KEOKUK ELECTRIC STREET RAILWAY AND POWER COMPANY,
KEOKUK, IA., Oct. 21, 1891.

Chicago Electric Motor Co., 205 and 207 S. Canal St., Chicago, Ill:

GENTLEMEN: Replying to yours of the 18th inst., we can say that we are well pleased with the work done in the past two months by your Mr. J. G. Hart. He rebuilt three (3) No. 32 Edison generators and overhauled the general equipment of our road to our satisfaction.

For general repair work on electric machinery we are pleased to refer street railway and light station managers to your company, if first-class work and reasonable prices are desired. Yours truly,

KEOKUK ELECTRIC STREET RAILWAY AND POWER CO.,
H. C. REINER, Secretary.

To all whom it may concern:

It lately having come to our notice that some builders of Tandem Compound Engines are copying our construction and design, we deem it no more than proper to give notice that this improved construction was patented November 18, 1890, and is the exclusive property of this company, and that we shall protect our rights as against all builders or users of engines.

The "Dick & Church" Tandem Compound Engine, as built by us, was illustrated in this journal in the issue of October 17, 1891, in which was shown cuts of the engine, together with a full description of same. The advantages of this construction, as against any other known design, are manifest, and others, as well as ourselves, evidently recognize it, but we trust this will be sufficient to prevent any further acts of piracy; at all events we have endeavored to protect the general public by publishing this notice. It is our good fortune to own this design for tandem construction, and we suggest that other builders who recognize its important advantages should at least have the courtesy to write us before making use of it, no matter whether they propose to use an exact reproduction, or merely copy as near as they think will be safe, and evade our claims. We should like them to at least do us the honor of letting us have the credit of possessing the merit of originality.

Respectfully yours,
PHŒNIX IRON WORKS COMPANY.
Meadville, Pa., November 18, 1891.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued November 24, 1891.

463,639. Electric-Motor Mechanism. Samuel E. Mower, New Haven, Conn., assignor to Henry G. Thompson & Sons, same place. Filed June 16, 1891.

The combination, with an axle, of an electric motor independent of the axle, its armature-shaft having a sleeve loosely mounted on it and provided with a gear in mesh with a gear on the axle, and a speed-reducing mechanism connecting the sleeve to the armature-shaft, comprising a gear on the sleeve, a gear on the shaft, a disc or drum located between the gears and mounted loosely on the shaft, and gears and pinions borne by the disc, adapted to respectively engage the gear on the shaft and gear on the sleeve.

463,683. Brake for Railroad-Cars. Moses G. Hubbard, Jr., Chicago, Ill. Filed Dec. 30, 1890.

In a car-brake, the combination, with separately-suspended brake-shoes, of two or more axially-rocking brake-beams pivoted in the brake-shoes or shoe-backs and means for rocking the brake-beams.

463,687. Car-Coupling. James W. McGill, Peoria, Ill. Filed Mar. 11, 1891.

The combination, with a draw-bar, a spring-actuated follower having a pin secured thereto, of a link having a boss with a tapering hole through which the pin passes, and a coupling-pin.

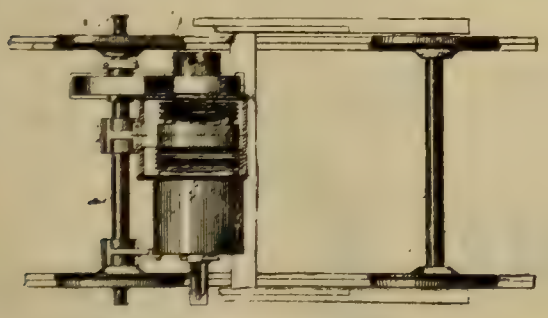
463,695. Car-Brake. William W. Allen, St. Paul, Minn. Filed June 22, 1891.

In a car-brake, a shaft journalled across beneath the car-frame and carrying shoes above the rails, the shoes having curved surfaces eccentric to the shaft and flat surfaces joined thereto without abrupt changes in the line of surface and with the flat surfaces wholly upon one side of a perpendicular line through the centre of the shaft, and means whereby the shoes may be forced downward upon the rails.

463,715. Conductor and Guide for Electric-Railway Trolleys. Joseph I. Conklin, Brooklyn, N. Y. Filed Feb. 10, 1891.

An insulated trolley charger and guide for electric railways, consisting of an inverted trough of metal the sides of which diverge from the base thereof.

463,716. Automatic Adjuster for Brakes. Elisha D. Eames, Watertown, N. Y., assignor to the Consolidated Brake-Adjuster Company, Chicago, Ill. Filed Jan. 25, 1890. Renewed May 6, 1891.

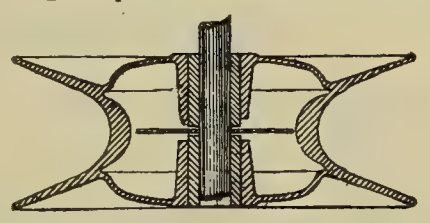


463,639.—ELECTRIC-MOTOR MECHANISM.

The combination, in a brake mechanism, of a threaded or notched brake-rod, a jaw, a thimble or other suitable device within the jaw to support the rod, a half-nut within the jaw adapted to engage the threaded rod, and a brake-lever connected to the jaw.

463,727. Railroad-Switch. Albert M. Grubbs, Forest Grove, Oreg. Filed Feb. 26, 1891.

In a railway-switch, the combination of main-track rails and siding-rails, movable points pivotally connected to the siding-rails on a line with each other and connected to each other near their free ends by a switch-rod, a point of which has its inner side adjacent to the main-track rail cut vertically, so as to provide a point which will be snugly against the inner side of the main-track rail when moved toward it, a movable point having a raised portion of a greater height than the tread of the main-track rail adjacent thereto, and a side-flange adapted to lie over the tread of the main-track rail, the overlapping portion terminating before reaching the end of the movable point, the overlapping portion being of less length than the point.



463,733.—SELF-LUBRICATING TROLLEY-WHEEL.

463,727. Railroad-Frog. Albert M. Grubbs, Forest Grove, Oreg. Filed March 19, 1891.

A frog made of a single piece and comprising rails or ways and a continuation of one of the rails which meets a track rail the continuation having a central raised portion, and a switch-rail having an inwardly-curved portion opposite the frog.

463,733. Self-Lubricating Trolley-Wheel. William Duncan, Allegheny, Pa. Filed Sept. 24, 1890.

A self-lubricating trolley-wheel, having side-walls forming an intermediate chamber, inwardly-extending hubs, a shaft extending through the hubs, a bushing seated in the hubs and fitting snugly on the shaft, and a washer fitted on the shaft between the hubs.

463,737. Car-Coupling. George E. Nichols, Huntington, W. Va. Filed April 11, 1891.

A draw-head having a spherical socket, an opening extending from the top of the socket, an opening at the front having beveled sides and vertical lugs, and an intermediate shoulder at the top and rear of the vertical opening, in combination with a draw-bar having spherical balls at its ends, an intermediate projection, and an offset adapted to engage the shoulder and hold the bar in an elevated position.

463,738. Car-Truck. Moritz Weber, St. Louis, Mo., assignor to George J. Kobusch, same place. Filed Jan. 31, 1891.

The combination of frames and pedestals, boxes having projections fitting in notches of the frame and leaf-springs.

463,760. Electric Conductor for Railways. Charles E. Sargent, Chicago, Ill. Filed July 10, 1891.

An insulated conductor for electric railways, made up of a wire U-shaped in cross-section and a permanently-attached layer of insulating material covering the external surface of the wire throughout its entire length.

463,761. Section-Insulator and Lightning-Arrester for Electric Railroads. Elihu Thomson, Swampscott, Mass. Filed Sept. 1, 1890.

A section-insulator for insulating adjacent sections of an electric-railway line conductor, comprising separate conducting-plates secured in place, but spaced apart and insulated at points somewhat above their contact-surfaces and having such contact-surfaces separated entirely from one another by an air-insulation space, but rounded and arranged in line to form a continuation of the path of travel of the contact device.

463,765. Trolley for Electric Railways. George H. Alton, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 16, 1891.

A trolley-pole carrying two contact portions for making contact with a suspended conductor at different heights, one of such portions being adjustably attached to the pole.

463,766. Switch for Electric Railways. Francis O. Blackwell, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Jan. 26, 1891.

A folding switch or gate pivoted so as to fold down flatwise in the path of travel of the trolley, thereby allowing the trolley to pass over it.

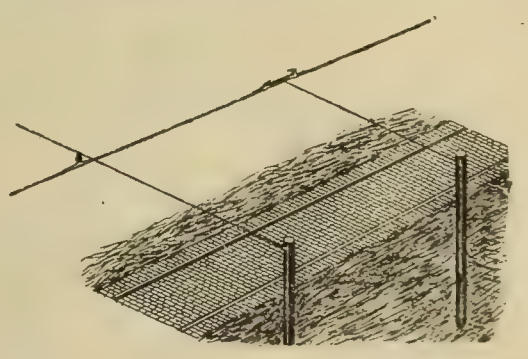
463,768. Car-Coupling. Ezra S. Meals, Harrisburg, Pa. Filed Feb. 13, 1891.

A car-coupler consisting of the combination, with a hollow draw-bar provided with a rigid hook, of a lever pivoted to the head of the draw-bar at the side thereof opposite the hook, the lever having an uncoupling-arm arranged to be swung outward into the recess of the hook, a rigid operating arm or handle on the lever, a draw-rod having a jointed or loose connection with the arm, and heavy and light springs encircling the rod.

463,782. Car-Coupling. John Van Dell, New Decatur, Ala. Filed Aug. 3, 1891.

In a car-coupler, the combination, with a draw-head having a T-opening in its upper side and a housing covering the opening and a swinging jaw pivotally connected to the draw-head, of a gravitating latch having lateral trunnions adjacent to its upper ends adapted to bear in the housing on the draw-head, so that the latch will hang vertically.

463,824. Trolley-Wire Hanger. Edward T. Birdsall, New York, N. Y., and Lemuel W. Serrell, Plainfield, N. J. Filed Dec. 1, 1890.



463,761.—SECTION-INSULATOR AND LIGHTNING-ARRESTER FOR ELECTRIC RAILROADS.

A hanger for the electric conductor, formed of one casting and having ends that are channelled on their under edges, a central lip channelled upon its upper surface, and an intermediate opening or slot for allowing the conductor to be passed above the lip and below the channelled ends, the under surface of the lip and the under surface of the conductor being in line or nearly so.

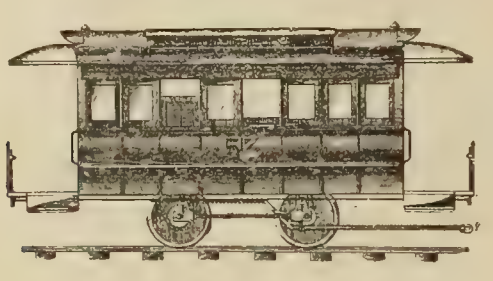
463,866. Car-Coupling. Amos C. Merritt, Allentown, N. Y. Filed May 4, 1891.

The combination, with a coupling-link provided with a fixed transverse brace bored through parallel to the sides of the link, of a concaved block or bearing having lateral

guides overlapping the link, screw-threaded and nutted rod, and coiled spring encircling the rod between the fixed brace and movable block.

463,907. Car-Brake Adjuster. Albert E. Manchester and Jacob C. Miller, Dubuque, Iowa. Filed Feb. 10, 1891.

A car-brake adjuster with a plate having an automatic take-up attached to the dead-lever of a power brake, in combination with a slide attached to the plate and connected with the fulcrumed or floating lever of the brake, whereby the brake upon one truck of the car will operate when the other brake has been disabled.



463,959.—VEHICLE STARTER.

463,925. Car-coupling. William P. Simpson, Nelsonville, Mo. Filed May 6, 1891.

In a car-coupler the combination of a draw-head formed with openings and having a curved vertical opening, a curved tumbler centrally pivoted in the upper part of the curved opening, a coupling-pin pivoted directly to the upper end of the tumbler, a rock-shaft mounted in suitable bearings in the top of the car and having a chain connection with the curved tumbler, and brackets placed in the path of the lever and adapted to support the same in an inclined position.

463,940. Car-Wheel Chill. Ferdinand E. Canda, New York, N. Y. Filed July 2, 1891.

A car-wheel chill consisting of a support formed of three or more parallel rings, two series of webs projecting inwardly from the rings toward the centre of the chill, the webs of one series alternating with those of the other series, one series of webs being supported by one outer ring and an inner ring, the other series of webs being supported by the other outer ring and an inner ring, and chilling-faces formed on the inner end of the webs, the chilling-faces, the webs and the rings being formed integrally in a single casting.

463,959. Vehicle-Starter. Peter D. Van Vradenburg, Binghamton, N. Y. Filed March 18, 1891.

In combination with the front and rear axles of a vehicle, gear-wheels fixed on the axles, a movable bar having racks upon its upper and lower edges adapted to engage the upper and lower sides of each gear, a runner secured to the bar, a rod provided with a coil-spring extending between the axles, and a device for lifting the rod in and out of engagement.

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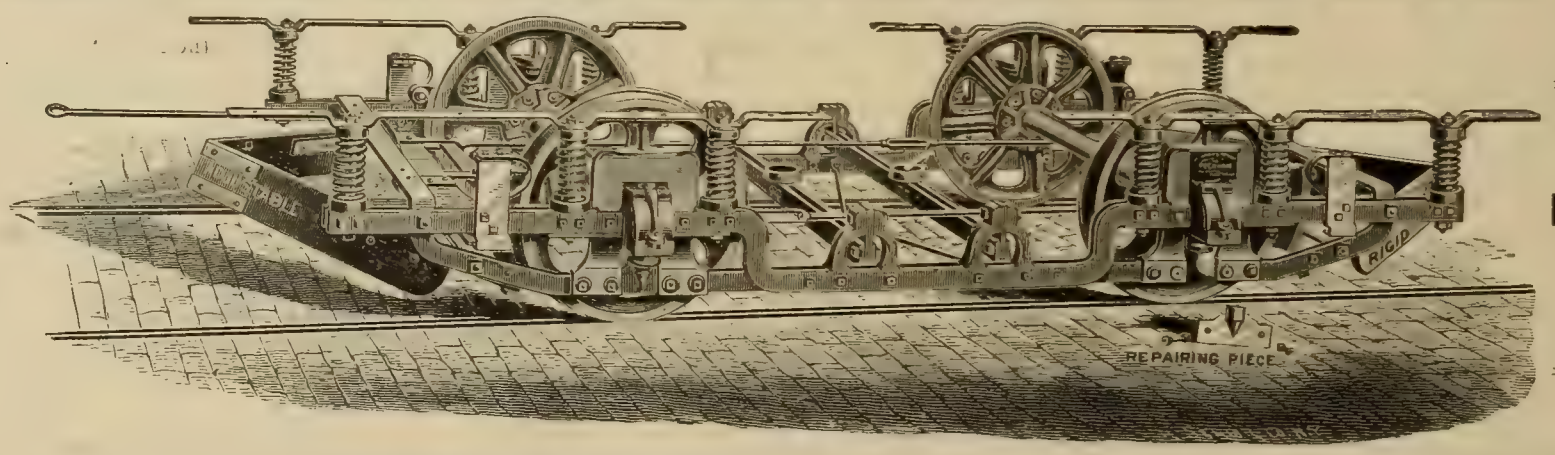
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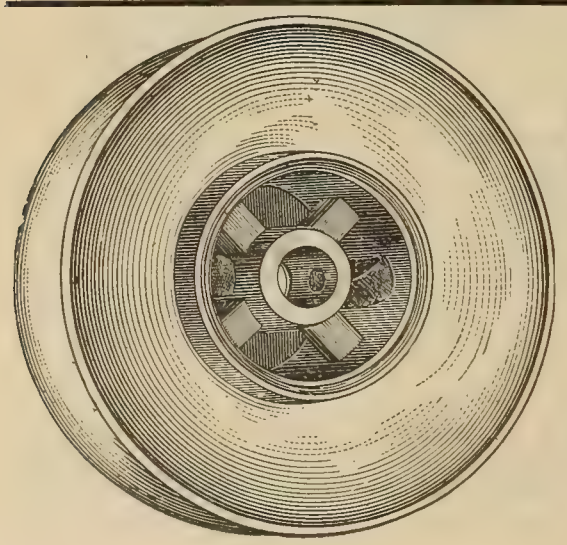
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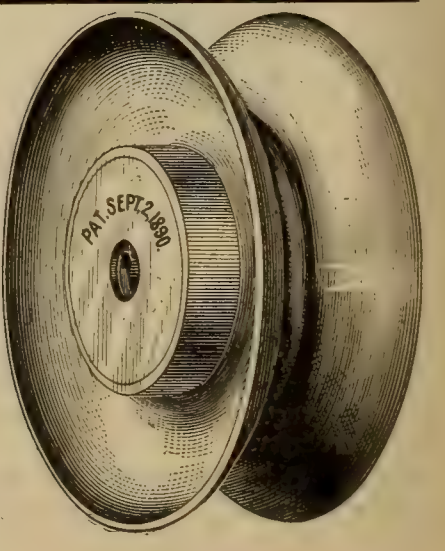
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For Electric Railways.

Smooth running; ways well oiled, prolongs the life of the wheel.
It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

BADGER BROTHERS, West Quincy, Mass.





VOL. I. NEW YORK, DECEMBER 12, 1891. No. 23.

STREET RAILWAY NEWS.

(WEEKLY.)

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ELECTRIC CARS IN BROOKLYN.

After many trials and tribulations it begins to look as if Brooklyn was at last to enjoy the luxury of electric cars on its streets. The hearings which have recently taken place before the Railroad Committee of the City Council on the question of granting the street-car companies permission to change from horse to electric power in the operation of their cars have been practically concluded, and it is thought that the committee will report favorably on the petition.

A good deal of opposition from certain quarters was presented, but that was to be expected. All reforms have to battle with more or less opposition, and it is only by persistence of purpose that the barriers can be broken down. Brooklyn, of all other places, excepting, possibly, New York, is sadly in need of rapid transit. True, it has elevated roads, but these are not ramifying enough to enable the people in every section to enjoy rapid transit. The street-car lines, on the other hand, run in every direction, and the adoption of electricity on the surface lines would give Brooklyn a boom that she has never before experienced. Unlike New York, Brooklyn has plenty of room to grow, and electric lines certainly will do more than anything else to build up the suburbs.

The conditions for the operation of electric lines by the overhead system are about as favorable in Brooklyn as can be found anywhere. The streets as a rule are of generous width, and there are no grades to speak of. It would be a great relief to the citizens to be free from the disagreeable features attending the use of horses, and a majority of them would no doubt hail with delight the advent of electricity as the motive-power for street cars.

The result of the committee's deliberations will be looked for with deep interest by all interested in electric traction.

LARGE OR SMALL UNITS?

As to the advisability and economy in using long cars on electric roads, there, of course, must exist differences of opinions, and it would be interesting to know just what proportion of street-railway managers favor long cars and how many advocate the use of cars of ordinary size.

In his address before the New York Street Railway Association, on the 15th of September last, Mr. John N. Beckley made some remarks on the subject which no doubt represent the views of a great many street-railway managers. "It seems to me," he said, "a mistake to equip a car body of greater length than eighteen feet, and I think a sixteen-foot car is still better. During the hours of the day when travel is heavy, it is easy to pull a trailer, and when traffic is light you are not then using up your power in hauling around a great lumbering double-truck structure practically empty."

The force of these remarks is apparent, but possibly as strong an argument can be put forward in favor of long cars. It would seem, however, to be the more economical method of operating an electric line to run smaller cars and add to the number as the demands of traffic require. A small car weighs less than a large one, and if few passengers are to be carried a small car is just as good as a large one and more economical to run. On the other hand there is no question that where traffic is heavy the larger cars render better service.

Every manager knows during what hours the travel on his road is heaviest and when it is lightest—at least he ought to know. With this knowledge as a basis an enterprising company might have both large and small cars for use according to the volume of travel. With such equipment the difficulties referred to would be quite entirely met, and the system would be a most flexible one.

WANT NIGHT TRAINS.

A petition signed by 3,000 persons living along the lines of the Brooklyn and Union elevated roads was presented to the directors of these roads on the 2d inst. by a committee representing the Tax-Payers' Association of the 26th Ward, Brooklyn, asking for all-night trains. It is said that most of these people work at night, and would be greatly benefited by the running of all-night trains. The directors promised to give the matter careful consideration, and extended some hope that the object of the petition might be realized.

COLLISION OF STREET CARS.

At 6:30 P.M., December 3, in New York City, an up-town and a down-town Broadway car, loaded with passengers, collided at the Bleecker street switch with terrific force, throwing the platform passengers into the street, and piling those inside of the cars against the front doors, but without serious injury. The up-town car had run off the track on the Bleecker street switch, the driver being unable to apply the brake in time to prevent the collision. Both cars were badly damaged.

OUR PHILOSOPHER SAYS THAT

The margin between success and failure is often a narrow one. Everything depends upon attending to the little things promptly and properly.

Bright cars and slick horses indicate prosperity, but the prosperity can be greatly increased by substituting the slick horses by the slicker power—electricity.

There is a wide gulf of inconsistency between grassy streets and electric railways, and where you find the latter you never find the former.

The larger the scrap-heap the smaller the dividends.

No street car company would operate its cars by electric power if it did not pay better than every other power.

THE STIRLING WATER-TUBE SAFETY BOILER.*

The latest development in boilers is the Water-Tube Safety Boiler shown below, which for safety, efficiency, economy and the facility with which it can be repaired or cleaned seems to be all that possibly could be required. Those who had an interest in its development worked on scientific principles, endeavoring to construct a high-pressure boiler without the defects of previous boilers of this class. It is practically the latest scientific and mechanical evolution of preceding research, experiment and result added to careful study and individual experience.

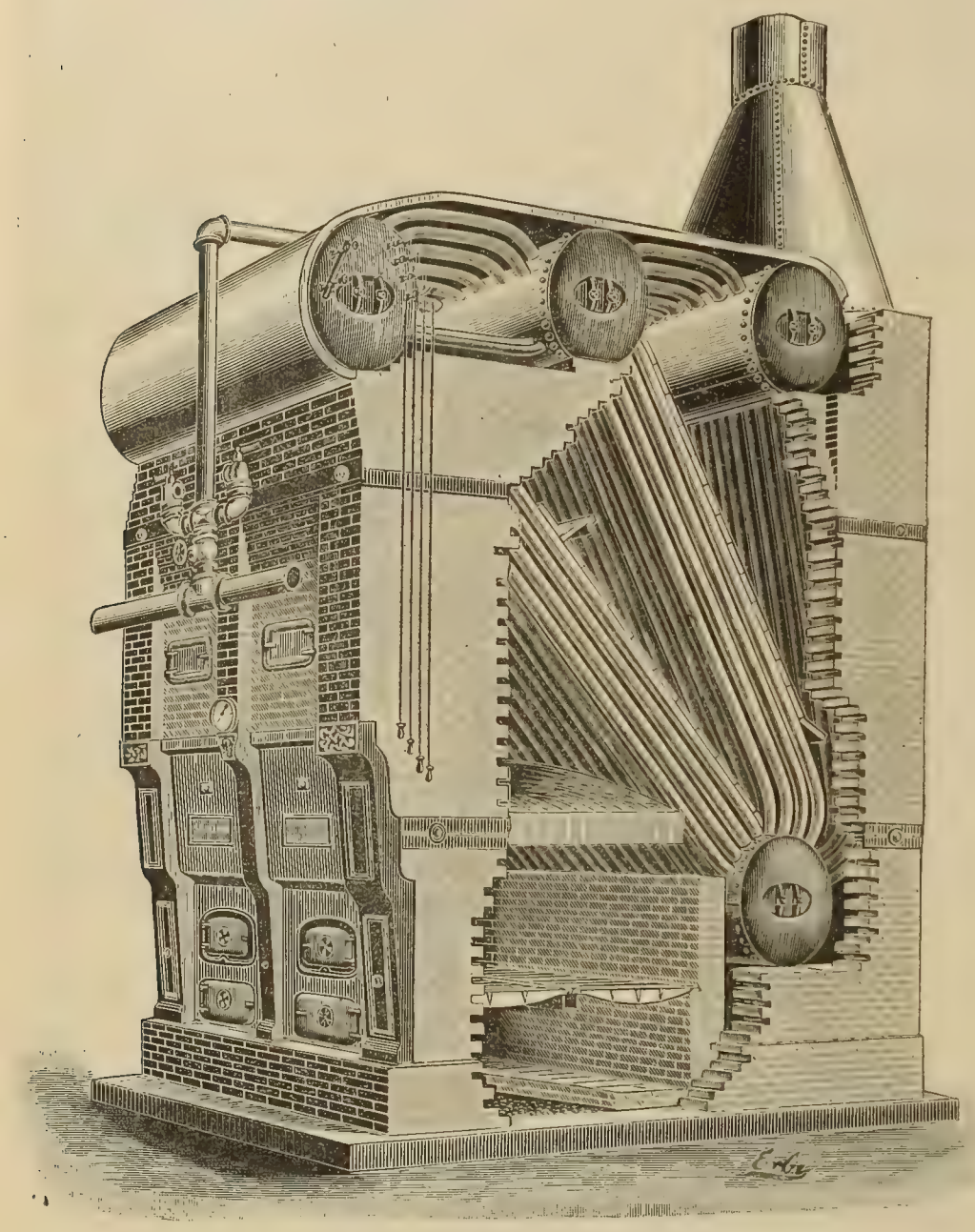
The aim of the inventor was to simplify and strengthen, to render safe and more effective, and at the same time to cheapen first cost and secure the greatest economy in labor and fuel, and to-day the firm manufacturing the boilers believes it has accomplished the end sought.

The boiler consists of two or more upper wrought-steel drums connected with each other and with a lower or mud-drum, also of steel, by tubes expanded directly into the drums. Not an ounce of cast-iron or cast-steel is used in its construction, preventing in a great measure galvanic oxidation. The manufacturer of the Stirling boiler uses a thin tube surface, as it assists the transmission of heat to such an extent that the most intense fire cannot injure the surface while the tube is covered by water on the inside. This is true in a measure of all water-tube boilers, but the thicker the shell of the tube the less conductivity it has. Fire contact with riveted joints, the weakest part of an ordinary boiler, has been wholly done away with.

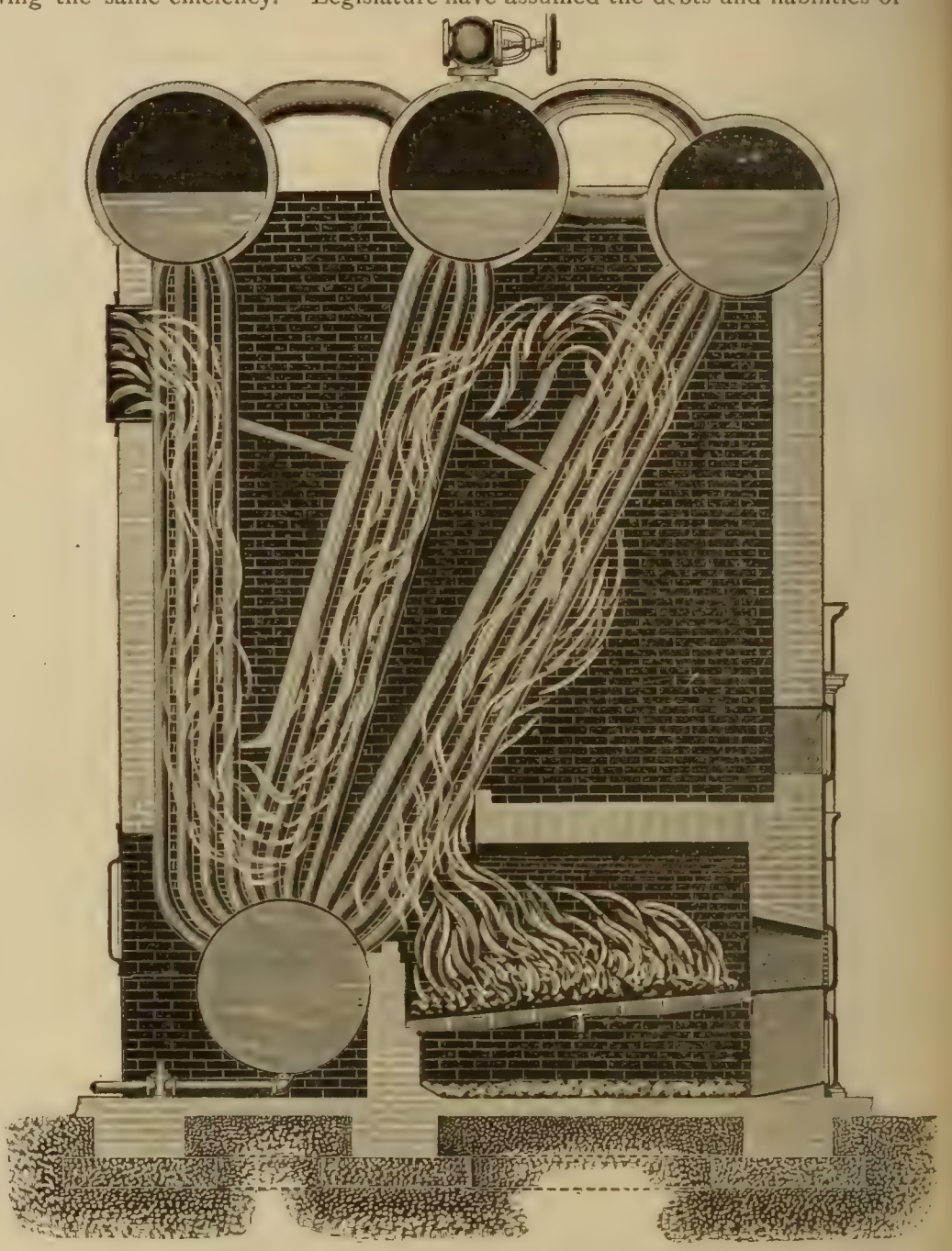
Owing to its construction the Stirling boiler will admit of more than the original width of grate surface, giving to each tube its full quota of direct heat contact, naturally resulting in a large draught area and consequently better combustion. Each water-tube has a separate outlet equal to its own area; in other words, each tube is expanded directly into the circulating drums and furnishes its own outlet, giving 100 % of outlet. This circulation practically insures dry steam requiring no super-heat or "drying." While the boiler is practically self-cleaning, the facilities for an occasional looking-into and general overhauling are better than in the ordinary boiler. The exterior also of plates and tubes is accessible at all points. To sum up the claims made for the boiler —and they seem to be well substantiated—it gives better draught, circulation and combustion; absorbs more heat and loses less in escaping gases, losing little or none from dust on the outside or sedimentary or chemical deposits on the inside of the tube, and consequently uses less fuel; uses any kind of fuel and any kind of water with the best results; steams quickly and furnishes dry steam; gives more steam and power from less heating surface and fuel; and loses no time, labor or material in cleaning or repairing. It certainly must be an economical boiler to use, and an absolutely safe boiler is the best possible boiler insurance.

At a number of tests made with Stirling boilers the horse-power developed was considerably more than their rated capacity, and their efficiency was proved to be everything the company claimed for them. A 150 horse-power boiler tested at the Toledo Bolt and Nut Works, Toledo, Ohio, last May, showed the boiler to be 48 % above its rated capacity, and a boiler tested at the Etna Iron and Steel Company's works, Bridgeport, Ohio, in September last having a rated capacity of 212½ horse-power, developed 346 horse-power, an increase of 62.8 %. The Etna Iron and Steel Company has made a number of tests of the boilers recently, all showing the same efficiency.

* The Stirling Company, Chicago, Ill.



STIRLING WATER-TUBE SAFETY BOILER.



SECTIONAL VIEW OF WATER-TUBE SAFETY BOILER.

THE WEST END COMPANY SUED.

Herbert L. Harding presented to the Supreme Judicial Court, December 1, a sworn affidavit in which he asked the court to order a special precept for an attachment of the property of the West End Company to the amount of $50,000, on the ground that the company is in danger of becoming insolvent.

Judge Morton, while he did not grant the precept, said he would hold the matter in abeyance in order that Mr. Harding may renew his application later if it is deemed advisable.

The suit in connection with which the application is made raises a number of important questions of law, one of which is second in importance only to that referred to relative to the financial condition of the West End Company, for Mr. Harding contends that the Malden & Melrose Railroad Company, if the answer of the West End Company is true, has lost its franchise, and that the tracks now operated by the West End are a nuisance and should be removed, and that a receiver for the road be appointed.

The plaintiff in the case is William Austin Whitney, who sues the Malden & Melrose Railroad Company, the Boston Consolidated and the West End Street Railway to recover about $35,000 on three judgments recovered some years ago against the old Malden & Melrose Company.

The Malden & Melrose was incorporated in 1856, and in 1862 made a traffic contract with the Middlesex Company by which it leased to the Middlesex all its property and franchise for the rest of its corporate life, the Middlesex agreeing to assume its debts and, after making itself whole, to pay the Malden & Melrose 8 per cent. on the capital stock of the latter company.

Mr. Harding, in his opening, said: "The facts show that the earnings of the consolidated roads would after a period of perhaps ten years have enabled the Middlesex to pay the Malden & Melrose dividends on its stock for years before the consolidation of the Middlesex and Highland roads in 1886. We stand as judgment creditors to the amount of $35,000, and in this suit seek to reach and apply on our debt whatever funds may be due on accounting with the Middlesex Company, or its successors, who have assumed its liabilities. Now, the Middlesex consolidated with the Highland road, and both companies have since been absorbed by the West End Company, who must under the act of the Legislature have assumed the debts and liabilities of the old companies. Since the filing of this bill, the West End and Middlesex Companies have filed their answers, which are somewhat startling in their character. They set up as a defence that the contract with the Malden & Melrose made by the Middlesex Company is not authorized by the terms of the charter. This answer presents novel features; for if the contract was *ultravires*, then the West End Company is in possession of a railroad whose franchise they have usurped, unless they have made an independent contract with the Malden & Melrose Company, and in that event they must have assumed its liabilities."

Mr. Harding's amendment to his bill asks that the court order the West End Company to assume and pay the plaintiff's debt; and that if the West End is not lawfully in possession of the Malden & Melrose, that the Attorney-General be made a party to the suit, and a receiver for the Malden & Melrose be appointed, and the tracks declared a nuisance. The court, against the objection of the defendant's counsel, allowed the amendment.

Mr. Harding asked that a special precept issue for an attachment of the West End Company's property, and filed the following affidavit:

"I did not cause any attachment to be made on the property of the respondent (when the suit was brought in September, 1890) because I believed that the company was then, and would continue to be, perfectly solvent, and because I had reason to be-

lieve that the suit would be amicably settled. The suit has been long pending, and since suit was brought the position of the respondent has materially changed in several respects. The capital stock has been largely increased and a further increase asked for and permission obtained from the Railroad Commissioners. The net earnings of the company for the year past are less than for the previous year, and the liabilities are larger and more uncertain. The introduction of new motive-power has been a source of large expense, and the ultimate result of the adoption of this motive-power is still uncertain. Officials of the company have repeatedly and publicly declared that unless certain privileges and immunities were granted to the company the company would not make any further investment in its plant, and would not complete the improvements already contemplated. The privileges and immunities demanded have not been accorded, and the future of the company is uncertain. Two former directors of the company who were supposed to be men of large wealth, have recently met with financial disaster, and there has been a radical change in the *personnel* of the directors. It is generally conceded that a very large outlay must be made in the near future by the company if it wants to control the street transportation of the city, either for elevated or underground railroads, or other methods of rapid transit. In view of these facts and considerations I request a special precept."

This was signed and sworn to by Mr. Harding, who said the company had invested $7,000,000 in its trolley system, which, in case of the adoption of a new system of rapid transit, would result in a loss of almost the entire outlay; and the wires and other apparatus are constantly wearing out and requiring replacement.

Prentiss Cummings, for the West End Company, said that in only two cases against the company had there been attachments; both were cases where damages for personal injuries were claimed, and in both the attorneys were lawyers who were well-known to be "off color." He would forbear mentioning any names. This was the third case. He thought it an extraordinary request. The company had assets of $20,000,000, and liabilities of not more than $7,000,000. As to the increase of the capital stock, that simply made the assets more valuable than ever. The West End Company was not and would not become insolvent. As to the present suit, the Supreme Court had declared the lease of the Malden & Melrose to the Middlesex void, and everybody knew that long ago. Besides, when the contract was made the former road was hopelessly insolvent. The present plaintiff was a son of the former treasurer of the Malden & Melrose, who had got into financial difficulties and left the country, never to return.

Judge Morton said that he did not at present see the special need for a special precept, but he would hold the motion in abeyance so that the request might be renewed in the future if there should be found to be a necessity.

BIOGRAPHICAL SKETCHES.

JOHN N. STEWART.

The biography of a man twice elected to an office of honor, in no matter what society or association it may be, cannot but be an interesting one, and that of John N. Stewart (whose picture is here shown), who was recently re-elected to the presidency of the Ohio State Tramway Association, is especially so.

He was born in Cleveland just forty-five years ago, and was educated in that city at the public schools there, and while still quite young became actively engaged in the construction of the Union Pacific Railway. When he returned to his native city he studied law for a time and afterwards became a member of the City Council.

The affairs of Mr. Stewart's (now) corduroy road in Ashtabula have now passed into history and are stored in the archives of the minds of those interested, but we venture to predict that sooner or later John N. Stewart will be complete master of the situation in Ashtabula.

Mr. Stewart is a splendid parliamentarian and an unrivalled presiding officer, both in the forum and at the festal board.

THE TROLLEY IN BROOKLYN.

On December 3 the Railroad Committee of the Brooklyn Board of Aldermen concluded the hearing on the applications of the various surface railroads for permission to substitute the electric trolley system for horse-power. Unless the committee is again appealed to from opponents of the trolley system there will be no further meetings. It is believed that the committee will report in favor of the application, and that the report will be approved by a decisive majority of the Board of Aldermen.

OILS FOR LUBRICATION.

Our English contemporary, *Industries*, prints an article on lubricants which possesses considerable information of value to those having in charge machinery of all kinds. Electric railway generators, above all other machines, require the best of care and the best of oil. Poor lubrication results in interminable vexations and dissatisfaction, and with the hope that the article may accomplish some good we reproduce it herewith:

"Until comparatively recently the engineer was confined in his choice of lubricants to the animal and vegetable fats and oils, and in the selection of these price was an important factor. Was it better to use rape oil than "gummed," or olive oil that turned rancid, or sperm oil at an almost prohibitory price? Each plan had its advocates and disciples, who clogged, corroded and stinted their bearings respectively. Nowadays, however, mineral oils are available which fulfil every requirement of ordinary lubrication, including that of cost. They are preferable to fatty oils for many reasons, most of which can be traced to their wholly different chemical constitution, consisting as they do almost entirely of hydro-carbons of the paraffin and olefin series, of great stability and inertness; while their rivals are composed of the glycerides of various fatty acids, and are less permanent, not only because of their greater complexity, but also because of the presence in them of small quantities of other bodies, albuminous or pectinous in character, which tend to induce



JOHN N. STEWART,

President Ohio Tramway Association.

fermentative changes, resulting in the production of free fatty acids, the presence of which is, of course, the cause of the corrosion attending their use. In special cases, where it is a necessity that the viscosity of the lubricant should vary as little as possible through wide ranges of temperature, it may be requisite to have recourse to an animal or vegetable oil, and for this reason there is little doubt that for certain purposes such oils will always command a sale; this is particularly the case with regard to sperm oil and its congeners. But before a mineral oil is chosen, it is needful to ascertain first whether it is to be of the right kind for its proposed use, and secondly, whether it be good of its kind. With this object it must be examined both chemically and mechanically by competent specialists, as few users of power have the knowledge and apparatus necessary. The only instance in which such examination can be dispensed with is when the oil selected is of some definite brand known to be of uniform quality, prepared for use with a particular class of work, and known by experience to fulfil its pretensions. Otherwise to "try" a perhaps much-puffed oil on valuable machinery, which it may possibly suit, but which it may, with at least equally great probability, not suit, is an experiment of the most expensive description.

"To come then to the qualities which a good mineral oil should possess. First, with regard to the specific gravity. An idea was once prevalent, and it is to be feared is still current, that the specific gravity of an oil had a definite relation to its viscosity, or—as the upholders of the notion would probably have preferred to say—body. This is, of course, quite erroneous, for though there is generally some rough concordance between the specific gravities and viscosities of oils of very similar origin in direction, if not in magnitude, no such similarity can be detected in the case of oils from different sources. Consequently no great importance can be attached to it. Next with regard to purity. Except in such cases where it is intended for some especial reason to use a mixed oil containing both mineral and animal or vegetable oil, it is obvious that nothing but hydro-carbons of mineral origin should be tolerated, anything else being a sophistication. Again, it is essential that the oil should have been properly refined. In the contrary case it will be liable to contain tarry matter, or acid generally sulphuric acid—or alkali, the two last substances being used in the process of refining, and being left in if the oil be imperfectly washed. Further, it is important that the oil should have a flashing point well above the maximum temperature it is likely to attain in its proposed use, both on the ground of economy and safety; this is easily fulfilled even in the case of cylinder oils. Another property that it is desirable the oil should possess is that of not solidifying when subjected to cold; this is, of course, chiefly in importance in exposed situations; an oil suitable for such use remains fluid, though becoming gelatinous many degrees below freezing point. Finally—and is to be remarked that the condition is a most important one—the viscosity must be suited to the work the oil is to do. It is generally admitted that a shaft revolving in an ideal bearing should be oil-borne throughout its motion; to approach this state of things it is necessary that the viscosity of the lubricant be sufficiently great to prevent disruption of its film under the maximum load normally carried. Anything higher than this is mischievous, for it means continual waste of power. It must be remembered that as the viscosity of a mineral oil diminishes rapidly with rise of temperature, it must be determined at the temperature which it is expected the bearing will attain while running under ordinary conditions; besides, it should be taken at a lower temperature—60° F. is commonly used as a standard—and also, preferably, at a higher one, so as to ascertain at the rate the viscosity changes. As an example of the differences that may be thus recognized, may be quoted the case of two oils of nearly the same viscosity at 60° F., which came under our observation, of which the first had the ratio of its viscosity at 60° F. to that of 120° F. as 1: 0.16, while that of the other was as 1: 0.11, a very considerable variation.

"Hitherto reference has been made only to unmixed mineral oils, but there is another class particularly adapted for use at high temperatures, or where very heavy loads have to be carried, viz.: mixed oils. Such mixed oils fall naturally into two divisions; in the first the requisite effect has been obtained by the addition of an animal or vegetable oil, while in the second the use of "oil pulp" has been resorted to. "Oil pulp" generally consists of aluminum oleate, and when dissolved in a mineral oil raises its viscosity greatly, but its presence cannot be considered legitimate unless the oil be sold as a special mixture. In place of the aluminum salt of a fatty acid, the sodium salt may be substituted, in which case, of course, the substance added is nothing more nor less than ordinary soap. Such a compound gives good results for cylinder use, and is greatly preferable to many of the "cylinder oils" that are often employed, of which the chief qualifications are their black color and tarry consistency, it being erroneously thought that because a good cylinder oil is of high viscosity and is often dark colered, the converse must necessarily be true, and that oils possessing these properties will be excellent cylinder oils. Where the use of mineral oil replaces that of tallow, there is an absence of the corrosion of the cylinder, consequent on the saponification of the fat by high pressure steam, with the production of free fatty acids, which are often present in such quantities as to form masses of iron soap weighing many pounds. Cases have occurred where the use of a mineral oil having been substituted for that of tallow, and this iron soap having been consequently dissolved out and for the first time brought to light, the new lubricant has been straightway condemned as the cause of the phenomenon!

"It is the occurrence of such misconceptions that engender the wish that some small amount of elementary chemical knowledge were more widely diffused, or at least that those not possessing it would abstain from assigning causes to effects with which they are unfamiliar."

RAPID TRANSIT.

The Boston Rapid Transit Commissioners have gone into executive session to consider the plan presented by Engineer T. C. Clark, of the West End Street Railway. The examination will occupy several days and the details will not be made public until President Whitney has explained them. It is thought the plan will be approved.

The scheme contemplates one tunnel under the Common, starting from Park square, and another from junction of Warrenton and Tremont streets the two tunnels uniting and emerging between Scollay and Adams squares.

From each end of the tunnels the road to be continued on an elevated structure.

THE SUPERIOR SAFETY OF THE HIGH-SPEED ELECTRIC CAR.

BY J. STANFORD BROWN.

The STREET RAILWAY NEWS may well lay stress, as it does in its editorial remarks of the issue of December 5, 1891, on page 189, on the greater freedom from accident where transport facilities, operated by mechanical power, are used instead of those propelled as of yore by the trusty horse or mule.

This is not only a matter of great interest and satisfaction to all electrical engineers, but is also of even greater import to the public.

We are gaining in our streets (1st), space, and thereby enabling more business to be done; (2d), cleanliness, whereby the public health is improved; and (3d), while saving time to the traveller by increased speed over old-fashioned methods, it is found, as you have so clearly shown, that he is carried with much greater safety to his person than heretofore.

One important reason why the quicker travel is the safer has, however, so far as the writer is aware, not yet been cited.

It is a well-known fact that in all trades and professions involving proximity to danger the more fully those subject to it are made aware of the danger the less dangerous it becomes for them to continue in that occupation.

This same consideration would seem to apply equally well in the case of electric cars. From childhood we have been accustomed to dodge under a horse's nose when crossing a street, more particularly those of us brought up in crowded city thoroughfares, and we dodged again in front of the horse car, often forgetting that, in the majority of cases, no poles are used, and that the car did not necessarily stop a horse's length behind the animal's nose.

With the trolley car there is neither horse nor pole to act as a partial fender, though a better one can be furnished readily; and just as fast as people learn that the car speed is such as to render it unsafe to experiment with, so soon, and so soon only, will they take proper care of themselves and their children.

Thus, incredible as it might sound at first hearing, the simple fact of the speed being sufficiently great to be dangerous makes it all the safer for the public at large.

TESTED BY FIRE.

A Pittsburg paper of the 28th ultimo contains the following regarding the recent fire which destroyed the barns and much of the equipment of the Second Avenue Passenger Railway Company:

The recent burning of the car-barns of the Second Avenue Passenger Railway Company, which resulted in the total destruction of twenty-six cars, demonstrated an interesting fact in connection with the electrical apparatus. In making an investigation of the wreck, in order to discover whether there might be anything left to be again used, the railway company found that of the various electrical equipments which were operated on the cars of its line, the motors of the Westinghouse Electric and Manufacturing Company were the only ones that could be utilized again, they being in a condition somewhat similar to that of a good safe which has passed through a fire.

This is a significant fact on the side of the claim of the Westinghouse Company that their motors are made of better material and that their construction is more substantial and that they are therefore better adapted to the severe service to which they are subjected in street-railway practice than is any other make of motor. This care to provide for the extraordinary strains to which street-railway apparatus is subjected will no doubt be looked upon by the street-railway companies as a proof of the superior excellence of the Westinghouse manufacture.

It would appear that the Second Avenue Company has accepted this fact fully insomuch as they have already purchased from the Westinghouse Company complete equipments to replace all of those that were destroyed by the fire.

GALVESTON'S STREET RAILWAY TROUBLES.

A suit has been instituted in the District Court, Galveston, Tex., by Mrs. Mary F. Boyce, of Houston, Tex., owner of 300 shares of the company's stock, against the Galveston City Street Railroad Company, its directory and the City of Galveston.

In her petition she alleges against the directory of said railroad company mismanagement and misappropriation of the funds and income of the company, and charges a wrongful investment of its earnings in other corporations; that at a stockholders' meeting 17,820 shares of stock were wrongfully declared paid up, and that the directory, by voting a large amount of fraudulently issued stock, have maintained themselves in the management and control of the company's affairs.

The plaintiff further alleges that the Board of Directors fraudulently invested $50,000 in buying stock in the Beach hotel and the Seaside Improvement Company, and without legal authority advanced over $149,000 to the company. The last-named corporation is practically owned by the railway company's Board of Directors. The petition further recites the insolvency of the defendant company, and requests the appointment of a receiver and the issuing of an injunction against the company's officers.

The Galveston City Street Railroad Company denies the charges of wrongful and unlawful action, but the statement of having invested in the building of the Beach hotel is not denied. The company claims that such an investment was extremely beneficial to its interests. The application for a receiver and injunction is now pending before the court.

STREET-CAR TRACK PAVEMENTS.

Lately many courts have been occupied in passing upon questions affecting the rights of street-car companies in the matter of paving portions of the streets occupied by their tracks. A case of this character has just been decided by the New York Court of Appeals, General Term. The parties in the case were the City of Binghamton *vs.* The Binghamton and Port Dickinson Railway Company. The question raised was the liability of a street railroad to pay for paving between its tracks and a foot or two on either side of the same style and sort as ordered by the Common Council to be laid in the street through which the railroad runs. In this case the city sued the company for $5,181.12, the cost of laying the Warren-Scharf asphalt pavement between the tracks on Chenango street. Binghamton was incorporated as a city under the laws of 1867, and the railroad company was incorporated under the laws of 1868. The railroad was constructed in 1871, and has since been regularly operated. In April, 1889, the Council ordered Chenango street paved with asphalt, let the contract, and the Warren-Scharf Company did the work satisfactorily. The railroad was duly notified to pave with asphalt between its tracks. It did not do it. The city ordered the work, it was done, and the city sued the company. It was tried before a referee, who decided in favor of the city. The company appealed, and the General Term reverses the referee's decision. The point made by the company was the legal distinction between "keeping in good repair" or "repairing" and "repaving" or new paving. Before the asphalt there was no pavement on Chenango street. The General Term says the rights of the railroad were obtained from the Legislature and that the city authorities had no right to increase the burden. The city could establish or alter the grade but could not compel the company to use any particular kind of material in paving. In the language of the Court: "It follows that the defendant is not bound by the determination of the plaintiff's Common Council that an asphalt pavement should be laid. Such a determination does not, as against the defendant, presumptively prove the necessity of such a pavement." The substance of the opinion is that the railroad charter was received and accepted, and obligation was thereby contracted in 1868 to keep the driveway between the tracks in good condition, when the surface of the street was composed of earth. The opinion states that it might be possible that the street needed paving, and that the railroad company was responsible for paving the portion of the street it was under obligations to keep in repair; but the ability of the Common Council to determine what kind of pavement should be laid is doubted. The opinion of the court is lengthy and the ground is gone over very carefully. The Utica case is cited in the opinion.

PERSONALS.

Mr. Otis K. Stuart, who for a long time has been treasurer of the Germania Electric Company of Boston, Mass., has resigned that position and will now give his exclusive attention to developing the business of the company in the southeastern district which comprises all the territory east of the Mississippi and Ohio rivers and south of New York State. STREET RAILWAY NEWS congratulates both the Germania Company and Mr. Stuart himself upon the change. The business is bound to receive a tremendous boom throughout that section of the country, as Mr. Stuart's abilities are bound to command it and Mr. Stuart himself will certainly be placed in a position where those abilities will have a more extended scope than they have ever yet had. To both Mr. Stuart and the Germania Company we most cordially extend our best wishes for continued success.

Mr. E. Peckham, of the Peckham Motor Truck and Wheel Company, Kingston, N. Y., paid us a friendly visit on Thursday, December 3.

A STORY IN FIGURES.*

The question whether electricity is a success commercially for street-railway propulsion is not the one which now exercises the minds of street-railway managers. This has been practically demonstrated within the past few years. It is an acknowledged fact that electricity as a motive power has "come to stay," and in no other branch has it so decidedly established its superiority as in the problem of rapid transit; and never in the history of the commercial world has there been so great an increase in the values of suburban property as there has been since the introduction of electric traction.

The following table, which has been carefully compiled from actual figures, shows the relative cost of operation per car mile, and per passenger carried, for electric, horse and cable traction:

Average of	Operating expenses per car mile. (cents.)	Interest charge per car mile at 6 per cent. on aver'ge investment. (cents.)	Total of operating expenses and interest per car mile. (cents.)	Cost per passenger carried, interest charge included. (cents)
22 Electric Roads...	11.02	3 03	14.05	4.53
45 Horse Roads.....	24.32	4.62	28.94	4.98
10 Cable Roads.....	14.12	6.97	20.91	4.77

FINANCIAL DEPARTMENT.

The recent cold snap with its spit of snow here and there caused a cold shiver to run down the back of the ordinary street-railway shareholder, for with the present adopted methods of propulsion the operating expenses until next May or June will increase and the income decrease, eating a big hole in the dividends; with only one saving clause—and that a vicious one—the certainty of a strike on many lines, which naturally leaves the money in the office which would otherwise be disbursed on pay-day. There are many who have their surplus invested in trolley roads who feel that after a fair trial, coupled with the aid of technical investigation, they are as safe as the condition of the science permits. Up to a very late day no doubt this conclusion was correct. All surface-road officials have data at their command which should, and probably do, show the itemized expense of the old-time mule or horse lines. The cable road, like the sea-serpent, flourishes at certain times in certain places. It is very well leading up out of a deep mine, over a long bridge, or an elevated road, or up a steep mountain, the top being the object in view, but as a method for ordinary street-railway traffic it is not a bit ahead of the storage battery. I know of at least two systems which could have been constructed for less than ten per cent. of what the Broadway cable line has cost, and be operated for forty per cent. less, beside being fifty per cent. more effective. Where do the shareholders and the public get off at, on that statement? Will the cable ever be dragged through the Broadway slot; will it be used long enough to smooth down the journals? are two questions which will probably be answered before the cars are hooked on. Next comes the overhead trolley. For small cities and many less thickly settled places this system like the aerial light equipment answers every purpose. Money invested in those roads is and will be a safe and growing investment. The Railway Commissioners have decided that it is a proper device for many locations if the majority of the property abutting consents. That there is no north and south space for it in New York City is so well known that even a 4-11-44 man would decline to entertain a proposition on the subject. The underground trolley has not had a fair trial as yet, and possibly will not until the Rapid Transit system is completed, and I have gone to glory. The continuous centre-rail has been tried almost as much as the mule, and, if it gets a chance, is the only thing yet invented that will kick harder. There you have the lot—plenty of opportunity to invest either with a chance or a certainty. Consider the times, conditions and securities. There is more legitimate profits to be made out of modern street railways than the old express, bus, mule or horse roads, as surely as there is from electric light over the oil or gas. Get in before the promoters have watered the stock and loaded the venture with bonds demanding a reserve fund nearly equal to current earnings. Put a stopper in

* Edison General Electric Co., New York.

such proceedings, and there are oceans of opportunities offering, the returns which will be mutually satisfactory and honest. The business being in operation can always adopt or change to the improved systems at the minimum of cost, and a vast majority of the old material continue ; but above all things get in early, and aid by your investment in saving to the corporation the usurer's moiety, or more in many cases.

Can any of our friends cite us a case of absolute bankruptcy of a street-railway company, after an undisputed possession of its route, equipped for a single year; or, on the other side, is it not a positive fact that the income goes on increasing and will until just before the arrival of the historical Australian savage to take possession of our fair land? From mule to electricity they all make their shareholders rich, and as the family increases so does the value, ganged by the income, continue as a means of support. Their business is cash and so divided that that which affects all other investments detrimentally has no effect on this industry. To be sure, in this as in any other business, opposition (and I assert that in this case it is opposition to the laws of nature) to the necessary ownership, supervision and emolument often gains a foothold which is for the moment detrimental to the interests of all concerned except the opponent personally. One of the most honored men in the nation has said, that "a public office is a public trust." Are not the officers of a corporation created and protected by the public, public officers, and are they less amenable to the people than those placed in other (similar) positions by the votes of the people? The present condition of the Galveston Street Railway as set forth in the STREET RAILWAY NEWS of the 5th inst. at considerable length shows what a great amount of friction a street railway company can stand from internal as well as external elements without losing commercial value. The same spirit is apparent in this controversy which requires a United States Supreme Court decision to decide the position, once for all, of a public servant in control of a corporation generally known as a public company. Capital invested in the Galveston Street Railway Company is informed that the directors are "responsible alone to the stockholders and the City is one of them." The City Treasurer should represent that interest and with the same zest that any other officially appointed guardian might, protecting it as public property for the benefit of the public. It is possible in a case like this that a receiver might be named to hold position during pendency of the question but there is no danger of bankruptcy. Street railway securities are the safest investment of the day.

REMARKABLE PERFORMANCE OF A STEAM-ENGINE GOVERNOR.*

It is commonly believed that certain kinds of work are most severe on an engine, because of the variable character of the load. This is not true, however, to the least degree, since the engine accepts only the reciprocating pressures distributed by its valve, and no change of load can make these changes of pressures more numerous or violent than would occur under constant load. A change to a longer cut-off merely continues the pressures through a greater part of the stroke ; while a shorter cut-off has no effect in making the reversal of pressures less sudden at the end of the stroke.

The real trouble experienced is an acknowledged inability, in the great majority of governors on the market, to effect a perfect adjustment for quick changes of load without being affected by the violent surging which generally occurs. When subjected to this strain they rapidly deteriorate with their effort to satisfy the demands upon them, while obstructing devices which insure a smooth, easy action of the governor have the very opposite effect upon the engine and the work it does.

Probably the severest duty imposed upon an engine governor is found in electric-railway work, where the changes of load are practically instantaneous, and often through a wide range, while the character of the service demands a constant speed. It is customary and considered sufficient in such work to measure the speed over a considerable interval of time, and the rate of speed per minute represented as the actual number of revolutions in that time, yet, extreme fluctuations of load might change the speed (even if but momentarily) far above or below this reading without in the least affecting the average.

With a view to thoroughly investigate the efficiency of the Westinghouse Compound-Engine Governor in this respect, a supplementary test was made upon an 18 and 30 x 16 engine of this type at the power-house of the Federal Street and Pleasant Valley Electric Street Railway, by C. F. Scott of the Pittsburg Laboratory of the Westinghouse Electric and Manufacturing Company. A special instrument was designed by Mr. Scott, reading to one-hundredth of one per cent. variation of speed and registering every half second.

Referring to Fig. 1 the following is a description of the apparatus: A milled centre inserted in that of the engine's shaft revolves a large wooden drum (whose circumference is 25 inches) at the same speed of the engine (250 revolutions per minute), while a belted screw feed moves an electro-magnet, whose armature supports a pencil, longitudinally along the cylinder. Another part of the apparatus is a pendulum adjusted to beat nearly at the speed of the engine and make electric contact at the centre of its motion to operate the armature and pencil upon the drum. A strip of paper stretched upon the drum receives the impressions of the pencil, and when developed displays a line of elongated dots at an angle to the edge of the paper whose inclination varies with the speed. The measured distance, in inches, of two dots that represent four revolutions of the engine, or 100 inches of the drum, is the per cent. of variation of the engine's speed from that of the pendulum ; and a plotted series of these measured distances from a base line, shown in Fig. 1, with a connecting line drawn through them, is the record of the governor's performance. A horizontal distance of one small square corresponds to two revolutions of the engine, or an interval of one half-second of time ; while a similar vertical distance represents a change of speed of one per cent. The curve above this illustrates the change of load by ampère readings over the same period of time.

As will be seen by the curve in Fig. 2, the engine showed remarkably steady speed under the various loads with which it was tested, changing but 1 %.

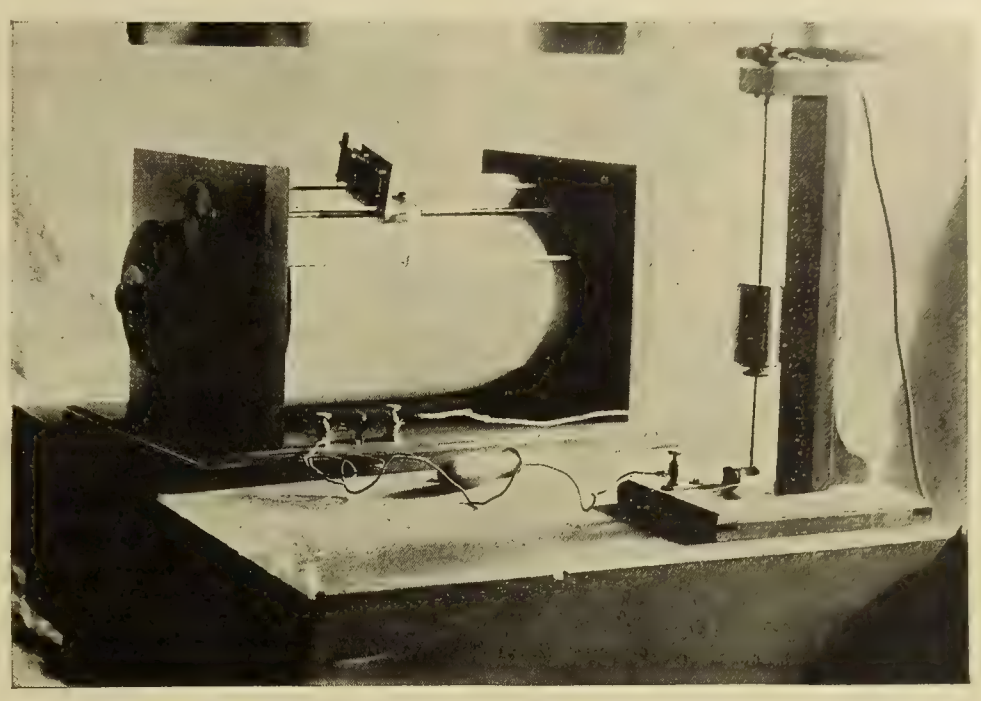


FIG. 1.—SCOTT'S NEW ELECTRIC REGISTER.

Each side of the neutral line represents the time of vibration of the pendulum through a total change of current equivalent to two-thirds of the rated power of the engine.

A test made at the same time with a steam-engine whose governors were actuated by centrifugal force, with moderate loads gave the curve shown in Fig. 3. The curve shows that after each new load the speed changed 1 % beyond the point at which it should have settled, and gradually worked back to the proper place. It is said this governor was perfectly free from obstructing devices ; yet, it is indicated plainly that adjustment did not commence until there was considerable change in its speed. The extra momentary change of speed could scarcely be noticed in the average service, but we think that in street-railway service the effects would be immediately felt.

In its new compound-engine governor the Westinghouse Machine Company disclaim broadly the originality of the principle of inertia in shaft governing, but insists that it has been the first to successfully apply the principle, and exhibits in these curves the evidence of the degree of perfection it has secured by the application.

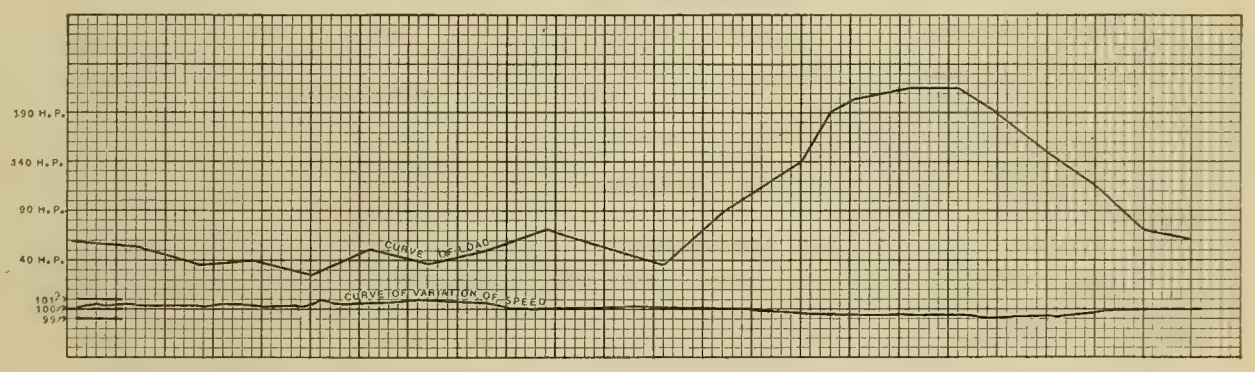


FIG. 2.—WESTINGHOUSE COMPOUND-ENGINE TESTS—CURVES OF LOAD AND CORRESPONDING CURVE OF VARIATION OF SPEED.

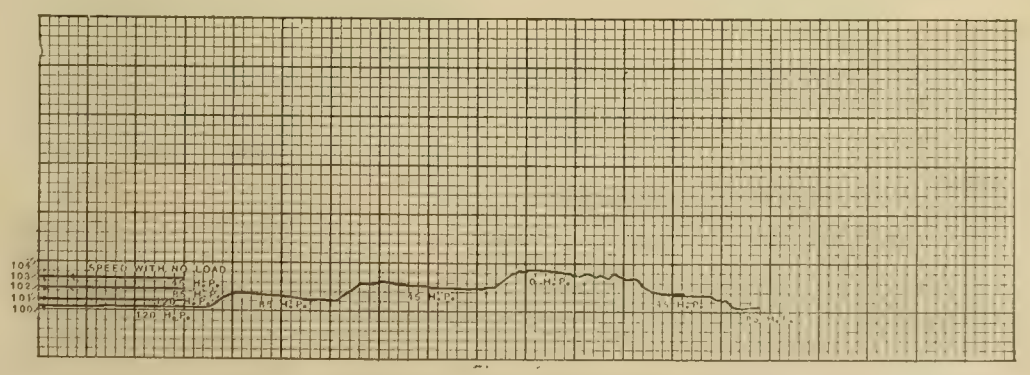


FIG. 3.—CURVE ILLUSTRATING VARIATIONS OF SPEED IN A STEAM-ENGINE WHOSE GOVERNORS WERE ACTUATED BY CENTRIFUGAL FORCE ALONE.

VALUABLE BOOKS.

The following is a selected few of the good books published which are of particular value to electric railway people :

THE ELECTRIC MOTOR AND ITS APPLICATIONS. By T. C. Martin and Joseph Wetzler. Third edition. 315 pages and 353 illustrations. $3.00.

THE ELECTRIC RAILWAY OF TO-DAY. By H. B. Prindle. 55 pages and numerous illustrations. Paper, 50 cents ; cloth, $1.00.

ELECTRIC RAILWAYS. By F. H. Whipple. 259 pages, 117 illustrations. $1.00.

DYNAMO CONSTRUCTION. By J. W. Urquhart. 352 pages, 112 illustrations. $3.00.

ELECTRIC MOTORS. By J. W. Urquhart. 178 pages, 30 illustrations. $3.00.

ELEMENTARY LESSONS IN ELECTRICITY AND MAGNETISM. By Silvanus P. Thompson. 456 pages and 168 illustrations. $1.25.

* The Westinghouse Machine Company, Pittsburg, Pa.

TREATISE ON LIGHTNING PROTECTION. By H. W. Spang. Illustrated. 75 cents.

THE STORAGE OF ELECTRICAL ENERGY. By Gaston Plante. 268 pages, 89 illustrations. $4.00.

ELECTRIC TRANSMISSION OF ENERGY AND ITS TRANSFORMATION, SUBDIVISION AND DISTRIBUTION. By G. Kapp. 348 pages, many illustrations. $3.00.

DICTIONARY OF ELECTRICAL WORDS, TERMS AND PHRASES. By Edwin J. Houston. 656 pages, 397 illustrations. $2.50.

HINTS TO POWER USERS. By Robert Grimshaw. 160 pages. $1.00.

ELECTRICITY AS A MOTIVE-POWER. By Count Du Moncel; translated by C. J. Wharton. 316 pages; 111 illustrations. $3.00.

ELECTRICITY IN DAILY LIFE. By Brackett, Pope, Wetzler, Morton, Buckingham, Webb, Hughes, Millis, Kennelly, and Starr. 288 pages, 125 illustrations. $3.00.

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STREET-RAILWAY LITIGATION.

Messrs. Samuel Jarvis and Roland R. Conklin, of Kansas City, Mo., stockholders in the Salt Lake City Railway Company, Salt Lake City, Utah, have brought suit against that company, asking the appointment of a receiver, for all the rights and property and business of the company, directing said receiver to take possession of all such property of the defendant company and to operate and care for the same under the order and direction of the court, and for the protection and benefit of the plaintiffs herein and all other stockholders; that a restraining order be issued directed to each of the defendants restraining them, as officers and directors, from further incurring obligations against the company in the making of extensions and in carrying on and operating of extensions of the road not authorized by the charter thereof, and from further using the bonds of the company and from giving obligations of the company with large and unusual rates of interest (12 per cent.), and from further carrying on in any way any wrongful acts with the intent and purpose of destroying the credit and assets of the company, and that an accounting may be had, that it may be determined what moneys of the corporation have been expended in extensions outside of the city, and what sums have been lost by the maintaining and operation of such lines; that defendant directors, and each of them, be adjudged to return to the company such sums of money as have been by them in this manner wrongfully expended, and that in default thereof plaintiffs may have judgment against such parties and each of them for the amount in which they are damaged, and which shall be determined by the accounting. Further, that the court will make such orders to the receiver as shall enable him to save the company from the loss of its bonds ($400,000) held as security for $85,000 (of the debts of the company) by the issuance of receiver's certificates and the raising of money thereby to save the forfeiture of the collateral or by such other means as may seem best; and that the plaintiffs may have such other and further relief as the court may direct and as in equity is just.

THE WEEK'S RECORD OF STREET RAILWAY NOTES.

ARKANSAS.

LITTLE ROCK.—Successful trial trip electric street railway November 20.

CALIFORNIA.

SANTA CRUZ.—November 25. Santa Cruz, Garfield Park and Capitola Electric Railway in operation to Garfield Park.

INDIANA.

TERRE HAUTE.—November 25. Striking street-car men return to work pending arbitration.

ILLINOIS.

CHICAGO.—Cicero and Proviso Electric Street Railway Co. building office-building and repair-shops corner Lake street and Cuyler avenue.

MASSACHUSETTS.

BOSTON.—Reported Baltimore Traction Co. and Union Passenger Co. to consolidate.

Reported West End Co. made proposition tunnel central portions city.

Eastside Street Railway Co. and Whitman Street Railway Co. will ask next Legislature authority lease roads to Brockton Street Railway Co.

West End Street Railroad Co. declared dividends 4 % upon preferred stock, and 5 % upon common stock payable January 1, 1892, to stockholders of record December 19, 1891.

SALEM.—November 30. President Orne, of Naumkeag Street Railway Co., took formal possession Essex electric road. Roads will continue as separate corporations.

MICHIGAN.

KALAMAZOO.—November 23. W. R. Adams appointed receiver Kalamazoo City and County Street Railway Company.

MINNESOTA.

DULUTH.—Duluth Street Railway Co. filed amendment articles incorporation including in territory where lines may be constructed towns West Duluth, New Duluth and such portions St. Louis county as company may acquire right-of-way.

MONTANA.

HELENA.—Lewis F. Menage purchased property Union Electric Railroad Company for $45,000.

Consolidated Street Railway Co. will erect brick power-house, 44 x 100 feet, to be completed January 1.

NEW YORK.

ONEIDA.—Reported Oneida Street Railroad Company discontinue operations December 1 to May 1.

OHIO.

COLUMBUS.—Columbus Consolidated Street Railroad Co. making arrangements double present steam-plant and motive-power.

TIFFIN.—Reported failure Field, Lindley & Co, New York, probably cause property Tiffin Street Railway Co. change hands, as members firm had large interests in railway company.

YOUNGSTOWN.—Reported company being organized, capital stock $100,000, to take up franchise offered Youngstown Electric Street Railway Company.

PENNSYLVANIA.

PITTSBURG.—Reported Pittsburg Traction Co. to buy property Duquesne Traction Co.

Reported Westinghouse electric motors used on cars Second Avenue Passenger Railroad Company, which were burned in car-barns recently, only motors which passed through fire in condition to be used again.

TENNESSEE.

NASHVILLE.—November 26. Employés Nashville Electric Railway and Power Co., employed on North Spruce street branch, quit work and brought suit for wages, for which company in arrears.

TEXAS.

HOUSTON.—Houston City Street Railway Company building brick car-houses and car-shops 250 x 141 feet.

VIRGINIA.

PETERSBURG.—Petersburg Street Railway Company will change from animal to electric power at once.

Election of Officers.

SAN FRANCISCO, CAL.—November 19. San Francisco and San Mateo Railroad Company. Directors: C. C. Butler, Behrend Joost, Fabian Joost, J. W. Hartzell and W. F. Thomas. Officers: President, Behrend Joost; vice-president, C. C. Butler, secretary and treasurer, J. W. Hartzell; treasurer, Nevada Bank.

ST. PAUL, MINN.—H. M. Sloane appointed superintendent entire St. Paul system, including both cable lines, E. P. Morgan, former superintendent cable lines, made roadmaster, and F. L. Buttler assistant superintendent.

Legal.

MEMPHIS, TENN.—George Nuss *vs.* Citizens' Street Railway Company, $500 damages being put off electric car after paying fare, because carried paint-bucket.

NEWCASTLE, PA.—Michael O'Toole *vs.* Newcastle Electric Street Railroad Company, for injuries received in collision, verdict $2,100 for plaintiff.

SAN FRANCISCO, CAL.—George H. Perry *vs.* Metropolitan Railway Company, for $14,000 legal services rendered securing street railway franchise for company from board supervisors.

Incorporations.

COLUMBUS, OHIO.—November 29. Worthington, Trentonville and Columbus Street Railway Company. Capital stock, $10,000. Incorporators: H. C. Cooke, A. B. Clarke, O. W. Aldrich, R. M. Weaver, H. D. Welling and J. F. Denison.

JACKSONVILLE, ILL.—November 28. Jacksonville Suburban Railway Co. Capital stock, $15,000. Incorporators: William S. Hook, Marcus Hook and Francis Hook.

New Roads.

ALLENTOWN, PA.—Reported electric street railway to be constructed to Emaus.

CLYDE, OHIO.—Electric street railway to Fremont being agitated.

Franchises.

BEVERLEY, MASS.—November 26. Naumkeag Street Railway Company granted permission for electric trolley system Rantoul street.

PITTSBURG, PA.—November 30. West End Passenger Railway Co. given permission change motive-power to electricity, and granted certain rights-of-way in West End.

Possible Purchases.

COLUMBUS, O.—Address O. W. Aldrich, Columbus, regarding contracts for proposed Worthington, Trentonville and Columbus Street Railway.

MARLBOROUGH, MASS.—Marlborough Street Railway Co. may require construction material for track extension.

PETERSBURG, VA.—Petersburg Street Railway Co. may require electrical equipment.

PITTSBURG, PA.—West End Passenger Railway Co. will need electrical equipment.

Track Extensions.

JERSEY CITY, N. J.—November 25. Work extending electric road Jersey City and Bergen Railroad Company to ferry began.

MARLBOROUGH, MASS.—Marlborough Street Railway Co. asked permission extend road.

Casualties.

BROOKLYN, N. Y.—November 22. Timothy Paterson, paver from Philadelphia, run over and killed on Union elevated line.

BUFFALO, N. Y.—Lady knocked down and seriously injured by electric car on Main street.

INDIANAPOLIS, IND.—November 17. Lady run over and injured by electric car, necessitating amputation right leg near hip.

JERSEY CITY, N. J.—November 22. Man struck by horse car York and Washington streets and severely injured.

LOGANSPORT, IND.—November 24. Boy of 14 who stole into power-house, electric street-railway company, experiment with wires, received injuries resulting total loss eyesight.

MEMPHIS, TENN.—November 6. Conductor electric line received shock from brass handle motor car, throwing him to ground and slightly injuring him.

NEWARK, N. J.—November 17. Man run over and killed by street car during heavy storm.

PITTSBURG, PA.—November 26. Second Avenue Passenger Railway's car-barn, Glenwood, burned. Twenty-five electric cars and entire building destroyed; loss $95,000, insurance one-half.

ROCHESTER, N. Y.—November 26. Lady struck by electric car and seriously injured.

SPRINGFIELD, MASS.—November 19. Springfield Street Railway Company's stables corner Main and Carew streets destroyed by fire. Loss $10,000, fully covered by insurance.

ST. PAUL, MINN.—November 20. Old car-barns street railway company, 7th and Tuscarora streets burned. Loss $10,000, fully covered by insurance.

WOODBURY, MASS.—November 7. Man had right foot crushed by street car on which he attempted to step.

THE DOWD GRAVITY TRACK-CLEANER.

As nearly all electric street railways use the rail as a return wire for the current, some method of keeping the rails clean of dirt and slush is necessary, as the mud and dry dirt which accumulate act as a resistance, sometimes very high. It requires much greater power to run over a dirty track, as the accumulation of filth prevents the full development of horse-power in the motor, and for this reason the rails should be kept clean. Power frequently falls away where it is most needed by reason of a dirty track; this calls for more safety fuses, besides the inconvenience of delays. Usually track-cleaners specially designed for the purpose are very expensive, requiring special trucks and motors, and often costing as much as the ordinary street car.

The Dowd track-cleaner overcomes the item of expense in apparatus of this class, as it can be applied to any car now in use. During the past summer test was made upon the Lynn and Boston a practical Railway Company's line between Crescent Beach and the Point of Pines, Revere, Mass., a piece of track that would be a severe test on any cleaner, and it is claimed that the Dowd apparatus did superior work—in fact, none could have done better.

This track-cleaner is the invention of Mr. P. A. Dowd, formerly New York agent of the Sprague Electric Railway and Motor Company, and one of the best known and most practical electrical engineers in the country. It is manufactured by Barbour, Stockwell & Co., Cambridgeport, Mass.

The Chicago City Railway Co. intends to build a piece of track expressly to have the Prouty motor tested, and if the latter works satisfactorily, it will be adopted on the road named.

BUSINESS NOTES.

The following is self-explanatory:

HARTFORD, CONN., Nov. 30, '91.

Charles D. Shain, Esq., District Manager Edison General Electric Co., New York:

DEAR SIR: I mail you to-day under separate cover a section of Edison commutator, which has had a life of 22 months, and is easily good for 12 months more, having only worn $\frac{1}{8}$ in. in the 22 months. This is a most remarkable record, and leads me to think that if I could get the "make" of the bar from the Edison Company we would have better luck with all our commutators so constructed. Can you ascertain for us whether or not this is a "drop forging," and what the mixture is, if made at your works, and if more of the same kind can yet be had? It was purchased in January, 1890, and is not numbered. If you will obtain the information for me I will esteem it a favor. Respectfully,

(Signed) *W. M. Ramsey, Electrical Supt.,*
FEDERAL ST. AND PLEASANT VALLEY RY. CO., PITTSBURG, PA.

The above letter is taken from the catalogue of the Edison General Electric Co., on the Edison System of Electric Railways, and the commutator bars, to which it refers, are drop forgings made from Tobin bronze, and were manufactured by the Billings & Spencer Co.

(Signed) *F. C. Billings, Ass't Supt.,*
THE BILLINGS & SPENCER CO.

The Ansonia Brass and Copper Co., of New York, is the sole manufacturer of Tobin bronze.

PRIVATE LETTER.

DEAR BOB: Your head's level in selecting our route to the Pacific coast, *you've only one night on the road* between Chicago and Denver, and you can take every meal on the cars, and have sufficient time in both cities to "fix up" and see a man. You're quite right—the "*glorious winter climate*" of *Colorado* is simply immense, and the "*Burlington Route*" service is a grand success. Yours, TOM.

MAP OF THE UNITED STATES.

A large, handsome map of the United States, mounted and suitable for office or home use, is issued by the Burlington Route. Copies will be mailed to any address on receipt of twelve cents in postage by P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R.R., Chicago, Ill.

The United States Mineral Wool Company, 2 Cortlandt street, New York, has just published a neat little pamphlet describing and illustrating the uses of mineral wool in architecture, car-building and steam-engineering. Estimates of the quantity required for different purposes are given, besides a number of letters from users recommending the wool for various purposes.

PLAYING CARDS.

You can obtain a pack of best quality playing cards by sending fifteen cents in postage to P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R.R., Chicago, Ill.

ONE OF THE FINEST.

Here is one of the many letters the Chicago, St. Paul & Kansas City Railway is constantly receiving in commendation of its superior facilities in the way of brand new coaches and sleeping-car accommodations:

"What you said about the cars on your road was true. They were the finest I saw on my way here, and the most roomy and comfortable. Should I have occasion to travel East, I shall try to use your part of the road, and shall recommend it to others."

It will be remembered this line is the only line in the West running the celebrated vestibule compartment Pullman sleeping-cars, in which the price for exclusive use of a drawing-room is no more than that of a section in the ordinary sleeping-car. The dining-car service is beyond comparison, and its express trains are run on the fastest schedule.

A car on the line of the Grand, Houston and West Forty-second street line in New York ran over a five-year-old boy (Frank Hess) on Delancey street November 22. The boy tried to cross in front of the horses, but the driver had no chance to stop the car in time to avert the accident. The cords of the knee were injured, but the boy will probably recover.

With any given work done, given loss on the line and electro-motive force of motor, the number of circular mills of the conductors will vary directly as the distance. Hence, with given conditions, if we double the distance, we must also double the cross-section, or, if we treble the distance, we must treble the cross-section.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued December 1, 1891.

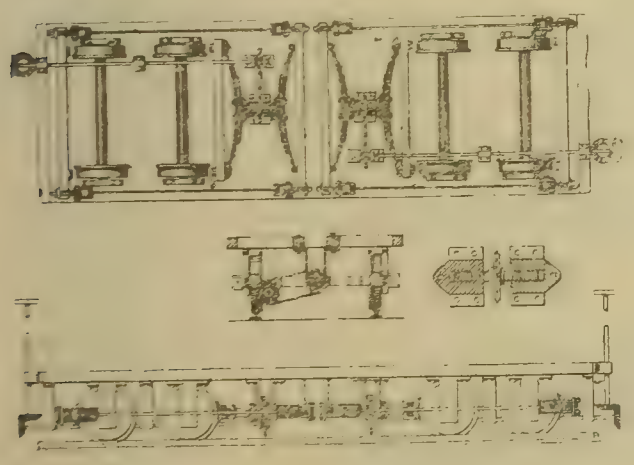
464,000. Car-Coupling. Aaron B. Allen, Pueblo, Col. Filed Feb. 25, 1891.

The combination, with the coupling-hook-locking pin, of an axially pivoted or mounted rod or lever passing through the upper end of the pin and provided with a lateral pin or arm adapted to rest upon the draw-bar.

464,002. Electric Brake. La Motte C. Atwood, St. Louis, Mo., assignor to the Atwood Electric Company, same place. Filed Feb 27, 1891.

In an electric brake, the combination of the shoes, a rock-shaft to which the shoes are connected, a pivoted lever connected to the rock-shaft, and two independent magnets located at different distances from the pivoted lever and operating successively for moving the lever at different stages.

464,028. Car-Axle. William S. Kisinger, Bellevue,



464,038—CAR-BRAKE.

Ky., assignor to Stiebel, Kisinger & Stiebel, Cincinnati, Ohio. Filed Nov. 24, 1890.

A car-axle, having an integral spindle, a sleeve having an outer collar, journal, hub-seat, bore, and inner collar, and a wheel secured to the hub-seat and bearing against an annular shoulder at the junction of the hub-seat and inner collar, which latter bears against the annular shoulder at the junction of the spindle and axle.

464,032. Railroad-Frog. Perry P. Merriman, Hardeeville, S. C. Filed Jan. 19, 1891.

The combination, with the turn-shaft bearings, of a plate arranged to turn in a base-plate.

464,038. Car-Brake. Anthony B. Pool and Joseph J. Beals, Boston, Mass. Filed April 28, 1891.

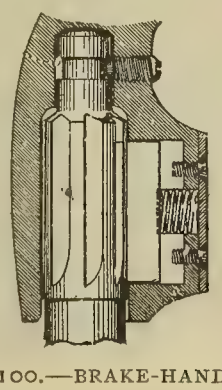
In a car-brake, an elongated brake-beam pendent from the car-body or truck, rods connecting the brake-beam with a supplemental beam pendent centrally from the car-body, in combination with a worm rotatable from the body and connecting mechanism for spreading adjacent beams.

464,041. Car-Truck. James T. Robinson, Altoona, Pa. Filed March 28, 1891.

In a pivotal truck, an elastic brace serving to unite the upper and lower frames of the truck.

464,054. Railroad-Tie. James C. Wolfe, New York, N. Y., assignor to the Metal Base Electrotype Company. Filed Feb. 20, 1891.

A metal railroad-tie, consisting of a solid bottom section, side and end sections provided with a series of openings therein, and web-sections also provided with openings and connecting the side sections.



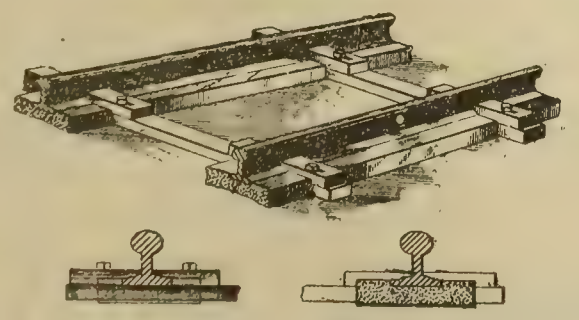
464,100.—BRAKE-HANDLE.

464,100. Brake-Handle. Peter M. Kling, St. Louis, Mo. Filed April 27, 1891.

The combination of a vertical brake-spindle having a fluted collar and annular recess thereon near one end, a brake-handle having a socket thereon adapted to take over the fluted end of the spindle and fastened thereon by means of a set-screw taking into the annular recess on the spindle, a housing on the handle, a horizontal spring-pressed dog loosely mounted therein and adapted to take through one wall of the housing and to automatically engage the fluted spindle to prevent the handle turning on the spindle in one direction and to be automatically released therefrom when the handle is turned in the opposite direction, and a detachable plate whereby the spring and dog are made removable.

464,111. Car-Starter and Brake. Frank J. Stafford, Cleveland, Ohio. Filed March 2, 1891.

A power-storing mechanism for cars, consisting of a plate firmly attached to a sill or cross-head of car-frame or platform, perforated parallel bars connected by rods with the plate, and springs surrounding the rods interposed between the bars and connected thereto, capable of expansion and contraction.



464,173—BED-SUPPORT FOR RAILWAY-TRACKS.

464,129. Crossing for Trolley-Wires. Robert M. Jones, Salt Lake City, Utah. Filed April 16, 1891.

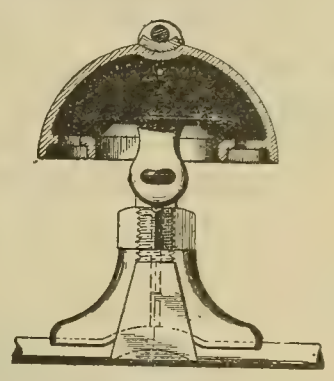
In a crossing for electric railway trolley-lines, the combination of a frame composed of two similar metal plates separated and distanced by interposed pieces, line-wire sections attached to studs in the plates of the frame and arranged between them at the attaching-points, studs and plates pivoted to the frame between the plates and adapted to fold up between the plates in line with the wires, an insulating-plate attached to the frame between the branches thereof, and a crossing line-wire attached to the insulating-plate.

464,173. Bed-Support for Railway-Tracks. Edward R. Edwards, Mineral Ridge, Ohio, assignor of one-half to Thomas A. Mitchell, Washington, D. C. Filed June 6, 1890.

Bed-supports formed of sections arranged on the road-bed under the rails between and on the same plane with the ties, forming with the ends of the ties continuous supports for the rails.

464,180. Railroad-Rail Fastener. James S. Peirce, Portsmouth, N. H. Filed July 6, 1891.

A fastening for railroad-rails, composed of two blocks set side by side and each formed with the seat extending under the rail, the recess receiving the laterally-extending portion of the base of the rail, the shoulder or upright wall bearing against the web of the rail, and the anchor depending from the bottom of the block.



464,411.—HANGER FOR TROLLEY-WIRES.

464,253. Car-Truck. Edgar Peckham, Kingston, N. Y., assignor, by mesne assignments, to the Peckham Motor Truck and Wheel Company, same place. Filed Oct. 30, 1890.

In an electric-motor truck, the combination, with longitudinal side-bars supported on the journal-boxes, of pedestals mounted on the side-bars and rising from the same, cross-bars suspended from the pedestals, and a motor-support mounted on the cross-bars.

464,309. Railroad-Tie. William B. Teall, Mason, Mich. Filed Feb. 11, 1891.

A railway-tie composed of two angle plates secured together to form a T shape in cross-section and vertically depending plates at one end only of each of the plates.

464,370. Trolley-Wheel for Electric Railways. Smith W. Kimble, Denver, Col., assignor to the Mica Asbetite Insulating Company, same place. Filed May 29, 1891.

A trolley-wheel comprising in combination two side pieces, each constituting a hub and flange in one piece, the pieces being screwed together, and a contact-ring let into a groove formed in and between the two side pieces.

464,371. Trolley-Wire Hanger. Smith W. Kimble, Denver, Col., assignor to the Mica Asbetite Insulating Company, same place. Filed May 29, 1891.

The combination of a continuous metallic bulb or shell tapering in form and flanged or turned under at its large end so as to leave a small central opening therein, a mass of molded insulating material filling the bulb and held in place

by the underturned edge thereof, and a metallic fastening attachment having its head imbedded in the mass, the bulb being hermetically sealed at the mouth by water-proof material.

464,379. Car-Mover. Edward A. Munson, Grand Rapids, Mich. Filed March 7, 1891.

A lever, a shoe formed in one piece with upwardly-projecting ears, the shoe having at its front end a pair of lateral lugs to embrace the upper part of the rail, the rear end being free from the lateral lugs and having a biting-point to engage only the upper face of the rail, and a spring between the front end of the shoe and the biting-point, the spring being free from lateral projections and bearing upon the upper part of the rail only.

464,411. Hanger for Trolley-Wires. Thomas E. Adams, Cleveland, Ohio, assignor to the Brush Electric Company. Filed July 17, 1890.

A shell having insulating material therein and closed by a plate having flanges depending therefrom.

464,424. Railway-Tie. Albert G. Budington, Austin, Tex. Filed March 3, 1891.

A railway-tie having a broad base, opposite side recesses, a longitudinal top rib, transverse dovetail recesses, one of which is of a width to accommodate the bases of two rails, similar but deeper recesses into which the first-named recesses open, vertical pin-openings extending down through the dovetail inner walls of the recesses, bolts extending up through the base of the long recess from opposite sides of the tie, a block through which the upper ends of the bolts pass, keys fitting the dovetail recesses and having the central notch to fit over the base of a rail and notched to register with the vertical pin-openings, and headed pins.

464,426. Car-Coupling. Harper Caldwell, Pineville, Mo. Filed July 7, 1891.

In a car-coupling, a draw-head provided with a recess in its forward end, a headed link secured in the recess, a lever secured to the link for turning it, stops for locking the lever, and a recess in the adjacent draw-head provided with a spring-actuated cover, into which recess the arrow-head of the link is adapted to be locked.

464,432. Car-Replacer. John M. Donnelly, Neihart, Mon. Filed June 25, 1891.

A plate provided at its front end with a pivoted block and adjacent thereto a clamp for securing the front end to a rail, an arm secured near the rear end of the plate for engagement with the opposite rail, and a plate having side flanges and ways for the car-wheel.

464,450. Street-Car. George T. Chapman, White Plains, assignor of one-half to William Harvey Merritt, New York, N. Y. Filed March 21, 1891.

The combination, in a car or other vehicle, of the truck-frame mounted on the axles, bow-springs suspended at the ends from supports carried on the truck-frame, and the car-body supported on the springs by standards resting in the curves of the bow near the ends by which the springs are suspended.

H. WARD LEONARD & CO.



"Secure bid from us for electrical apparatus or construction before deciding. Railways, Lighting, Transmission of Power, Wiring, etc."

Address ELECTRICAL EXCHANGE BLDG.,

NEW YORK CITY.

THE ✧ ONLY ✧ GEARLESS ✧ MOTOR.

THE BEST

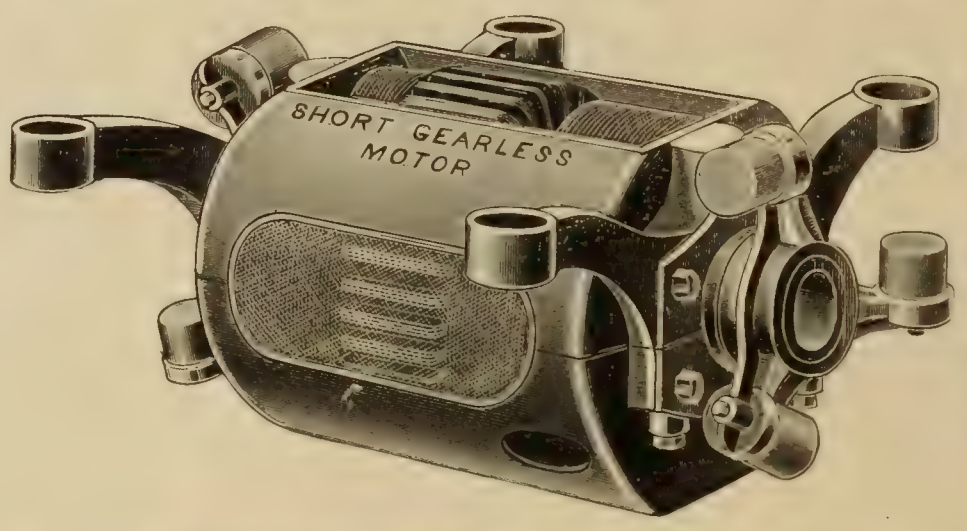
Protected Street Car Motor

ON THE MARKET.

Over 500 Separate Claims.

OVER 25 SEPARATE U. S. PATENT LETTERS,

Besides Its Iron Cover.



ITS RECORD

In Cleveland, Pittsburgh & St. Louis

IS UNSURPASSED.

It has been proved in actual service to be highly efficient, to take less than average current, to be a FIRST-RATE hill-climber, to be noiseless, to be inexpensive to operate.

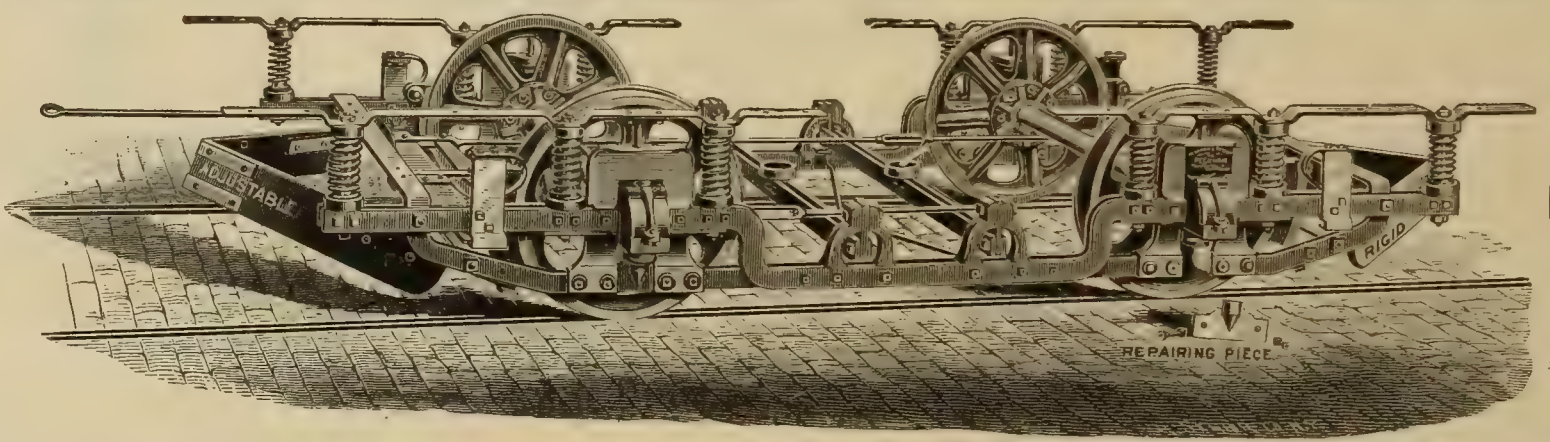
Send for Catalogue.

THE SHORT ELECTRIC RAILWAY CO., Cleveland, Ohio.

Peckham's Patent Cantilever Motor Truck.

GUARANTEED TO PREVENT BOTH END AND SIDE OSCILLATION OF ELECTRIC CARS RUNNING TWENTY MILES AN HOUR.

ADAPTED TO ANY STYLE OF MOTOR.



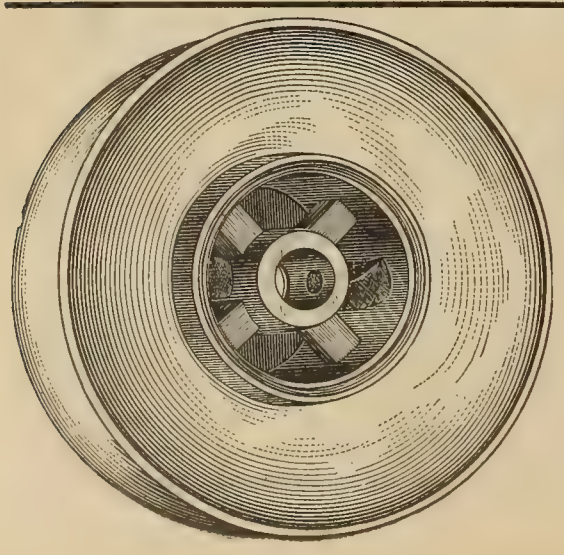
EQUIPPED WITH INTERCHANGEABLE OR RIGID WHEELS.

The Strongest, Most Economical, Easiest Riding and Easiest Repaired Motor Truck in Use. Equipped with Peckham's Patent" Cantilever Extension Side Frames Radial Gear and Pendulum Motor Hangers. The Only Motor Truck with Flexible Journal Bearings. The Only Motor Truck with Flexible Motor Supports.

New York Office, 45 BROADWAY.

MANUFACTURED BY

THE PECKHAM MOTOR TRUCK AND WHEEL CO., Kingston, N. Y.



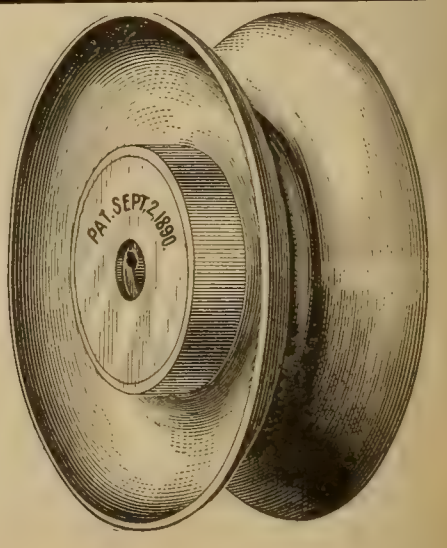
BADGER'S PATENT

SELF-OILING TROLLEY WHEEL,

For Electric Railways.

Smooth running; ways well oiled, prolongs the life of the wheel.
It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable.
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

BADGER BROTHERS, West Quincy, Mass.





VOL. I. NEW YORK, DECEMBER 19, 1891. No. 24.

STREET RAILWAY NEWS.

(WEEKLY.)

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THE ELECTRIC AGE PUBLISHING CO.,
Publisher.

J. B. TALTAVALL, *President.* T. R. TALTAVALL, *Sec. and Treas.*
W. T. HUNT, *Vice-President.* E. V. CAVELL, *General Manager.*

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ACCIDENTS.

During the past week the average number of accidents have happened, directly or indirectly, by reason of street cars being permitted to be run, and our esteemed contemporary, the New York *World*, followed its usual custom of seizing upon these mishaps for the purpose of filling space in its lurid columns.

In its issue of Dec. 5, STREET RAILWAY NEWS made particular allusion to the fact that the permission accorded to passengers of riding on the front platform is decidedly "conducive to the swelling of the accident record" and the experience of the past week confirms that assertion.

The *World*, however, while making all that it possibly can out of mishaps, while claiming that the drivers of these cars are never punished, fails to even mention the fact that fully 80 % of these unfortunate accidents occur through utter carelessness or negligence upon the part of the party injured.

In a letter to STREET RAILWAY NEWS, Mr. J. Stanford Brown, referring to its article of the 5th, drew particular attention to the fact that "from our childhood we have been accustomed to dodge under a horse's nose, when crossing the street," and a careful examination and analysis of the chapter of accidents during the past year warrants us in making the assertion that a very large majority of these accidents are directly traceable to that very fact.

The ideas conveyed in the one-sided reports of street-car accidents, as published in the *World*, are misleading, inasmuch as the general tenor is, that whenever a person happens to get hurt—no matter from what cause—by a street car, the poor driver should be immediately jailed for an indefinite period as being responsible for the accident.

That there are many instances where criminal carelessness on the part of horse-car drivers cannot be denied, yet it is equally fair to assume that no driver would be wilfully careless and jeopardize human lives to the extent intimated.

The sensational spirit which pervades these accounts arouses within a great many ignorant minds a feeling of enmity against the operating companies, and cultivates one of bitter resentment against them, which invariably manifests itself during troublous times, when the spirit of dissatisfaction and strife is abroad, and when opportunity presents itself for giving vent to those feelings.

While upon the minds of intelligent and thoughtful men this line of argument can have but little effect, yet we venture to say that we will be sustained in expressing the opinion that such a policy is a very dangerous one to follow, for the reasons aforesaid, and that, from a journalistic standpoint, a most reprehensible, if not an almost criminal one.

And why? Ignorance is invariably guided by what it sees in print, for the reason that it is not within its power to think intelligently; therefore the blame cannot be justly attributed to the readers of these accounts, but the responsibility for the terrible results which may eventually ensue will rest upon those who now consider it their bounden duty to the public to sensationalize all matters which plausibility can succeed in conveying an impression adverse to corporations.

SANDING TRACKS.

There exists in Baltimore at the present time a little "unpleasantness" between the City Passenger Railway Company and the Superintendent of Street Cleaning.

Baltimore's street-car system, as is well known, is rather antique, and the citizens of the Monumental City have as yet not had a taste of rapid transit of their own. Some leaven is at work, however, and Baltimore will undoubtedly fall in line with other progressive places before long.

The differences referred to relate to the use of sand on tracks of the above-named line in order that the horses may have a surer foothold. No less than eight of these animals were injured in one night recently by slipping down, and the Society for the Prevention of Cruelty to Animals is likely to interfere in behalf of the faithful horses.

The railroad company sought to prevent the slipping of the horses on Baltimore street by sprinkling sand on the track. Ordinarily such a proceeding would be looked upon as a humane and creditable act, but a very serious objection was at once raised by the storekeepers along that thoroughfare. They objected to the use of sand on the track for the reason that it soon gets ground into a fine dust which is blown into their stores and ruins their goods.

The Mayor of the city has the question under advisement, and in a few days he will decide whether the practice of sanding the tracks shall be continued or not.

BROOKLYN BRIDGE.

The annual report of the trustees of the New York and Brooklyn Bridge for the past twelve months shows that the receipts for tolls have been nearly $50,000 in excess of what they were for the corresponding period in 1890, and it must be remembered that no tolls have been collected from foot-passengers since the last of May.

The cable line hauled 49,766,043 passengers during the year, about 11,000,000 passengers less than those handled by the Chicago City Railway during a like period. The increase of income over that of the preceding year was $56,967.11, while the excess of passenger traffic is 369,886, no less than 44,268,370 foot and railway passengers having passed over the bridge during the year.

The amount received from the city of New York on construction account was $180,000; that from the city of Brooklyn, $360,000; that from rent of telegraph wires, real estate, etc., $105,284.86.

Eighty-nine persons were injured by some means or other on the bridge, while half that number were taken sick on the cars, and there was but one known suicide. The total number of runaways was 42, while 8 lost children were found on the bridge.

During the month of October the bridge cars transported no less than 120,767 passengers per day, a larger number than that carried for the same amount of time since the road commenced operations.

During the year the cable ran 7,300 hours, and the records show that, while thirty delays were reported, yet the entire time occupied by them was only 177 minutes.

It is proposed to duplicate almost everything in the power-house in such a manner as to provide for, virtually, a complete and perfect duplication of the entire cable-driving mechanism.

Figures such as the above must impress upon the thoughtful minds the fact that a similar enterprise—only bridging the North instead of the East river—will certainly be productive of no less favorable results.

PERSONALS.

Mr. H. Martin, of Boston, called at our office last week.

Mr. Hann, of the New York Car Wheel Works, was met in Baltimore last week.

H. H. Littell, General Manager of the Buffalo Ry. Co., was in town last week.

Mr. Edward Cline, of J. G. Brill Company, happened in at our office a day or two ago.

Mr. Joseph R. Illicott, General Manager of New York Car Wheel Works, was met in Boston lately.

Chas. A. Benton, Gen'l Mg'r of Detroit Electric Works, was in town last week accompanied by his wife.

Mr. S. S. Leonard, of the Hill Clutch Works, Cleveland, Ohio, called at our office during the past week.

Mr. W. B. Ferguson. Pres. of Gloucester Street Railway Co., was a welcome visitor at our office during the past week.

Mr. Maybin W. Brown, President of the Eastern Electrical Supply Company, was in town last week, and called at our office.

Another caller at our office since our last issue was Mr. H. R. Hammeken, Assistant Treasurer and Manager of the Electric Engineering and Supply Co. of Syracuse.

Mr. Otis K. Stuart, accompanied by Mrs. Stuart, paid us a very delightful visit last week, while *en route* from Boston to Philadelphia, in which latter-named city Mr. Stuart will now have his headquarters.

FUSES ON ELECTRIC CIRCUITS.

On December 7 last Mr. C. C. Haskins read a paper before the Chicago Electric Club on the subject of safety devices on electric conductors, from which we take the following extract :

"The law of Ohm, that multiplication table of practical as well as theoretical electricity, tells us, as you all know, that with a given source of electricity the current that will traverse any conductor is regulated by the resistance of that conductor, and it is also well known to you that resistance or opposition to the flow of current results in the development of heat.

"These two factors are made available to furnish the equivalent of the safety-valve for a steam-engine, or, better perhaps, the soft-plug in a boiler, to stop the strain ; in the one to prevent an explosion, and in the other to forestall a conflagration.

"Various metals, having different electrical carrying capacity, must necessarily be variously affected thermally; and as some of these fuse at a much lower temperature than others it is readily seen that protection from abnormal heat in an electrical conductor is readily arrived at by the use of the fusible strip, which, placed in direct line with the passing current, will, before undue heating of the conductor proper takes place, melt, and thus break the continuity of the conductor.

"Such, briefly stated, is the usual method of protection from abnormal currents.

"Let us look at this subject for a brief time, and see if in practice this is as reliable as theory would indicate.

"The material from which these devices are constructed may be either a simple metal or an alloy of two or more metals in combination. A curious fact in this connection is that an alloy may be made of two metals which has a lower melting point than either of the metals of which it is made.

"The metals which are more commonly used are tin, bismuth and lead.

"The melting point of tin is .....451° F.
" " " of bismuth is.....512° F.
" " " of lead .....620° F.

"Authorities differ two or three degrees on these melting points, but that is a matter of small consequence for the purpose of this paper.

"Now, different combinations of these metals will give us widely different results. Equal parts of tin, which fuses at 451°, and lead, which fuses at 620°, will give us an alloy which will fuse at 385°. Tin and bismuth in similar proportions will fuse at 250°. One of tin, one of lead, and four of bismuth will melt at 200°. Lead 5, tin 3 and bismuth 8 forms a combination which melts at 212°. Other combinations will give us an upward range far above the necessities of the case, and the admixture of other metals will give any desired melting-point.

"W. H. Preece has furnished us with the results of a long list of experiments in his fuse table. This table gives the sizes of pure wire which will fuse by a current of from 1 to 5 ampères up to 50, by steps of 10 ampères to 100, and by steps of 20 ampères to 200 ampères. These figures are given for tin, lead, copper and iron.

"In the matter of safe carrying capacity of copper wire there seems to be considerable diversity of opinion.

"This appears to be one of the rough spots in the highway of success. There are several tables purporting each to be the best, so that it is rather difficult to decide between them, and as the safe carrying of the copper has something to say as to the capacity of the fuse, the doctors are not all in perfect harmony over the case.

"We are told that a 0000 wire B. & S. gauge is good for 312 ampères by one authority ; a second says 229 ampères, while a third says 300 ampères, and the last speaker says 175 ampères. No. 6 is given at 65.2, 48, 80 and 35 ampères. Number 14 is given 16.2, 11, 22 and 10. These various figures come now from the Board of Trade of Great Britain, from Boston, from New York and from Montreal. How nearly great minds arrive at solid conclusions !

"With such a broad field for selection it would certainly seem possible that a perfectly reliable fuse should be readily accomplished for any known requirement, and yet with such a disagreement of authorities as are given above it is not very strange if the fuse manufacturer should occasionally err in the capacity of the wares he offers."

THREATENED STREET-CAR WAR IN PHILADELPHIA.

The Traction Company's declaration of its intention to parallel the lines of the People's Passenger Railway by running omnibuses on Broad street and Girard avenue has taken tangible form, says a Philadelphia paper, in the application of David H. Lane to Chief Bullock, of the Bureau of Highways, for licenses for 100 "'buses" to be controlled by the Philadelphia Traction Company. The proposed route is on Broad street, from Germantown avenue to Snyder avenue, and on Girard avenue, from Belmont avenue to East Norris street.

Chief Bullock referred the application to Director Windrim, accompanied by a letter directing his attention to an opinion by the City Solicitor, in 1889, in which he declared that the power of the Chief of the Bureau of Highways was only ministerial.

In this opinion, which was given to Director of Public Works Wagner, the City Solicitor, after calling attention to the ordinance of May 10, 1855, regulating the granting of licenses for the running of omnibuses, said : "The power by this ordinance given to the Chief Commissioner of Highways is now, by virtue of the act of June 1, 1885, and the ordinances passed to carry the same into effect, vested in you. The power, however, to issue a license, as given by said ordinances, is a ministerial one.

"Whether Councils have power to grant a discretion in such matters to a ministerial officer is a disputed point. It is clear, however, they did not in this in tance give any discretion. On the contrary, the proviso of section 3 of the ordinance of 1855 shows beyond question that it was the intention of Councils that the officers issuing the license should not exercise any discretion. In other words, Councils reserve to themselves the entire control and supervision of the routes and stands and the regulation of omnibus lines, and left in the Commissioner of Highways only a bare authority to issue licenses to such applicants as had complied with the ordinance.

"I therefore advise you you have no right to refuse the license to such persons as shall comply with the law."

Should the licenses be granted the "'buses" would not run before next spring, as many things will have to be attended to first, such as the construction of the vehicles and of stables, and various other details.

While the Traction people deny all intention of engaging in a war with the People's Line, the opinion gains ground that this is the first gun in a long and bitter warfare, and but the preliminary skirmish on the part of the Traction Company for the ultimate absorption of all the lines west of Sixth street.

The action of the Traction Company does not seem to disturb the officers and stockholders of the People's Line, who look upon the matter very philosophically.

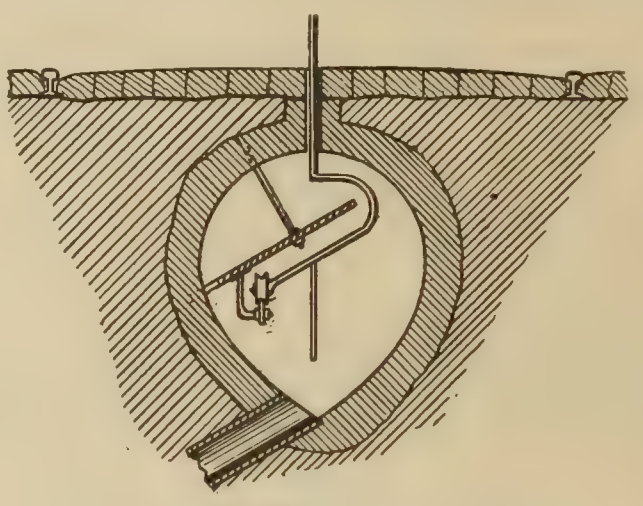


FIG. 1.—CROSS-SECTION OF CONDUIT.

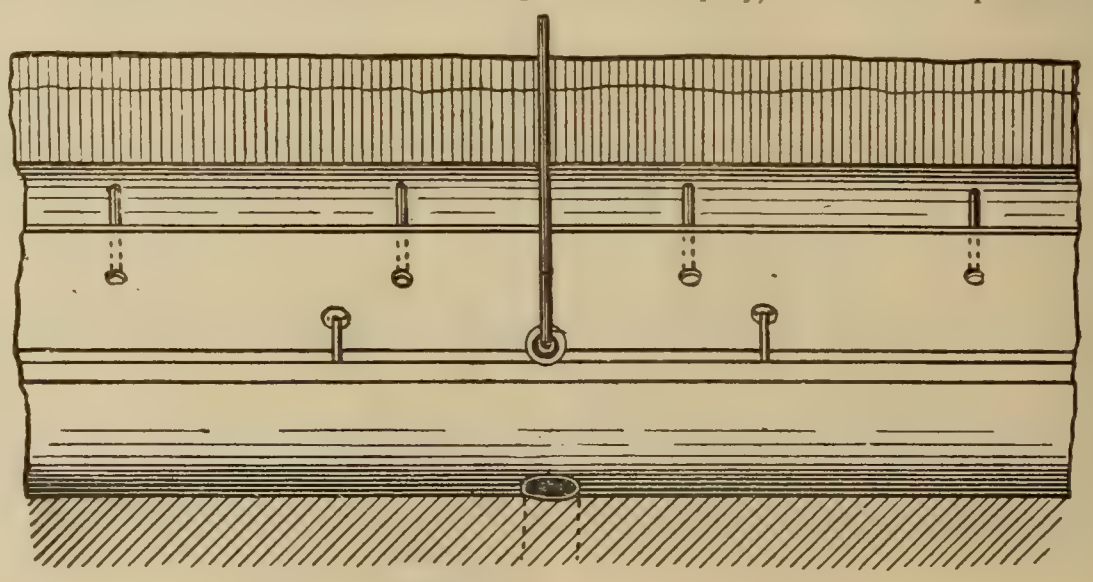


FIG. 2.—LONGITUDINAL SECTION OF CONDUIT.

NEW CONDUIT SYSTEM OF ELECTRIC RAILWAY.

One of the latest ideas of the underground system for electric railways is illustrated and described below.

The system is the invention of Mr. S. D. Nesmith, of Cleveland, Ohio, and necessitates the use of an underground conduit for its practical operation. The feature of Mr. Nesmith's invention is the protection-plate, which is placed in the conduit in such a manner that the trolley-wheel may ride on the electric conductor placed beneath and attached to the said protection-plate.

Fig. 1 gives a sectional view of the conduit, showing the protection-plate and the trolley-wheel in contact with the trolley wire, or electric conductor. It will be noticed that the trolley-arm is of peculiar shape in order to avoid contact with the protection-plate.

Fig. 2 is a longitudinal section of the conduit having the protection supporting-plate, conductor and trolley arranged in working order therein.

At suitable intervals along the bottom of the conduit are provided sluiceways, leading into a sewer for drainage, and to the trolley-arm is attached a depending branch-arm to which a brush may be attached when required, for the purpose of sweeping and cleaning the bottom of the conduit. Man-holes are also to be provided at suitable intervals for the purpose of giving access to the conduit for inspection, repairs, etc.

Crossings, curves and switches may be arranged for in this system very easily.

What Mr. Nesmith claims as his invention is the combination with a conduit of the supporting-plate referred to, placed in a slanting position by rods, and provided with an electric conductor suspended in a suitable manner; also the combination of the electric system with a conduit having sluiceway drainage.

SUIT AGAINST A STREET RAILROAD COMPANY.

A Utica paper says:

"The firm of Munson Bros., of Utica, composed of Edmund L., Alfred H. and Countcil Munson, has brought suit against the Utica Belt Line Street Railroad Company to recover $86.05 with interest from October 14, 1891. This is for work, services and materials performed on tracks, switches and roadbed of defendant. On the warrant of attachment there is an undertaking or bond in the sum of $250, signed by Munson Bros., D. C. Hurd and Quentin McAdam.

"Attached to the warrant is the affidavit or complaint of William W. Fowler, who sues to recover for repaving with cobble between the tracks and for two feet each side on Columbia and Whitesboro streets, at 30 cents a yard, or $268.35.

"He also swears that the Belt Line has transferred some of its property to the Thomson-Houston Company, and that it is managed solely in the interest of that company; that the Belt Line Company, with intent to cheat and defraud its creditors, has removed large amounts of property to New York; that about $1,600 of its money has been removed from here; that contrary to law it has taken up the tracks and wires on the West Belt at the dictation of the Thomson-Houston Company, and has sold the property in Ohio for the benefit of the Thomson-Houston Company; that John Doyle, acting for the Belt Line Company, has taken off parts of two generators at the power-house, of the value of $1,200, and that these have been shipped to Massachusetts, and that the Belt Line caused these to be removed to defraud its creditors; that John Weston, bookkeeper at Mather's Bank, has stated that the Belt Line has withdrawn from the bank and sent to Massachusetts about $1,700, with interest, to defraud its creditors; that the company is greatly indebted to various persons, and has not for some time been able to pay its bills at maturity; that it is hopelessly insolvent and unable to pay its debts. The facts in the Wesley Mather suit are also alluded to."

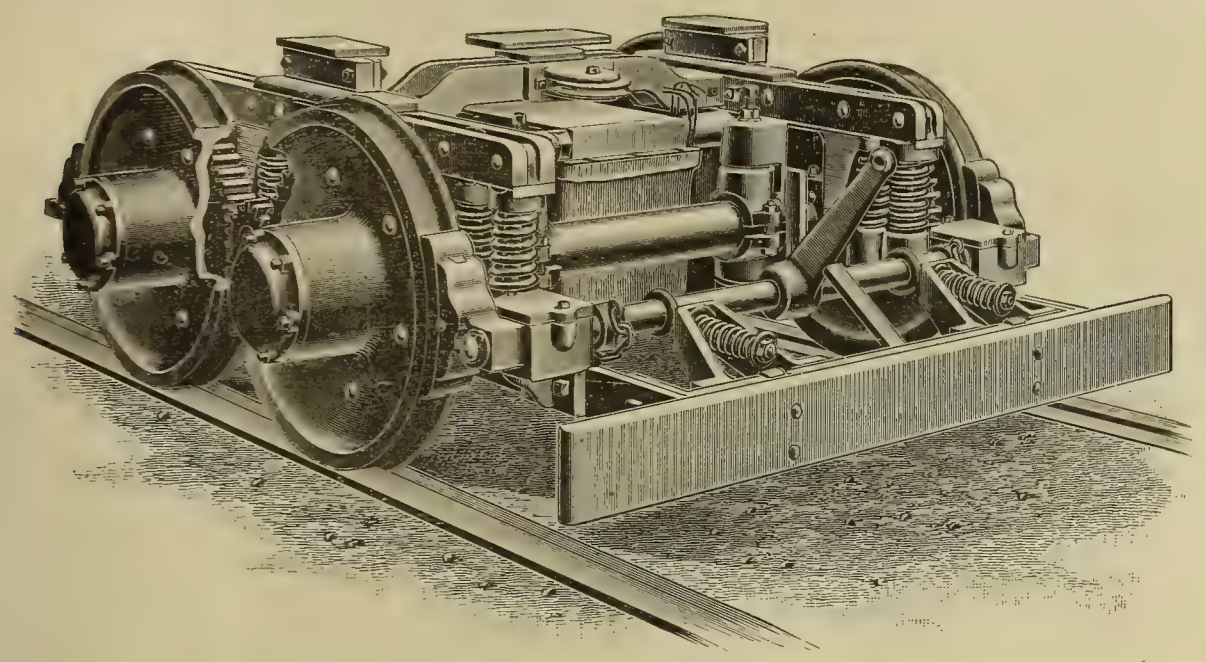
The U. S. Portelectric Company, New York (incorporated in W. Va.), has been incorporated with a capital stock of $5,000,000. Incorporators : Thomas L. James, John Straiton, A. J. Dittenhoefer, C. F. James, Percival Knauth, William James, John T. Williams, Henry Huss, Frank Lawton and Whipple V. Phillips.

A NOVEL ELECTRIC RAILWAY TRUCK.*

An electric truck possessing some novel features has recently been placed upon the market.

The accompanying illustration shows the features of this new truck in a very clear manner. The wheels ore 26 inches in diameter, and are loose upon the axle. The well-known Tripp Roller Bearing is fitted on the inside of the hub and is carried on a 4½ inch journal.

The truck is interchangeable on long, open or box cars. One motor distributes the traction to the four



TRIPP LOOSE WHEEL TRUCK, NO. 11.

wheels, and the truck is warranted to take any curve without interfering with the car sill or running-board.

The compactness of the truck will be noticed, and its action in practical use will no doubt be watched with interest by street-railway people. As the truck is a departure in many respects from those of other makes, its efficiency will be a question of great importance, and the manufacturers predict for it great success. It is well made, and much skill and time have been devoted to its development.

The truck is known as No. 11.

RAPID TRANSIT IN CHICAGO.

The question of passenger transportation on street lines in Chicago is to be the subject of an exhaustive investigation by the City Council. Mayor Washburne in a message dealt extensively with the question of intramural transportation, and all the suggestions made were adopted by the Council. The message is as follows:

"CHICAGO, December 5, 1891.

"It having come to your knowledge and to the knowledge of the administration, from published reports and observation, that the present facilities rendered the public for passenger transportation within the city are wholly inadequate to the present needs of the city, and are daily growing more inadequate, and in view of the fact that the World's Columbian Exposition will soon add very greatly to the demands of travel in all parts of the city, it is desirable that radical and immediate steps be taken to remedy the evil.

"It is plain that the facilities within the power of the present surface roads, even if they were improved to the point of perfection, are insufficient to care for our rapidly-growing population, and its inadequacy will become more marked each year.

"Your honorable body has granted ordinances to two elevated railroad corporations in this city, both of whom have partially constructed their roads. For many months both these companies have remained apparently idle and appear to be taking no steps to perfect their roads and grant to the public a service which they are in duty bound to provide as soon as practicable.

"The necessity for immediate action is apparent to you all and every observant citizen. It is extremely difficult for conflicting interests, such as here stare us in the face, to come to any definite understanding or agreement unless such conflicting interests be brought into close and friendly contact.

"I would therefore suggest, with the view of having a comprehensive report upon this to-day all-important problem, and which will lay before the administration and the public the difficulties to be met and the obstacles to be overcome and the best means of overcoming them, that a committee of two members of your honorable body from each division of the city be appointed to investigate and report upon this subject, in order that such committee from your honorable body may be fully apprised of the various interests to be considered, and that there be added to this committee two substantial citizens from each division of the city, and, if you think best, one or more representatives from each of the railroad companies now in existence.

"Urging upon your honorable body the necessity for immediate action upon the subject, which now appears to be already claiming your attention, I have the honor to remain

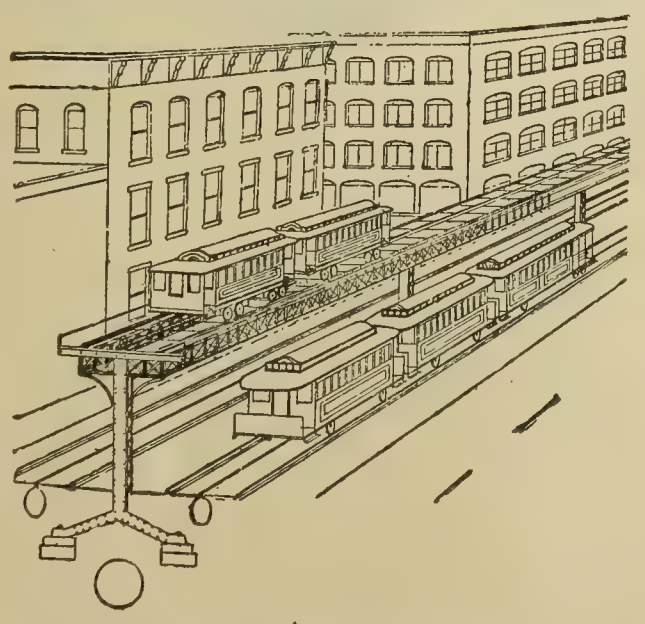
"HEMPSTEAD WASHBURNE, *Mayor.*"

At the same meeting resolutions were adopted and will be sent to the Mayor as recommendations from the City Council, that additional loops be constructed on the outskirts of the business districts for the accommodation of extra cars.

A motion was made and referred to the judiciary committee to instruct the Corporation Council to draw up an ordinance providing that the City of Chicago shall construct street-car tracks at the request of a specified number of property-owners on the streets over which the street railways are to run.

At a meeting of the Council Judiciary Committee the "no seat, no fare" ordinance was recommended for passage, Corporation Counsel stating that it was perfectly legal.

Ex-Alderman F. M. Chapman has a plan for a system of elevated electric street railroads that has been commended by engineers and capitalists. His system, he thinks, would settle the question of rapid transit if permission could be obtained to construct a line.



PLAN OF CHICAGO'S PROPOSED ELECTRIC ELEVATED ROAD.

"My plan," said he, "provides for an elevated road supported on iron posts erected between the double tracks of the surface roads. Electricity," he continued, "is the motive-power, and it is arranged to pass through a thoroughly insulated conduit to the motor underneath each car. According to this plan an elevated structure could be built on the south side from 22d street, down Wabash avenue, through Lake street and south on State to 22d. It would in fact be an immense loop. A double-track line could extend south of Cottage Grove avenue and another on State street.

"For a north-side line the single track could come down Clark street to Adams or Jackson, and north again on Wells to its junction with Clark, from which point a double track could be built with a branch on Lincoln avenue.

"The west-side single tracks could be built on Madison and Randolph streets to Ogden avenue and then extended as double tracks.

"The posts on which the tracks are to be placed are one foot square with a sort of ⅄-shaped base underground, so that the sewers would be undisturbed. The superstructure of the single tracks is four feet wide and fourteen feet above the surface of the street. A strong guard-rail is contemplated that would extend two feet on each side of the track and be about fifteen inches in height. The cars would be similar to street cars but of lighter construction and placed on double trucks. The double-track sections are supported on iron posts similar to those of the single tracks.

"It is estimated that the cost per mile of the system would be $150,000. Each line could carry 30,000 passengers an hour.

"One-half of the people north of 22d street do not patronize the cable cars because it is impossible to secure seats. If a franchise could be obtained for the roads a company composed of Chicago citizens could easily be formed to construct the lines. The trouble is," he added, "that it is almost impossible to secure the consent of adjacent property-owners for elevated lines in the business district."

A road somewhat similar in construction is in use by the Los Angeles cable road over the tracks of the Southern Pacific railroad, a distance of 1,500 feet. The plan suggested by Mr. Chapman is the one that will probably be used by the Chicago and Evanston Electric road in gaining access to the business district.

In the plans of that road the columns that are to support the structure will be 2 feet wide and 15 inches through and will be 30 feet apart. In order to properly balance the structure the superstructure and foundation will be of the same width, 17 feet, the latter being made of railroad iron and cement. The upper part will be of the same general style of construction as the alley elevated, only lighter, being capable of sustaining a strain of 100,000 pounds.

Residents in the vicinity of Grand Crossing object to the substitute ordinance introduced November 30 by which the Calumet Electric Street Railway Company is given a franchise on South Chicago avenue from 71st street to Grand Crossing.

It was asserted that the original ordinance provided for a road on South Chicago avenue as far north as Grand Crossing. The people of that section declare that if the new ordinance is passed people living between Grand Crossing and Cottage Grove avenue at 71st street will have to pay a double fare.

Grand Crossing property-owners threaten to resort to litigation if the South Side Company refuses longer to operate its line on South Chicago avenue.

CONSOLIDATIONS.

It is reported that a gigantic street-railroad combination is under process of formation in St. Louis, and, it is said, will pool the interests of every railroad corporation in the city.

It is reported that the Traction Company, in Philadelphia, is endeavoring to secure control of all the street-car lines west of Sixth street, and, according to our information, it looks as though its efforts will be successful. If this is done it will be a great addition to the present system.

The officers of the People's, Citizens' and Thirteenth and Fifteenth Streets lines professed to be ignorant of the attempt to secure control of the properties, but it was stated by well-informed capitalists that the Traction people are not idle, and that the acquisition of the lines named is only a question of time. The statement that the application of the Traction Company for a license to run coaches on Broad street and Girard avenue is merely a flank movement, designed to bring the People's line to terms, was generally regarded as correct. The officers of the People's line claimed that they knew nothing about the movements of the Traction Company, that they did not intend to sell out, and that if the Traction Company wanted to run coaches in its territory it could do so.

It is believed that the license will be granted shortly and that the Traction Company will at once place the coaches in service. Messrs. Widener and Elkins have returned from New York, after inspecting a number of designs for the coaches. They declare that they are not making war upon the People's line, but are simply going into the enterprise because they believe that it will pay.

NEW ELECTRIC LINE IN OHIO.

An electric railway is to be built between Springfield, Ohio, and the neighboring towns west of that city. The right-of-way has been granted by the County Commissioners to J. C. Williams and W. H. Sterritt. The new line will include New Carlisle, and Dayton may be taken in.

* Tripp Manufacturing Co., 180 Summer St., Boston, Mass.

HANGERS AND PULL-OFFS.*

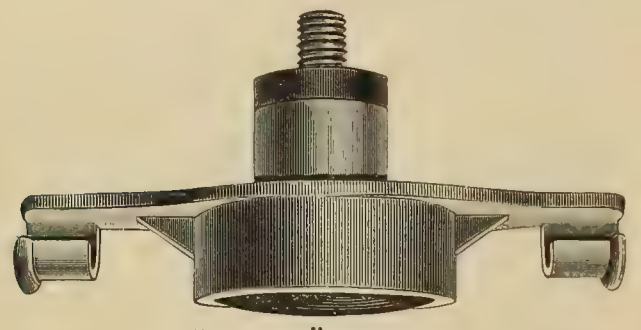
The accompanying illustrations show the "Elliott" Hanger and Pull-off, two very important parts in electric railway construction. One very necessary feature of such apparatus is strength, and for these devices which are illustrated below it is claimed that they possess this quality to an eminent degree. Their insulating qualities, too, are unsurpassed, and the loss of current when using these hangers and pull-offs is reduced to the lowest possible point.

This hanger and pull-off will stand a strain of over 8,000 pounds, and the insulating material cannot be broken, the whole combination being remarkably simple.

These goods have established an excellent reputation for serviceability, and seem to take well among electric railway people. While they are reliable goods, their cost is very low, and they are in every way very efficient. The manufacturing company calls attention to their merits as being: strength, excellence of insulation and low price.

WILL CHICAGO HAVE ELECTRIC CARS?

We learn from a Chicago paper that an experimental electric railway is soon to be constructed on West 12th street, that city. Its builders claim that it will revolutionize street-railway traffic in Chicago.

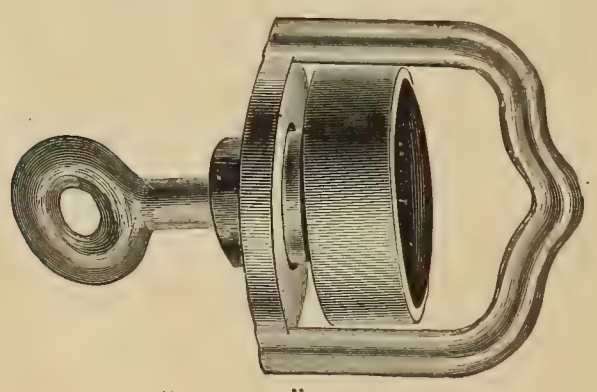


"ELLIOTT" HANGER.

The West Chicago Street Railway Company has been negotiating for some time with the Wells & French Company, car and bridge builders, for the construction on a portion of 12th street of a section of the Siemens & Halske electric road. O. W. Meysenberg, president of the Wells & French Company, said that the new system was about to be tried by Mr. Yerkes, and expressed the opinion that it was by far the best system of electric street roads that had been put in use.

"The line will be similar to those built in Buda-Pesth, Hungary, by Siemens & Halske, where they have been in successful operation two years," said Mr. Meysenberg. "A representative of these gentlemen is now in the city and will superintend the construction of the new line.

"In the new system there are no poles or storage batteries. The electric current passes through a conduit built beneath one of the rails but not in contact with it. The current does not touch the rail, and there is no danger from electricity by reason of coming in contact with the tracks. The voltage is so low that in case of a shock being given there would be no ill-effects. But this is impossible, for every portion is so well insulated that none of the current can escape."



"ELLIOTT" PULL-OFF.

The rail is double, with an aperture in the centre through which connection is made with the current in the conduit. The other rail may be such as is used in the ordinary street-car track. In outward appearance the electric car is similar to the ordinary street car. The motor is below the carriage, inclosed in a protecting box placed between the axles. The power is applied by means of a chain-gearing working over a cog-wheel on one of the axles. Below the platform are appliances that enable the driver to regulate the speed of the car.

Mr. Meysenberg, in discussing the proposed road, said that the lines at Buda-Pesth were the only ones so far constructed. "They have proved successful in every respect," he added, "and there is no doubt that such will be the case here. They can be operated much cheaper than the ordinary electric line, for they require a much less voltage. As soon as Mr. Yerkes returns from New York the plans for constructing the line will be completed and a more detailed account can be given. The system is not a complicated one, and I am confident that it will in time supplant the horse-car lines. The speed of the cars can of course be increased or lessened, but it is possible to attain a high rate."

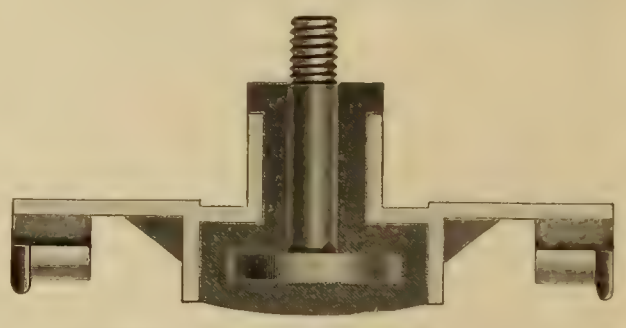
* Revere Rubber Co., 62 Franklin street, Boston, Mass.

PRESIDENT WHITNEY SPEAKS TO THE BOSTON TEAMSTERS' ASSOCIATION.

President H. M. Whitney, of the West End Company, Boston, made an address at the banquet of the Boston Master Teamsters' Association, on December 8, in which he referred to the rapidly increasing demands for transportation in that city, and said that the question was a difficult and puzzling one to solve.

"My whole time for four years," he said, "has been devoted to this, and I now believe that the main trouble is that the streets are not sufficiently large enough for the traffic that goes through them.

"During the past five years the way the outskirts and suburbs of the city have been built up is both surprising and pleasing to me, and from present indications it looks as though this state of affairs would continue. Now, when you consider that there has been no effort to increase the surface of the streets of travel, and that people are travelling more and there are more people to travel, you cannot be surprised at this. It needs no argument of mine to tell you that something must be done, and that, too, immediately. The only feasible plan to relieve the streets of Boston, I fully believe, is the one I submitted to the Rapid Transit Commission yesterday —that of tunnelling the Common. I see no other way in which we can solve the problem and still preserve the existing rate of fare. This is a question that also involves the social life of the community. We want people to go into the suburbs, where they can get pure air and rear their children outside of the hurry and bustle of Boston, and give them the opportunity to come to their places of business for 5 cents. Every year it is becoming harder to transport people from the suburbs for that compensation. Every resource should be harbored to bring about



SECTIONAL VIEW OF "ELLIOTT" HANGER.

this result. The West End's scheme tends to take the cars off the most crowded streets and give way to the teams. I believe the streets should be widened, especially those streets of the old part of the city, between the Charles River and Adams Square. These old cow-paths have not been changed for 200 years, and the city has no one but itself to blame, and owes something to itself and you. You men, as an association, should grapple with this question in a vigorous manner, and go before the Transit Commission, men who have no political motive to indulge, and see to it yourselves that a change be brought about. The streets leading from Cragie's Bridge should be widened and straightened and then it will be better for us all. I agree heartily with the Rapid Transit Commissioner who went abroad and reported that foreign cities were widening their streets to meet the demands of traffic. Our interests are the same, and it is just as much for your interest as ours to want the streets widened. Appoint a committee from among your members and let it confer with the commission. The opportunity is open to you. Embrace it."

DESPITE THE VIGOROUS KICKING.

The opening of the electric road in Austin, Texas, recently, was referred to by the *Statesman* of that city in the following characteristic manner, in its issue of December 4:

"Despite the vigorous kicking of various and sundry people in and around Austin, the electric-car lines are now completed and the cars are now running in and out of the great network of curves and switches at the Avenue and going to every part of the city. The line was put in complete operation yesterday at noon, and the cars were crowded all the afternoon. This company, which has been of so much benefit to Austin, is here to stay, and whether they get the encouragement of kickers or not, they are going to make things hum."

NORRISTOWN WANTS RAPID TRANSIT.

Some of the citizens of Norristown, Pa., think that the time has come when rapid transit by electric cars should be adopted in that enterprising city. The Norristown *Herald* of December 7, referring to the subject of electric cars, says:

"Although there is some opposition to the trolley system of propulsion, as applied already by many of the street-railway companies throughout the country, there is not as yet anything better as a substitute for horses to do this work. In time there will no doubt be other means than the overhead wire for conveying the necessary power. In the mean time people will have to be educated up to the point where their exaggerated ideas as to its dangers will disappear.

"There is perhaps no better way to show to our people the success and advancement in this line than to quote the experience in localities where street railways are operated under the improved plan.

"In West Chester, where the population hardly justifies such an experiment, the street cars are running successfully and by the trolley system. We have heard of no accidents resulting from contact with the wire. On the contrary, persons who were most disinclined to favor the system are, now that it is in operation, enthusiastic patrons of the road.

"At Allentown, Reading, Scranton and Pottsville, the trolley system is also in operation successfully, proving to the people of these towns that while accidents will occur they are generally the result of carelessness of the victim or those having control of the motive power.

"To go farther away from home we might quote much to recommend the new system. Ansonia, Connecticut, is a town with perhaps a third of the population of Norristown. It has had an electric road in operation for more than three years. The *Evening Sentinel*, published there, in a recent issue commending the adoption of the system to East Hartford, where there is some opposition to it, says:

"'In Ansonia the trolley system of electric roads has been in operation over three years. In that time there has not been a fatal, nor even a serious, accident from the wires, and there is positively no more danger, nor hardly as much as from electric-light wire.

"'Every day, nearly, reports of accidents from cable cars are published, yet we do not learn of the wholesale condemnation of this system because of them. There seems to be a strong prejudice, an unfounded one at that, against electricity for street-car propulsion, born, probably, from the mysteriousness of the current and the inadequate knowledge of the people concerning the subtle fluid. It is not strange, though it is foolish. New Haven condemns electric street cars largely on account of the danger. And yet New Haven is supposed to be a city of intelligent and educated people.

"'Ansonia's experience with the trolley system has been very gratifying, and we doubt if any inducements could be offered to lead us to return to horse-power.'

"Similar testimony comes from the 400 and more towns where the trolley system is in operation.

"How soon will the street-car companies of Norristown combine to bring about the needed improvement?"

The *Herald* has presented the matter in a very clear and accurate manner, and it now remains for the street-car companies to take the hint. If they are enterprising and far-seeing they will not defer the matter any longer than necessary. When a movement in favor of the introduction of electric cars begins it does not subside until the cars are in operation.

NEW LINES.

The managers of the electric railroad in McKeesport, Pa., state that their cars will be running on regular schedule on Christmas Day next. The power-house is completed and the street-wiring is nearly finished. Five cars are on the line ready for service, and three more are expected from Philadelphia at once. The line is to be extended to the Pennsylvania Railroad Depot, and it is thought the McKeesport and Duquesne lines will establish an exchange of tickets, which will enable passengers to go from Duquesne to the centre of the city on one fare.

The formal opening of the Beaver Traction Company's lines from Beaver Falls to Beaver, Pa., took place on the 9th inst. Ten gayly-decorated cars containing a brass band, railway officials, city officials, members of the press and citizens from Beaver Falls and Pittsburg, left the former place and proceeded to Beaver. Speeches were made and a banquet was tendered in the evening to the Press Club and the visiting brethren from Pittsburg.

ELECTRIC CARS IN NEW ORLEANS.

The ordinance granting the New Orleans and Carrollton Railroad Company the right to operate the overhead electric system on its road between New Orleans and Carrollton was considered at a meeting of the New Orleans City Council Committee on Streets and Landings on December 4.

There was a very large delegation of citizens living along the line of that road present, including its president, Mr. Hernandez, and Mr. Crosby, of the Thomson-Houston system of electric railway.

Mr. B. C. Shields, chairman of the delegation, read a lengthy memorial which had been drawn up at a recent meeting of the citizens for presentation to the committee, touching the subject under discussion, after which he called upon Mr. Abbott, one of the delegation, to make a few remarks. Mr. Abbott confined his argument principally to the ground already traversed at the different meetings and conferences upon the subject, and which were fully reported at the time of their occurrence. He said, however, that fully 99 per cent. of the people residing on St. Charles avenue and contiguous thereto were in favor of the ordinance before the committee. Over 4,000,000 people travelled over the Carrollton line during the year, and to them the proposed change from mule to electric power was a question of time, principally. But then the benefits would be realized in other effects, and more particularly in the vast improvements which this proposed change would bring about.

He asked that the ordinance be passed just as it had been introduced, or as near so as possible. He hoped at least that it would not be loaded down with hampering amendments, which would practically have the effect of defeating the ordinance entirely. So far as the conductors and all that sort of thing were concerned, he promised that the patrons of the road would look after them.

Mr. Thomas A. Marshall, Jr., also addressed the committee in favor of the ordinance. He assured the committee that the presence of so large a number of citizens was not for the purpose of overawing or intimidating the committee, but merely to show the interest that was being felt in the matter and the friendliness of the people toward the new movement. The desire of the people was unquestionably for the project, and not only were they in favor of its inauguration on the Carrollton Railroad, but on every other road of the city as well. In the matter of rapid transit the city was notoriously deficient, and every year was lagging behind.

He complimented the Council on its good work in general and the splendid impulse it had given to progress and reform. As such the present ordinance was worthy of its favorable consideration, and he asked that it be passed without amendments.

The statement that poles were disfigurements; that electricity was destructive of human life, or that the company itself had hitherto neglected to perform its franchise obligations, were matters scarcely deserving of consideration in the present instance. If the railroad had not complied with its charter obligations the city could secure an enforcement of them through the courts. He asked that the wishes of the people be respected, and they being satisfied as to the adoption of the new method, the Council's duty was to be accordingly satisfied.

Mr. Shields stated that the people of Carrollton and elsewhere along the line of the Carrollton Railroad were desirous, above all things, to have *rapid transit*, and to have it as soon as possible. The committee might, therefore, rest assured that they would neither consent nor encourage any hindrance or obstruction on the part of the company to the success of the enterprise. The city could throw around the ordinance such safeguards as its representatives might deem necessary for its protection in the premises.

Mr. Hodgson put the question directly to Mr. Hernandez as to when the proposed work would be commenced and when completed. The company had asked that it be confined to no particular system, but expressed a preference for the Edison.

Mr. Hernandez said that Mr. Crosby, the General Superintendent of the Thomson-Houston system, was in the city at the invitation of the Carrollton Railroad Company, and had spent considerable time during the week in figuring on the cost of constructing and equipping a line under that system in New Orleans. The Carrollton Railroad Company felt favorably disposed to the Thomson-Houston system, and it was more than likely they would adopt it on their line. In the event of the adoption of this system, the company would naturally want some little time to enable them, if possible, to dispose of their mules and make their financial arrangements. It would take about four months' time to put the new system in perfect operation—say about March or April next. He (Mr. Hernandez) meant business, his ambition being to have the finest road in the South. He would not, however, accept the franchise if the clause with reference to conductors was insisted upon; nor would he accept it with that reducing the fare to five cents. In the matter of conductors the road could be depended upon to protect itself, and if it was found that it could not be operated satisfactorily without them they would be introduced as a part of the service. So, also, if it was ascertained that the five-cents schedule would pay the company, that too would be adopted in due time The people were sure of rapid transit, but the railroad company was not sure that the enterprise was going to pay it. The city was out nothing in the whole matter, and yet had all to gain in the vastly-increased beauty of the upper districts and the material addition to its assessment rolls.

Some of the delegation expressed the opinion that the committee was disposed to deal too severely with the railroad company, to which Mr. Landry made reply by calling attention to the trouble the city was at present having with the St. Charles Street Railroad Company, growing out of the failure of the latter to comply with a certain obligation required under its charter, viz. : the matter of paving Baronne street. From that he inferred the necessity of subjecting corporations to a thorough understanding of their obligations and enacting clauses enforcing their unqualified compliance.

Mr. Shields said that when the delegation asked that the ordinance be adopted as offered, it was simply meant that the measure be not loaded up with amendments tending practically to kill it. If there was anything in the ordinance which the committee did not understand, there could be no objection to its being referred to the City Attorney for his opinion.

Mr. Crosby, of the Thomson-Houston system, said the system referred to would, as applied to New Orleans, consist of two different methods. One above Lee Circle, where one pole would be erected between the tracks on the neutral ground. On Baronne and Jackson streets a different system would be required, as there was no neutral ground on those thoroughfares. The poles would have to be put on both sides of these streets with span-wires across, and upon these the trolley-wires would be supported. The poles would be placed 125 feet apart.

The trolley-wires were generally eighteen feet above the track, and the wires themselves could be temporarily removed to admit of passing processions, etc. He admitted that the overhead wires were not desirable, but they could not be done without. There was no danger from a shock, and as an evidence of this fact stated that although millions of people had been carried by the system, no one had ever been killed. The average time made in the suburbs of some cities is about twenty miles an hour, but a motor could be made to run from thirty to thirty-five miles in that time. The schedule in New Orleans could be made to suit the patrons of the road, or the company, as the case might be. On the neutral ground of St. Charles avenue excellent time could be made.

In reply to a question put by Mr. Hodgson, Mr. Crosby said that it was not usual to run electric cars without conductors, but was satisfied that it could be done, nevertheless. The introduction of electric motors had increased travel on lines more than 200 per cent. in some places, and he thought the necessity of placing conductors on the New Orleans road would make itself apparent in time.

CHICAGO NOTES.

A Milwaukee avenue grip car ran into a coal wagon, Dec. 8, at the corner of Milwaukee avenue and Desplaines street. The car left the track, breaking the grip-shaft, which struck the gripman, McGarrity, in the face, breaking his jaw. The injured man was taken to his home and travel was delayed about an hour.

Forty new cars are about to be placed on the Ogden avenue line of the West Chicago Street railroad. This will relieve to a slight extent the crowded condition of the cars on that line, for the new cars are five feet longer than those they displace. The old cars will be taken off or put on other lines. The new cars were made in St. Louis, and Superintendent Nagle, of the west side company, said that they were the handsomest cars yet brought to the city.

Another of Mr. Yerkes' grip cars stuck in the La Salle street tunnel, Dec. 8, at 6:45 P.M., when the cars were crowded. A Clybourn avenue grip car, No. 423, pulling two trailers, broke its brake-chain and a piece of iron lodged in front of a wheel. Before the real trouble was discovered four big horses had tugged and hauled at the heavy train for half an hour and two following grip cars had tried to push the train up the incline to Michigan street. Hundreds of passengers got off and walked through the tunnel, which was enveloped in a sulphurous haze.

TO CHANGE TO ELECTRIC POWER.

A company has been organized in Fresno, Cal., with a capital of $1,000,000 to establish in Fresno a complete modern electric-railway system. The incorporators of the company are Dr. Lewis Leach, Fulton G. Berry, J. R. White, Ben R. Woodworth, Morris Messenger, W. F. Chandler and Marcus Pollasky. The officers of the company have not as yet been elected.

It is understood that this company has secured options on all three of the existing street-car lines, which it proposes to turn into electric roads.

It is said that the service will be improved in every way. Fifty miles or more of road will be built, and rapid transit will be established.

PURCHASING AGENT FOR ELECTRIC COMPANIES.

The purchasing for central stations is a matter of the greatest importance and is often attended to by those not fully informed as to the market.

This information is best obtained in a city where all the leading manufacturers do mostly congregate, and who know that the parties purchasing goods are up to the times and have a record for getting the lowest prices.

Dividends can be saved if this business is properly done. The electrical field is expanding daily and new features of the business are being taken up by those who, from experience, seem fitted for the work.

We refer particularly to the number of men who have become experts in engineering and construction as being under the new branches which are becoming of great importance, and now the question of buying by experts is about to be given a trial.

Mr. Charles E. Chapin, who recently withdrew from the well-known A. B. C. firm, of New York City, having given the matter of buying his exclusive attention for a long time, proposes to contract with electrical-supply houses and central stations, either to purchase on commission, or retainer, buying electrical apparatus and supplies including the steam plants, and in fact everything pertaining to the business of electricity.

The success of Mr. Chapin as a buyer is well-known, and he makes this outline of what he proposes to do.

The position of a resident buyer is to purchase such merchandise as is stipulated by parties ordering, and it will be his endeavor to cater fully to the requirements of his clients. Being independent in all ways he will be able to place before them the various apparatus or supplies that are on the market with the lowest price to be obtained, from which a choice can be made.

From past experience, which has been satisfactory to his employés, he feels that he will be able to save dollars to the concerns who place their business in his hands.

Mr. Chapin has secured offices in the Electrical Exchange Building, Rooms 417 and 418, in this city, where he will be pleased to receive catalogues of anything new in the electrical field and to see his old friends.

AN IMPORTANT SUIT.

A Boston paper says that the Edison Co. has brought suits against the West End Street Railway, of Boston, which is using nearly 400 Thomson-Houston cars, and thereby infringes, it is claimed, a number of the Edison patents. It is claimed that the patents controlled by the Thomson-Houston and other companies which were earliest in the electric railway field cover all existing forms of underrunning trolley, carbon brush, compound wound dynamos, overhead switches, pull-off-wires at curves, metallic sheath for magnet-cores of motors and dynamos and other important features.

ELECTRIC LINES IN BEATRICE, NEB.

It is reported that a deal has been consummated between New York capitalists and the Beatrice Street Railway Company, of Beatrice, Neb., and it is likely that the existing lines will be operated by electricity. It is said that when the work of improvement is completed that Beatrice will have one of the most complete electric railway systems in the West.

THE WEEK'S RECORD OF STREET RAILWAY NOTES.

AUSTIN, TEX.—December 2. Electric street railway to cemetery in operation.

BOSTON, MASS.—Bunker Hill car-house being remodelled to accommodate electric cars.

EAST LIVERPOOL, OHIO.—December 5. Electric street railway to Wellsville in operation.

GRAND RAPIDS, MICH.—Jacob Seligman, Saginaw, Mich., purchased interest F. W. Dickerson in Reed's Lake Electric Railway.

HARTFORD, CONN.—December 5. Successful trial trip Barrett storage-battery car.

LOS ANGELES, CAL.—Reported central part road Los Angeles Consolidated Railway Company sold to San Francisco syndicate.

LYNN, MASS.—Reported Lynn and Boston Street Railway Company will have entire road electrically equipped within another year.

NEW YORK, N. Y.—John Murray arrested December 11 picking pockets on car New York and Brooklyn Bridge.

PITTSBURG, PA.—Second Avenue Electric Railway Co. will replace Glenwood car-house, recently burned, by fireproof, steel buildings.

TERRE HAUTE, IND.—December 4. Street-railway strike amicably settled.

Extensions.

CHICAGO, ILL.—Calumet Electric Railroad Company will make extensive track extensions in near future.

GREENVILLE, ALA.—Greenville Street Railway Company will extend lines near future.

JERSEY CITY, N. J.—Jersey City and Bergen Railroad Company intends build line connect with ferry foot Bay street.

TOLEDO, OHIO.—Metropolitan Street Railway Co. will extend to westerly city limits.

Casualties.

BOSTON, MASS.—December 4. Lady run over a killed by electric street car.

Double-decker electric car collided with express wagon, slightly injuring driver.

PATERSON, N. J.—December 5. Man slipped under wheels Main street horse car, receiving injuries from which died.

SALEM, MASS.—December 3. Two passengers and two employés injured by collision of electric cars on Boston street.

ST. JOSEPH, MO.—November 30. Union Railway Company's car-house destroyed by fire. Thirty-five electric motors destroyed. Loss $65,000, fully insured.

Legal.

AKRON, OHIO.—Lida M. Dussell *vs.* Akron Street Railway Co., $20,000 injuries received.

BOSTON, MASS.—International Trust Co. *vs.* Keokuk (Iowa) Electric Street Railway and Power Co. for receiver.

INDIANAPOLIS, IND.—Martin J. O'Reilly *vs.* Citizens' Street Railway Co., $25,000 damages injuries sustained by son jumping from street car after driver refused stop.

ROCKFORD, ILL.—Injunction suit Rush R. Sloane *vs.* People's Electric Railway Company decided favor defendant.

SPRINGFIELD, MASS.—Michael Fitzgerald *vs.* Springfield Street Railway Company for injuries received, $17,075 for plaintiff.

YOUNGSTOWN, OHIO.—Thomas Braithwait *vs.* Youngstown Street Railway Company, $25,000 damages injuries received.

Personal.

GLOUCESTER, MASS.—A. B. Martin, Superintendent Gloucester Street Railway Company, paid us visit few days ago.

WORCESTER, MASS.—J. B. Chapin, Superintendent Worcester Consolidated Street Railway Company, resigned December 5.

Increase of Capital.

CARTHAGE, MO.—Carthage, Carterville, Webb City and Joplin Rapid Transit Company to $500,000.

PLYMOUTH, MASS.—Plymouth and Kingston Street Railway Company will increase capital stock to $100,000.

Election of Officers.

MINNEAPOLIS, MINN.—December 1. Judson Pneumatic Street Railway Company. Directors: W. L. Judson and F. S. Barker, Chicago; Lewis Walker, Meadville, Pa.; H. D. Cook, Harry L. Earl and James H. Taylor, Washington, and James F. Williamson, Minneapolis.

SAN FRANCISCO, CAL.—Electric Railway Development Company. Directors: Dr. De Witt Clinton Moore, George T. and J. W. Dunlap, W. M. Fitz Maurice and Ira V. Hitchcock.

New Roads.

MIDDLETON, PA.—Street-railway company organized construct electric street railway to Steelton.

PORT RICHMOND, N. Y.—Authorities place asked for franchise electric street railway between Prohibition Park and Port Richmond.

Franchises.

ASBURY PARK, N. J.—Seashore Electric Railway Company asks extension franchise to 50 years.

BUCYRUS, OHIO.—December 8. Suburban Electric Railway Company granted franchise construction electric street railway to Gallion.

PITTSBURG, PA.—Braddock and Turtle Creek Street Railway Co. granted right-of-way Corey avenue.

SAN FRANCISCO, CAL.—Consolidated Street Railroad Company granted franchise for street railway from power-house Temescal to Mountain View Cemetery.

Incorporations.

ALBANY, N. Y.—December 4. Port Richmond and Prohibition Park Electric Railroad Co. Capital stock $50,000. Incorporators: W. Jennings Demorest, William Wardell and Joseph H. Bogardus, New York; Isaac K. Frank and Alexander S. Bacon, Brooklyn; B. F. Frank, Dr. C. L. Haskell and E. D. Clark, Staten Island.

FRESNO, CAL.—Fresno Electric Railway Company. Capital stock $1,000,000. The incorporators are local capitalists and will substitute electricity for horses on the existing lines.

NORFOLK, VA.—December 6. Port Norfolk Electric Railway Company. Capital stock $10,000. Incorporators: Reid Carpenter, Mansfield, O.; William H. Stewart, Portsmouth; S. M. Cooper, Cincinnati; M. W. Mason, Norfolk, and H. B. Mason, Norfolk county.

OTTUMWA, IA.—December 7. Ottumwa Electric Railway Company. Capital stock $500,000. Incorporators: W. R. Daum, J. B. Sax, George P. Daum, Charles F. Blake, L. B. Doud and Calvin Manning, Ottumwa, Ia.

SAN DIEGO, CAL.—November 30. San Diego Electric Railroad Company. Capital stock $250,000. Incorporators: J. A. Spreckles and A. B. Spreckles, San Francisco, Cal.; E. S. Babcock and Chas. F. Hinde, Coronado, Cal.; Joseph A. Flint, San Diego, Cal.

SAN FRANCISCO, CAL.—December 3. Electric Railway Development Company. Capital stock $500,000. Incorporators: Dr. De Witt Clinton Moore, Oakland, Cal.; Geo. F. Dunlap, J. W. Dunlap, William M. Fitzmaurice, Ira V. Hitchcock, San Francisco, Cal.

VINEYARD MASS.—December 8. Dukes County Street Railway Company. Capital stock $200,000. Officers: President, C. H. Emerson, South Farningham; secretary, Charles Strahan, Cottage City; attorney, Edward Allen Davis, Boston.

WESTERN NOTES.

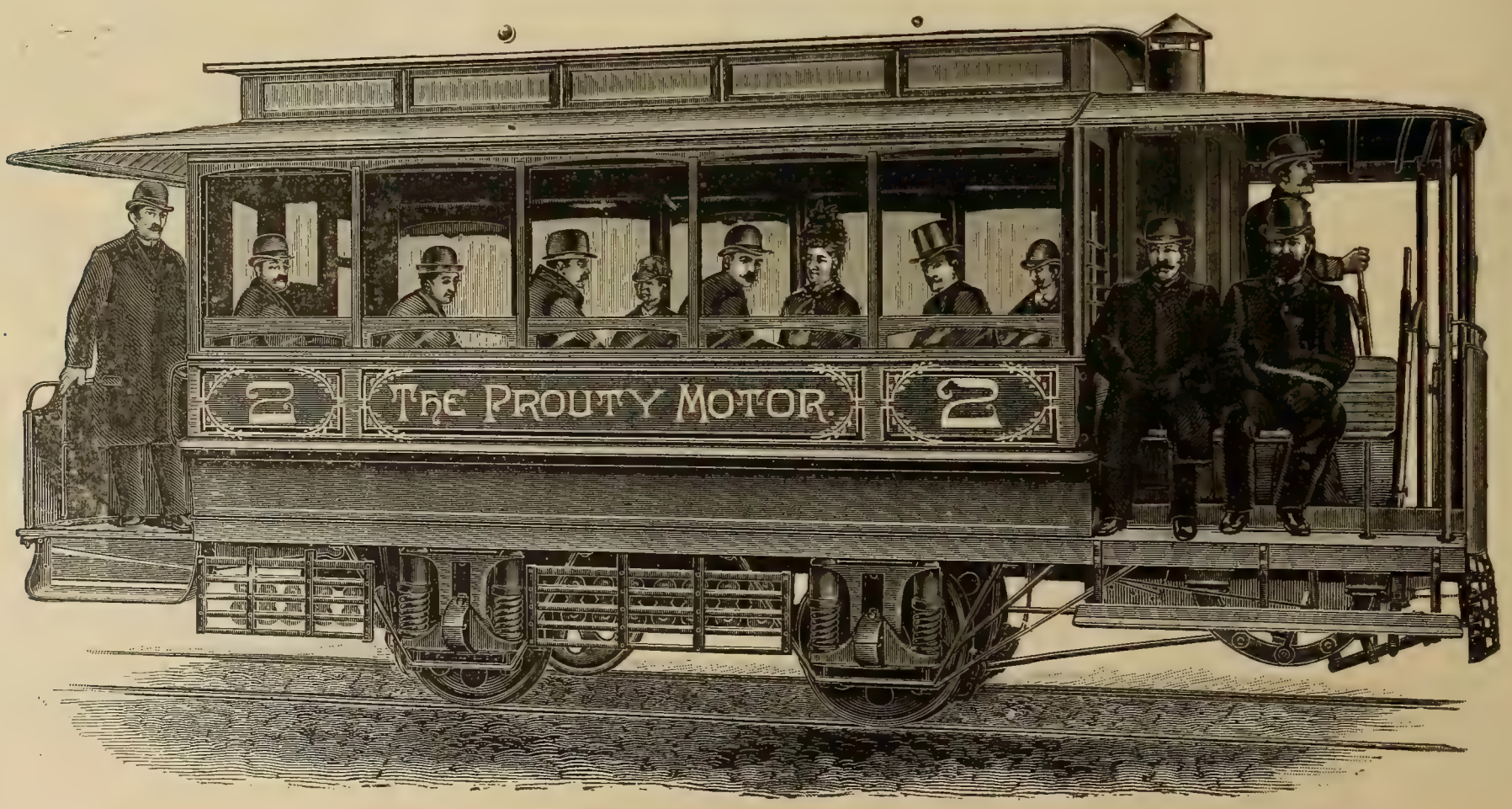
THE CHICAGO STREET-CAR HEATING CO., manufacturer of the Duplex Street-Car Heater, Chicago, is meeting with good success. The Russell Street Carrette Co., of Chicago, has adopted Duplex heaters. Orders have also been received from street-car companies in Bloomington, Ill., and St. Louis, Mo., for heaters to be placed in cars in these places.

THE EDWARD P. ALLIS CO., Milwaukee, Wis., manufacturer of the Reynolds' Corliss engines, is turning out in every twenty-four hours engines aggregating 300 horse-power. The engines are manufactured in sizes from 25 horse-power to 2,000 horse-power. The company also manufactures saw-mill, mining, and flouring-mill machinery. It is said that the first rolling-mills (Gray's patent) were manufactured by it. The engine used in the water-works at Omaha, Neb., which is said to be the largest in the world, was built by the E. P. Allis Co. This engine pumps 18,000,000 gallons of water every twenty-four hours. The company's plant in Milwaukee is said to be the largest of its kind in this country, occupying 17½ acres of land and employing 1,500 men. The company's interests are looked after by Mr. F. A. Larkins, the business manager, who is an able, intelligent and affable gentleman. The members of the firm and those in charge of its works have been identified with the manufacture of automatic engines since the earlier days of their introduction into this country, and during these years they have reaped the benefits of a wide experience in designing and constructing engines to meet any and all conditions of service to which they are applied. The practical application of this matured experience is attested by the fact that the Reynolds' Corliss engine has successfully performed the varied work consequent to the sale of over 1,400 engines of all kinds in twelve years without, as far as known, a single failure.

N. D. W

THE PROUTY MOTOR.

The accompanying cut represents a car equipped with the latest form of this noiseless steam motor, and we hope to publish a full editorial description of the same in our next issue.



BOSTON NOTES.

NEW ENGLAND OFFICE STREET RAILWAY NEWS,
BOSTON, Dec. 12, 1891.

MR. H. H. HARRISON, formerly of the Lieb Machine Works, New York, is now connected with the street railway department of the Thomson-Houston Co. Mr. Harrison will devote his entire attention to this department, and will travel throughout the country a greater portion of the time. He is an indefatigable worker and no doubt will be very successful in the interests of his company.

MR. CHARLES J. MAYER, of the R. D. Nuttall Co., Allegheny, Pa., well-known manufacturer and dealer in electric railway supplies, is in town hustling for business, and he is meeting with good success.

MR. J. BRADFORD SARGENT, New England agent of the Stirling High-Pressure Water-Tube Boiler, who until recently has had his office at Leicester, has, owing to the pressure of business, removed his headquarters to 620 Atlantic avenue. His offices are large and commodious and elegantly furnished. Mr. Sargent is meeting with great success, which is based on the efficiency of the "Stirling." While this boiler has been on the market less than three years, the total capacity of those now in practical use throughout the country is over 100,000 horse-power.

AN electric railway connecting Lynn with Boston is now in course of construction. The Boston Bridge Company, 70 Kilby street, is now engaged in building the roof of the power-house for this road at Lynn. D. L. T.

The New Avondale Electric Road, in Cincinnati, O., is rapidly approaching completion, and will probably be in operation within the next thirty days.

PLAYING CARDS.

You can obtain a pack of best quality playing cards by sending fifteen cents in postage to P. S. Eustis, Gen'l Pass. Agent, C., B. & Q. R.R., Chicago, Ill.

A MAP OF CHICAGO,

Showing location of World's Fair, principal streets, hotels, railway stations, street-car lines, boulevard system and other points of interest, will be sent free upon receipt of a silver dime. Address Geo. H. Heafford, General Passenger Agent, Chicago, Ill.

BUSINESS NOTES.

THE necessity for first-class material and workmanship in the construction of electric cars is now generally recognized, and this fact naturally develops or brings out the best skill and workmanship that can be obtained for this class of work. The Kuhlman Company, of Cleveland, Ohio, is alive to the interests of street-car companies, and keeps a large stock of all kinds of wood usually required for the construction of street cars. He is a practical street-car builder himself, and his experience extends over a period of 20 years. Many of his cars are found on various railroads throughout the West, including the lines in the following places: Newburg, Ohio, and Mt. Clemens, Mich. He also does a good deal of work in the line of rebuilding, and cars remodelled by him are found on the Canton, O., and Berea, O., street lines. His practical knowledge especially fits him for this work, and as he keeps a large stock of material on hand, he is enabled to fill orders on short notice.

THE EDW. P. ALLIS COMPANY,

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STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued December 8, 1891.

464,490. Electric Railway-Signal. Charles E. Buzzell, Leaf River, Ill. Filed June 20, 1891.

The combination of a suitable appliance for actuating a railway switch or signal, a normally-closed electrical main circuit in which is included instruments suitable for telegraphic purposes, a battery, and an automatic circuit-breaker, an electrical switch in a circuit normally rendering the automatic circuit-breaker inoperative, the electrical switch opened and closed by the movement of the actuating appliances.

464,505. Conduit-Conductor for Electric Railways. Walter H. Knight, New York, N. Y. Filed Aug. 4, 1888.

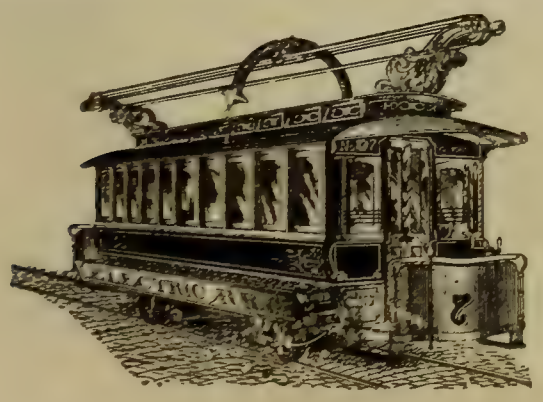
In a conduit for an electric railway, the combination, with a slot-rail, of a substructure therefor, a socketed bracket attached to the interior of the said substructure, an insulator in said socket, and a main supply-conductor supported by the insulator.

464,513. Electric Fare-Recording System. Barton S. Molyneux, Minneapolis, Minn. Filed Feb. 28, 1891.

The combination, in an electric fare-recording system, of an electric circuit with a suitable recorder or register and a source of electricity included in the circuit, electric fare-registers carried by the several cars of the street-railway system, and means for connecting the same in the circuit at a predetermined point or points along the railway.

464,527. Wheel for Railway-Cars. Nicolaus Smith, Gellivare, assignor to Robert Fawcus Smith, Stockholm, Sweden. Filed Aug. 28, 1890.

In a railway-car wheel, the combination of two discs having hub-flanges turned toward each other, cut away, and



464,557.—ELECTRIC RAILWAY SYSTEM.

adapted to interlock by the partial rotation of one disc relative to the other, and a surrounding rim.

464,536. Automatic Pipe-Coupling for Railroad-Cars. James W. Ware, Cape May, N. J., assignor of one-half to J. Straton Ware, same place. Filed Dec. 24, 1890.

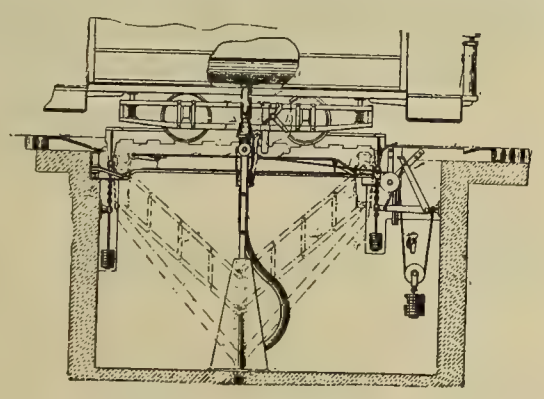
The combination, with the pipe having internal transverse rods, of a valve mounted therein and having arms extending radially outward to the walls of the pipe and then longitudinally along the same beyond the transverse rods.

464,552. Railway-Tie. John A. Carl, Bridgeport, Pa. Filed May 23, 1891.

The herein-described metallic tie, made tubular and provided with a longitudinal partition interposed between the bottom and top of the tie and serving as a brace or support for the top.

464,557. Electric-Railway System. Léon O. Dion, Natick, Mass. Filed Dec. 5, 1890.

An electric-railway system consisting of a fixed conductor, a series of branches extending therefrom along fixed supports arranged in suitable proximity to the car-tracks, each having an overhanging portion provided with a terminal free to move vertically, a car adapted to move on the track and provided with a motor, a storage-battery suitably connected with the motor, an endless contact-belt, and loosely-mounted pulleys around which the belt is passed, one of the pulleys being connected with the storage-battery, the con-



464,614.—STREET RAILWAY.

tact-belt being arranged lengthwise of the car in position to be brought by the movement of the car into contact successively with the lower ends of the terminals of the fixed conductors, each contact partially charging the battery.

464,572. Car-Coupling. George D. Lewis, Port Allegheny, Pa. Filed July 15, 1891.

In a car-coupling, the combination, with the hollow U-shaped draw-head, of wings pivotally connected at their front ends to the arms of the draw-head, L-shaped feet on the wings passing into the draw-head, pivoted and spring-actuated levers bearing the feet and wings normally outward, and chains leading from the rear ends of the levers over suitably-located pulleys to a common point, and thence out the top of the draw-head.

464,587. Carriage-Actuating Mechanism. William H. Phillips, Jenkintown, assignor to himself, Arthington Gilpin, and Paul W. Knauff, Philadelphia, Pa. Filed Feb. 2, 1891.

The combination, with an electric generator and a circuit leading therefrom, of a switch normally held open, an electro-magnet arranged in the circuit to hold the switch closed, a car or its equivalent, a drum carried on the car, a conduit-wire wound on the drum and electrically connected with a wire on the car and with the circuit from the generator, a motor carried on the car and geared to drive the same, a switch connected with wire, and with the motor, the switch being adjustable, so as to reverse the current in the motor connection, and gearing actuated by the motor and connected with the switch to break the circuit and reverse the switch after the motor has made a determined number of revolutions.

464,596. Car-Brake. John Trendley, St. Louis, Mo., assignor of two-thirds to John W. Schorr and Charles Noll. Filed May 21, 1891.

In a car-brake, a pulley fixed upon a movable drum of smaller diameter than the pulley, a brake-chain attached to and wound on the pulley and attached to and wound on the shaft of a crank-lever U, two stay-chains wound upon the drum in an opposite direction from the rope or cable and attached to the car-frames in front, a brake-chain wound around the drum in an opposite direction to the stay-chains and attached by its other end to the brake mechanism of the car, two supports fixed to the frame-work of the car and supporting a movable drum, and a movable drum having the ropes and pulley attached thereto and movably impinging on the supports.

464,614. Street-Railway. Whitcomb L. Judson, New York, N. Y. Filed Sept. 25, 1890.

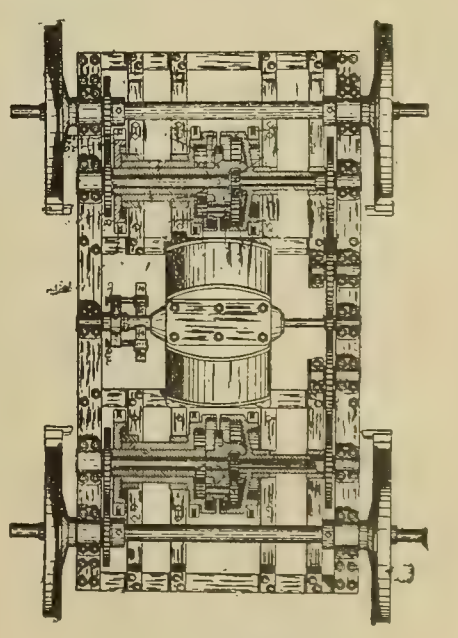
The combination, with the car and the air-main extending along the line of travel, of a receiving-nozzle on the car, the movable nozzle communicating with the main, a nozzle-guide located on the car parallel with the receiving-nozzle, and a guiding-arm or projection on the charging-nozzle for engagement with the guide to effect registration of the nozzles.

464,615. Street-Railway. Whitcomb L. Judson, New York, N. Y. Filed Sept. 25, 1890.

The combination, with a movable car, of a pivoted trap located on the line of travel and a trolley located under the trap and movable by the car to open the trap.

464,616. Street-Railway. Whitcomb L. Judson, New York, N. Y. Filed Sept. 25, 1890.

The combination, with an air-conduit having a movable section telescoping with the adjacent fixed sections of an air-nozzle connected to the movable section.



464,640.—TRANSMITTING MECHANISM FOR MOTOR-CARS.

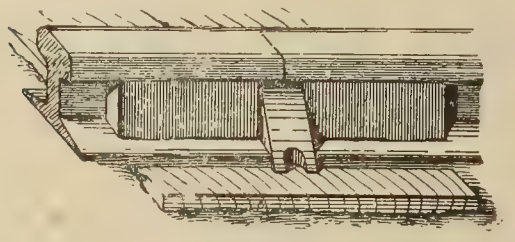
464,640. Transmitting Mechanism for Motor-Cars. Charles W. Thomas, Jersey City, N. J., assignor of five-sixths to Philip Van Volkenburgh, New York, and John H. Pendleton, Brooklyn, N. Y. Filed Jan. 23, 1891.

The combination, with a motor, of fast and loose transmitting mechanism having annular racks of diverse diameters, which, together with a driving-shaft having pinion, and with driven shaft having an arm, all revolve independently about a common axis, a shaft journalled in the arm, differential pinions on the shaft, of which one pinion meshes in one of the pinions, and the annular rack and the other meshes in the annular racks, a friction-drum integral with each of the racks, and three independently-operated brake

systems, one for each rack-drum, by which the operator is enabled to disconnect the driving and driven portions or to produce a fast or slow forward or a retrograde rotation of the driven portion.

464,673. Drill for Electric Railways. Harry P. Bradford, Little Rock, Ark. Filed July 27, 1891.

The combination of a supporting base with a drill-rod,



464,699.—RAILWAY-RAIL JOINT.

and a series of supports or bearings therefor, adjustably attached to the base, so as to permit the rod to be supported at varying distances from but parallel to the base.

464,696. Rail-Joint. Milton C. Niles, Chicago, Ill. Filed Nov. 4, 1890.

In a rail-joint, the combination, with the chair provided with an overhanging lip at one or both sides thereof, of a wedge resting upon the rail-flange, a clamping-plate extending between the wedge and lip, and means for operating the plate.

464,699. Railway-Rail Joint. Algernon G. Edmondson, San Buenaventura, Cal. Filed March 20, 1891.

A railway-rail joint consisting of the fish-plates fitted to the sides of the rails and crossing the line of their meeting ends, the plates having lugs on their lower edges fitting in slots in the foot of the rails on each side of the web, and a cross stay or bridge fitting the joint of the rails from below and bearing on the sides of the fish-plates, whereby the fish-plates are held.

464,702. Rail-Joint. Milton C. Niles, Chicago, Ill. Filed March 17, 1891.

In a rail-joint, the combination, with the rails and the base-plate provided with an inclined shoulder along one side edge thereof, of a wedging lever-plate fulcrumed upon the rail-flange and bearing at its outer edge against the inclined shoulder on the base-plate, a brace-plate confined between the inner end of the lever-plate and the rail-top, and tightening-bolts working through the base-plate and actuating the lever-plate.

464,712. Car-Coupling. John J. D. Kingsbury, East Bloomfield, N. Y. Filed April 4, 1891.

A slide operated by a spring, a supporter or guide to pin, and a balance-weight.

464,753. Brake for Railway-Cars. Edward G. Desoe, West Springfield, Mass. Filed Aug. 20, 1891.

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THE BEST

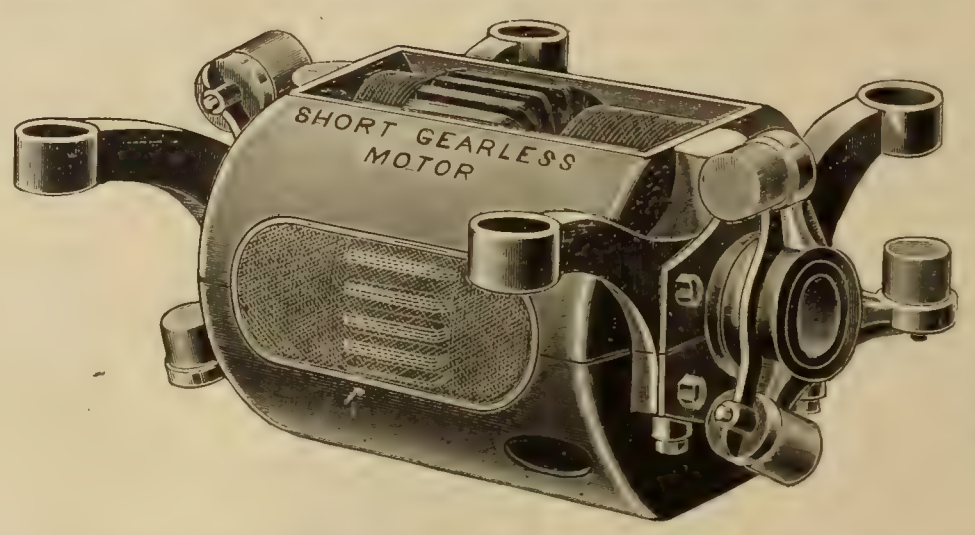
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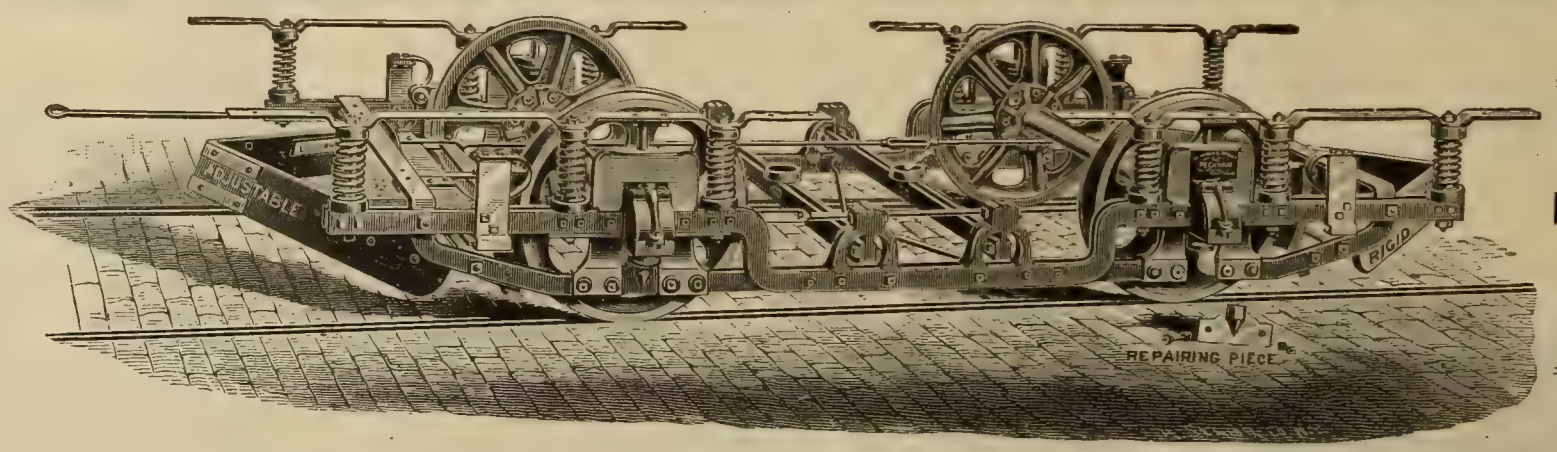
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ADAPTED TO ANY STYLE OF MOTOR.

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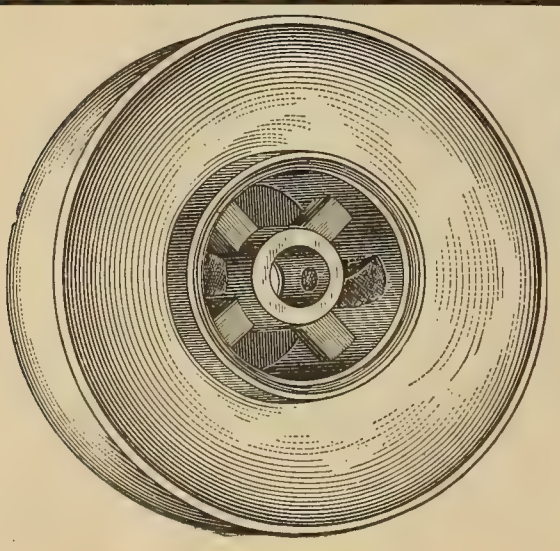
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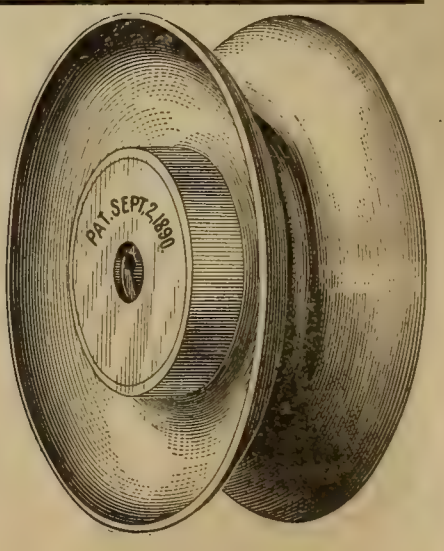
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For Electric Railways.

Smooth running; ways well oiled, prolongs the life of the wheel.
It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

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VOL. I. NO. 25. NEW YORK, DECEMBER 26, 1891.

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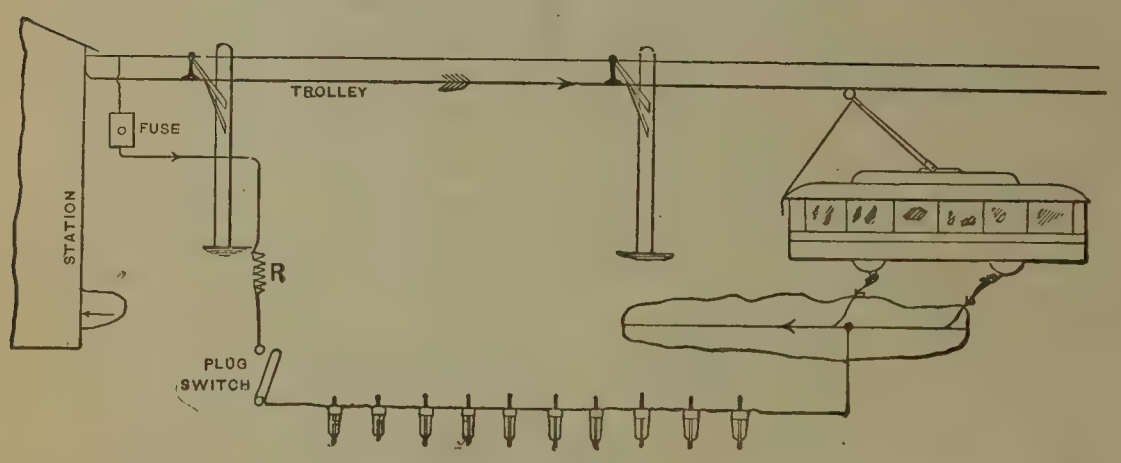
ELECTRIC ENGINEERING & SUPPLY CO., Syracuse, N. Y., U. S. A.

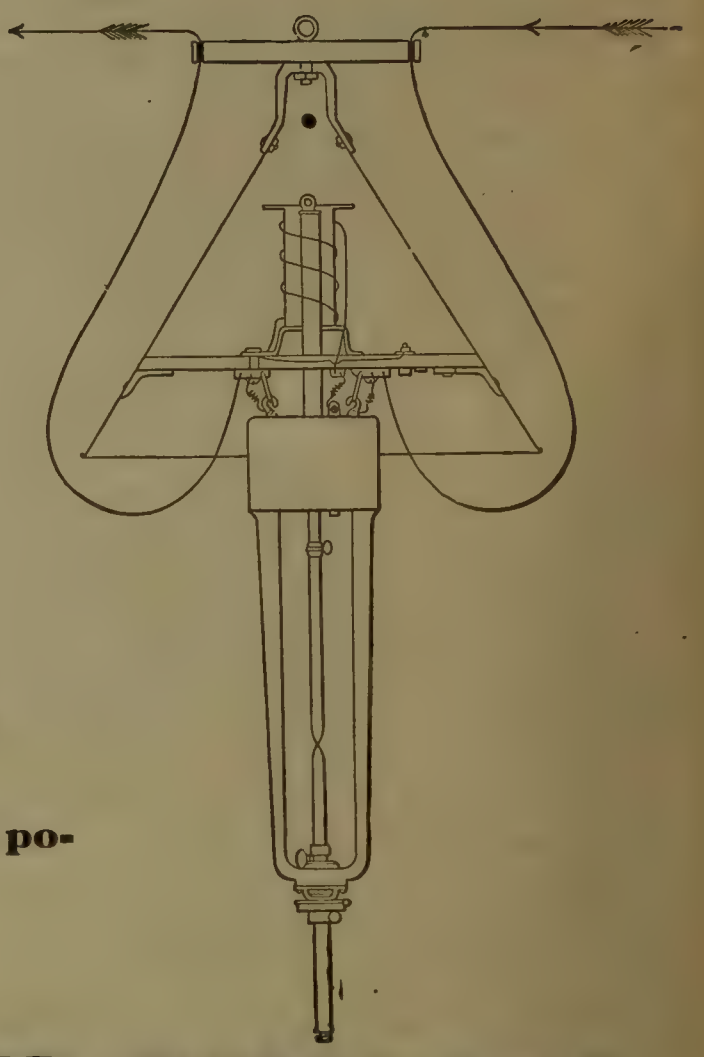
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See also Lists of Horse (*), Cable (‖), Dummy (†) Railways.

STATE.	CITY.	COMPANY.	CAPITAL.	BONDS.	MILES.	MOTOR CARS.	TRAILERS.	SYSTEM.	PRESIDENT.	SUPT., SEC. OR GEN. MAN.	DATE OF ANNUAL MEETING.
Ala.	Birmingham	†*Birmingham Ry. and Electric Co	3,000,000		58	35	25	T.-H.	T. H. Hellman	H. Jenison, Gen. Mgr.	
"	Oxford	Oxford Lake Line Ry. Co.	175,000					T.-H.	T. C. Hill	H. W. Sexton, Sec.	
Ark.	Little Rock	†City Electric Ry. Co. (leased by Cross St. Ry. Co.)							H. G. Allis	R. P. Bradford, Sec. and Man.	
B. C.	Victoria	National Elec. Tramway & Lighting Co.			10½	9	2	T.-H.	Hon. D. W. Higgins.		
"	Vancouver	Vancouver Electric Ry. & Land Co. Ltd	200,000		6½				T. Dunn	F. L. Darne, Supt.	Feb., 1st Mon.
Cal.	Los Angeles	Electric Rapid Transit Co.	500,000		8.50	10	6	Edison	D. McFarland	W. W. Manspeaker, Sec.	
"	Oakland	Oakland & Berkeley Rapid Transit Co.	250,000		12	12	4	"	J. G. McNear	H. S. Hunt, Sec.	
"	"	Oakland Cons. Elec. St. Ry. Co.	2,000,000		26	30	20	" & T. H.	J. W. Coleman		
"	Los Angeles	Los Angeles Consolidated Elec. Ry. Co.	6,000,000		55				Gen. M. H. Sherman	F. V. McDonald, Sec.	
"	Sacramento	Central Street Ry. Co.	500,000		8	10	10	Edison	J. J. Henry	L. L. Lewis, Mgr.	
"	San Jose	*San Jose & Santa Clara R.R. Co.	500,000		13	10	6	T.-H.	J. H. Henry	W. N. Sheaf, Supt.	
"	"	First St. R.R.			6	5	5	"		E. M. Rosenthal, Sec.	
Can.	Ottawa	Ottawa Electric St. Ry. Co.							J. W. McRae	D. C. Dewar, Sec.	
"	Toronto	Metropolitan St. Ry. Co.						T.-H.			
"	Winnipeg	*The Winnipeg St. Ry. Co.	100,000		4	4		Edison	James Austin	Albert W. Austin, Sec.	
Col.	Colorado Springs	Colorado Springs Rapid Transit Ry. Co.	500,000	350,000	22	21	14	"	F. L. Martin	Chas. Wilson, Supt.	Mar., 1st Mon.
"	Denver	‖Denver Tramway Co.	1,000,000		68	32	20	* " Short & T.-H.	R. Curtis	W. G. Evans, Sec.	
"	"	University Park Ry. & Elect. Co. (con. with Denver Tram'y)			3.50	3		"	Milo A. Smith	S. G. Collins, Sec.	
"	"	Denver & Suburban Ry. Co.	500,000		16⅝				S. J. O'Donnell	L. V. Levington, Sec.	
"	"	So. Denver Cable Co. (con. with Denver Tramway)			4	4	4	"	R. Curtis	W. G. Evans, Sec.	
"	"	Colfax Ave. Electric Ry. Co.	150,000		6.5	5	4	"	M. A. Smith	S. M. Perry, Gen. Mgr.	
"	Pueblo	*Pueblo City Ry.	500,000	500,000	22	21	8	T.-H.	J. E. Downey	J. B. Downey, Gen. Man	
Conn.	Birmingham	Derby St. Ry. Co.	50,000	5,000	3.26	5		Baxter	H. Holton Wood	B. U. Porter	Apr., last Mon.
"	Hartford	*Hartford & Wethersfield Horse R.R. Co.	200,000		4	4		Edison			
"	Southington	Southington & Plantsville Tramway Co.	20,000	16,000	2	2		T.-H.	Jas. H. Osborne	L. E. Southworth, Sec.	Apr., 1st Mon
Del.	Wilmington	*Wilmington City Ry. Co.			12	10		Edison	W. Canby	J. F. Miller, Sec.	
D. C.	Washington	Eckington & Soldier Home Ry. Co.			10	10	10	T. H.	G. Truesdell	J. Paul, Sec.	
"	"	Georgetown & Tenallytown St. Ry. Co.	200,000		10	5		" & Short	R. C. Drum	J. E. Beall, Sec.	
"	"	Glen Echo R.R. Co.	100,000		6	6		Westinghouse	E. Balzley	E. Balzley, Sec.	
"	"	Washington Elec. St. Ry. Co.	60,000		3	4		"	J. B. Wilson	S. B. Ewing, Sec.	
Ga.	Americus	Americus St. Ry. Co.			5	4		T.-H.	J. Felder		
"	Athens	*Athens Ry Co.			5.50	4		Rae	E. G. Harris	J. T. Voss, Sec.	
"	Atlanta	Atlanta & Edgewood St. R R. Co.			3.50	4	4	T.-H.	Joel Hurst	Litt. Bloodworth, Sec.	
"	"	Fulton County St. Ry. Co.	350,000		12.75	10	6	"	L. J. Hill	W. S. Thompson, Sec.	
"	Augusta	Augusta Ry. Co.	300,000		24	19	3	Edison	S. B. Dyer	R. M. Spivey, Sec.	
"	Macon	Macon City & Suburban St. R. R. Co.			16	8	6	T.-H.	G. F. Work	E. E. Winters, Gen. Mgr.	
"	Macon	Central City Ry. Co. (leased to Macon City & Suburban)			5	4		"			
"	Savannah	Savannah St. & Rural Resort Ry.	100,000		8.2	15	6		W. G. Cooper	C. Sassy, Gen. Mgr.	
Ill.	Alton	Alton Improvement Association	25,000	25,000	3¼	2			Chas. W. Milnor	H. R. Phinney, Supt.	
"	Aurora	Aurora St. Ry. Co.	300,000		13	15	10	Rae	R. B. Dodson	D. A. Belden	
"	Bloomington	Bloomington City Ry. Co.			12	12	20	United Elec. Trac. Co	J. J. Paterson	W. H. Paterson, Sec.	
"	Cairo	Cairo Elec. Ry. Co.	100,000								
"	Champaign	Urbana & Champaign St. Ry. Co	150,000		4	3	4	Westinghouse	F. G. Jaques	W. B. McKinley, Gen. Mgr.	
"	Chicago	Calumet Electric Ry. Co.	500,000		5	4		Rae	J. D. Harvey	O. S. Gaither, Sec.	
"	"	Cicero & Proviso Electric Ry. Co.	1,000,000		16	12		Edison	D. J. Kennedy	F. E. Ballard, Sec.	
"	Decatur	Citizens Electric St. Ry. Co.	150,000		9	11	5	T.-H.	D. S. Shellabarger	W. L. Shellabarger, Sec.	
"	"	Decatur Electric Ry. Co.	100,000		3.50	4		Rae			
"	Elgin	Elgin City Ry. Co.	200,000		10	12	3	Edison	Wm. Grote	A. B. Church, Sec.	
"	Harvey	Harvey Transit Co.				3		Short			
"	Joliet	*Joliet St. Ry. Co			3	4		T.-H.			
"	Kankakee	Kankakee Elec. Ry. Co.			4½	4		Westinghouse			
"	La Salle and Peru	†City Elec. Ry. Co. oper. Peru & La S. Horse and Dummy R.R.	125,000		8	8	6	Edison	L. P. Merrifield	W. C. Riale, Sec.	
"	Moline	Moline Central St. Ry. Co.	100,000	48,000	4	3	2	" & W'house	W. R. Moore	W. R. Moore	Sept. 26.
"	Ottawa	Ottawa Electric St. Ry. Co.	150,000		8	8	4	T.-H.	T. J. Evans	T. P. Bailey, Sec.	June.
"	Peoria	*Central Ry. Co.	600,000	200,000	17	31	50	"	J. B. Greenhut	H. R. Woodward, Gen. Mgr.	
"	Quincy	Quincy Horse Ry. & Carrying Co.			11	15	7	"	W. S. Warfield	E. K. Stone, Jr., Sec.	
"	Rockford	Rockford City Ry. Co.	150,000		13	13	5	"	R. N. Baylies	R. N. Baylies, Mgr.	
"	"	*West End St. Ry Co.	30,000		4½	6	3	Short	J. S. Ticknor	S. Roseborough, Gen. Man.	
"	Springfield	Springfield City Ry. Co.	125,000	125,000	10½	12	6	T.-H.	R. N. Baylies	R. N. Baylies, Gen. Mgr.	April, 2d Tue
"	"	Citizens' St. R.R. Co.	200,000		11	42		Rae	J. H. Schuck	D. Grady, Supt.	
"	"	People's Elec. Ry. Co.	200,000	200,000	11	10	32		J. H. Schieck	C. F. Henman, Sec.	May 1
"	Sterling	Union Electric Ry. Co.			6	7		Edison	A. H. Howland		
"	"	Union St. Ry. Co. of Sterling & Rock Falls.			6	7		"	"	H. C. Ward, Sec.	
"	Streator	Streator Ry. Co.	300,000		5½	6		T.-H.	P. F. Barr	W. Miller, Mgr.	
Ind.	Anderson	Anderson St. Ry. Co	25,000		5				D. C. Williams	D. C. Williams, Mgr.	
"	Elkhart	*Elkhart Elec. & Ry. Co.	100,000		7	9		Rae	O. N. Lumbert	J. W. Ellis, Sec.	Mar. 1
"	Indianapolis	*Citizens' Street Ry. Co.	100,000		70	7		Short	W. H. Fowler	W. T. Steele, Supt.	
"	La Fayette	La Fayette St. Ry. Co.			5	9	3	Edison	G. E. C. Johnson	Rice J. Hawyer, Sec.	
"	Logansport	*Logansport Street Railway			4½	5			S. Spencer	J. T. McNary, Gen. Mgr.	
"	Marion	Queen City Elec. Ry. Co.	150,000		6	4	1	Rae	G. L. Mason	W. H. Wiley, Supt.	
"	Richmond	Richmond City St. Ry. Co.			4	8	10	T.-H.	J. C. Shaffer	W. H. Shaffer, Sec.	
"	South Bend	*South Bend & Mishawaka St. Ry.	250,000		16	6	6	"	J. McM. Smith	O. S. Baylies, Sec.	
"	Terre Haute	*Terre Haute St. Ry. Co.	158,000		8.5	10	28	Westinghouse	R. W. Rippetoe	L. D. Thomas, Sec.	
Iowa.	Burlington	Burlington Electric Ry. Co.	625,000		12	12	12	"	W. F. Putman	F. G. Jones, Supt.	
"	Clinton	State Elec. Co.	300,000		5	6		T.-H.	E. C. Walsh	G. T. Brown, Supt	
"	Council Bluffs	Omaha & Council Bluffs Ry. & Bridge Co.	1,500,000		20	26	26	"	J. T. Stewart	A. K. Stone, Gen. Supt.	January
"	"	Council Bluffs St. Ry. Co.			8	46		" & Edison	"	C. H. Reynolds, Gen. Sup.	
"	Davenport	Davenport Central Ry. Co.	150,000		2.75	7		Edison	W. L. Allen	O. S. McNeil, Sec.	
"	"	" & Rock Island Elec. Ry. Co.	500,000		24	50	68	T.-H.	C. B. Holmes	E. A. Holmes, Sec.	
"	Des Moines	Des Moines St. R.R. Co.	2,000,000		29.51	36	12	"	J. S. Polk	G. P. Hipper, Sec.	
"	"	Des Moines Suburban Ry. Co.	500,000		12½	8			C. H. Gatch	G. H. Huttenlocher, Sec.	
"	Dubuque	Dubuque St. R.R. Co.			15	22		E. D. Co. Stor.	J. A. Rhomberg	J. H. Rhomberg, Supt.	
"	"	Electric Ry. Light and Power Co.	500,000	100,000	10	12	8	Edison	W. L. Allen	P. A. Matthews, Sec.	
"	"	Key City Electric St. Ry. Co.	200,000		5½	6	4	"	L. H. Biglow	Jos. Angell, Supt.	
"	Keokuk	Keokuk Electric St. Ry. & Power Co.			6	6	4	"	G. L. Lincoln	O. J. Chapman, Sec	June, 1st Tue
"	Ottumwa	*Ottumwa Ry., Electric and Steam Co.	200,000	100,000	7	5	3	T. H.	G. L. Reiner	O. J. Chapman, Sec.	
"	Sioux City	Sioux City St. Ry. Co.	300,000	400,000	15	30	16	Edison	J. F. Peavey	A. B. Peavy, Supt.	Jan., 1st Tues.
"	"	Riverside Park Ry. Co.			8	6	6	Westinghouse	C. W. Hornick	C. M. Swan, Sec.	Jan. 1st Thurs.
Kan.	Ft. Scott	Fort Scott Rapid Transit Ry. Co	500,000	100,000	6	6	8	Edison	E. W. Brady	A. B. Brady, Sec.	
"	Salina	Salina Electric Ry. Co.	100,000						C. L. Baun	L. S. Winters, Secy.	
"	Sedalia	Sedalia St. Ry. Co.			4	4		Edison	Jos. D. Sicher	Chas. S. Conrad, Sec.	
"	Topeka	Topeka Rapid Transit R. R. Co.	600,000		18	30	20	T.-H.	J. B. Bartholomew	J. M. Patten, Gen. Mgr.	Jan., 1st Mon.
"	"	Electric Rapid Transit Co	500,000		8			Edison	D. McFarland	W. W. Manspeaker, Sec.	
"	Wichita	Wichita Electric Ry. Co	100,000	300,000	25	25	10	T.-H.	J. O. Davidson	T. G. Fitch, Gen. Mgr.	
Ky.	Covington	The So. Covington & Cincinnati St. Ry. Co.	500,000		30	10	10	Short	E. F. Abbott	G. M. Abbott, Sec.	
"	Frankfort	Capital Ry. Co.	100,000						P. McDonald		
"	Lexington	Pass. & Belt Ry. Co.	1,000,000		12	10	15	Edison	C. H. Stoll	F. V. Bartlett, Sec.	
"	Louisville	*Central Pass. Ry. Co			10	16	20	T.-H. & Short	B. Du Pont	T. J. Murray, Gen. Mgr.	
"	"	*Louisville City Ry. Co.			20	55		T.-H.	J. B. Sheed	H. H. Littell, Gen. Mgr.	
"	Maysville	*Maysville St. R.R. Transfer Co.	30,000		3	4	7	Westinghouse	A. M. J. Cochran	R. A. Cochran, Sec.	
"	Paducah	Paducah St. Ry. Co.	100,000		9	10	6	Edison	G. C. Thompson	A. S. Thomson, Sec.	
La.	Shreveport	Shreveport Ry. & Land Improvement Co.	100,000		5.25	4	4	T.-H.	T. B. McCutcheon	T. G. Thatcher, Sec.	
Me.	Augusta	Augusta, Hallowwell & Gardiner R.R. Co.	120,000		8	4	4	"	J. M. Haynes		
"	Bangor	Bangor St. Ry. Co.	200,000		6	9	10	T.-H.	F. M. Laughton	M. H. Wardwell, Sec.	
"	Portland	*Portland R.R. Co.	200,000		14.6	7			R. J. Libby	A. E. Newman, Gen. Man.	
Md.	Baltimore	North Ave. Electric Ry. Co.	50,000		3	6		Baxter	Wm. H. Whitridge	L. M. Frederick, Sec.	
"	Bay Ridge	Bay Ridge Electric Ry. Co.			2	4		Edison	H. Wellington		
"	Cumberland	Cumberland Elec. Ry. Co.	100,000		5	5	5		L. A. Fletcher	G. D. Landwehr, Sec.	
Manitoba.	Winnipeg	*Winnipeg St. Ry. Co.	100,000		3½	5		Edison	J. Austin	A. W. Austin	
Mass.	Beverly	Beverly & Danvers St. Ry. Co. (Not running)			3					J. S. Baker, Supt.	
"	Boston	Boston & Revere Elec. St. Ry. Co.	50,000					T.-H.			
"	"	Lynn & Boston R.R. Co.	500,000		6	9		"	Amos F. Breed	E. C. Foster, Supt.	
"	"	*West End St. R.R. Co.	13,550,000	3,250,500	6.8	350	25	"	H. M. Whitney	F. H. Monks, Gen. Man.	
"	Brockton	East Side St. Ry. Co.	45,000		528.5	6	6	Edison	A. C. Thompson	A. G. Reynolds, Gen. Man.	
"	Gloucester	*Gloucester St. Ry. Co.	60,000		4	3	3	United Elec. Trac. Co	W. B. Ferguson	D. S. Presson, Clk.	
"	Holyoke	Holyoke St. Ry. Co.	50,000		7	16		T.-H.	L. Perkins	W. S. Loomis, Sec.	January.
"	Lowell	*Lowell & Dracut St. Ry. Co.	20,000		5	18		Bentley-Knight	August Fels	P. F. Sullivan, Sec.	
"	Lowell	*Lowell Suburban St. Ry. Co.	300,000	100,000	27				E. M. Tucker	P. F. Sullivan, Gen. Man.	
"	Lynn	Lynn Belt Line St. Ry. Co.	350,000		4.50	8	2	T.-H.	Q. A. Towns	G. H. Breed, Sec.	
"	Marlborough	Marlborough St. Ry. Co.	50,000		3.25	6	8	Edison	S. Boyd		
"	Milford	Milford & Hopedale St. Ry. Co.	50,000		6	6			E. P. Usher		
"	New Bedford	*Union St. Ry. Co.	260,000		3½	5	5	T.-H.	Hon. W. Howland	W. H. Allen, Sec.	
"	Newburyport	*Newburyport & Amesbury Horse R.R. Co.	80,000		6	6		"			
"	North Adams	The Hoosac Valley St. R.R. Co.	50,000		5.93	5	5	T.-H.	C. H. Richmond	H. A. Fitzsimons, Supt.	
"	North Attleboro	Interstate St. Ry Co.	120,000		9				H. M Daggell	P. E. Brady	
"	"	Attleboro, N. Attleboro and Wrentham St. Ry. Co.	60,000	50,000	6¼	8	9	T.-H.	Peter Norny	L. W. Dillon, Supt.	
"	Pittsfield	Pittsfield Electric St. Ry. Co.	40,000		3.33	4	4	Westinghouse	J. H. Cunningham	C. E. Baines, Gen. Man.	October, 3d Wed.
"	Plymouth	Plymouth & Kingston St. Ry. Co.	35,000	35,000	6¼	4		T.-H	J. H. Cunningham	C. E. Barnes, Supt.	October.
"	Quincy	Quincy & Boston St. Ry. Co.	50,000		9	4	12	"	J. Q. Adams	J. A. Duggan, Supt.	
"	"	Manet St. Ry. Co.						Edison	A. D. S. Bell	C. W. Morton, Supt.	
"	Salem	Naumkeag St. Ry. Co.	100,000		5	12		T.-H., Edison	Chas. Odell		
"	"	*Essex Elec. St. Ry. Co.	50,000		5	7	21	"	Orlando W. Norcross	F. E. Farnham, Gen. Man	
"	Springfield	*Springfield St. Ry. Co.	4,000,000		18	20	4-H.	"	J. Olmsted	A. E. Smith, Gen. Mgr.	Jan., 2d Wed.
"	West Newton	Newton St. Ry. Co.	100,000		5.47	8	8	"	G. W. Morse	F. G. L. Henderson, Supt.	Jan. 29.
"	Whitman	Whitman St. Ry. Co.	40,000		3.12			"	G. O. Jenkins		
"	Worcester	Worcester & Shrewsbury Ry. Co.	40,000		2.75	2		United Elec. Trac. Co	H. H. Bigelow	J. E. Bigelow, Supt.	
Mexico	Nuevo Laredo	Int. Bridge Tramway Co.		80,000	1.27	2		Sprague	P. Orcelas	Chas. F. Yaeger, Pur. Agt.	
Mich.	Adrian	Adrian City Electric Belt Ry. Co.	50,000		2.80	3	1	Rae	J. H. Blain	W. W. Rhodes, Sec.	Jan., 2d Wed.
"	Ann Arbor	Ann Arbor St. Ry. Co.	100,000	60,000	5½	6	1	Edison	H. P. Glover	H. T. Morton, Gen. Mgr.	August.
"	Battle Creek	*Battle Creek Electric Ry. Co.			12	6		Short	John L. Beveridge	F. J. Wilson, Secy.	
"	Bay City	*Bay City St. Ry. Co.			12				Jas. Clements	Byron Alley, Supt.	
"	Detroit	Detroit, Rouge River & Dearborn St. Ry. Co.	100,000		1	1		Edison			
"	"	*Detroit City Ry. Co.			1				Geo. Hendin	Cameron Currie, Sec.	
"	"	East Detroit & Grosse Point Ry. Co.	100,000		9	5	2	Rae	W. H. Wells	H. Baker, Sec.	
"	"	Hamtram & Grosse Point Ry.			11	6			Jas. McMillan	S. T. Miller, Sec.	
"	"	Highland Park Ry. Co.	50,000		3.50	4	2	"	F. E. Snow	W. T. Hart, Supt.	
"	Grand Rapids	Reeds Lake Elec. St. Ry. Co.	50,000		3	2					
"	"	‖Consolidated St. Ry. Co.	2,000,000		12				A. J. Bowne	J. M. Hagar, Sec.	
"	Lansing	Lansing City Ry. Co.	50,000	160,000	7	7	7	Westinghouse	H. L. Hollister	M. D. Skinner, Sec.	Jan. 1.
"	Marquette	Marquette City & Presque Isle Ry. Co.	100,000		4.5	3	6	T.-H.	F. O. Clark	M. E. Assire, Sec.	
"	Muskegon	Muskegon Ry. Co	100,000		11	36	9	Short	F. A. Nims	R. A. Fleming, Sec.	
"	"	Lake Michigan Extension			3	5	3	"			
"	Port Huron	Gratiot Electric Ry. Co.	50,000		2.25	6	6	Van Depoele	W. F. Botsford	J. H. Talbot, Sec.	
"	"	Port Huron Elec. Ry. Co. (leased to Gratiot Elec. Ry. Co.)			2.50	8		" "			

STREET AND SUBURBAN RAILWAYS USING DUMMY LOCOMOTIVES, STEAM OR TRAMWAY MOTORS.—Continued.

UNITED STATES.—Continued.

NAME OF ROAD.	CITY.	STATE.	NAME OF MAKER.
Denison Rapid Transit Ry. Co.	Denison	Tex.	
Denison Land & Investment Co.	"	"	Baldwin.
Denver & Berkley Park Rapid Transit Ry.	Denver	Colo.	"
Des Moines Belt Line Ry.	Des Moines	Iowa	"
East Birmingham Dummy Line	Birmingham	Ala.	Porter.
" End R.R.	Memphis	Tenn.	Baldwin.
" End Ry. Co.	"	"	Porter.
" Fifth St. Ry.	Kansas City	Mo.	Baldwin.
Eastside Ry Co.	Topeka	Kansas	Richmond.
*Elmira & Horsehead Ry. Co.	Elmira	N. Y.	Porter.
Evansville, Suburban & Newburg R.R.	Evansville	Ind.	Baldwin.
Florence R.R. & Improvement Co.	Florence	Ala.	Richmond.
Fort Madison St. Ry. Co.	Fort Madison	Iowa.	
Fountain Head R.R.	Knoxville	Tenn.	Baldwin.
Front St. Cable Ry. Co.	Seattle	Wash.	
Gadsden Land & Improvement Co.	Gadsden	Ala.	Baldwin.
‖Geary St., Park & Ocean R.R.	San Francisco	Cal.	"
Great Salt Lake & Hot Springs Ry.	Salt Lake City	Utah.	"
Helena, Hot Springs & Smelter R.R.	Helena	Montana	"
" Motor Ry.	"	"	"
Highland Avenue and Belt Ry. Co.	Birmingham	Ala.	"
Home Avenue R.R. (freight)	Dayton	Ohio	Porter.
Houston Belt & Magnolia Park R.R.	Houston	Tex.	Baldwin.
Huntsville Belt Line & Monte Sano R.R.	Huntsville	Ala.	"
Independence & Monmouth R.R.	Independence	Oregon	"
‖Interstate Consolidated Rapid Transit Ry.	Kansas City	Kansas	"
Kansas City, Independence & Park Ry.	"	Mo.	"
Lake Manaway Railway	Council Bluffs	Iowa	Porter.
†La Salle & Peru Horse & Dummy R.R. Co.	La Salle	Ills.	
Leavenworth Rapid Transit Co.	Leavenworth	Kansas	Baldwin.
Lincoln Rapid Transit Co.	Lincoln	Neb.	Porter.
Long Beach Land & Water Co.	Los Angeles	Cal.	"
Memphis & Prospect Park R.R.	Memphis	Tenn.	
*Meridian St. Ry. Co.	Meridian	Miss.	Richmond.
Metropolitan St. Ry.	Atlanta	Ga.	Porter.
" " R.R.	"	"	Baldwin.
Milledgeville & Asylum Dummy Line R.R.	Milledgeville	"	Porter.
Milwaukee & Whitefish Bay Ry.	Milwaukee	Wis.	"
*Mobile St. Ry Co.	Mobile	Ala.	
*Montgomery Terminal & St. Ry. Co	Montgomery	"	
Mt. Penn Gravity R.R.	Reading	Pa.	Baldwin.
Mt. Tabor St. R.R.	Portland	Oregon	"
Muncie St. Ry. Co.	Muncie	Ind.	Porter.
Nashville & West Nashville Ry.	Nashville	Tenn.	Baldwin.
Neversink Mountain Elec. Ry.	Reading	Pa.	
Neversink Mountain Ry.	"	"	
*New Orleans City & Lake R.R.	New Orleans	La.	Porter.
" Spanish Fort & Lake R.R.	"	"	"
North Birmingham St. Ry.	Birmingham	Ala.	Baldwin.
North Hudson County R.R.	Hoboken	N. J.	"
" " "	"	"	Porter.
North Park St. Ry. Co.	Grand Rapids	Mich.	Baldwin.
North St. Paul R.R.	St. Paul	Minn.	"
*Ogden City Ry.	Ogden	Utah.	"
Onset Bay Grove Association	Onset	Mass.	"
*Onset St. Ry. Co	"	"	
Overland Ry.	Nashville	Tenn.	Baldwin.
Oxford Lake Line	Anniston	Ala.	Porter.
Pacific Improvement Oakland R.R.	San Francisco	Cal.	"
Park Ry.	Denver	Col.	"
Park & Ocean R.R. Co.	San Francisco	Cal.	
Pendleton, Mt. Lookout & E. Walnut Hill Ry. Co.	Cincinnati	Ohio.	
Petersburg & Asylum R.R.	Petersburg	Va.	Baldwin.
People's Ry. Co.	Pottsville	Pa.	
Point Defiance Ry.	Tacoma	Wash.	Porter.
Portland City Real Estate Association	Portland	Ore.	Baldwin.
Portland & Vancouver Ry. Co	"	"	
Willamette Bridge Ry. Co. (for. Woodstock & Waverly)	"	"	
Port Townsend Construction & St. R.R.	Port Townsend.	Wash.	Porter.
Presidio & Ferries Ry. Co	San Francisco	Cal.	
Prospect Park & Belt R.R	Memphis	Tenn.	Baldwin.
Provo City Ry	Provo City	Utah.	"
Rapid Transit Co. of Baltimore	Baltimore	Md.	"
Richmond City Ry. Co	Richmond	Va.	Richmond.
" " & Seven Pines Ry.	"	"	
Rochester & Lake Ontario R.R.	Rochester	N. Y.	Baldwin.
Rome Land Co.	Rome	Ga.	"
San Bernardino & Redlands R.R.	San Bernardino	Cal.	"
San Diego St. Car Co.	San Diego	"	
* " & Pacific Beach Ry.	"	"	Baldwin.
Searey & West Point R.R. Co	Seary	Ark.	
*Selma St. R.R.	Selma	Ala.	Baldwin.
" Ry. Co.	"	"	Porter.
Seymour St. Car Co.	Seymour	Ind.	Baldwin.
Sheffield St. Ry	Sheffield	Ala.	Richmond.
Sioux City & Highland Park Motor Ry.	Sioux City	Iowa.	Porter.
" Rapid Transit Co	"	"	"
Southern California Motor Ry.	Colton	Cal.	Baldwin.
" " " R.R.	San Bernadino	"	Porter,
So. Seattle Cable Ry. Co.	Seattle	Wash.	
Spokane & Montrose Motor R.R.	Spokane Falls	"	Porter.
St. Louis Cable & Western Ry.	St. Louis	Mo.	"
St. Ry. of Grand Rapids	Grand Rapids	Mich.	Baldwin.
Tacoma & Fern Hill St. Ry.	Tacoma	Wash.	Porter.
" & Puyallup R.R.	"	"	"
" St. Ry.	"	"	"
Tallapoosa St. Ry. Co.	Tallapoosa	Ga.	Baldwin.
*Tampa St. Ry.	Tampa	Fla.	Porter.
Topeka Belt Ry. Co.	Topeka	Kansas	
Tower & Soudan R.R.	Tower	Minn.	Porter.
Tuscaloosa Belt Ry.	Tuscaloosa	Ala.	Baldwin.
Vicksburg St. R.R.	Vicksburg	Tenn.	Porter.
Waco St. Ry.	Waco	Tex.	"
Waldo Park Ry. Co.	Kansas City	Mo.	
Watertown & Lake Kampeska Ry. Co.	Watertown	Dak.	
Watertown Lake Kampeska Ry.	"	So. Dak.	
West End & Atlanta Ry.	Atlanta	Ga.	Richmond.
" Jersey R.R.	Sea Isle City	N. J.	Baldwin.
" Side Rapid Transit Co.	Salt Lake City	Utah.	
" Side Circle Ry.	Topeka	Kansas	Baldwin.
Wheeling and Elm Grove R.R.	Wheeling	W. Va.	"
Wichita Rapid Transit Co.	Wichita	Kansas.	Porter.
" & Valley Centre Motor Ry.	"	"	Baldwin.
†Willamette Bridge Co., formerly Woodstock & Waverly R.R.	Portland	Oregon	"
	Seattle	Washington	

FOREIGN.

Cucuta R.R.	Cucuta	U. S. of Colombia	Porter.
Empreza Mayrink	Santos	Brazil	Baldwin.
Hamilton & Dundas St. Ry.	Hamilton	Ontario	"
Lacorda, Camargo & Co.	Santos	Brazil	"
La Prueba R.R.	Havana	Cuba	"
Maracaibo Tramways	Maracaibo	Venezuela, S. A.	Porter.
Mexican National Ry. (Zacatecas Tramway)	Zacatecas	Mexico	Baldwin.
Paramatta City Tramways	Paramatta	New South Wales	"
Sydney City Tramways	Sydney	" "	"
Tramway Rural	Buenos Ayres	S. A.	Porter.
Urbano R.R.	Havana	Cuba	Baldwin.

HORSE RAILWAYS IN NORTH AMERICA.

*** See also List Electric Railways; † See also List Dummy Railways; ‖ See also List Cable Railways.**

Officers of Street Railway Companies are particularly requested to see that their road is properly represented in these Directories.

STATE.	CITY.	COMPANY.	CAPITAL.	BONDS.	MILES.	CARS.	GAUGE.	PRESIDENT.	GEN. MAN., SEC. OR SUPT.	DATE OF ANNUAL MEETING.
Ala.	Anniston	Anniston City Ry. Co.	100,000		6	9	4-8½	J. W. Bigsby	Ogden E. Edwards, Gen. Mgr.	
"	Bessemer	† Bessemer & Birmingham R. R.	250,000		13½	15	4-8½	T. T. Hillman	J. B. McClary, Supt	
"	Birmingham	*† Birmingham Ry. & Electric Co	3,000,000	$1,500,000	58	26	4-8½	T. T. Hillman	Robt. Jemison, Gen. Mgr.	Dec. 9.
"	"	Highland Av. & Baltimore R.R. Co.			28	12	4.8½	A. M. Caldwell	L. W. McCants, Gen. Mgr.	
"	New Decatur	Decatur St. Ry. Co	100,000	$40,000	3¾	5	4-8½	W. W. Hedges	W. A. Bibb, Supt.	Oct. 6.
"	Ensley	Ensley Ry. Co. (con. with Bir. Ry. & Elec. Co.)			8½	12	4-8½	Wm. A. Walker	J. B. McClary, Supt.	
"	Mobile	† Mobile St. Ry. Co.	500,000		31	73	5-2½	W. M. Duncan	R. K. Warren, Supt.	
"	Montgomery	† Montgomery Terminal & St. Ry. Co.			10	24	4	Ignatius Pollak	R. A. Mitchell, Supt.	
"	Selma	† Selma St. R.R. Co			7½	5	4-9	H. L. McKee	H. H. Stewart, Sec.	
"	Tuskaloosa	Tuskaloosa St. Ry. Co.	100,000		4	9	4-8½	James H. Fitts	S. F. Alston, Sec.	
"	Montgomery	Capital City Ry. Co.	Succeeded by Montgomery Terminal Co.						Geo. P. Ayers, Supt.	
"	Union Springs	Union Springs St. Car Co	10,000		2	5	5-1	Wm. Stakly	A. D Fielder, Supt.	
Ariz.	Phoenix	Phoenix St. Ry. Co.			3	2	3-6	M. H. Sherman	J. McMillan, Sec.	
Ark.	Fort Smith	Fort Smith St. Ry. Co.	150,000		14	13	3-6	Samuel McLoud	Samuel McLoud, Gen. Mgr.	Aug., 1st Tues
"	Helena	Citizens' St. Ry. Co.	30,000		2½	4	4-8½	H. S. Hornor	Jno. H. Thompson	July, 1st Mon.
"	Hot Springs	Hot Springs St. Ry. Co			8	19	4¼	S. W. Fordyce	J. B. Fordyce, Sec.	
"	Little Rock	† Capital St. Ry. Co.			17	56	4-10	H. G. Allis	H. P. Bradford, Sec.	
"	"	City Electric Street Railway Co.	600,000	600,000	22	52	4-10	"	"	April 4.
"	Pine Bluff	Citizens' St. Ry. Co.	200,000		12½	27	4 & 4-8½	Thos. S. James	Arthur Murray, Supt.	
"	Searcy	† Searcy & West Point R.R. Co.	75,000		10¾	4	4-8½	Jas. E. Skillen	W. H. Lightle, Supt	
"	Texarkana	Texarkana St. Ry. Co.	40,000		5	8	4	J. Deutschman	B. M. Foreman, Supt.	
Cal.	Alameda	Alameda, Oakland & Piedmont R.R. Co.	100,000		5	13	3	Theo. Meetz	Rudolph Mohn, Supt.	
"	Alhambra	Alhambra & Pasadena St. Ry. Co.	12,000		3	3	3-6	A. C. Weeks	Sam. Drake, Gen. Mgr.	
"	Eureka	Eureka St. R.R. Co.	60,000		4	8	4-8½	J. Soash	R. M. Fernald, Supt.	
"	Fresno	Fresno, Belmont & Yosemite R.R. Co.	500,000		2½	6	4-8½	E. C. Winchell	A. M. Drew, Sec.	
"	"	Fresno R.R. Co	200,000		4	6	4-8½	Dr. L. Leach		
"	Los Angeles	Depot Railway Co	100,000		3½	12	3-6	J. M. Davies	J. J. Davies, Sec.	
"	"	Los Angeles & Vernon St. Ry. Co	90,000		6	8	4-8½	D. G. Stephens	F. A. Gibson, Sec.	
"	"	Main St. & Agricultural Park R.R. Co.	200,000		13	33	3-6	W. J. Broderick	Wm. Hawks, Supt.	
"	"	‖ Pacific Ry. Co.	2,500,000	2,500,000	21.05	43	3-6½ & 4-8½	C. B. Holmes	J. J. Akin, Supt.	January.
"	"	Los Angeles Ry. Co.								
"	Marysville	Marysville & Yuba City St. R.R. Co.	20,000		4	4		D. E. Knight	W. T. Ellis, Jr., Sec	
"	Oakland	Broadway, Berkeley & Piedmont R.R. Co.			9	24	5	W. B. Morse	M. Howe, Supt.	
"	"	‖ Cons. Piedmont Cable Co.	2,000,000	1,000,000	21	25	5 & 3-6	Mont. Howe	H. P. Garthwaite, Gen. Man.	April 22.
"	"	Highland Park & Fruit Vale Ry. Co.	500,000	100,000	9	8	4-8½	E. C. Sessims	Frank J. Woodward, Sec.	
"	"	Fourteenth St. R. R. Co.			10	12	5	P. J. Van Lobeusels	W. B. Morse, Supt.	
"	"	Oakland R.R. Co			8	11	3		Geo. Y. Loring, Supt.	
"	"	Oakland, Brooklyn & Fruit Vale R.R. Co.			2 1-5	6	5		"	
"	Ontario	Ontario & San Antonio Heights Ry. Co.	150,000		8	2	4-8½	C. E. Harwood	Chas. Frankish, Gen. Mgr.	
"	Pasadena	City Ry. Co.	50,000		5½	5	4-8½	A. J. Painter	M. D. Painter, Supt.	Dec., 1st Mon.
"	"	Alhambra & Pasadena Ry. Co.			3	3	3-6	A. C. Weeks	Sam. Drake, Mgr.	
"	"	Colorado St. Ry. Co	50,000		5½	5	3-6	Geo. E. Mahary	S. O. McGrew, Supt.	
"	"	Pasadena St. Ry. Co.	200,000		3½	5	3-6	R. Williams	R. Williams.	
"	San Francisco	Potrero & Bay View R.R. Co.			3¼	10	5	Leland Stanford	H. O. Rogers, Supt.	
"	"	‖ Market St. Cable Ry. Co.			27	212	4-8½	"	A. W. Barrow, Supt.	
"	"	City R.R. Co.			11	67	5	Chas. F. Crocker	N. J. Bailey, Supt.	
"	"	Central R.R. Co	1,000,000		12	57	5	"	J. F. Clark, Supt.	
"	"	Ferries & Cliff House Ry.	2,500,000		21.80	82	3-6	W. J. Adams	H. H. Lynch, Supt.	
"	"	North Beach & Mission Ry. Co.	2,000,000		16	47	5	Albert Meyer	M. Skelley, Supt.	July, 4th Mon.
"	"	Ocean Beach Ry. Co.			2		4-8½	Leland Stanford	J. T. Willcutt, Sec.	
"	"	Omnibus Cable Co.	2,000,000		10	150	5	Gustav Sutro	C. L. Anderson, Supt.	January.
"	"	† Park & Ocean R.R. Co.	250,000		9	23	4-8½	Chas. F. Crocker	J. L. Wilcutt, Sec.	
"	Pomona	San Antonio & Holt Ave. St. R.R. Co.	50,000	2,000,000	15	70	5	Gustav Sutro	C. L. Anderson, Supt.	
"	"	Orange Grove St. R R. Co	25,000		4	3	3-6	J. D. Carson	W. M. Woody, Supt.	
"	Redlands	Redlands St. Ry. Co.	25,000		3½	1	4-2	R. J. Waters	H. L. Sloan, Sec.	
"	Riverside	Riverside & Arlington St. Ry.	200,000		8	5	4-6	S. C. Evans	G. O. Newman, Supt.	
"	Sacramento	Sacramento City Ry. Co.			9	30	5		V. J. Chamberlain, Supt.	
"	"	Highland Park Ry. (owned by City Ry.)			1½		5	Owned by City R.R. Co.		
"	San Diego	† San Diego St. Car Co.	250,000		7	50	4-8½	Milton Santee		
"	San Francisco	‖ Sutter St. Ry. Co.	2,000,000		13	50	5	R. J. Morrow	A. K. Stevens, Sec.	June, 2d Mon.
"	"	‖† Presido & Ferries Ry. Co.			8	30	5	W. Clift	W. Clift, Supt.	
"	San Jose	First St. & San Pedro St. Depot R.R. Co.						Frank C. Bethel		
"	"	North Side Horse R.R. Co.			2¼	3	3	Jacob Rich	E. M. Rosenthal, Sec.	
"	"	* San Jose & Santa Clara.	500,000					J. H. Henry	J. H. Henry, Gen. Man.	
"	"	Willow Glen R.R. Co.			2½	3	3		E. M. Rosenthal, Sec.	
"	San Luis Obispo	San Luis St. Ry. Co.			2½	5	3		C. H. Philips, Gen. Mgr.	
"	Santa Anna	Santa Anna, Orange & Tustin St. Ry. Co.			10	6	3-6	M. J. Bundy	M. J. Bundy, Supt.	
"	Santa Barbara	Santa Barbara St. R.R. Co.	50,000	50,000	7	6	3-6	G. H. Banebrake	C. R. Diver, Supt.	Oct. 10.
"	Santa Cruz	Pacific Ave. R.R. Co.	10,000		6	9	3	Thos. Cole	E. S. West, Gen. Man.	April, 2d Tues.
"	Santa Rosa	So. Side St. Ry. Co.	10,000		2	4	4-8½	B. M. Spencer	B. Hottenger, Supt.	
"	"	Santa Rosa St. R.R. Co.	25,000		1⅝	5	3-6	M. L. McDonald	J. B. Reed, Supt.	
"	Woodland	Woodland St. Ry. Co.	30,000		1	3	3	T. Ross	J. D. Lawson, Supt.	
Can.	Belleville	Belleville St. Ry.	30,000		2	6	4-8½	S. Lockwood, owner		
"	Brantford	Brantford St. Ry. Co.	40,000		5	7	3-6	D. A. Flack	Chas. H. Flack, Gen. Mgr.	

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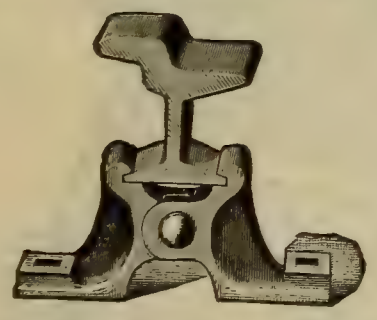
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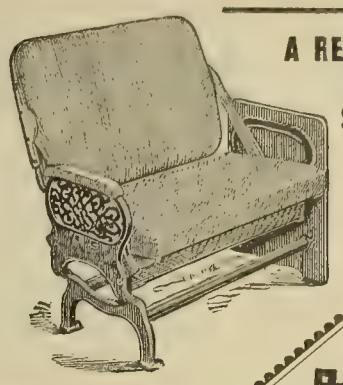
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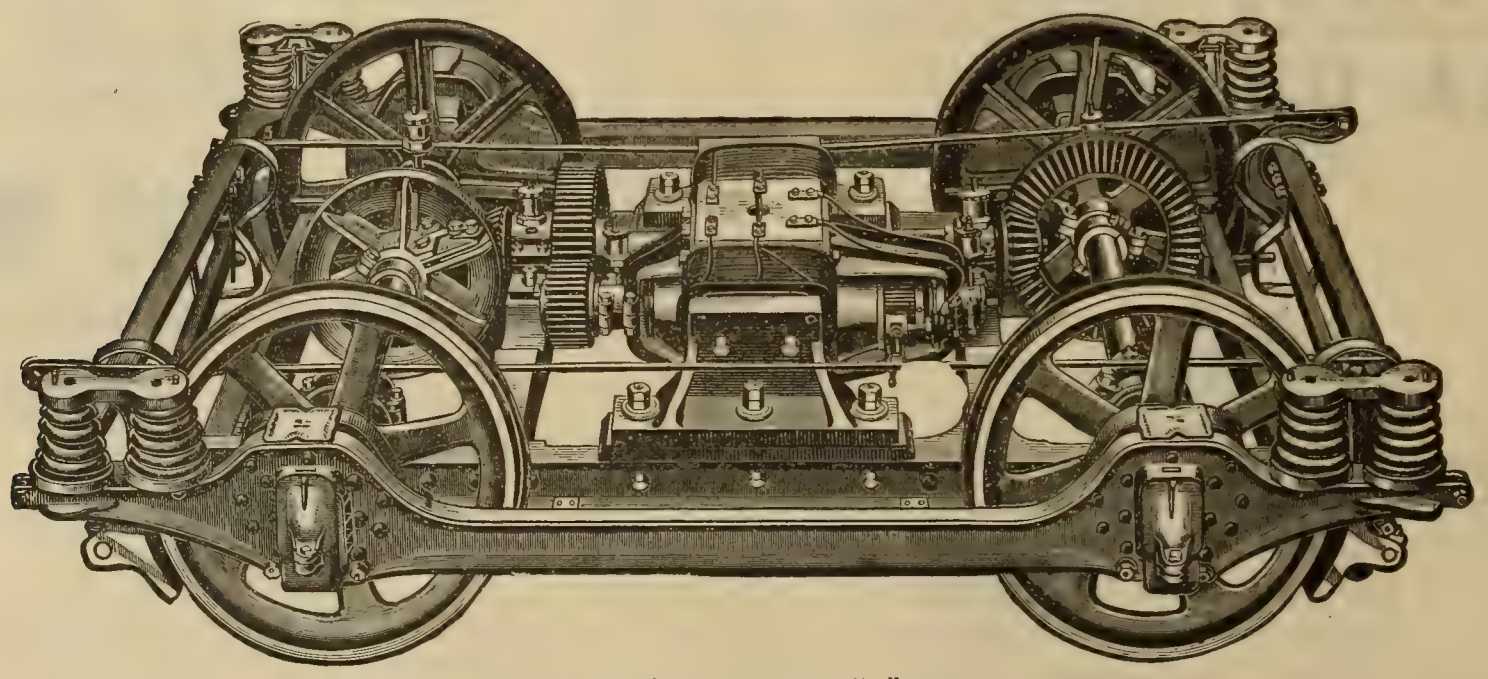
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VOL. I. NEW YORK, DECEMBER 26, 1891. No. 25.

STREET RAILWAY NEWS.

(WEEKLY.)

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YULE-TIDE IN 1891.

Again we are reminded upon all sides that

"The Christmas bells from hill to hill"

are pealing forth their joyous chimes, and discontented indeed is he who dares intimate that we, who make our living in the busy marts of commerce, have not very much to be grateful for in this Yule-tide of '91.

Not very many months ago the enormous drain made by Europe on our gold caused a tightness in the money market which almost threatened to create a condition of things similar to that which existed in the dark days of '73, but the marvelous natural resources of the country, coupled with prompt action upon the part of the Government in the matter of bond redemption tided over the threatened trouble until our gold commenced to return to us, and the transportation of unusually bountiful harvests rendered doubly valuable by the failure of crops abroad, brought more ducats to our till and stimulated the monetary circulation.

That very grave financial troubles resulted, directly or indirectly, from the erstwhile panicky condition of trade we all remember and deplore, but it is an eloquent tribute to the stability of the true financial status of the country to realize that, beyond ordinary comments, hardly a ripple was caused on the street by the threatened collapse of the great Westinghouse interests; by the failure of such an established concern as that of S. V. White & Co., or by the later *fiasco* of Field, Lindley, Weichers & Co.

Should not such a favorable state of things inspire us with the utmost confidence in the unprecedented state of prosperity of this grand country of ours? Should not such confidence tend towards a great stimulation to all industries; to the construction of new street-car lines; to the consequent increased number of cars, rails and the thousand and one things pertaining to the proper construction and equipping of a modern street railway? Most assuredly it should, and does, and we do not hesitate to predict for the ensuing year—according to statistics in this office—that 1892 will be a highly prosperous one to all engaged in the promotion of street-railway construction and equipment.

Therefore do we now, at this festive season, extend to you, our friends and readers, the hand of fraternal greeting, and with it assure you that to you and your families, STREET RAILWAY NEWS wishes all joys and blessing for the

"Yule-tide of '91."

OUR FIRST VOLUME.

With this issue STREET RAILWAY NEWS closes its first volume, and it is with pardonable pride that we point to the standing that it has attained in the community.

In its issue of July 11 we stated that we did not consider it necessary to offer any "apologies for its inception—any excuse for living," and we expressed the belief that "the street-railway interests of the world have now assumed importance enough to justify the publication of a weekly paper devoted exclusively to those interests;" we promised to improve the paper week by week, and to leave nothing undone within our power to make "STREET RAILWAY NEWS a welcome arrival each week."

Have we kept our promises; have we done all this? If we have, then we ask that due credit be given us; if we have not, then we would like to have it pointed out to us wherein we have failed. That it was unnecessary to apologize for living is evidenced by the healthy condition of STREET RAILWAY NEWS to-day; that there was a demand for a weekly street-railway paper is apparent by the reception which it has met with and by the very rapid growth of its subscription list.

Starting as it did as the pioneer of weekly street-railway journalism, its path was beset with thorns, and nothing but absolute confidence in its future, backed up by Messrs. Pluck, Perseverance and Persistence, with Mr. Cash as a silent partner, could ever have carried it to the elevated pinnacle it now occupies in the esteem of its constituents.

In its first volume STREET RAILWAY NEWS has published no less than 860 notes of interest concerning street railways throughout the world, nearly 400 "patents," 261 "illustrations," 115 "new incorporations," an equal number of "new franchises," a record of 171 "accidents" and 182 "extensions," 104 "new roads," 167 "legal" items, 136 "possible purchases," 59 "changes of power," etc. And we doubt if there is another paper in existence that can show such splendid development in so short a time.

In conclusion, we will promise to continue in the march of progress and to double our endeavors during 1892, and, not only to make the NEWS a welcome arrival, but a *sine quâ non* to every one interested, directly or otherwise, in the street-railway industry.

FRONT PLATFORM AGAIN.

Again we call attention to the fact that, for reasons to which we have made frequent reference, riding on the unguarded front platform of a surface car is an essentially risky proceeding, and it is a significant but indisputable fact that the ratio of casualties is reduced to a phenomenal degree on electric lines where passengers are not permitted to ride on the front platform, or, if so, the platforms are protected by safety-gates.

Another frequent cause for accidents is the feverish mania possessed by a great many for boarding or leaving a car whilst the car is in motion. Can any sane man declare the operating company responsible for such casualties? We answer "No!"—but the daily press refuses to acknowledge this fact—its especial province, thus far, appears to be to place the poor, unfortunate driver behind the bars and not to even suggest a remedy for the evil.

But by far the largest number of accidents occur to children who, as is well known, find it hard to resist the temptation of dashing across the street right under the horses' nose. We, ourselves, have frequently seen this happen, with our own eyes, and, upon one particular occasion, saw the driver rein in his horses so abruptly that their fore feet were almost off the ground—and, even then the child (a small boy) escaped the hoofs by a miracle.

We assert that if safety-gates are put on front platforms, or passengers forbidden to ride there, that casualties will be much less frequent, and still less so (as experience has taught us) when a high speed is maintained as on cable or trolley lines, the very speed at which the car is travelling not only deters people from boarding the car while under way, but frightens children from the habit of rushing across the street in front of cars—two very prolific sources of accident. When these changes have taken place—as they most surely will sooner or later—the sensational dailies will have to seek another application for their favorite "juggernaut" instead of the awfully-reviled, but, nevertheless particularly convenient, street car.

BROOKLYN TO HAVE THE TROLLEY SYSTEM.

The Brooklyn Board of Alderman on December 21 granted permission to four of the surface railroad companies in that city to adopt the overhead trolley system on their lines. These roads are: the Brooklyn City, the Atlantic Ave., the Coney Island and Brooklyn and the Brooklyn City and Newtown.

THE PROUTY MOTOR.*

In accordance with our promise made in connection with the illustration of the Prouty Motor in our last issue, we herewith give a description of that machine.

That system of street-car propulsion which provides for the generation of the power on each car or train is unquestionably the ideal one—that is to say, each car or train should be independent of every other on the line, and not dependent upon power transmitted or transferred to it from some distant point. In such a system the means for generating the power and the mechanism for transmitting it to the car should be so constructed as in no way to obstruct the room for passengers on the same car, or interfere with their comfort. It must, moreover, be free from any annoyance to observers and the general public.

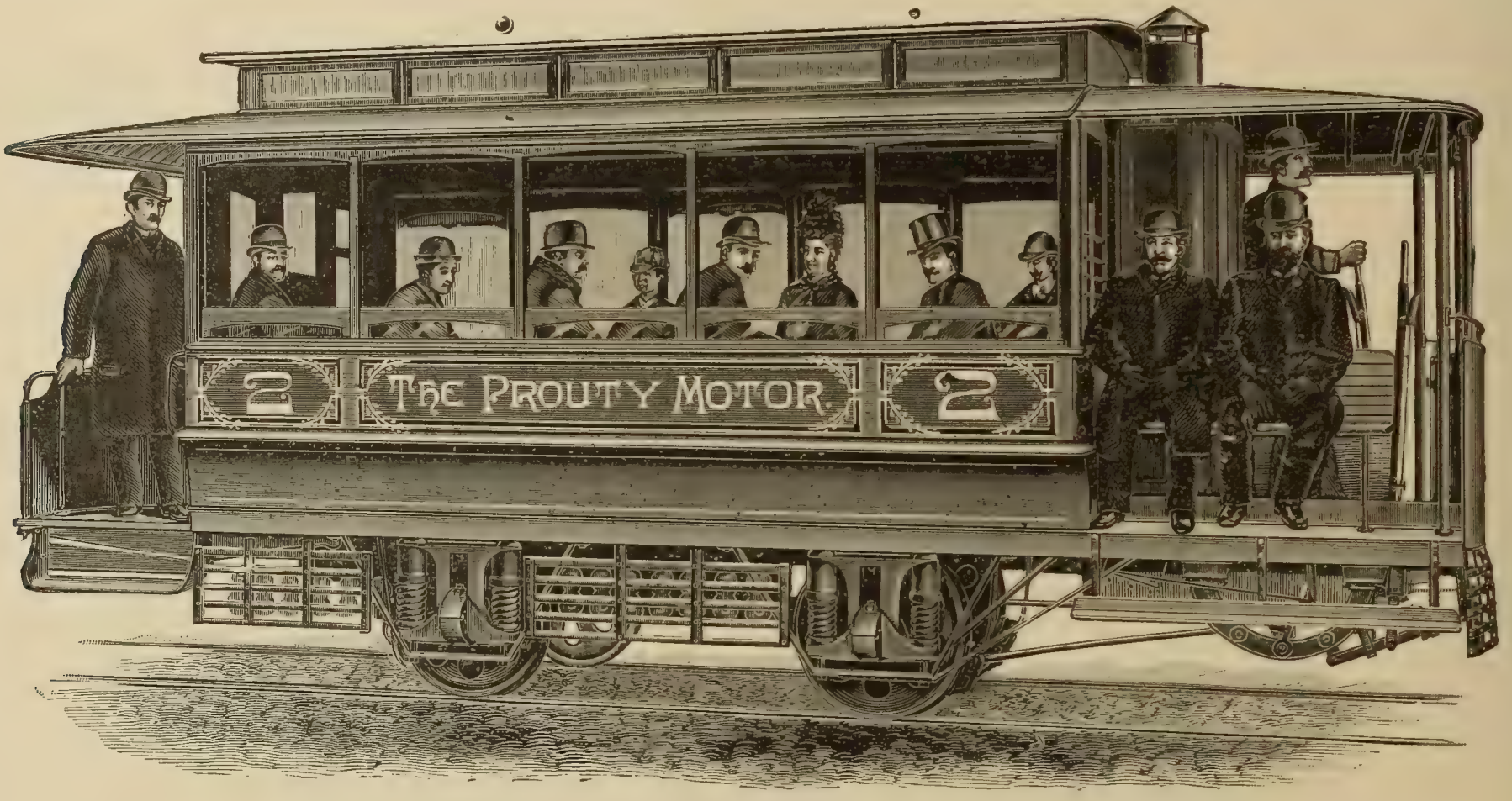
These requirements are said to be met in the motor under consideration. The power used in this system is that of steam, and it is generated in the apparatus which is located on the left side of the front platform. The generator is capable of furnishing motive-power at a working pressure of from 100 to 150 pounds to operate a motor continuously. These generators are designed for a capacity of 250 pounds working pressure, to be non-explosive and to make a ten-mile run without replenishing the fire. The space occupied by the generator on the platform does not exceed 40 inches in length, 40 inches in height and 20 inches in width above the platform; the fire-box is below the platform and clears the ground 10 inches

The motor is capable of drawing the motor car and a 14-foot trailer, all loaded, over curves and ordinary grades, and its location is under the centre of the front platform, entirely out of view.

The water supply is carried under the seats in horizontal pipes with a capacity of 80 gallons. The exhaust steam passes into a horizontal pipe under the main body of the car for the purpose of warming the car by radiators under the seats; it then passes out through the "Prouty Silencer and Condenser" located under the car-body, without noise or current of vapor.

The power is transmitted to the wheels by means of a vertical rocking lever pivoted at the lower end under the centre of the front platform, the upper end being connected by an arm to the motor-wheel, which is revolving continually. The sliding box on the rocking lever supporting one end of the Pitman rods, which are connected at the other end, one above and one below the car-axle, to two Prouty right and left clutches, thus giving rotary motion to the axles. The axles are connected by Pitman rods, which transmit the traction to the four wheels.

These motors are designed to run from a slight motion to 12 miles an hour.



PROUTY MOTOR CAR.

WHO WAS THE INVENTOR OF THE ELECTRIC RAILWAY?

The following interesting dispatch emanated from Washington on the 16th inst.:

"The Patent Office has just issued two patents covering pioneer inventions in electric railways which will probably have an important bearing upon the electric railway interests of the country. The original application of one of the patents was filed on August 17, 1879, and the patent thereon was issued pursuant to a recent decree of the Supreme Court of the District of Columbia, overruling the Commissioner of Patents in rejecting the application. The inventor is George F. Green, a resident of Kalamazoo, Mich., and at the time of filing his application he was too poor to employ an attorney to assist him in its preparation and prosecution. Owing to his unfamiliarity with patent matters, the application prepared by himself did not meet all the requirements of the Patent Office, principally on account of his failure to use technical terms and language in describing his invention, and as a result he has been twelve years without his patent.

"His invention was pronounced patentable from the start, but after a long period of suspension, awaiting his turn to be placed in interference with applications of Prof. Thomas Ball and Stephen D. Field, of Massachusetts, Thomas A. Edison, and Prof. Siemens of Berlin, claiming the same invention, they refused to admit his application to the interference for technical reasons, and a new application was required. The interference, it is said, was also decided against him on a narrow construction of the issue, and a patent was issued to Field covering what the Patent Office construed to be the specific patentable matter.

"But Green's claims, covering the broad matter, were persistently prosecuted by way of appeal to the Supreme Court of the District of Columbia, and the latter tribunal over-ruled the Patent Office, thus securing to Green the claims for which he had been so long contending. An experimental railway, which appears to have been the first full-sized electric railroad ever operated from a stationary source of electric energy, and capable of carrying passengers, was built by Green in 1878. But his invention was made long prior to this date. It was a small model of an electric railroad, built and operated by Green about the winter of 1874–75, for the purpose of exhibiting his invention to capitalists and demonstrating its practicability."

THE STREET-RAILWAY TROUBLES IN DETROIT.

A new phase of Detroit's street-railway troubles has developed lately. On December 10 John M. Brewer and Emil Stroh, who hold a franchise given by the trustees of Hamtramck for a street railway on Gratiot ave., notified the Board of Public Works, through Mr. Edwin F. Conely, that the work of laying rails would begin next morning, December 11. This announcement created a sensation, as permission to lay these rails had already been refused by the board.

It appears that when Messrs. Brewer and Stroh made application to the Board of Public Works for permission to lay their tracks on Gratiot avenue they claimed to have already received permission from the Board of Trustees of Hamtramck to build and operate a street railway on Gratiot avenue from the old easterly limits of the city on Sheridan avenue to the village of Leesville. At that time the board refused the request and referred the matter to the City Council, and that body turned it over to the Committee on Streets and Ordinances, of which Alderman Watson is chairman. As no action had been taken on the subject by the committee the Board of Public Works was in a decidedly embarrassing position when the question came up. Immediate action was necessary if the work announced by Mr. Conely was to be stopped, and Mayor Pingree was appealed to.

Upon the board's statement of the case Mayor Pingree at once said that he would assume the responsibility of taking steps to prevent the laying of tracks according to the programme of Messrs. Brewer and Stroh, and he promptly summoned the city's legal advisers and asked them whether an injunction could not be obtained and served immediately. They gave it as their opinion that it would be necessary to get an order from the City Council before proceeding with the case. This was impossible. The Mayor said he would take the responsibility, and asked them to prepare the document. The Sheriff and County Clerk were at once notified to keep their offices open so that papers could be filed and served at a late hour. Judge Gartner was also notified that he would be asked to issue a temporary injunction at his house during the evening. The question of the grounds on which a temporary injunction should be served came up and the franchise itself furnished it, City Attorney Casgrain having a copy of it.

It was found that the franchise had been obtained between the dates in which the territory it covers was taken into the city and the time the act was approved. Thus, the act taking in the annexed territory was passed on May 7 and was signed by the Governor on May 13. The approval of the franchise which extended over this territory was given May 9. The franchise was given to Strathearn Hendrie, Cameron Currie and others, and assigned by them to Emil Stroh and John M. Brewer. The franchise was not limited by any term of years, and, therefore, is perpetual if not in violation of the constitution of the State.

Referring to the matter the Mayor says: "The time had come to act and it was impossible to wait for a meeting of the Council. I am sure that body will approve of my action in asking the city legal authorities to proceed at once before the damage to public interests had been done. There was no time to wait for nice distinctions or official etiquette. The business required peremptory action, and I have done my best to prevent the seizure of a public street by a street-railway corporation."

In this connection the refusal of the Board of Public Works to grant the right to use the streets will be interesting reading. The board refused permission on the following grounds: No street railway can be properly put down with the ground in the condition it is at present. The parties applying for permit, or rather who notified the board of their intention to begin at once to lay track, acknowledged that it is not their intention to put down such a track as can be used for street-railway purposes, nor to put it down to any legally-designated portion of the street; but that it is (or was) their intention to lay a sort of temporary track on the side of the street in such a manner as to run a car or cars over it, in order to save the franchise they assert they obtained from or agreed to with the Township Board of Hamtramck in May last. Even if granted the franchise

*Prouty Noiseless Motor Co., Chicago, Ill.

claimed, prior to the act bringing the territory into the city, May 13, 1891, these parties had ample time to attempt to exercise their alleged rights in a season of the year better adapted to the proper laying of street-railway trac ks.

Judge Speed p repared the petition for the temporary injunction, which recites that if the franchise is legal it does not relieve it from the police powers of the city, but is subject to them. The road must be constructed under the supervision of the Board of Public Works, and with due regard to the rights of the public using the street. The construction and operation of said railroad would be an obstruc on to public travel on said street and a public nuisa ce. The Township Board of Hamtramck had no right to grant a franchise on Gratiot road. This road is not a highway, and had been surrendered by the State to a toll road company, and was not, therefore, a public thoroughfare. For these reasons a temporary injunction was asked restraining the Gratiot Avenue Railway Company, its officers, servants and agents, from entering upon said Gratiot road or avenue and constructing, maintaining or operating a street railway or line until the further order of the court.

The bill was presented to Judge Gartner, and he issued a temporary injunction as prayed for. It was placed in the hands of a deputy sheriff, and he was sent to the scene of the proposed railway with instructions to serve it upon the first man who attempted to commence laying the road.

It was expected that an attempt would he ma de to begin laying the tracks at midnight of Decem ber 11, but no effort in this direction was begun. At midnight the vicinity was deserted except for a Deputy Sheriff, who was on hand with the injunction and instructions to remain until morning.

On December 12 David Howcroft and several citizens of Leesville called on the Mayor to present a petition asking that the construction of the Hamtramck street railway be not delayed. The petition was signed by fifty citizens living at the end of the proposed line. The Mayor asked Howcroft what benefit he expected to derive from the construction of the line. He said the company had promised to deliver citizens from the end of the line to the City Hall for a 5-cent fare.

When told that this was impossible, and that there was nothing in the contract about the rate of fare, Mr. Howcroft was surprised. He was shown a copy of the franchise, which, without its technical terms, is as follows: Whereas Henry Plass, Emil Stroh, John M. Brewer, George Hendrie, Cameron Currie and Strathearn Hendrie desire to construct a railway through Gratiot avenue from the eastern city limits of Detroit to the easterly limits of the township of Hamtramck, permission is given the gentlemen to construct and maintain a single or double track, in the said highway, to the western limits of Hamtramck. The track shall be laid so as to obstruct the road as little as possible, and shall be laid on the road-bed so far as the same is feasible. The road shall be finished by January 1, and in operation, unless prevented by strikes or riots, cars to be run every hour, the power to be used to be the same as used on Gratiot avenue. In regard to fares the franchise reads: "The said grantees, their associates and assigns, organized into a railway company under the laws of this State, shall be entitled to charge not more than five cents for the carriage of any single passenger for one continuous trip over that portion of the railway within said township, until incorporated into the Detroit city limits." If not satisfied with the road the franchise owners have permission to use a private way on either side of the road.

The document is signed by Roger Echlin, Richard Griffin, Columbus Burnett and William Bachmer as trustees. There is no limit to the franchise, and any fare could be charged after the city limits were extended. No provision was made for the payment of tax or paving the streets. After reading the copy of the franchise Mr. Howcroft expressed surprise at its terms, and instead of leaving the petition to be presented to the Council he took it away with him and said he would call a meeting of the citizens of Hamtramck for Monday night to consider the matter.

The Committee on Streets and Ordinances met at the Mayor's office on the 12th to consider the Hamtramck franchise. It was the sense of the committee that the legal advisers of the city investigate the subject and report to the committee. Edwin F. Conely appeared for the company and contended that the franchise was legal even if there was no restriction as to the length of the franchise or manner of conducting the road. He announced that he would move for a dissolution of the injunction early in the coming week.

City Counsellor Speed will have charge of the case for the city.

The directors of the Gratiot Avenue Street Railway Company, which is the company involved in this case, held a meeting on the night of December 11, at which the trouble was discussed in all its bearings. The petition of the Board of Public Works upon which the injunction was granted, was read and considered. The stockholders were unanimously of the opinion that the matter should be carried to the courts, where they believe they can secure the justice due them by the right of their charter from the township of Hamtramck and by the right of their honesty in wishing to lay a suitable road for the benefit of the people of Leesville and vicinity.

BIOGRAPHICAL.

FREDERICK B. BROWNELL.

The subject of this sketch is the well-known carbuilder of St. Louis, and was born in the city of Troy in December, 1851, of American parents, and was one of a family of twelve children. He was educated in the public schools of Troy, and left the High School at the age of 15, when he went to St. Louis, in which city he engaged himself with Brownell & Waldron. He was in the employ of this firm



FREDERICK B. BROWNELL.

for about six months, when he entered as an apprentice in the paint-shop of Andrew Wight, of St. Louis, in March, 1867. Six years later he was placed in charge of the works, and in 1875 the concern was incorporated as the Andrew Wight Company, with Andrew Wight as President and Mr. Brownell as Vice-President.

At the death of Mr. Wight in 1877 Mr. Brownell was made President of the company, and three years later he purchased a controlling interest in the same, at which time the name of the concern was changed to the Brownell & Wight Car Company.

Last year the interest of about six-sevenths of the stockholders was secured by Mr. Brownell, when the name of the concern was again changed, this time to the Brownell Car Company.

When about 28 years of age Mr. Brownell married Miss Anna Jones, of Indianapolis, Ind., and now has a daughter 11 years old.



"B. & M." TROLLEY.

Mr. Brownell's face is well known, he having been a regular attendant at conventions for a great many years.

ANNUAL MEETING.

The annual meeting of the stockholders of the Birmingham Railway and Electric Company, Birmingham, Ala., was held December 8, and the old board of directors and officers were re-elected. The election of superintendents will take place at the next meeting of the directors on January 1.

The report of earnings showed 50% increase over the mule cars and decrease in operating expenses.

"B. & M.' TROLLEY.*

A trolley wheel which is said to possess some excellent features is that illustrated and described herewith. This wheel is made of a composition called "nickelum-bronze," and will stand long wear.

It is claimed to have the longest life of any trolley wheel on the market. To the trade it is known as the "B. & M." Metal Perfection Trolley, and the advantages it possesses are that it runs true at all times; the wear takes place uniformly and smoothly; the bearings wear in a uniform manner; there is no sparking at the contact between the wheel and its harp, and it is self-oiling.

The "B. & M." trolley has a record of 10,000 miles, with little if any wear either on the rim or the bearings.

The bronze is excessively tough, of a silvery color, and does not tarnish, blacken or oxidize, and being finished to a polish which it retains, does not wear out the trolley wire.

The Lincoln Street Railway Co., Lincoln, Neb., has been using "B. & M." wheels with very great satisfaction, and in a letter from the general manager that gentleman states that there is no comparison between brass and the "B. & M." metal wheels, that the latter far outlasts the former.

RAPID TRANSIT IN NEW ORLEANS.

In our last issue we gave an account of the meeting of the New Orleans City Council Committee on Streets and Landings, which was held December 4 last, to consider the ordinance granting to the New Orleans and Carrollton Railroad Company the right to operate the overhead electric system on its road between the two places named.

Referring to the action of the City Council on this subject, the New Orleans *Picayune* of December 9 makes some statements that are full of interest to street-railway men in general, and show the great need for improved methods of transportation in and about that city.

"The City Council has done its part," says that paper, "in the movement for more rapid transit of passengers between Canal street and Carrollton. It has adopted an ordinance permitting the Carrollton Railroad to use on its tracks cars propelled by electricity. Some device in which an overhead wire will be used is authorized. The city has done something towards cutting down the price of passage over the route, and it requires that the electric cars be provided with conductors.

"The citizens of New Orleans who have so uncomplainingly collected and deposited fares for the street-railroad companies should hail this innovation as the beginning of a reform that will force similar accommodations on the other lines. If our people were not so benevolent and ready to work for others without fee or reward, they would long ago have driven the bob-tailed cars from the city, as was done in St. Louis and elsewhere years ago. The passengers in a crowded car refused to collect and pass up fares, and there was no law to compel them. It was held that no person who paid when called on by the company's agent was required to collect and pass up fares for others, and no person could be held to have refused to pay fare who had not been called on by a collector. In this way the companies were forced in their own defence to employ collectors on each car, and the increased expense had to be met by furnishing larger cars, and thereby increasing the accommodations for carrying passengers.

"We do not counsel the people of New Orleans to adopt any such retaliatory tactics toward their street-car companies, because some of them do not have a business that would justify any serious increase in their expenses, but we indulge the hope that a movement has been inaugurated by the action of the City Council that will go far to create a decisive reform in our facilities for street travel, one by which the car companies and the people will mutually profit."

INSPECTING THE WEST END COMPANY'S PLANT.

The Railroad Commissioners of the New England States had a consultation in Boston on the 12th instant, and in the afternoon of the same day, by invitation of President Whitney, of the West End Street Railway, they enjoyed a ride to Cambridge on the Pullman double-deck parlor-car, and also inspected the central power station at the South End.

During the trip the heating and breaking appliances were explained to the gentlemen, all of whom expressed their appreciation of the beauty and comfort of the car. During the ride up North avenue the visiting commissioners held a meeting,

* New York Electrical Works, 155 Leonard street, New York.

and "Voted, that the hearty thanks of the visiting commissioners be tendered to the Massachusetts board for the perfect arrangements and profuse hospitality which have rendered this occasion one of so much enjoyment and profit, and to the West End Railway Company for this excursion."

Upon reaching the car-house the gentlemen alighted and examined the exterior of the car at their leisure. Entering another car, one of the long electrics, the return trip to Boston was quickly made. After crossing the bridge the cars run through Charles, Boylston, Dartmouth, Tremont, Northampton and Hampden streets, to Dudley street, and the car then ran back to Harrison avenue and down the avenue to the central power station.

Here Mr. Pierson, the electrical engineer of the company, met the visitors, and showed them over the station. The colossal character of the plant excited the wonder of the visitors. Two of the huge engines were at work, and as the big drive-wheels—38 feet in diameter and with 10-foot faces—made their 70 revolutions per minute, some idea of the immense power developed was obtained.

TO CHANGE TO CABLE-POWER.

The directors of the Baltimore City Passenger Railway Company held a special meeting Dec. 11, with President Oden Bowie in the chair, and awarded the contract for cabling the Red and White lines to E. D. Smith & Son. There were several other bidders, including firms at Washington and Kansas City, Mo. Messrs. Smith & Son were formerly from Philadelphia, but are now located in Baltimore. They cabled a portion of the old "People's Line" for the Baltimore Traction Company and are now at work on the Fayette and Gilmor street extensions. They have built two cable roads in Philadelphia, one in Pittsburg and two in Chicago. All the material has been ordered by President Bowie. The contractors said that they would begin work on the Red and White lines about March 1 next, and have them completed by the early fall.

PLANS FOR RAPID TRANSIT IN BOSTON.

Mr. R. T. White, of New York, described the system of rapid transit, of which he is the inventor, before the Rapid Transit Commission in Boston on the 11th inst. To meet the conditions in Boston he suggested a road which could be made with a single or a double track. He did not propose to tunnel the Common nor that part of Tremont below Dover or Boylston street which Mr. Whitney proposed to undermine. His idea was to have his road enter a tunnel at Harrison avenue and run through Bedford to Chauncy street, then to Franklin street, then through the hill to the West End, there branching, one track going to Cambridge and the other to the depots. His tracks would be ten feet wide.

Regarding an elevated line to South Boston, he would prefer to build his own bridges on all waterways. They would be constructed on the double cantilever principle. The underground system suggested by Mr. Whitney, involving the expenditure of many millions per mile, was not, in his opinion, feasible.

Mr. White then illustrated with his model the details of its construction. Its posts above ground are to be all steel, set up in a plate of cast iron imbedded in concrete. Below this, for a distance of seven feet, would be a granite block, and under that a pile, eight feet below. The trucks of his invention are so constructed that the weight of the cars would be over the centre of the supporting-post, of which there would be one for each bracket-like track. He would prefer electricity to steam, and his cars, which would weigh no more than four tons, would be 40 feet long, with a door on each side and one at each end. This latter idea would expedite the passage of travellers to and from the cars. The cost of his road, including all equipments, would be about $250,000 per mile.

His stations would be in the centre of the street, and would not darken the streets as they do in New York, because the tracks are all open. He hoped, if the Commission still had the rapid-transit idea under consideration, to submit expert testimony after January 1.

THE THIRD AVENUE CABLE LINE, NEW YORK.

Commissioner Gilroy has decided to permit the continuance of the work on the Third Avenue Cable road in this city as long as the weather remains favorable. Work is being carried on night and day so as to advance it as rapidly as possible.

FIRST ALL-NIGHT ELECTRIC SERVICE.

The residents of the East End of Pittsburg are rejoicing over the establishment of all-night service on the Duquesne electric line. This gives to East Liberty rapid-transit all-night service, which has so long been desired. The cars leave Fifth avenue and Wood street, Pittsburg, for East Liberty every half hour between 1 and 5 A.M., and it is said that this is the first all-night electric service ever established. It is likely that the effect of this new order of things will be very beneficial to East Liberty.

FINANCIAL DEPARTMENT.

I want to call the serious attention of all present and intending investors in street-railway securities to the list of railway corporations in this issue and with the request that they take a little time and foot up the columns representing capital, bonds, miles and cars, and at their first leisure compare the totals with other investments in which they are interested, or the volume of which they have fair knowledge. I venture the assertion that not one per cent. outside of the officials whose business it is to keep posted in this particular interest can, before the addition is completed, come anywhere near the result. Then you should remember that the electric list will much more than double in 1892; and the earning capacity of the present mileage will nearly quadruple by reason of the extensions being added at much less expense; the power and stations being nearly adequate to the extra demand. Although we have been at a very considerable expense of time and money to get our list full and correct we have by no means exhausted our resources in that direction. The new channels of information are increasing with each issue of STREET RAILWAY NEWS. There is an immense field for the safe investing of capital in this industry, and it does not stop with the visible car moving on the track, but reaches back to the factory, foundry and workshop where they are constructing the dynamos and motors, to the mountains where the poles are produced and the mines from which come the metals for rails and conductors. Street railways will in the next census occupy a position within the first score of remunerative industries in the United States, and there is every reason to suppose that if all electric investments are enumerated under a separate head that it will be one of the first ten. Money is being called for all over the land to be used in changing from animal to electric power, beside the impetus given in the general direction of introducing street-railway service where none previously existed. The bonds issued to construct and maintain the roads in the first instance bear from five to seven or eight per cent. interest, the majority being at least ten years while many are as long as fifty-year first mortgages, and of such a local nature that the interest is sure. It is, and of necessity must continue to be, a cash business. The rails and cars being in place every improvement in the application of power can be introduced at the least possible expense and without delay in traffic or income. The trolley system generally, accepted as the height of the art to-day, can be changed to any newly-discovered method except storage, using everything except the poles.

The old axiom, "It takes money to make the mare go," is changed to "It takes money to run the dynamo," so far as any extensive passenger service is concerned. Dollar for dollar the electric investment will return a greater interest than city real estate for many years to come, nor will there be many opportunities to float paper roads; their very local nature will not permit it; each little community will take care of its own; the stock at least must be to a fair extent locally owned and desirous of securing a dividend, and that, with the knowledge that a bond stands between them and it offers all requisite protection to the investor. It will bear the broad glare of public examination from whatever point it is viewed.

EXHIBITS AT THE WORLD'S FAIR.

We are recently in receipt of an item published in a Chicago paper referring to the fact that the American Street Railway Association had recently made application for 50,000 feet of space in the Transportation Building of the World's Fair for the purpose of getting together a representative exhibit of street-railway appliances. Upon referring the item to Mr. W. J. Richardson, Secretary of the Association, he replied as follows:

OFFICE OF THE AMERICAN STREET RAILWAY ASSOCIATION,
BROOKLYN, N. Y., December 15, 1891.

E. V. Cavell, Esq., Gen'l Mgr. St. Ry. News.

MY DEAR SIR: I am in receipt of yours of the 9th instant, and in reply thereto would say that the American Street Railway Association made application some two years ago for 20,000 feet of space in the Transportation Building.

At the recent annual meeting of the Association Mr. Willard A. Smith, Chief of the Department of Transportation, whose intention it was to be present for the purpose of addressing the meeting upon the subject of the World's Fair, but who, in consequence of the illness of his family, did not arrive until after the close of the business session—and who made one of the party on the excursion—said that he believed that 50,000 feet would be none too much space for the exhibit of the street-railway industry. I presume Mr. Smith has made application in behalf of the Association for that space, as he has entered thoroughly into the spirit of the matter, and is desirous of making the exhibit a success in every particular. I am, sincerely yours,

W. J. RICHARDSON, *Secretary.*

REPORTED RESIGNATION OF MR. VILLARD.

During the past week the report was widely published in the daily papers of this and neighboring cities to the effect that Mr. Henry Villard had been requested to resign the presidency of the Edison General Electric Company. The report has as yet not been confirmed nor contradicted, and what basis there is for it it is impossible to learn.

On the 12th instant Mr. Samuel Insull, Second Vice-President of the Edison General Electric Company, entertained at dinner at Delmonico's, in this city, the various officials and heads of departments of the company, at which Mr. Thomas A. Edison and Mr. Henry Villard were present. Whether there is any relation between this dinner, the meeting held in Chicago a few days previously, and the rumor of Mr. Villard's resignation it is impossible to state; but the opinion is held by some that there is a distinct relationship between the three.

DEVELOPMENT OF STREET RAILWAYS IN TEN YEARS.

The development of street railways during the decade lying between the Tenth and Eleventh Censuses—a development both as to facilities and amount of business done—may certainly be counted as one of the most remarkable features of the whole comprehensive business of transportation. Looking first to the question of length, it is found that in 1880 there were 2,050 miles of street railways in operation, while in 1890 this number had risen to 5,783 miles, an increase in the 10 years of 3,733 miles. This increase, remarkable as it is for the whole 10 years, is still more remarkable when the decade is divided into two periods of 5 years each, for then it is seen that the most astonishing development has been during the last half of the 10 years and at a rate before unparalleled. The figures show that during the first 5 years the increase of mileage was 888 miles, while during the last half it was 2,845 miles. Looking for the cause of this extraordinary increase it can readily be found in the introduction of electric roads. These roads, which on June 30, 1890 constituted nearly one-fifth of the number of street railways, were none of them in operation previous to the year 1886. In that year two electric railways were beginning to operate; in 1887 the number had increased to 6; in 1888 to 30; and in 1889 to 57, while during the first 6 months of 1890 no fewer than 49 new electric roads were reported for. The development of cable roads has also largely assisted in this increased mileage, but not nearly to such an extent as the electric railway, while, as has been shown, the year 1886 was the year of inception of the electric road, the first cable railway beginning to run in 1877. The increase by years is shown in the following table:

Years.	Total length (Miles).	Increase.	
		Miles.	Per cent.
Ten years.....	.....	3,733.31	182.10
1880.....	2,050.16	.....	.....
1881.....	2,150.09	99.93	4.87
1882.....	2,342.20	192.11	8.93
1883.....	2,506.14	163.94	7.00
1884.....	2,680.31	174.17	6.95
1885.....	2,938.29	257.98	9.63
1886.....	3,268.58	330.29	11.24
1887.....	3,890.22	621.64	19.02
1888.....	4,499.49	609.27	15.66
1889.....	5,285.11	785.62	17.46
1890 (6 months)....	5,783.47	498.36	9.43

Looking to the urban locality of increase it is found that the most remarkable is in the smaller cities, a fact that is plainly illustrated in the subjoined table

Items.	Length of Street Railways (Miles).		Factor of Increase.
	1890.	1880.	
All cities.....	5,783.47	2,050.16	2.82
Cities of more than 50,000 inhabitants..	3,205.59	1,584.16	2.02
Cities of less than 50,000 inhabitants.....	2,577.88	466.00	5.53

When the final computations were made it was found that on July 1, 1890 the street-railway companies of the United States in independent operation numbered 789 and that these, repeating the previous figures, carried on their operations over 5,783 miles of street line, or over a total track length of 8,123 miles. On this length of line 32,505 passenger cars were in use; the roads and equipment cost all told $389,357,289; they gave employment to 70,764 men, and carried the astonishing total of 2,023,010,202 passengers. A good idea of the extent of this traffic may be realized when it is stated that the street railways of the United States carried each year a number of passengers considerably greater than the population of the globe, and when it is also stated that the steam railways of the United States with all their 157,759 miles of line and 25,665 passenger cars only carried during the same year 472,171,343 passengers, or 1,550,838,859 passengers less than were carried by the street railroads.

The increase by geographical divisions will be seen by the following table:

Geographical Divisions.	Length of Line.		Increase.	
	1890.	1880.	Miles.	Per ct.
The United States	5,783.47	2,050.16	3,733.31	182.10
North Atlantic	2,063.94	1,035.60	1,028.34	99.30
South Atlantic	465.93	135.96	329.97	242.70
North Central	1,867.93	508.46	1,359.47	267.37
South Central	773.05	242.63	530.42	218.61
Western	612.62	127.51	485.11	380.45

It will be noticed that the Wetern Division shows the greatest per cent. of increase and the Northern Central the next, although the two Southern Divisions display a rapidity of construction which is in keeping with the other forms of development marking this section of the country.

Dealing somewhat more with particulars, the 27 principal cities of the United States are next taken up and their increase shown:

Cities.	Length of Line.		Increase.	
	1890.	1880.	Miles.	Percent.
Baltimore	100.57	46.54	54.03	116.09
Boston, Lynn & Camb.	237.83	95.56	142.27	148.88
Brooklyn	173.24	111.65	61.59	55.16
Buffalo	44.30	25.44	18.86	74.14
Chicago	193.11	80.47	112.64	139.98
Cincinnati	67.90	48.18	19.72	40.93
Cleveland	88.38	26.41	61.97	234.65
Denver	79.12	8.00	71.12	889.00
Detroit	59.25	26.56	32.69	123.08
Indianapolis	45.00	15.00	30.00	200.00
Jersey City & Hoboken	46.65	15.40	31.25	202.92
Kansas City	69.42	9.50	59.92	630.74
Louisville	84.42	39.25	45.17	115.08
Milwaukee	52.75	11.41	41.34	362.31
Minneapolis	58.00	9.00	49.00	544.44
Newark and Elizabeth	62.59	37.54	25.05	66.73
New Orleans	112.59	81.89	30.70	37.49
New York	180.56	130.55	50.01	38.31
Omaha	51.50	4.50	47.00	1,044.44
Philadelphia	276.94	258.17	18.77	7.27
Pittsburg & Allegheny	65.95	38.63	27.32	70.72
Providence	44.95	35.30	9.65	27.34
Rochester	35.83	13.02	22.81	175.19
St. Louis	115.25	63.29	51.96	82.10
St. Paul	25.27	6.00	19.27	321.17
San Francisco	89.11	57.08	32.03	56.11
Washington, D. C	45.22	29.47	15.75	53.44

The western cities again show the largest percentage of increase, but Boston and its neighborhood show the greatest absolute increase and Chicago is second. The reason for Philadelphia's remarkable length of line lies in the fact that this is street length, it being a peculiarity of that city, and in some degree of the Boston roads, that the tracks usually occupy different streets in going to and from a terminus instead of being laid upon the same street. The result is that roads in these two cities traverse a greater length of street in proportion to track length than in New York, Brooklyn and Chicago. The difference between the two calculations can be seen in the following table showing *street* length of line and *track* length of these 5 cities:

Cities.	Street length of line.	Track length.
Philadelphia	276.94	390.33
Boston, Lynn and Cambridge.	237.83	377.42
Chicago	193.11	365.76
New York	180.56	351.53
Brooklyn	173.24	351.12

Still keeping to the same 27 principal cities, the preceding statistics of cars, employés, passengers and cost are to be distributed as follows:

Cities.	No. of cars.	No. of employés.	No. of passengers carried in one year.	Total cost.
Baltimore	490	1,547	40,659,982	$6,709 450.39
Boston, Lynn and C.	2,396	4,188	129,038,563	17,604,671.76
Brooklyn	2,862	6,359	147,500,399	17,711,765.51
Buffalo	219	730	16,685,983	2,012,541.46
Chicago	3,657	5,796	180,326,470	26,943,443.78
Cincinnati	561	1,213	37,905,370	8,056,031.64
Cleveland	730	1,650	39,164,773	7,156,027.89
Denver	461	866	21,535,735	7,518,400.14
Detroit	296	772	22,791,566	2,370,197.61
Indianapolis	205	482	9 863,000	1,683,765.13
Jersey C. and Hob.	317	880	24,115,322	2,629,759.62
Kansas City	652	1,376	38,000,978	12,344,487.44
Louisville	429	746	21,281,584	3,713,078.88
Milwaukee	248	622	14,512,156	4 208,956.24
Minneapolis	324	616	14,648,529	3 836,233.60
Newark and Eliza.	244	525	20,068,884	3,282,381.75
New Orleans	527	876	30,510,662	5,978,464.89
New York	3,503	12,778	449,647,853	99 294 071.24
Omaha	200	469	11,900,000	6,500,000.00
Philadelphia	1,368	4,136	165,117,627	15,746,376.08
Pittsburg and All.	378	1,529	46,099,227	10,076,053.83
Providence	349	787	18,473,722	2,080,068.76
Rochester	192	510	11,372,596	6,615,586.46
St. Louis	1,469	2,501	67,800,252	10,716,195.77
St. Paul	227	433	11,245,805	2,653 585.54
San Francisco	988	2,398	80,619,005	17,239 933.24
Washington, D. C.	451	1,112	31,032,187	3,552,659.95

Turning next to motive-power the following division of statistics is decidely interesting:

Items.	All Motive-Powers.	Distribution.			
		Animal.	Electric.	Cable.	Steam.
Length of line	5,783.47	4,061.94	914.25	283.22	524.06
Length of all tracks	8,123.02	5,661.44	1,261.97	488.31	711.30
Number of cars	32,505	22,408	2.895	5,089	2,113
Number of employés	70,764	44,314	6,619	11,673	8,155
Number of passengers	2,023,010,202	1,227,756,815	134,905,994	373,492,708	286,854,685
Total cost	$389,357,288.87	$195,121,682.50	$35,830,949.63	$76,346,618.23	$82,058,038.51

Perhaps the most notable feature of the above table is the fact that in 1890 the railways operated by animal power were still far ahead of all others as regards their gross operating statistics. Rapid as was the advance of electric and cable roads during the latter 5 years of the decade, only a beginning was made in the supplanting of the older form of motive-power. It is interesting also to see that although both in number and length of lines the electric railways have far outstripped the cable railways, the latter nevertheless represent twice as great an investment, operate nearly twice the number of cars, and do a business more than twice as great. These relative figures point clearly to the far greater density of traffic upon the cable lines and to their large first cost. The cable lines almost without exception operate in the denser portions of the large cities, while the greater part of the electric roads are either suburban or serve the people of comparatively small cities.

(To be continued.)

ANGRY TAXPAYERS TORE UP THE TRACKS.

On the 15th inst. the Buffalo Street Railway Company made a second attempt to lay a track on Hertel avenue from Tonawanda street to Niagara street for the purpose of completing the electric road between Buffalo and Tonawanda. The residents of Hertel avenue, however, who have been opposed to the construction of the line along their property became very indignant at what they considered the unwarrantable action of the railroad company, and turned out in a body and ripped up the track. They did as much damage as possible to the work, and were cheered and aided by the onlookers.

The taxpayers along Hertel avenue claim that the action of the railroad company was a direct steal.

The railroad company is after an injunction against the belligerent residents of Hertel avenue.

COMPLAINTS ABOUT THE ST. PAUL ELECTRIC SERVICE.

The electric car service in St. Paul, Minn., is causing a great deal of dissatisfaction among the patrons of the line. It appears that certain changes have been made in the method of operating the line in the Hamline street and Anthony Park district, which the citizens of that section claim are very inconvenient to themselves and uncalled for.

It is stated that the same cause for complaint exists on other subdivisions of the system, notably upon the interurban lines. It is claimed that an insufficient number of cars are provided, and that service has become irregular, unreliable and irresponsible.

A large meeting of the citizens was held a few evenings ago in the first-named district to give vent to their feelings toward the railroad company, and there seems to be a general feeling of indignation over the service rendered.

THE WEEK'S RECORD OF STREET RAILWAY NOTES.

ALPENA, MICH.—Messrs. C. D. and E. D. Haynes, of New York, want the right to build a street railway here, and have petitioned the Common Counsel for the same.

BOSTON, MASS.—The positions of division superintendents on the Naumkeag and Essex Railroads have been abolished.

The citizens of Naumkeag have presented a petition to the Beverly selectmen, asking for the electric road the right to run cars through Cabot street in Naumkeag.

BRADDOCK, PA.—The street-railway war between the Braddock and the Braddock and Turtle Creek Companies has been terminated and the injunction suits have been withdrawn, the Braddock Company agreeing to pay the costs. The trouble between the two was the refusal of the latter to allow the former company to use its track at certain points.

CHARLESTON, S. C.—The first instalment of iron for the new West End Electric Railway Company has arrived from New York, and work on the new line will be begun at once.

COLUMBUS, MISS.—A new street dummy line here is considered a certainty, and the officers have gone north to purchase the necessary rolling stock. Mr. E. Cohn has been elected president, and Mr. C. E. Rodenburg, secretary.

HARTFORD, CONN.—New cars have been put on the Main street extension, and the service has been very greatly improved, which is much appreciated by the general public.

INDIANAPOLIS, IND.—The citizens of North Indianapolis are circulating and signing a petition to the Citizens' Street Railway Company asking for an extension of the line, so that the citizens in that section will not be compelled to walk or pay an extra fare.

JACKSONVILLE, FLA.—It is said that a capitalist of Omaha was in Tampa recently looking around with a view of building an electric street-car line in that place.

JERSEY CITY, N. J.—The Citizens Association of Greenville continue to agitate the rapid-transit question, and it is said that the prospects of realizing their object is very bright.

LANSING, MICH.—The Lansing Electric Street Railway Company has been sold to the Continental Trust Company of New York, and the capital has been increased from $50,000 to $175,000. The line will be thoroughly overhauled and be put in first-class condition.

LEBANON, PA.—The new cars of the Lebanon and Annville Street Railway Company are being equipped by the Edison General Electric Company.

LOWELL, MASS.—The work of substituting electricity for horse-power on the railroads here will be completed next spring.

MCKEESPORT, PA.—The Street Railway Company's carhouse is completed, and the transfer-table and switches have been put in.

MEMPHIS, TENN.—The new power-house of the Citizens' Street Railway Company is now in permanent operation. The power was formerly obtained of the Memphis Electric Light Company.

MINNEAPOLIS, MINN.—The residents on Blaisdell avenue are having a little war with the street railway company, and object to the holes that are dug for trolley poles. Their grievances go so far as to fill up the holes before the poles have been set.

NEW HAVEN, CONN.—Mayor Sargent has thwarted the attempt of the syndicate which controls the New Haven and West Haven Railroad and also the Winchester avenue line to run the tracks of the latter, which have been laid to Chapel street through College down Chapel, to connect with the West Haven tracks. The police have been ordered by the Mayor to prevent the tearing up of the street, and arrest those who may do so for trespass.

PHILADELPHIA, PA.—It is generally expected that the negotiations of the Traction Company for the 13th and 15th streets line have reached a point that insures control of the road to the former at an early date. It is also said that there is a likelihood of success in the movement to secure control of the 10th and 11th streets line.

PITTSBURG, PA.—The Sharpsburg electric branch of the Citizens' line is now in successful operation. Ten cars are now running.

POMONA, CAL.—Word has been received from President Bogman, of the Pomona and Ontario Railroad, work on which is to be begun next spring, that he has decided on using storage batteries on his line.

SEATTLE, WASH.—Work on the Grand street electric line is progressing favorably.

ST. JOSEPH, MO.—The citizens of Wyatt Park are up in arms against the Wyatt Park Street Railway Company, and demand better service on that line.

STILLWATER, MINN.—J. R. Lane and A. F. Cutter, of Davenport, Ia., representing a syndicate of Davenport capitalists, are negotiating for the purchase of the Stillwater Street Railway.

Incorporations.

BOSTON, MASS.—Charles Goss, L. F. Marston, N. Y. Ellis and others, have filed petition for incorporation as the Haverhill and Amesbury Street Railway Company, for the purpose of constructing and maintaining a surface railway.

DES MOINES, IA.—The Ottumwa Electric Railway Company with a capital stock of $500,000, has been incorporated.

HARRISBURG, VA.—A charter has been granted to the Quaker City Elevated Street Railway of Philadelphia. Capital stock $150,000. The road will be 12 miles long.

MANCHESTER, VA.—The Petersburg Street Railway Company, with a capital stock of $100,000, is about to be incorporated. Electric power will be introduced, and it is likely that communication will be had with several towns in this vicinity.

PORTLAND, ME.—The Standard Electric Power and Car Company, has been organized here with a capital of $500,000. The officers are: President, John K. Wrightman, Boston, Mass.; Treasurer, George G. Heckert.

Personal.

BOSTON, MASS.—J. T. Hicky has been appointed general manager, and James O'Leary, traffic manager of the Naumkeag and Essex Street Railroad.

NORFOLK, VA.—Mr. Thad Cross has assumed the position of manager of the street railway.

PARKERSBURG, W. VA.—Capt. McCosh has been elected superintendent of the Park City Street Car Company.

PITTSBURG, PA.—Mr. E. W. Davis, superintendent of the Pittsburg Traction Company, has resigned his position, to take effect on January 1 next. Mr. Davis will then assume the management of the Marshall foundry at the Construction Company's works. It is understood that William Elkins, son of the President of the Pittsburg Traction Company, will be appointed to fill Mr. Davis' place.

ROCHESTER, N. Y.—The report that C. K. Minary would resign the position of superintendent of the street-railway company here, on January next, is denied by President Beckley.

WHITMAN, MASS.—Mr. J. D. Wilks has resigned the position of superintendent of the Eastside and Whitman Electric Railroad Companies, and Mr. Horace Rogers, who was for many years superintendent of the Brockton Street Railway, was elected to fill the vacancy. Mr. Wilks will take charge of the electric wiring of the street railway in Brockton.

New Roads.

BALTIMORE, MD.—It is stated that work on the electric road to Curtis Bay will be pushed forward with all possible speed and that cars will be running early in the spring.

BATTLE CREEK, MICH.—The trolley wires on the electric road are all in place and as soon as the crossings are put in the cars will be put into operation.

BOSTON, MASS.—A new horse line will be established to run between Camden street stables and the Northern depots *via* Columbus avenue, Boylston street, Tremont, etc.

On December 12 a new electric line was established by the West End Company to be known as the Cross Town Line. It runs between Grove Hall and the Northern depots.

The Legislature is to be asked for a charter for the Lowell, Lawrence and Haverhill Street Railway Company.

The Association of the Citizens of South Boston has resolved that in their opinion the safety and convenience of that section of the city demand an elevated railroad as the only practical method of relieving the crowded condition of the streets, and for cheap rapid transit for the people of that section of Boston and other parts of the city.

BUCYRUS, O.—The Board of Directors of the Suburban Railroad has accepted the franchise for constructing and operating an electric road between this place and Galion.

LITTLE ROCK, ARK.—Citizens of Searcy are agitating the question of an electric street railway for their town.

LAKE CHARLES, LA.—The street railway which has been in course of construction for several weeks has been finished, and it is now in regular operation.

NORFOLK, VA.—The Legislature has been petitioned to incorporate a rapid transit company of Norfolk, Va., with a capital to not exceed $500,000. The incorporators are: Philip Corbin and Andrew Corbin, New Britain, Conn., and New York City; Charles E. Whetmore, M. Murray, L. Grandy, D. R. Dunn and A. H. Rogers. The company is authorized to construct and operate a street railway and use any power it desires.

NORWALK, O.—An electric road is talked of from Stotts Station to Ruggles Beach *via* Norwalk, Milan and Berlin Heights.

OMAHA, NEB.—The Omaha City Council has granted a franchise to the Council Bluffs Transit Company, giving the right-of-way over all the streets of the city, except West Broadway west of 16th street, Washington avenue, South 8th street and Frank street.

SANDUSKY, O.—Messrs. H. C. Post, George Barney, W. H. Gilcher, J. C. Gilchrist, G. H. De Witt, J. S. Cowdery, R. E. Schuck, T. B. Taylor and A. W. Miller, have applied to the Erie County Commissioners for permission to build an electric street railroad from the Soldiers' Home in this city to Milan.

SAN FRANCISCO, CAL.—The North Beach and Mission Railroad Company has begun the construction of its electric line on Folsom street.

SAVANNAH, GA.—Right-of-way has been granted for a horse railway on Montgomery street, from 12th to Baynard.

TOLEDO, OHIO.—The village council of Perrysburgh, O., is considering the granting of an ordinance giving the right-of-way through the village to a Toledo syndicate, for the purpose of building a street-car line and operating it by any other power than horse. This will probably place Perrysburgh in communication with Toledo.

Increase of Capital.

COLUMBUS, O.—The Columbus Consolidated Street Railway Company has increased its capital stock from one million to one and one-quarter million dollars.

Possible Purchases.

PARKERSBURG, W. VA.—The Parks City Street Car Company intends to put on some new cars.

WESTCHESTER, PA.—There is some talk of building an electric railroad between Kennett and Yorklyn, Del. Samuel Pennock of Kennett Square has the matter of surveys in charge.

Financial.

BOSTON, MASS.—President Whitney reports that the net earnings for October of the West End road increased about $40,000.

SPOKANE FALLS, WASH.—All the property of the Spokane Electric Railway Company has been transferred in trust to the Franklin Trust Company, of Brooklyn, N. Y. The company has bonded its property for $100,000 at 6 % interest, the life of the bonds being 20 years.

Change of Power.

BROOKLYN, N. Y.—Consent from the majority of property owners along Flatbush avenue to change the power of the street railroad from horse to electric has been secured, and as soon as the railroad company secures the same right on the portion of Flatbush avenue in this city, it is expected that the trolley will be used throughout the town of Flatbush.

CANANDAIGUA, N. Y.—The street railway company has decided to substitute horse-power by some practical mechanical motive-power, and the officers are investigating the different systems of propulsion, with the chances in favor of electricity.

HARTFORD, CONN.—The City Council has granted the Hartford and Wethersfield Horse Railway Company permission to substitute electricity through State, Market and Morgan streets and erect poles and wire on those thoroughfares.

PATERSON, N. J.—The Board of Aldermen has granted the Paterson Central Railway Company and the Central Electric Railway Company the right to run electric cars through a number of streets.

TOPEKA, KAN.—The Topeka Street Railway Company has petitioned for the right to use electricity on the Topeka street-car lines.

Franchises.

ANNISTON, ALA.—The franchise of the Anniston Street Railway Company has been transferred to the Anniston Electric Railway Company.

HOT SPRINGS, S. D.—Mr. F. T. Evans wants a franchise to build a street railway here.

Extensions.

BOSTON, MASS.—The Committee on Roads and Bridges of the Boston City Council has reported favorably on the petition of the West End Street Railway Company, for permission to lay double tracks in Mt. Auburn street, and to extend the overhead system in that thoroughfare.

BROOKLYN, N. Y.—The Kings County Elevated Railroad has been extended and the work completed as far as Montauk avenue. No further work will be done for the present.

MILWAUKEE, WIS.—The Common Council Committee on Railroads has decided to recommend the passage of the general ordinance regarding extensions of the various lines as submitted by Mr. Payne at a recent meeting of the Real Estate Board.

NEWBERN, N. C.—It is reported that the Electric Street Car Company will extend its lines to Polloksville and Trenton.

NEW BEDFORD, MASS.—The Selectmen of Tisbury have granted the Cottage City Street Railway Company permission to extend its tracks to Vineyard Haven.

NEW HAVEN, CONN.—The West Haven Horse Railroad Company has asked for permission to lay a temporary track on Chapel street from Temple to College.

READING, PA.—The Franklin street branch of the Reading and Southwestern Railway Company was formally opened on the 12th inst.

PAWTUCKET, R. I.—The City Council has granted the Interstate Street Railway Company the right to lay rails on certain streets in Pawtucket.

SENECA FALLS, N. Y.—Work has been begun on the extension of the Seneca Falls and Waterloo Electric Railway track from its present terminus eastward through Fall street.

Election of Officers.

MONTGOMERY, ALA.—The stockholders of the Montgomery Belt Line Railway Company met on December 9 and elected a board of directors, which afterwards met in New York and elected the following-named officers: President, A. A. Wiley; Vice-President, M. F. Plant, and Secretary and Treasurer, J. Moultree.

NASHVILLE, TENN.—At a meeting of the stockholders of the Union Electric Railway Company, on December 9, the following directors were elected: T. W. Wrenne, Isaac T. Rhea, J. H. Bruce, H. B. Buckner, W. C. Dibrell, James P. Bryne, R. W. Turner, J. C. Bradford, M. M. Gardner, T. O. Morris, James Simmons, Lewis T. Baxter, J. P. Williams and B. F. Wilson. The directors met and elected the following officers: President, T. W. Wrenne; Vice-President, Isaac T. Rhea; Secretary and Treasurer, G. W. Cunningham, and General Manager, E. G. Connette.

SCHENECTADY, N. Y.—At a meeting of the trustees of the Schenectady Street Railway Company, December 14, the following-named officers were elected: President, John Kreusi; Secretary, F. S. Stephenson, and Treasurer, William E. Gilmore.

Legal.

BOSTON, MASS.—The West End Company has been sued by John K. Hill, aged 6 years, for $20,000 damages. He claims to have been thrown down in the street and crushed by an electric car.

CLEVELAND, O.—Mrs. Annie Lewis and her husband, Lorenzo W. Lewis, have each begun suit against the Broadway and Newburg Street Railway Company for damages amounting to $5,500, for injuries alleged to have been received through the carelessness of one of the company's agents.

Mr. Almarian Hauser has brought suit against the Brooklyn Street Railroad Company for $5,000 damages, claiming that the conductor threw him off the car, badly injuring him.

DUNKIRK, N. Y.—An injunction has been served upon Mayor Martin, by the Dunkirk and Fredonia Street Railway Company, restraining the Common Council, its agents and employés, from interfering with the company in erecting suitable poles for the operation of its railway by electricity. This was followed by an injunction upon the company restraining it from erecting poles.

INDIANAPOLIS, IND.—Jacob Miller has sued the Citizens' Street Railway Company for $5,000 damages. He was jammed between a car and one of the centre-posts on the electric line and badly crushed, his injuries permanently disabling him.

KEOKUK, IA.—H. C. Reiner has been appointed receiver of the Keokuk Electric Street Railway Company. Mr. Reiner was formerly secretary of the company.

SAGINAW, MICH.—Mrs. Ann O'Reilly has commenced suit against the Saginaw Union Street Railway Company, for $10,000 damages, for injuries received. Mrs. O'Reilly claims to have been thrown violently against the stove in a car which was off the track and she suffered internal injuries.

SAN FRANCISCO, CAL.—Ida Kellensberger has sued the Market Street Railway Company, for $50,000 damages, for injuries received while riding on one of the cars last year.

WILKESBARRE, PA.—In the matter of the injunction of the D., L. & W. R. R. against the Wilkesbarre and West Side Electric Railway Company, Judge Rice denied the injunction, but specified certain conditions to be observed by the street-car people. The D., L. & W. R. R. Company sought to restrain the street-car company from crossing the former's tracks.

Casualties.

COLUMBUS, O.—Charles Rooste, aged 19 years, on December 10, was thrown under the wheels of the trailer of an electric car while attempting to alight, and sustained severe injuries.

CHICAGO, ILL.—Charles T. Rockcastle was thrown from the rear platform of a grip car on Washington street on December 10, during a collision, and was badly crushed.

NATICK, MASS.—On December 11, a horse driven by Mr. H. E. Leland, of Needham, took fright at the approach of an electric car, and, in suddenly turning, threw Mr. Leland in front of the car. He sustained some injuries on the head.

PITTSBURG, PA.—Two electric cars collided on the Manchester road on the 10th inst.; one of the conductors was badly cut about the face, but no injuries were sustained by any of the passengers.

Frank Plowmaker, of Jeanette, Pa., was severely injured by an electric car at the Lake Erie depot in this city on the night of December 12.

BUSINESS NOTES.

The Aspen Mining Company, Aspen, Col., has placed an order for four sets of Burton Electric Heaters with the Electric Merchandise Company, Chicago, for use in the mining company's motor stations. The following letter has been received by the Burton Electric Company:

ALLENTOWN AND BETHLEHEM RAPID TRANSIT CO.,
ALLENTOWN, PA., Dec. 10, 1891.

Burton Electric Co., Richmond, Va.

DEAR SIRS: Please ship eight more electric heaters with switches, being the equipment for two cars same as we had before. They are giving excellent satisfaction and are liked by the patrons of the road much better than the stoves. Yours truly,

(Signed) A. H. HAYWARD, *Sup't.*

Among other companies ordering electric heaters are the Benson & Halcyon Heights Railroad Co., Omaha, Neb.; Edison General Electric Co., Portland, Ore.; Maschinenfabrik Oerlikon, Oerlikon bei Zurich, Switzerland; Newburyport & Amesbury Horse Railroad Co., Newburyport, Mass.; Warrensburg Electric Light Co., Warrensburg, Mo.

FOUR HUNDRED MILES AS THE CROW FLIES

Is the distance covered in a single night by the Limited Express trains of the Chicago, Milwaukee & St. Paul Railway between Chicago and the Twin Cities of the Northwest—St. Paul and Minneapolis.

These trains are vestibuled, electric lighted and steam heated, with the finest dining and sleeping car service in the world.

The electric reading light in each berth is the successful novelty of this progressive age and is highly appreciated by all regular patrons of this line. We wish others to know its merits, as the Chicago, Milwaukee & St. Paul Railway is the only line in the West enjoying the exclusive use of this patent.

For further information apply to nearest coupon ticket agent, or address Geo. H. Heafford, Gen'l Pass. Agent, Chicago, Ill.

PRIVATE LETTER.

DEAR BOB: Your head's level in selecting our route to the Pacific coast, *you've only one night on the road* between Chicago and Denver, and you can take every meal on the cars, and have sufficient time in both cities to "fix up" and see a man. You're quite right—the "*glorious winter climate*" of *Colorado* is simply immense and the "*Burlington Route*" service is a grand success. Yours, TOM.

A MAP OF CHICAGO,

Showing location of World's Fair, principal streets, hotels, railway stations, street-car lines, boulevard system and other points of interest, will be sent free upon receipt of a silver dime. Address Geo. H. Heafford, General Passenger Agent, Chicago, Ill.

ONE OF THE FINEST.

Here is one of the many letters the Chicago, St. Paul & Kansas City Railway is constantly receiving in commendation of its superior facilities in the way of brand new coaches and sleeping-car accommodations:

"What you said about the cars on your road was true. They were the finest I saw on my way here, and the most roomy and comfortable. Should I have occasion to travel East, I shall try to use your part of the road, and shall recommend it to others."

It will be remembered this line is the only line in the West running the celebrated vestibule compartment Pullman sleeping-cars, in which the price for exclusive use of a drawing-room is no more than that of a section in the ordinary sleeping-car. The dining-car service is beyond comparison, and its express trains are run on the fastest schedules.

STREET RAILWAY NEWS' ILLUSTRATED PATENT RECORD.

Issued December 15, 1891.

464,780. Trolley for Electric Railways. John W. Schlosser, Washington, D. C. Filed Aug. 10, 1891.

A vertically-swinging trolley jointed to permit independent falling motion of its upper end, in combination with automatic trip devices, whereby the parts are held in fixed relations until the arm rises above the upper limit.

464,787. Car-Coupling. Horace S. Beahm, Philadelphia, Pa., assignor of one-half to James Lamont Williams, same place. Filed May 8, 1891.

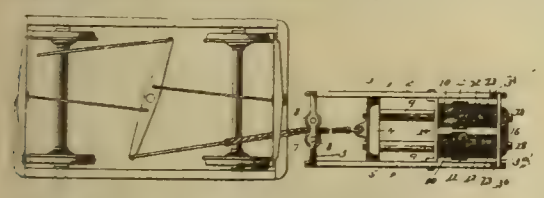
A car-coupling consisting of a draw-head terminating in a hook, a link pivoted thereto and adapted to extend beyond the same, a bifurcated arm connected to the link, and mechanism for raising and lowering.

464,793. Rail-Joint. Edward Samuel, Philadelphia, Pa., assignor to the William Wharton, Jr., and Company, Incorporated, same place. Filed July 24, 1891.

The combination, in a rail-support, of the arched bridge-piece extending from one tie to another under the joint of the rails and supported by the ties, the bridge-piece having a lip on one side engaging one edge of the base-flanges of the rails and transverse bolts engaging the opposite edge of the base-flanges and confining the rails to the support.

464,825. Car-Coupling. James A. Hinson, Des Moines, Iowa, assignor to the Hinson Car Coupler Company, same place. Filed April 9, 1891.

The combination, with the draw-head, of a vertical-plane car-coupler having a hollow shoulder formed on its interior



465,034.—ELECTRIC CAR-BRAKE.

and a knuckle pivotally secured to the draw-bar, of a spring-metal bar pocketed or inserted in the hollow shoulder and adapted to rotate or turn the knuckle outwardly.

464,836. Car-Coupling. James H. Sweeney, Franklin, Tenn. Filed April 6, 1891.

In a car-coupling, the combination of a draw-head, pin-support link-lifter having its shaft provided with a toothed wheel segment or plate, a pawl arranged to engage the teeth of the segment or plate, and a connection between the pawl and pin-support, whereby the movement of the support may operate to move the pawl.

464,847. Car-Brake. Henry F. Braun, Denison, Tex. Filed Aug. 17, 1891.

In a car-brake, the combination, with the operating brake-rods and independently-arranged brake-shoes, of fixed lever-arms having a fixed pivotal bearing with the car-frame and independent lever-arms connected with the brake-shoes, the fixed lever-arms, and with the operating-rods, the independent lever-arms arranged to transmit the brake-power to the shoes.

464,866. Car-Coupling. William B. Guernsey, Norwich, N. Y., assignor to Jane M. Guernsey, same place. Filed July 18, 1890.

In a car-coupling, the combination of the draw-head, the swinging knuckle pivoted thereto, and a rearwardly-extending draw-bolt connected and locked to the knuckle independently of the draw-head.

464,878. Cable-Grip. Louis Kannenstine, St. Louis, Mo., assignor of twelve twenty-fifths to Arthur R. Thickitt and William Pelkus, both of same place. Filed July 29, 1891.

The combination, in a cable-grip, of the grip-jaws hinged to a vertically-movable plate, means for imparting such movement to the plate, plates acting to press the jaws inward upon the cable on the elevation of the plate, and springs acting to force the jaws outward.

464,924. Removable Shoe for Cable-Car Grips. Charles Fitzgerald, Pittsburg, Pa., assignor of one-half to J. E. Rugg, same place. Filed Aug. 7, 1890.

The combination, with a frame formed with a slot and with a bevelled shoulder at one end of the slot and also formed with perforated projections, and projections having countersinks at their interior ends, and a plate having openings through which the projections pass and engaging at its ends the projections of the removable shoe fitted snugly with the frame and having bevelled ends, one end of which shoe fits closely against the bevelled shoulder of the frame, a bolt having on its inner end an enlarged head formed with a bevelled side engaging the opposite end of the shoe, a nut in the opposite end of the bolt, headed bolts extending through the projections and having their heads received by the countersink therein, and nuts on the outer ends of the bolts.

465,034. Electric Car-Brake. Edmond Verstraete, St. Louis, Mo., assignor of one-half to Peter M. Kling, same place. Filed Feb. 5, 1891.

Claim.—1. In an electric car-brake, the combination of the frame, a sliding cross-head, a magnet secured to the cross-head, and a sectional solenoid, one of said sections being larger than the others, substantially as and for the purpose set forth.

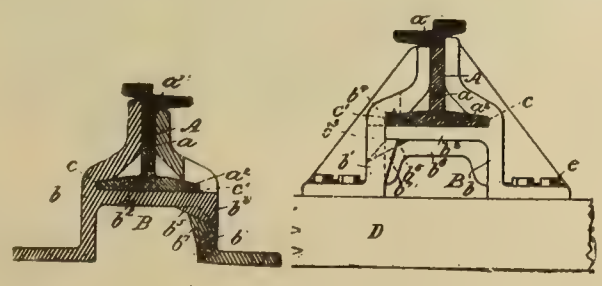
Claim.—3. In an electric car-brake, the combination of a frame, a sliding cross-head, magnets secured to the cross-head, sectional solenoids, pole-pieces, and pole-connecting piece, the pole-pieces having stems fitting in perforations in the piece, and having heads, substantially as and for the purpose set forth.

465,122. Momentum-Reservoir Motor. Marion M. Bailey, Denver, Col., assignor of one-fifth to Anderson M. Holmes, same place. Filed Feb. 28, 1891.

The combination, with a vehicle mounted upon wheels, of a series of elliptical springs connected by suitable blocks slidingly mounted upon stationary guide-rods, and a belt or cable secured at one extremity to one of the outer springs of the series and at the opposite extremity to a winding mechanism actuated from the axle of the vehicle, whereby the springs may be compressed as the vehicle moves forward and the power thus stored utilized in imparting motion thereto, as set forth.

465,191. Pick-Up and Throw-Off Mechanism for Cables. George Muller, Hoboken, N. J. Filed March 24, 1891.

Claim 8 reads: In a pick-up and throw-off mechanism for cables, the combination, with a frame, of a bar fitted to slide on the said frame, links pivotally connected with the said bar, angular arms pivotally connected with the said links and each having a friction-roller adapted to engage the cable, guiding-arms pivotally connected with the said



465,223.—RAIL-CHAIR.

angular arms and pivoted on the said frame, bearings secured on the said frame and having vertical slots engaged by the pivots of the said guiding-arms, and a pawl pivoted on each of the said links, and adapted to engage with its free end the bearing for the corresponding guiding-arm, substantially as shown and described.

465,223. Rail-Chair. George E. Walls, Philadelphia, Pa. Filed July 29, 1891.

Claim.—1. A rail-chair comprising two members, whereof one is provided with a bridge-piece having a wedge-shaped tenon and a rib and the other provided with a mortise, the construction being such that both members engage and support the top and bottom flanges of the rail without bolts, nuts, or screws, substantially as described.

Claim.—3. A rail-chair comprising two sections or members, whereof one is provided with a lateral bridge-piece with a hooked tenon having a transversely-ranging rib, and the other member provided with a recessed bracket and mortise, the construction being such that said members or sections are dovetailed together, so as to form a self-clamping sectional chair for engaging and supporting the top and bottom flanges of a rail, substantially as described.

Claim.—4. The combination of a rail-chair comprising two sections or members, whereof one is provided with a bridge-piece having a hooked tenon and a rib and the other with a recessed bracket and a mortise with an I-shaped rail, the construction and arrangement being such that the parts of said chair are dovetailed to each other and the top and bottom flanges of said rail firmly clamped to said chair without nuts, bolts, and screws, substantially as described.

465,256. Fare-Registering Punch. Charles H. Folger, Cincinnati, Ohio. Filed June 5, 1891.

Claim.—1. In an alarm punch, the combination of a frame, having a downwardly-projecting handle at its rear end and an elongated or pistol-barrel-shaped wad-chamber at the opposite end, the said chamber being provided with a hole at its rear end to receive a punch or cutter, alarm and registering devices secured upon said frame intermediate the handle and wad-chamber, and a lever, arranged transversely between and in the plane of the handle and wad-chamber and provided with a punch or cutter, adapted to enter the hole in the wad-chamber, and



465,383.—FENDER FOR STREET-RAILWAY CARS.

means connecting said lever with the alarm and registering devices, whereby the said devices will be actuated upon the operation of said lever, substantially as shown and described.

465,383. Fender for Street-Railway Cars. Robert H. Marsh, Boston, Mass. Filed May 20, 1891.

Claim.—3. A car-fender frame composed of the rods and supported by horizontal rods, rigidly secured to the car-truck, the inner ends of the said rods being connected by a turn-buckle, whereby the several parts of the frame may be separated from each other, substantially as described.

Claim.—4. The combination, with a railway-car, of an upwardly-folding fender having at its rear end a transverse rod supported by and adapted to turn in eyes or bearings at the ends of horizontal rods, rigidly secured to the car-truck, said fender being connected with the car-platform by yielding connections, substantially as described.

Claim.—5. The combination, with a railway-car, of an upwardly-folding fender consisting of a frame provided with a flexible covering and having a rope extending from its outer edge to the car-platform, whereby the said fender may be drawn up against the end of the car, substantially as described.

465,389. Car-Brake. James T. Robinson, Altoona, Pa. Filed March 28, 1891.

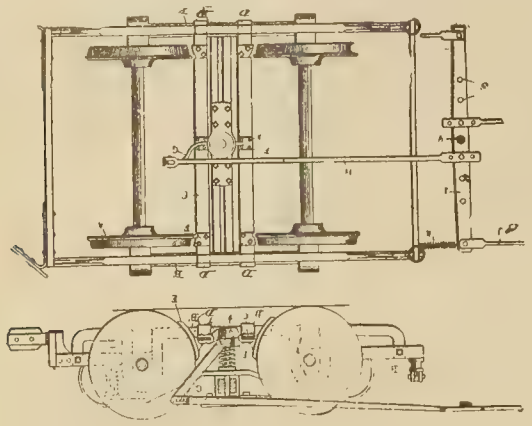
Claim.—1. The combination of the rails, composed of the vertical portions or parts and the rounded portions or parts, the hangers, provided with the ribs and the inclined shoulders, the binding-blocks, provided with the bevelled ribs and the bolts, substantially as and for the purpose specified.

Claim.—2. An elevated track comprising the rails, the hangers, the intermediate stay-blocks, the hooked hanger, each of the hangers and blocks having the ribs and the shoulders, the binding-blocks, provided with the ribs, and means for binding the rails, substantially as and for the purpose specified.

465,407. Electric Railway. George F. Green,

Kalamazoo, Mich., assignor, by direct and mesne assignments, to Oliver S. Kelly, Springfield, Ohio. Filed Sept. 15, 1879.

Claim.—1. The combination, substantially as set forth, of a railway-track, one or more stationary means of electric supply, electrical conductors extending from said means of electric supply along the lines of said track, and consisting wholly or in part of the rails thereof, vehicles moving along said track, electro-dynamic motors whose coils are constantly excited so long as the poles of said motors are in circuit with the means of electric supply fixed upon said vehicles for imparting motion thereto, and wheels supporting said



465,389.—CAR-BRAKE.

vehicles upon the track, and also serving to maintain continuous electrical connection between said means of electric supply and motors, substantially as described.

Claim.—2. The combination, substantially as set forth, of a railway-track, one or more stationary electric batteries, electrical conductors extending from said batteries along the lines of said track, and consisting wholly or in part of the rails thereof, vehicles moving along said track, electro-dynamic motors whose coils are constantly excited so long as the poles of said motors are in circuit with the electric batteries fixed upon said vehicles for imparting motion thereto, and wheels supporting said vehicles upon the track, and also serving to maintain continuous electrical connection between said batteries and motors, substantially as described.

465,432. Electrical Railway. George F. Green, Kalamazoo, Mich., assignor, by direct and mesne assignments, to Oliver S. Kelly, Springfield, Ohio. Filed May 15, 1886.

Claim.—1. The combination of one or more stationary sources of electric current, a conducting-circuit formed wholly or in part of an insulated line of rails of a railway-track, a wheeled vehicle movable upon or along said line of rails, one or more rotating electric dynamic motors mounted upon said vehicle for propelling the same and included in said circuit of conductors, and a circuit controller placed on said vehicle and also included in said line of conductors, substantially as described.

Claim.—2. The combination of one or more stationary sources of electric current, the conducting-circuit formed wholly or in part of an insulated line of rails of a railway-track, a wheeled vehicle movable upon or along said line of rails, one or more rotating electric dynamic motors, whose coils are continuously excited so long as the poles of said motors are in circuit with the means of electric supply, mounted upon said vehicle for propelling the same and included in said circuit of conductors, and a circuit controller placed on said vehicle and also included in said line of conductors, substantially as described.

COMBINATION OF ROADS IN PITTSBURG.

A dispatch from Pittsburg on December 17 says that the stockholders of the Pittsburg and Duquesne traction lines, the first cable and the others electric, which parallel each others routes for five miles to the East End, met at their respective offices on that date and ratified an operating contract by which the Pittsburg company takes charge of the Duquesne lines.

The Pittsburg is owned chiefly by Eastern men the most prominent stockholders being Messrs Widener and Elkins, of Philadelphia, and Daniel Lamont and ex-Secretary of the Navy William C. Whitney, the New York street-car magnates. The chief stockholder in the Duquesne is Chris Magee. The two Pittsburg roads cost millions for construction. The Duquesne, including branches, has about thirty-one miles of track.

As a result of this deal the Elkins-Widener-Lamont-Whitney syndicate, it is said, becomes the controller of the passenger carrying privilege of every great city in the Union.

Established 1883.

P. A. CLUM & CO.,

Brass Founders and Manufacturers of Electric Ry. Motor and Journal Bearings.

Aluminum and Phosphor Bronze Gears. Trolley Wheels. etc., in Castings or Finished. Battery Zincs.

ROCHESTER, N. Y.

Correspondence Solicited.

THE EDW. P. ALLIS COMPANY,

MILWAUKEE, WIS.

Builders of Reynolds' Corliss Engines.

SPECIAL DESIGNS FOR

ELECTRIC LIGHT AND RAILWAY SERVICE.

Estimates Furnished on Complete Plants of any Capacity.

WRITE FOR ENGINE AND BOILER CATALOGUES.

H. WARD LEONARD & CO.



"Secure bid from us for electrical apparatus or construction before deciding. Railways, Lighting, Transmission of Power, Wiring, etc."

Address ELECTRICAL EXCHANGE BLDG.,

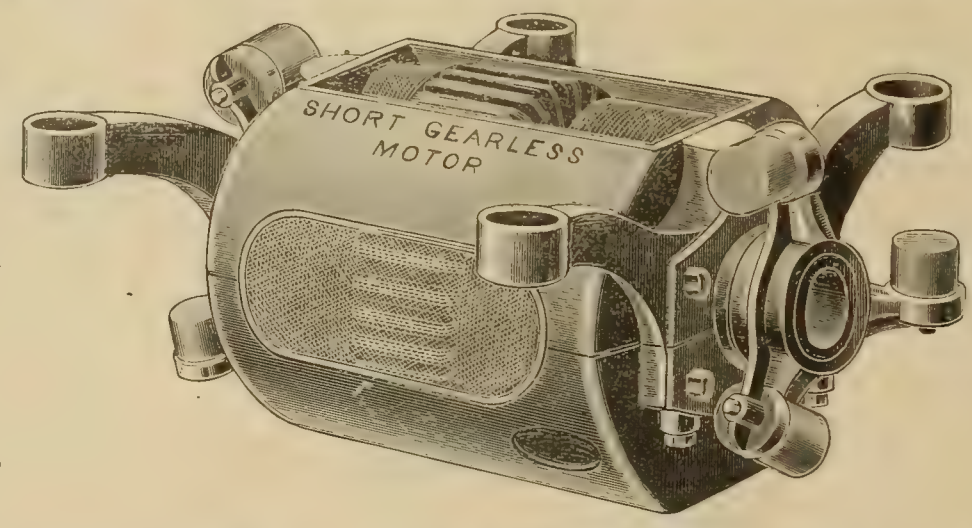
NEW YORK CITY.

THE ✳ ONLY ✳ GEARLESS ✳ MOTOR.

ITS RECORD

In Cleveland, Pittsburgh & St. Louis

IS UNSURPASSED.

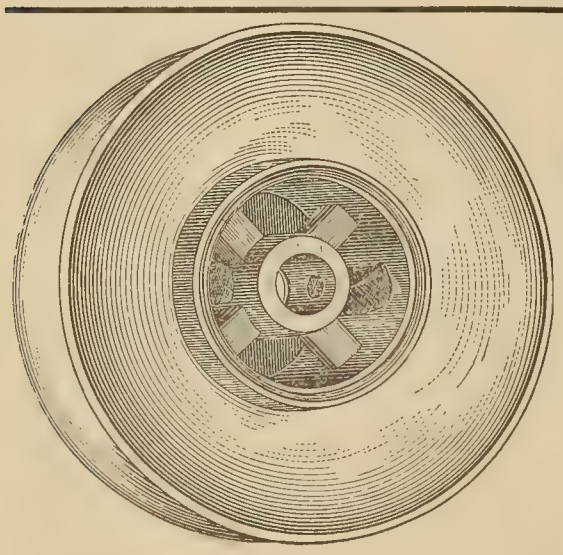


IT HAS BEEN PROVED IN ACTUAL SERVICE

To be highly efficient,
To take less than average current,
To be a FIRST-RATE hill-climber,
To be noiseless,
To be inexpensive to operate.

Send for Catalogue.

THE SHORT ELECTRIC RAILWAY CO., Cleveland, Ohio.



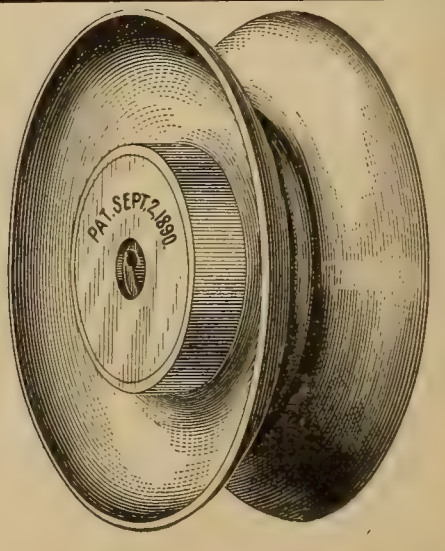
BADGER'S PATENT

SELF-OILING TROLLEY WHEEL,

For Electric Railways.

Smooth running; ways well oiled, prolongs the life of the wheel.
It insures a good bearing always on the wire.
Obviates the noise and rattle of a dry bearing.
Does not wear out pins, nor slip or jump on the wire.
Saves time, labor and annoyance, and is always reliable
Requires no attention when once filled with oil.
The oil is fed through wicks to pin and passes back to chamber through space on the end—thus using oil over and over.

BADGER BROTHERS, West Quincy, Mass.



FROM THE NEVA.

The following letter from the mouth of the Neva is an excellent sample of numbers received daily, showing that there is an increasing demand for American inventions in foreign countries:

РЕДАКЦІЯ ЖУРНАЛА

„ГАЗЕТА ЭЛЕКТРИКА“.

Редакторъ-Издатель
Альфонсъ Густавовичъ Шавинжи
Военный Инженеръ.

С.-Петербургъ,
~~Симбирская улица, д. № 20, кв. 8~~
Телефонъ № 508.

№ ____ St Petersburgh 2/14 September 1891
Tatarski St № 12

The Franklin Electric Co
126 Liberty St N. Y.

Dear Sirs

Refering to your advertisement in the Electrical Age re your Primary Batteries, you would greatly oblige, by sending me, at your earliest convenience full particulars of same, with circular, lowest quotations, & what percentage you allow to the trade

Awaiting the favour of your reply
I remain Dear Sirs
Yours very truly

Alph. Stchawij

From Alph G. Stchawinski
Engineer

HORSE RAILWAYS IN NORTH AMERICA—Continued.

STATE.	CITY.	COMPANY.	CAPITAL.	BONDS.	MILES.	CARS.	GAUGE.	PRESIDENT.	GEN. MAN., SEC. OR SUPT.	DATE OF ANNUAL MEETING.
Kan.	Wichita	* The Wichita Electric Ry. Co	1,000,000	300,000	25	4	4-8½	Chas. S. Gleed	Geo. H. Nolte, Sec	Jan., 1st Tues. after 1st Mon.
"	Winfield	Union St. Ry. Co	25,000	.....	4½	5	4	Wm. Mathewson	C. Ferguson, Gen. Mgr	July 7.
Ky.	Ashland	Ashland & Cattletsburg St. Ry. Co	.....	.....	2	3	4-8½	A. C. Campbell	S. P. Hager, Supt	May.
"	Dayton	South Covington & Cincinnati (Dayton Division St. Ry. Co.)	.....	.....	5	11	5-2½	E. F. Abbott	Lawrence Williamson, Supt	
"	Henderson	Henderson St. Ry	100,000	.....	6½	7	4-8½	E. G. Sebre, Jr	John W. O'Brien, Supt	July 1.
"	Lexington	Lexington City Ry. Co. (con. with Pass. & Belt Ry. Co.)	.....	.....	..	..	....	.....	.....	
"	Louisville	* Louisville City Ry. Co	.....	.....	53	..	....	J. B. Speed	H. H. Littell, Gen. Man	
"	"	* Louisville City Ry. Co	.....	.....	73	270	5	J. B. Speed	.....	
"	"	Crescent Hill R.R. Co	.....	.....	3	..	5	B. Du Pont	T. J Minary, Gen. Mgr	
"	"	Kentucky St. R.R. Co	.....	.....	8	..	5	.....	.....	
"	Maysville	* Maysville St. R.R. Transfer Co	30.000	.....	..	..	....	A. M. J. Cochran	R. A. Cochran, Jr., Gen. Man.	
"	Newport	South Covington & Cincinnati St. Ry. Co	.....	.....	..	..	....	.....	John A Williamson, Supt	
"	Owensboro,	Owensboro City R.R. Co	25,000	.....	4	11	4-8	Jno. Gilmore	R H. Neely, Supt	
La.	Alexandria	City Ry. Co	.....	.....	..	..	....	E. B. Wheelock	Albert Pettingen, Supt	
"	New Orleans	New Orleans R.R. Co	185,000	21,000	9½	32	4-9½	B. Beonbay	P. Cougot, Sec	Feb., 1st Mon.
"	"	New Orleans & Carrollton Ry. Co.	800,000	.....	16	78	4-8½	Joseph Hernandes	Chris. V. Haile, Supt	
"	"	New Orleans R.R. Co	.....	.....	15	45	5-2½	Alden McLellan	Alden McLellan	
"	"	St. Charles St. R.R. Co	600,000	165,000	15	64	5-2½	Alden McLellan	Alden McLellan, Supt	Jan., 2d Mon.
"	"	Algiers & Gretna R.R.	.....	.....	3¼	4	3	J. E. Auvray	John Reaney, Supt	
"	"	Crescent City R.R Co	115,000	.....	26	79	5-2½	W. J. Behan	A V. Smith, Supt	
"	"	† New Orleans City & Lake R.R. Co	1,500,000	.....	60	..	5-2½	J. A. Walker	F. Wintz, Supt	
"	Natchitoches	Natchitoches St. R.R. Co	.....	.....	2	10	4-8½	Phanor Brezeale	J. A. Ducournau, Sec	
"	Shreveport	Shreveport City R. R. Co	.....	.....	..	..	....	S. Levy, Jr	P. J. Trezevant, Sec	
Maine.	Belfast	Waldo St. Ry. Co	.....	.....	1½	6	4-4	Nathan F. Houston	.....	
"	Biddeford	Biddeford & Saco R.R.	40,000	.....	6	12	4-8½	H. Banks	Chas H. Prescott, Mgr	
"	Fryeburg	Fryeburg Horse R.R. Co	10,000	.....	3	3	4-8½	Freeman Hatch	Seth W. Fife, Supt	June, 1st Tues.
"	Portland	Ocean St. R.R. Co. (operated by Portland R.R. Co.)	.....	.....	..	..	....	H. J. Libby	E. A. Newman, Gen. Mgr	
"	"	* Portland R.R. Co	200,000	.....	11	53	4-8½	"	" " "	
"	Lewiston	Lewiston & Auburn Horse R.R. Co	100,000	.....	10	22	4-8½	F. W. Dana	J. E. Fairbanks, Supt	
"	Waterville	Waterville & Fairfield Horse R.R. Co	.....	.....	3½	5	4-8½	G. W. Williams	John S. Brockett, Supt	
Md.	Baltimore	Baltimore & Powhatan Ry. Co	50,000	.....	6	6	5-4½	E L. Freeman	James McKitrick, Supt	
"	"	Highlandtown & Port Breeze Ry. Co	.....	.....	11	25	5-4½	F. Hazlehurst	Jas. Smith, Supt	Feb., 1st Mon.
"	"	Baltimore City Pass Ry. Co	,000,000	.....	46¾	136	5-4½	Oden Bowie	S. L. Bridge, Sec	Jan., 2d Wed.
"	"	Baltimore, Brooklyn & Cedar Hill Ry. Co	50,000	.....	10	25	5-2	C. Orrick Swan	I. M. Thompson, Supt	
"	"	Baltimore, Catonsville & Ellicott's Mills Pass Ry Co	.....	.....	6	10	5-4½	Nelson Perin	W. W. Orndorff, Sec	
"	"	‖ Baltimore Traction Co	.....	.....	35	..	5-4½	T. E. Hambleton	Wm. A. House, Jr., Gen. Man.	
"	"	Baltimore Union Pass Ry. Co	750,000	.....	16	62	5-4½	N. Perrin	Leon Fender, Sec	
"	"	Baltimore & Hall Springs R.R. (owned by Baltimore City Pass. R.R. Co.)	.....	.....	..	..	....	Oden Bowie	S. L. Bridge, Sec	
"	"	Baltimore & Yorktown Turnpike Road Co	.....	.....	11½	21	....	S. H. Tagart	A. B. Sanks, Supt	
"	"	Central Ry. Co	250,000	.....	12	..	4½	Peter Thompson	Walter Blackstone, Sec	
"	"	North Baltimore Pass Ry. Co	600,000	.....	21	..	5-4½	Jas. L. McLane	Thos. J. Wilson, Sec	
Mass.	Boston	Somerville Horse R.R. Co. (leased to West End St. Ry. Co.)	163,000	.....	..	..	4-8½	Josiah Q. Bennett	John N. Studley, Jr	Jan., 2d Mon.
"	"	Boston & Chelsea R.R. Co. (" Lynn & Boston)	121,000	.....	4.15	..	4-8½	W. W. Whieldon	John H. Studley, Sec	
"	"	Winnisimmet R.R. Co. (leased to Lynn & Boston)	50,000	.....	2	..	4-8½	T. N. Proctor	E. F. Oliver, Sec	
"	"	* West End St. Ry. Co	13,550,000	3,250,000	256.8	2000	4-8½	H. M. Whitney	F. H. Monks, Supt	Nov., 2d Thurs.
"	Brockton	Brockton St. Ry. Co	150,000	.....	..	..	....	W. W. Cross	H. B. Rogers, Gen. Man	
"	Cottage City	Cottage City St. Ry. Co	150,000	.....	13½	39	4-8½	W. C. Vanderlip	E. G. Eldridge Sec	
"	East Wareham	East Wareham, Onset Bay & Point Independence St. Ry. Co	.....	.....	1¾	6	5-8½	T. B. Griffith	J. E. Eldridge, Supt	
"	Fall River	Globe St. Ry. Co	300,000	.....	17½	68	4-8½	F. S. Stevens	J. H. Bowker, Gen. Man	
"	Fitchburg	Fitchburg St. Ry. Co	60,000	.....	6.87	18	4-8½	H. A. Wallis	Wesley W. Sargent, Supt	
"	Framingham	Framingham Union St. Ry. Co	60,000	.....	7.35	14	4-8½	C. H. Emerson	J. R. Entwistle, Sec	
"	Gloucester	* Gloucester St. Ry. Co	60,000	.....	3	..	4-8½	W. B. Ferguson	J. H. Cunningham, Gen. Man.	
"	Haverhill	Haverhill & Groveland St. Ry. Co	144,000	.....	15	39	4-8½	Ira A. Abbott	Jno. A. Colby, Sec. & G'l Man.	October.
"	Lawrence	Merrimack Valley St. R.R. Co	80,000	.....	11	35	4-8½	W. B. Ferguson	N. E. Morton, Supt	
"	Lowell	* Lowell & Drayeut St. Ry. Co	20,000	.....	..	..	....	.....	.....	
"	"	* Lowell Suburban St. Ry. Co	300,000	.....	27	53	4-8½	E. M. Tucke	P. F. Sullivan, Gen. Man	Oct., last Thurs.
"	Malden	Malden & Melrose Ry. Co	.....	.....	8	..	4-8½	Chas. E. Powers	.....	
"	"	East Middlesex St. Ry. Co	200,000	.....	16	58	4-8½	Amos F. Breed	Welsey Wentworth, Supt	
"	Natick	Natick & Cochituate St. Ry Co	25,000	.....	3	8	4-8½	Harrison Hapwood	Frank Hayes, Sec	
"	"	Black Rocks & Salsibury Beach St. Ry. Co	.....	.....	21½	33	4-8½	E. P. Shaw	E. P. Shaw, Gen. Man.	
"	New Bedford	* Union St. Ry. Co	260,000	.....	12½	..	4-8½	Samuel C. Hart	Franklin Woodman, Gen. Man.	
"	Newburyport	* Newburyport & Amesbury Horse R.R. Co.	80,000	.....	12	..	....	Chas. Odell	W. A. Larabee, Supt	
"	Northampton	Northampton St. Ry. Co	50,0000	.....	3¼	11	4-8½	J. C. Hammond	E. C. Clark, Supt	Dec., 2d Tues.
"	Onset	† Onset St. Ry. Co	.....	.....	1½	2	4-8½	E. Gerry Browne	.....	
"	Quincy	Quincy St. R.R. Co. (Leased to Quincy & Boston)	.....	.....	4½	10	4-8	Jno. Q. Adams	John A. Duggan, Supt	
"	Salem	* Essex Electric St. Ry. Co	50,000	.....	4½	12	4-8½	King Upton	D N. Cook, Supt	
"	Springfield	* Springfield St. Ry. Co	4,000,000	.....	20	..	2-8½	John Olmsted	A. E. Smith, Man	
"	Taunton	Taunton St. Ry. Co	100,000	.....	..	10	4-8½	Wm. C. Lovering	Geo. C. Morse	Oct., 2d Mon.
"	Whittinsville	Whittinsville St. Ry. Co	20,000	.....	9	15	4-8½	G. W. Lasell	J. W. Lasell, Sec	
Manitoba	Winnipeg	* Winnipeg St. Ry. Co	100,000	.....	5	15	4-8½	Jas. Austin	A. W. Austin, Pur. Agt	Oct. 21.
Mex	Matamoras	Matamoras & Santa Cruz Ry	12,000	.....	2	8	....	F. Armendaiz, owner	G. Aramburu	
Mich.	Ann Arbor	Ann Arbor & Ypsilanti St. Ry. Co	100,000	.....	5½	10	3-6	C. Beal	J. T. Jacobs, Sec	Oct., 1st Mon.
"	Battle Creek	* Battle Creek Street Ry. Co	.....	.....	12	16	4-8½	J. E. Burridge	P. P. Judson, Supt	
"	Bay City	* Bay City St. Ry. Co	.....	.....	20	32	4-8½	Jas. Clements	Byron Alley, Supt	
"	Detroit	Fort Wayne & Elmwood Ry. Co	250,000	.....	13	59	4-8½	Jas. H. Vhay	N. W. Goodwin, Sec	Jan., 3d Tues.
"	"	Grand River St. Ry. Co	.....	.....	51	250	4-8½	Hugh McMillan	Jno. Grant, Gen. Man	
"	"	* Detroit City Ry. Co	.....	.....	26	112	4-8½	Geo. Hendrie	Jno. H. Fry, Gen. Man	
"	Grand Rapids	Grand Rapids St. Ry. Co	.....	.....	12	88	4-8½	A. J. Bowne	J. R. Chapman, Supt	
"	"	*‖ Consolidated St. Ry. Co	2,000,000	.....	18	..	4-8½	"	J. M. Hagar, Sec	
"	"	‖ Valley City Street & Cable Ry. Co	600,000	.....	6	18	3-6	"	J. R. Chapman, Gen. Man	
"	"	Jackson City Ry. Co	.....	.....	..	..	....	Hiram H. Smith	Henry H. Smith, Supt	
"	Kalamazoo	Kalamazoo City & County St. Ry. Co	100,000	.....	12	..	4-8½	Wayne Griswold	F. H. Davis, Supt	
"	Mt. Clemens	Muskegon Ry. Co	25,000	.....	1½	3	4-8½	C. W. D. Miller	A. W. Bishop, Supt	
"	Saginaw	City of Saginaw St. R.R. Co	.....	.....	3	9	4-8½	David H. Jerome	F. G. Benjamin, Supt	
"	"	* Saginaw Union St. Ry	200,000	.....	25	12	4-8½	F. E. Snow	W. J. Hart, Gen. Man	Aug., 2d Tues
"	Sault Ste. Marie	* Sault Ste. Marie St. Ry. Co	25,000	.....	4¼	5	4-8½	Thos. Ryan	Geo. A. Cody, Supt	Jan. 1st Mon.
"	St. Joseph	St. Joseph & Benton Harbor St. Ry. Co	.....	.....	3	10	4- ½	W. W. Bean	W. W. Bean, Supt	
Minn.	Anoka	Anoka St. Ry. Co	15,000	.....	3	6	5-8½	R. Mahany	Jas. Mahany, Sec	
"	Duluth	Duluth St. Ry. Co	100,000	.....	3½	..	3-6	J. J. Hibbard	Wallace Wanner, Sec	
"	"	Minnesota Point St. Ry	100,000	.....	3½	4	3-6	J. J. Hibbard	Walter Murray, Man	May 1.
"	Mankato	Mankato St. Ry. Co	550,000	.....	3½	5	3-6	W. M. Farr	John C. Noe, Sec	
"	Minneapolis	* Minneapolis St. Ry. Co	1,000,000	.....	22	252	3-6	Thos. Lowry	D. W. Sharpe, Supt	
"	"	Minneapolis, Lyndale & Minnetonka Ry. Co	.....	.....	14	40	4-8½	F. C. Pillsbury	E. H. Center, Sec	
"	St. Cloud	St. Cloud City St. Car Co	.....	.....	2	2	4-2	C. P. McClure	Frank Tolman, Sec	
"	Winona	Winona City Ry. Co	.....	.....	4	10	3-6	B. H. Langley	B. D. Hatchez, Sec	
Miss.	Enterprise	Enterprise St. Ry. Co	.....	.....	1¼	2	3-6	John Kampe	J. W. Gaston, Sec	
"	Jackson	Jackson City R.R.	5,000	.....	1½	5	5	Maurice Moses	.....	
"	Meridian	† Meridian St. Ry. & Dummy Line	50,000	$ 10,000	6	11	4-8½	Geo. S. Court	Abe Moses, Sec	
"	"	Meridian Road Co	.....	.....	5	7	4-8½	W. W. George	H. S. King, Sec	
"	Natchez	Natchez St. Ry	.....	.....	3¼	4	3-8½	M. Moses	Abe Moses, Sec	
"	Vicksburg	Vicksburg St. Ry. Co	.....	.....	..	..	....	.....	.....	
Mo.	Carthage	Carthage Horse Ry. Co	30,000	.....	4½	5	3-6	L. B. Daughtry	C. E. Newell	
"	Clinton	Clinton St. Ry. Co	.....	.....	2	5	4-1	A. P. Frowein	A. P. Frowein, Gen. Man	
"	Harlem	Kansas City Ry. Co	.....	.....	2.01	4	4-8	W. E. Weiner	J. R. Anderson, Supt	
"	Independence	Kansas City, Independence & Park Dummy Line	.....	.....	..	..	....	.....	.....	
"	Kansas City	East Fifth St. Ry. Co. (not now in operation)	100,000	.....	5	9	4-8½	Wm. J. Smith	Wm. H. Lucas	
"	"	‖ Grand Av. Ry. Co	1,200,000	.....	1¾	7	....	W. H. Holmes	O. F. Holmes, Gen. Man	May, 2d Tues.
"	"	*‖ Metropolitan St. Railway Co	2,000,000	.....	11	42	4-8½	C. F. Morse	R. J. McCarty, Gen. Man	
"	"	N. K. C. St. Ry. Co	.....	.....	2	4	8- ½	W. E. Winner	J. R. Anderson, Supt	
"	"	South Side St. Ry. Co	20,000	.....	..	..	....	A. P. Smith	C. S. Palmer, Sec	
"	"	Kansas City, Masten & Westport R.R. Co. (con. Grand av.)	100,000	.....	22½	90	4-8½	W. H. Holmes	C. F. Holmes, Gen. Man	
"	Lexington	Lexington & Kansas City Land and Investment Co	.....	.....	2½	2	4-4	R. G. Estill	Jas. Wentworth, Sec	
"	Springfield	Springfield Electric St. Ry. & Improvement Co	.....	.....	5½	..	4-8¼	.....	W. L. Bailey	
"	St. Joseph	People's St. Ry., Electric Light & Power Co	.....	.....	10	33	4-8½	L. R. Bacon	W. T. van Brunt, Gen. Man	
"	"	Circle Cable Ry. Co. (Owned by Wyatt Park Ry. Co.)	.....	.....	15	22	4-8½	W. J. Hobson	C. W. Hobson, Sec	
"	St. Louis	Benton Bellefontaine Ry. Co	400,000	.....	8	72	4-10	Jas. Campbell	R. McCulloch, Sec	
"	"	Baden & St. Louis R.R.	50,000	.....	3¼	10	4-9½	Geo. S. Case	H. Nelson, Supt	
"	"	Cass Ave. & Fair Ground Ry. Co	300,000	.....	8½	31	4-10	D. G. Hamilton	R. McCulloch, Gen. Mgr	March
"	"	‖ Citizens' Ry. Co	500,000	.....	21	105	4-10	"	Thos. Jones, Gen. Man	
"	"	Fourth St. & Arsenal Ry. Co	150,000	.....	6	20	4-10	Chas. Green	Patrick Shea	
"	"	Jefferson Ave. Ry. Co	100,000	200,000	5	40	4-9	Jno. Scullin	Jas. H. Roach, Sec	
"	"	Northern Central Ry. Co	200,000	.....	10½	26	4-10	D. G. Hamilton	R. McCulloch, Gen. Mgr	March.
"	"	South Broadway Line	600,000	150,000	3	13	....	.....	.....	
"	"	* Union Depot R. R. Co	.....	.....	5	185	4-10	John Scullin	Jas. Scullin, Supt	
"	"	Union R.R. Co	600,000	.....	8	33	4-10	D. G. Hamilton	Robt. McCulloch, Gen. Man	March.
"	Warrensburg	Elec. Springs Ry. Co	.....	.....	2¼	4	4	M. F. Dowd	M. F. Dowd, Gen. Man	
"	Webb City & Carterville	Twin Cities Isl. Ry. Co	50,000	.....	3	4	4-8½	A. H. Rogers	J. M. Maret, Supt	April, 1st Tues.
Mont.	Anaconda	Helena, Hot Springs & Smelter R.R. Co	.....	.....	6¼	6	4-8½	E. D. Edgerton	H. C. Hombert, Gen. Man	
Neb.	Beatrice	Beatrice St. Ry. Co	.....	.....	4	5	4-8½	J. D. Kilpatrick	A. L. Green, Sec	
"	Grand Island	Grand Island St. Ry. Co.	50,000	.....	7	11	4-6	A. H. Baker	W. C. Lamon, Supt	
"	Hastings	Hastings Improvement Co	55,000	50,000	6½	12	4-8½	.....	N. W. Hayden, Gen. Mgr	
"	"	Citizens' St. Ry. Co	100,000	.....	5	6	4-8½	Robt. Batty	Jno. Hampshire, Supt	
"	Kearney	Kearney Electric Co	.....	.....	6	2	....	Geo. W. Frank	E. E. Mandeville, Supt	Jan., 1st Mon.
"	Lincoln	Standard St. Ry. Co	.....	.....	5	6	4-8½	C. T. Brown	D. W. Brown, Supt	
"	"	* Lincoln City Elec. Ry. Co	1,200,000	.....	..	..	....	F. W. Little	E. L. Wooley, Supt	
"	"	South Lincoln St. Ry. Co	.....	.....	12½	1	4-8½	S. W. Burnman	Wm. Olier, Sec	
"	"	Lincoln Rapid Transit Co	.....	.....	1½	12	4-8½	John Fitzgerald	C. A. Adams, Gen. Man	
"	Nebraska City	Nebraska City St. Ry. Co	50,000	.....	13½	4	4-8½	H. H. Bartling	J. C. Watson, Sec	January.
"	Norfolk	Norfolk St. Ry. Co	50,000	.....	2½	4	4-6	R. A. Stewart	.....	March.
"	Omaha	‖ Omaha St. Ry. Co	5,000,000	.....	4½	216	4-8½	Frank Murphy	F. A. Tucker, Supt	
"	Red Cloud	Red Cloud St Ry	.....	.....	87½	3	....	L. M. Cravill	.....	
"	Wymore	Wymore & Blue Springs Ry. Co	33,000	.....	3½	4	3-6	J. H. Reynolds	E. P. Reynolds, Sec	
"	York	York St. Ry. Co	.....	.....	4½	4	4	W. T. Scott	M. A. Green, Sec	
N. B.	St. John	‖ St. John City Railway Co	.....	.....	7	..	4-8½	Jno. F. Zebley	.....	
N. C.	Hendersonville	Hendersonville Horse, Ry. Co	6,000	.....	1	3	4-8½	.....	S. V. Pilkins	
"	Winston	Winston Salem Ry. & Elec. Co	150,000	.....	8	12	....	J. H. McClement	H. S. Cooper, Gen. Man	
N. H.	Dover	Dover Horse R.R. Co	.....	.....	2½	6	3- ½	Mary E. H. G. Gow	A. C. Grout, Supt	
"	Laconia	Laconia & Lake Village R.R. Co	30,000	.....	2.67	10	3	A. Q. Folsom	Edmund Little, Sec	
"	Manchester	Manchester St. Ry	25,000	.....	9	24	3	C. Williams	G. H. Knowles, Supt	
"	"	Massabesic Horse R.R. Co	100,000	.....	6	..	....	J. F. Briggs	Geo. I. McAllister, Sec	
"	Nashua	Nashua St. Ry. Co	.....	.....	6	20	3	G. H. Knowles	G. H. Knowles, Gen. Mgr	
N. J.	Bloomfield	Newark & Bloomfield R.	.....	.....	..	..	....	.....	.....	
"	Camden	**Camden Horse R.R. Co	250,000	250,000	11.25	42	5	Wm. S. Scull	S. J. Fenner, Supt	Jan., 3d Mon.
"	Elizabeth	Elizabeth & Newark Horse R.R. Co. (con. with Newark Pass).	.....	.....	75	200	5-2½	Thos. C. Barr	J. N. Akarman, Supt	
"	Jersey City	Pavonia Horse R.R Co	.....	.....	4	30	4-10	.....	M. E. Staples, Gen. Mgr	
"	"	Jersey City & Bergen R. R. Co	1,000,000	.....	..	126	4-10½	Chas. B. Thurston	Thos. M. Sayre, Supt	
"	Keyport	Keyport & Matawan St. Ry. Co	30,000	.....	3	6	4-8½	Thos. R. Brown	A. M. Brown, Sec	

HORSE RAILWAYS IN NORTH AMERICA—Continued.

STATE.	CITY.	COMPANY.	CAPITAL.	BONDS.	MILES.	CARS.	GAUGE.	PRESIDENT.	GEN. MAN., SEC. OR SUPT.	DATE OF ANNUAL MEETING.
N. J.	Keyport	Penn. R.R. Co	.....	.....	6½	37	4-8½	.....	.....	
"	New Brunswick	N. B. City Ry. Co	100,000	.....	4	6	....	Henry Conger	Wm. F. Price, Supt	
"	Orange	Orange, Crosstown & Broomfield St. Ry. Co	60,000	.....	7	13	5-2	Francis M. Eppley	Thos. Marsh, Sec	
"	Passaic	* Passaic, Garfield & Clifton Ry. Co	60,000	.....	1	..	....	W. R. Brown	A. G. Earle, Gen. Man	
"	Paterson	* Paterson Ry. Co	1,250,000	.....	33	30	4-8½	Garret A. Hobart	E. J. Lawless, Gen. Man	
"	Philipsburg	Philipsburg Horse Car R.R. Co	.....	.....	14	33	5-2	Col. Lewis Perrine	Benj. V. Hill	
"	Trenton	City Ry. Co	.....	.....	10	29	5-2½	L. Perrine	J. H. Solomon, Sec	
"	"	Trenton Horse R.R. Co	.....	.....	10	29	5-2	Daniel Runkle	J. H. Solomon, Sec	June, 1892.
N. Y.	Babylon	Babylon St. Ry. Co	25,000	.....	1½	..	4-9	W. F. Norton	David S. Sammis, Supt	
"	Binghampton	Binghampton & Port Dickinson R.R. Co	28,000	.....	7½	25	4-8½	H. Westcott	N. L. Ostom	Aug., 1st Mon.
"	"	* Binghampton St. R. R. Co	160,000	200,000	14	5	4-8½	J. B. Landfield	J. P. E. Clark, Supt	
"	"	Court St., East End R.R	35,000	.....	3.27	9	4-8½	Charles M. Stone	Miles Leonard, Supt	
"	"	Main Court & Chenango St. Ry. Co	30,000	.....	6	10	4-8	Harvey Westcott	N. L. Osborn, Supt	
"	"	West Side St. Ry. Co	25,000	.....	1½	..	4-8½	C. M. Stone	W. G. Phelps, Sec	
"	Brooklyn	* Brooklyn City Railway Co	6,000,000	2,289,000	84	500	4-8½	Dan'l F. Lewis	H. M. Thompson, Sec	
"	"	Coney Island & Brooklyn R. R. Co	500,000	.....	16	113	4-8½	H. W. Slocum	E. F. Drayton, Sec	
"	"	Van Brunt St. & Erie Basin R.R. Co	150,000	.....	1½	13	4-8½	D. N. Binns	F. I. Lucas, Supt	
"	"	Atlantic Avenue R.R. Co., of Brooklyn	2,000,000	.....	44	200	4-8½	Wm. Richardson	W. J. Richardson, Sec	May 1.
"	"	Broadway R.R. Co. of Brooklyn	525,000	350,000	11	90	4-8½	Edwin Beers	Robert Sealy, Sec	May, 1st Mon.
"	"	Brooklyn City & Newtown R.R. Co	1,000,000	1,000,000	21½	218	4-8½	Jno. N. Partridge	John L. Heins, Supt	Apr., 2d Mon.
"	"	* Brooklyn City R.R. Co	6,000,000	2,289,000	176	540	4-8½	D. F. Lewis	H. M. Thompson, Sec	January.
"	"	Brooklyn, Bushwick & Queens Co. R.R	100,000	.....	11	47	4-8½	Geo. W. Van Allen	F. Hartshorn, Supt	
"	"	* Coney Island & Brooklyn R.R	500,000	.....	22	90	4-8½	H. W. Slocum	D. W. Sullivan, Supt	
"	"	South Brooklyn Central R.R. Co	125,000	.....	8½	45	4-8½	Wm. Richardson	W. J. Richardson, Sec	
"	Buffalo	* Buffalo Ry. Co	6,000,000	.....	55	273	4-8½	Henry M. Watson	Edw. Edwards, Supt	
"	Canandaigua	Canandaigua St. R.R. Co	30,000	.....	2¾	6	4-8½	Frank O. Chamberlain	Chas. C. C. Sackett, Supt	
"	Cortland	Cortland & Homer Horse R.R. Co	40,000	.....	4.09	19	4-8½	C. H. Garrison	B. B. Terry, Supt	July, 1st Tues.
"	Deerfield	Deerfield & Utica R.R. Co	12,000	.....	4¼	3	4-8½	F. G. Weaver	A. T. Goodwin, Sec	
"	Elmira	* Elmira & Horseheads Ry. Co. (runs six electric motors)	400,000	.....	14	23	4-8½	D. C. Robinson	C. H. Baldwin, Gen. Mgr.	Nov. 2.
"	Far Rockaway	Village Ry. Co	25,000	.....	1	4	4-8½	C. A. Cheever	Andrew McTigue, Supt	
"	Frankfort	Frankfort & Ilion St. Ry. Co	.....	.....	2½	5	5	A. C. McGowan	J. L. Hoard, Supt	
"	Fredonia	Dunkirk & Fredonia R.R. Co	57,000	.....	3½	6	4-10	W. McKinstry	M. M. Fenner, Gen. Mgr.	Oct., 3d S
"	Fulton	Fulton & Oswego Falls St. Ry. Co	15,000	.....	6,000 ft	4	4-8½	Joseph Walker	Chas. Lyman, Sec	
"	Greenbush	North & East Greenbush St., Ry. Co	50,000	.....	1.7	6	4-8½	A. Bleeker Banks	.....	
"	"	Albany & East Greenbush Horse Ry. Co	.....	.....	1.7	62	4-8	" "	J. W. Gascoigne, Supt	
"	Herkimer	Herkimer & Mohawk St. Ry. Co	20,000	.....	1½	4	4-8½	H. D. Alexander	E. L. Prince, Sec	
"	Huntington	Huntington R.R. Co	30,000	26,000	3	3	4-8½	E. D. Davidson	G. M. Tileston, Sec	
"	"	West Side St. Ry. Co	.....	.....	1½	..	4-8½	C. M. Stone	W. G. Phelp, Sec	
"	Johnstown	Johnstown, Gloversville & Kingsbro' Horse R.R. Co	.....	.....	4	6	4-8½	W. S. Northrup	L. Caton, Supt	
"	Larchmont	Larchmont Horse R.R. Co	25,000	.....	1½	3	4-8½	C. H. Murray	W. H. Campbell, Sec	
"	Lockport	Lockport St. R.R. Co	35,000	.....	4	8	4-8½	John Hodge	.....	
"	L. I. City	Steinway & Hunters Point R.R. Co	250,000	.....	30	86	4-8½	G. A. Steinway	A. D. Moulton, Supt	
"	"	L. I. City & Newtown Ry. Co	150,000	.....	7	17	4-8½	Isaac Buchanan	Michael Conway, Supt	
"	"	Riker Avenue & Sanders Point R.R. Co	20,000	.....	4	..	4-8½	G. A. Steinway	A. D. Moulton, Supt	
"	Mohawk	Mohawk & Ilion R.R. Co	15,000	.....	1½	4	4-8½	J. B. Rafter	.....	June 3
"	Mt. Vernon	Mt. Vernon & East Chester Ry. Co	60,000	.....	3	7	4-8	W. R. Bergholz	Leo Bergholz, Sec	
"	Newburg	Newburg St. Ry. Co	.....	.....	5	11	4-8½	Antonio Rasines	Wm. P. Rayland, Supt	
"	New Rochelle	New Rochelle Ry. & Transit Co	.....	.....	8	14	4-8½	C. H. Coffin	Frank Ryan, Supt	
"	New York	Broadway & Seventh Avenue R.R. Co	.....	.....	16	227	4-8½	Henry Thompson	Henry A. Newell, Supt	
"	"	Central Crosstown R.R. Co	600,000	.....	5.22	47	4-8½	Geo. S. Hart	Milton J. Masson, Sec	
"	"	Central Park North & East River R.R. Co	1,800,000	.....	26	183	4-8½	G. B. Scribner	.....	
"	"	Christopher & Tenth St. R.R. Co	650,000	.....	7½	44	4-8½	Louis de Bebian	Geo. Linch, Sec	
"	"	Dry Dock, East Broadway & Battery R.R. Co	1,200,000	.....	18½	181	4-8½	Wm. White	F. F. White, Supt	
"	"	Eighth Avenue R.R. Co	1,000,000	.....	20	112	4-8½	Geo. Law	James Affleck, Sec	
"	"	Forty-second St. & Grand St. Ferry R.R. Co	750.000	.....	10.14	72	4-8	Geo. Green	John M. Calhoun, Supt	
"	"	Forty-second St., Manhattanville & St. Nicholas Ave. Ry. Co.	2,500,000	.....	8	85	4-8½	Jno. S. Foster	S. M. Sisson, Supt	
"	"	Harlem Bridge, Morrisania & Fordham Ry. Co	350,000	.....	18.18	66	4-8½	H. Spratley	H. Spratley, Supt	
"	"	Houston, West St. & Pavonia Ferry R.R. Co	250,000	.....	8	40	4-8¼	Daniel S. Lamont	H. W. Eddes, Supt	
"	"	Twenty-third St. Ry. Co	600,000	400,000	14	90	4-8½	W. L. Elkins	Thos. H. McLean, Gen. Man	June, 3d Mon.
"	"	Twenty-eighth & Twenty-ninth Sts. R.R. Co	500,000	.....	..	50	4-8½	J. H. Crane	D. S. Apgar, Sec	
"	"	New York & Harlem R.R. Co	10,000,000	.....	18½	162	4-8½	C. Vanderbilt	Alfred Skitt, Supt	
"	"	Jerome Park R.R.	.....	.....	12.3	5	4-8½	W. A. Duer	Fred. A. Lovecraft, Sec	
"	"	Ninth Avenue R.R. Co	800,000	.....	16	20	4-8½	Geo. Law	Lewis P. Foulk, Supt	
"	"	Manhattanville & St. Nicholas Avenue Ry. Co	.....	.....	18.32	85	4-8½	John S. Foster	S. M. Sisson, Supt	
"	"	Third Avenue R.R. Co. (horse and cable)	5,000,000	5,000,000	28	423	4-8½	Lewis Lyon	John H. Robertson, Supt	
"	"	East Broadway & Battery R.R. Co	.....	.....	18½	181	4-8½	Wm. White	F. F. White, Supt	
"	"	Sixth Avenue R.R. Co	1,500,000	.....	9½	117	4-8¾	Frank Curtiss	Peter A. Miller, Supt	
"	"	Chambers St. & Grand St. Ferry R.R. Co	800,000	.....		25	4 8½	Henry Thompson	G. Carter, Supt	
"	Niagara Falls	Niagara Falls & Suspension Bridge Ry. Co	50,000	.....		14	4-8½	C. B. Gaskil	Chas. B. Hill, Sec	
"	Ogdensburg	Ogdensburg St. Ry. Co	70,000	.....		7	4-8½	W. H. Daniels	E. A. Newell, Sec	
"	Olean	Olean St. Ry. Co	10,000	.....		3	3-6	John Fobes	John Fobes, Supt	Sept., 1st Tues.
"	Oneonta	Oneonta St. Ry. Co	20,000	.....	2¾	4	4-8½	Geo. I. Wilber	F. D. Tallmadge, Gen. Man	Mon. preceding 2d Tues. in Jan
"	Oneida	Oneida Ry. Co	15,000	.....	1½	3	4-8½	W. E. Northrup	H. C. Stone, Gen. Man	Oct., 2d Tues.
"	Pelham	Pelham Park R.R. Co	50,000	.....	3	8	3-6	W. R. Lamberton	F. Underwood, Supt	
"	Poughkeepsie	City R.R. Co	85,000	.....	4	9	4-8½	W. Young	C. M. Davis, Supt	
"	Rochester	* Rochester Ry. Co	5,000,000	.....	60	274	4-8½	A. G. Yates	John N. Beckley, Sec	
"	"	Union St. Ry. Co	.....	.....	..	..	....	John Conway	W. S. Moore, Sec	
"	Rome	Rome City St. Ry. Co	50,000	50,000	6¾	14	4-8½	Antonio Rasines	W. P. Rayland, Supt	Oct., 1st Tues.
"	Rondout	Kingston St. R.R. Co	.....	.....	2.78	8	4-8½	James G. Lindsley	W. H. De Garmo, Supt	
"	Salina	Woodlawn & Butternut St. Ry. Co	.....	.....	1¾	6	4-8½	John S. Kaufman	Peter Kappener, Supt	
"	Schenectady	Schenectady St. Ry Co	25,000	.....	2¼	5	4-8½	John Kruesi	W. B. Turner, Supt	
"	Staten Island	Staten Island Belt Line R.R. Co	.....	.....	3	10	4-8½	.....	Thomas Moore, Supt	
"	"	South Beach Ry. Co	17,500	.....	..	4	....	F. H. Skeele	A. H. Farrar, Gen. Mgr	
"	Stillwater Village	Stillwater & Mechanicsville St. Ry. Co	10,700	.....	4½	4	4-8½	W. L. Denison	Edw. J. Wood, Sec	Nov., 2d Fri.
"	Syracuse	Syracuse & Onondaga R.R. Co. (Leased to People's Ry. Co.)	.....	.....	2½	11	4-8½	A. N. Palmer	H. H. Durr, Supt	
"	"	Central City Ry. Co	100,000	.....	2.88	20	4-8½	J. D. Ochsner	H. H. Durr, Supt	
"	"	Fifth Ward R.R. Co. (Owned by Consolidated)	.....	.....	3.48	12	4-8½	.....	.....	
"	"	Fourth Ward Ry. Co " "	.....	.....	4	9	4-8½	.....	.....	
"	"	Genesee & Water St. R.R. Co (Owned by Consolidated)	.....	.....	4½	8	4-8½	.....	.....	
"	Syracuse	New Brighton & Onondaga Valley R.R.	.....	.....	17.8	4	4-8½	.....	.....	
"	"	People's Ry. Co	300,000	.....	6	30	4-8½	A. N. Palmer	H. D. Durr, Supt	
"	"	Seventh Ward Ry. Co. (Owned by Consolidated)	.....	.....	3	..	4-8½	.....	.....	
"	"	The Syracuse Consolidated St. Ry. Co	1,250,000	.....	50	70	4-8	J. Dunn, Jr	T. L. Pode, Sec	
"	"	Syracuse & Geddes Ry. Co. (Owned by Consolidated)	.....	.....	2½	13	4-8½	.....	.....	
"	"	Woodlawn & Butternut St. Ry. Co	.....	.....	3½	5	4-8½	.....	.....	
"	Utica	Utica, Clinton & Binghamton St. R.R. Co	849,485	.....	..	..	....	James J. Scollard	R. S. Williams, Sec	
"	"	Oneida S. R.R. Co	40,000	.....	1½	3	4-8	Henry Ney	F. J. Cronk, Sec	
"	Waterford	Waterford & Cohoes R.R. Co	25,000	.....	2	..	4-8½	Thomas Breslin	C. C. Ormsby, Sec	
"	Yonkers	Yonkers St. Ry. Co	200,000	.....	5½	14	4-8½	Edmund Stephenson	D. W. Stephenson, Supt	
N. C.	Charlotte	Charlotte St., Ry. Co	.....	.....	3¼	7	4-8	E. P. K. Osborne	I. H. Wilson, Supt	
"	"	City Ry. Co	50,000	.....	5	..	4-8½	E. D. Latta	A. H. Allen, Supt	
"	Durham	Durham St. Ry. Co	.....	.....	2	2	4-8½	W. T. Blackwell	John L. Markham, Sec	
"	Hendersonville	Hendersonville St. Ry. Co	.....	.....	1	2	4-8½	.....	S. V. Pickens, Supt	
"	Wilmington	Wilmington St. Ry. Co	50,000	.....	4	11	4-8½	J. D. Bellamy	W. H. Howell, Supt	
Ohio.	Bellaire	Bellaire St. R.R. Co	.....	.....	2½	5	4-8½	U. O. Crane	Fred. Rodenig, Mgr	
"	Berea	Berea St. R.R. Co	150,000	.....	1½	2	3-6	C. W. D. Miller	A. W. Bishop, Supt	
"	Chillicothe	Chillicothe St. R.R. Co	.....	.....	4	10	4-8½	Warren P. Noble	Jos. P. Meyers, Supt	
"	Cincinnati	Price Hill Inclined Plane R.R. Co	400,000	.....	8.13	4	5-6	H. H. Littell	M. H. Littell, Gen. Mgr	
"	Cleveland	‖ Cleveland City Cable Ry. Co	4,000,000	1,885,000	13	18	4-8½	Frank De H. Robison	M. S. Robison, Supt	
"	Dayton	Dayton St. R.R. Co	300,000	.....	8½	15	4-8½	C. J. Ferneding	A. W. Anderson, Supt	April, 2d Mon.
"	"	Oakwood St. Ry. Co	300,000	.....	8	18	4-8½	Chas. B. Clegg	Harrie B. Clegg, Sec	Jan., 1st Mon.
"	"	Wayne & Fifth St. R.R. Co	100,000	.....	6½	10	4-8½	G. W. Shaw	Eugene Weichet, Sec	
"	"	Fifth St. R.R. Co	400,000	.....	10	30	4-8½	D. B. Corwin	T. E. Howell, Supt	
"	Defiance	Defiance St. Ry. Co	25,000	.....	3	5	....	Andrew Sauer	Wm. Carter, Sec	
"	Findlay	‖ Findlay St. Ry. Co	.....	.....	12	19	4-8½	G. B. [illegible]per	Chas. Smith, Supt	Jan., 1st Tues.
"	Fremont	Fremont St. Ry. Co	125,000	.....	4½	2	4-8½	F. N. Carter	E. J. Carter, Supt	
"	Hamilton	Hamilton St. Ry. & Electric Co	.....	.....	7	6	4-8	Ellis M. Potter	Ch. E. Heiser, Sec	
"	Ironton	The Ironton & Pettersburg St. Ry. Co	100,000	.....	4½	10	4-8½	C. H. Harman	T. T. Johnson, Supt	
"	Lancaster	Lancaster St. R.R. Co	30,000	.....	3	3	4-8½	Wm. Duffy	Frank Burnett, Sec	
"	Marietta	The Marietta St. Ry. Co	.....	.....	3	4	4-8½	E. B. Dyer	Walter Kerby, Supt	
"	Middletown	Middletown & Madison St. R.R. Co	.....	.....	2	4	4-8½	C. F. Gunckel	D. L. Sutphin, Supt	
"	Newark	‖ Newark City Ry. Co	200,000	.....	7½	12	4-8½	J. W. Lanehart	C. A. Lark, Supt	
"	"	Newark City Ry. Co	.....	.....	7	1	4-8½	R. Scheidler	H. Scheidler	
"	Portsmouth	Portsmouth St. R.R. Co	25,000	.....	4½	8	3-6	James Skelton	G. B. Chase, Supt	
"	Springfield	Citizens' St. R.R. Co	200,000	.....	19	22	4	Ross Mitchell	Chas. A. Harris, Sec	Jan., 3d Mon.
"	Tiffin	Tiffin St. Ry. Co	.....	.....	5½	17	4-4½	D. A. Lindley	Joseph Murphy, Supt	
"	Toledo	‖ Toledo Com. St. Ry. Co	150,000	.....	2	1	.....	.....	.....	
"	"	Central St. Ry. Co. (Operated by Toledo Com)	.....	.....	11	15	4-8½	.....	Gen. Man., Albion, E. Lacey	
"	"	Metropolitan St. Ry. Co. " " "	.....	.....	14	20	4-8½	.....	Gen, Man., Albion, E. Lang	
"	"	* Toledo Elec. Ry. Co	800,000	.....	2¼	3	....	.....	.....	
"	"	* Toledo Consolidated St. Ry. Co	.....	.....	..	..	....	.....	.....	
"	Zanesville	Zanesville & McIntire Ry. Co	.....	.....	3	16	3-6	F. M. Townsend	W. C. Townsend, Sec	
Oregon.	Albany	Albany St. Ry. Co	16,000	.....	1	2	3-6	L. Flinn	C. G. Burkhart, Supt	
"	Baker City	Baker City St. Ry. & Motor Co	50,000	10,000	2	2	3-6	J. H. Wilson	Ralston Cox, Sec. and Supt	
"	Corvallis	Corvallis St. Ry. Co	50,000	.....	1	1	3-6	S. F. Campbell	L. M. Robinson, Sec. and Mgr	December.
"	Portland	Portland St. Ry. Co	.....	.....	12	10	3-6	Jos. Holladay	H. S. Holmes, Sec	
"	"	Transcontinental St. Ry. Co	.....	.....	16	36	3-6	Tyler Woodward	D. Wakefield, Sec	
Ont.	Hamilton	Hamilton St. Ry. Co	205,000	.....	15	52	4-8½	B. E. Charlton	T. B. Griffith, Pur. Agt	
"	Port Sarnia	Sarnia St. Ry. Co	20,000	.....	..	2	5	O. D. Scaife	Alex. J. Miller, Sec	
"	London	London St. Ry. Co	100,000	.....	6	30	4-8½	V. Cronin	.....	
Penn.	Alleghany	Numery Hill Incline Plane Ry. Co	60,000	.....	2	5	4-8½	J. S. Symington	H. M. Miles, Pur. Agt	
"	"	Thirtieth St. Bridge & Troy Hill Inclined Plane Ry. Co	.....	.....	..	2	10-2	James Callery	J. J. Saint, Supt	
"	Allentown	Allentown Pass. Ry. Co	45,260	.....	8	19	4-8½	C. H. Haman	J. A. Bonnell, Supt. and Mgr.	
"	Beaver Falls	Beaver Valley St. Ry. Co	60,000	.....	3.1	8	5-2½	H. C. Patterson	James Owery, Supt	Jan. 1.
"	Bradford	Bradford & Kendall St. Ry	12,000	.....	1½	2	4-8	J. Broder	G. H. Moore, Sec	January.
"	Bellevue	.....	.....	.....	½	..	‖....	.....	L. G. Fisher	
"	Chester	Chester St. Ry. Co	100,000	.....	7½	18	2¼	J. W. Lindsay	.....	
"	Easton	Easton & West End Pass. Ry. Co	120,000	.....	7	15	5-2	H. A. Sage	Leander Stern, Supt	
"	Harrisburg	* East Harrisburg Pass. Ry. Co	250,000	.....	10½	..	5-2½	Jno. Q. Denney	F. B. Musser, Gen. Man	
"	"	Harrisburg City Pass. Ry. Co. (con. E. Harrisb'g Pass. Ry. Co.	125,000	.....	5	26	5-2½	H. A. Kelker	A. Roberts, Sec	May, 2d Mon.
"	Lancaster	Lancaster & Millersville R.R. Co	40,000	.....	5½	5	4-8½	J. C. Hager	C. Dennes, Sec	
"	Meadville	Meadville Elec. St Ry. Co	.....	.....	..	..	....	F. P. Ray	F. A. McFarland, Supt	
"	McKeesport	McKeesport Pass. Ry. Co	100,000	.....	3	5	5-2½	J. C. Smith	L. Richardson, Supt	
"	Norristown	Citizens' Pass. Ry. Co	80,000	.....	4¾	..	5-2½	H. M. Lutz	Louis Huck, Supt	Jan., 2d Mon.
"	Philadelphia	Germantown Pass. Ry. Co. (Leased to People's Pass. Ry. Co.)	1,500,000	100,000	3	6	5-2½	John Slingluff	Geo. R. Kite, Sec	
"	"	Green & Coates St. R.R. Co. " " " "	500,000	.....	..	..	....	Moses A. Dropsie	Louis S. Renshaw, Sec	Jan., 2d Mon.
"	"	People's Pass. Ry. Co	1,500,000	.....	46	167	5-2	Howard A. Stevenson	C. Whiting, Mgr	
"	"	Lombard & South Sts. Pass. Ry. Co	625,000	.....	10	51	5-2	E. J. Moore	R. B. Selfridge, Sec	
"	"	Empire Pass. Ry. Co	600,000	.....	8½	32	5-2	J. McManes	D. W. Dickenson, Sec	

HORSE RAILWAYS IN NORTH AMERICA—Continued.

State.	City.	Company.	Capital.	Bonds.	Miles.	Cars.	Gauge.	President.	Gen. Man., Sec. or Supt.	Date of Annual Meetin
Penn.	Philadelphia	The Ridge Av. Pass. Ry. Co.	420,000		15	64	5-2	E. B. Edwards	W. S. Blight, Sec.	Jan., 2d Mon.
"	"	Citizens' Pass. Ry. Co	500,000		12	37	5-2	Ch. E. Ellis	John Q. Adams, Sec.	Jan., 2d Mon.
"	"	Frankworth & Southwork, Phila. City Pass. R.R. Co.	1,250,000		18.10	108	5-2	Jeremiah J. Sullivan	W. H. Janney, Supt.	
"	"	Hestonville, Mantua & Fairmont Pass. R.R. Co.	2,050,000		20	60	5-4½	Chas. H. Lafferty	W. C. Foster, Sec.	
"	"	North Phila. Pass. Ry. Co.	300,000		..	..	....	H. A. Stiles	F. H. Williams, Sec.	
"		Phila. City Pass. Ry. Co.	1,000,000		41.7	133	5-2½	W. W. Colket	T. W. Pennypacker, Sec.	
"	"	‖ Phila. Traction Co.	5,000,000	1,193,000	104.4	515	5-2½	W. H. Kemble	D. W. Dickson, Sec.	Nov., last Tues.
"	"	Phila. & Darby Ry. Co.	200,000		6½	..	5-2½	Beauveau Borie	W. W. Colket, Sec.	
"	"	Phila. & Gray's Ferry Pass. R.R. Co.	308,750		10⅓	41	....	Matthew Brooks	W. H. Brooks, Supt.	
"	"	Schuylkill River Pass. Ry. Co.	500,000		3.11	..	5-2	Oliver Hopkinson	J. C. Dawes, Sec.	
"	"	Second & Third Sts. Pass. Ry. Co.	1,060,200		37	116	5-2½	Horace T. Potts	D. W. Stephens, Supt.	
"	"	Seventeenth & Nineteenth Sts. Ry. Co.	500,000		6½	..	....	Matthew S. Quay	J. B. Peddle, Sec.	
"	"	Thirteenth & Fifteenth Sts. Pass. Ry. Co.	1,000,000		15½	89	5-2	B. S. Kinkel	W. P. Cooper, Supt.	
"	"	Union Pass. Ry. Co.	1,500,000		70	348	....	W. H. Kemble	John B. Peddle, Sec.	
"	"	West Philadelphia Pass. Ry. Co.	750,000		18½	122	5 2½	Peter A. B. Widener	Jas. S. Gorman, Supt.	
"	"	Schuyler			2	..	4-8½	G. K. Sigfried	Chas. T. Swan, Supt.	
"	Pittsburgh	‖ Mt. Oliver Incline Ry. Co.	100,000	44,500	1.9	5	5-2½	D. S. Bricknell	M. S. Holden, Supt.	May, 1st Tues.
"	"	Penn. Inclined Plane Ry.			..	..	....	Joshua Rodes		
"	"	Pittsburg & Alleghany Traction Co.	350,000		10	47	5-2½	"	James C. Cotton, Supt.	
"	"	Pittsburg & West End Pass. Ry. Co.	200,000		9	21	5-2½	John C. Reilly	William J. Burns, Supt.	
"	"	Transverse Pass. Ry. Co.	300,000		6½	39	5-2	C. L. McGee	Miller Elliot, Supt.	
"	"	‖ Central Traction Co.	1,500,000		2	30	5-2½	G. I. Whitney	W. C. Smith, Supt.	
"	"	Castle Shannon Incline Plane Ry.			..	..	....	Walter Chess		
"	"	*‖ Citizens' Traction Co. (10 electric Motors).	3,000,000		28	73	5-2½	Jno. G. Holmes	J. E. Rugg, Gen. Supt.	November.
"	"	Duquesne Incline Plane Ry.	50,000		..	..	....	Samuel Severance	Wm. H. Graham, Sec.	
"	"	* Federal St. & Pleasant Valley Ry. Co.	1,300,000		..	..	4-8½	D. F. Henry	Wm. J. Crozier	
"	"	Fort Pitt Incline Plane Ry. Co.	50,000		2	..	10	Wm. Flein	S. H. French, Sec.	
"	"	Pittsburg Union Pass. R. R. Co.	100,000		8	23	5-2½	W. Dalzell	Jas. C. Cotton, Supt.	
"	"	* Second Av. Pass. Elec. Ry. Co.	300,000		10	5	5-2½	Jas. V. Callery	C. G. Mclnor, Sec.	
"	"	South Side Pass. R.R. Co.			6	8	5-2½	D. Z. Birckell	Miller Elliot, Supt.	
"	"	Forty-third St. & Millvale St. Ry. Co.	20,000		1	5	5-2	P. W. Siebert	P. W. Siebert, Supt.	
"	"	Monongahela Inclined Plane Ry. Co.	150,000		..	1	5	Jas. M. Bailey	John L. Awl, Supt.	
"	"	St. Clair Inclined Plane Ry. Co.	150,000		..	2		U. S. Hughes	W. S. Jones, Sec.	
"	Pittston	Pittston St. Car Co.	10,000		1¾	3	5-2	I. Everitt	E. W. Mulligan, Supt.	
"	Reading	Reading City Passenger Ry. Co.	300,000		23	36	5-2½	B. F. Owen	J. A. Rigg, Supt.	Jan., 2d Tues.
"	"	Perkiomen Av. Pass. Ry. Co.			..	..	....			
"	Roxborough	Manakuny & Roxborough Incline Plane & Ry. Co.	58,476		5½	8	5-2½	C. J. Walton	A. Tibben, Supt.	
"	Sanbury	Sanbury & Northumberland St. Ry. Co.	75,000		..	..	....			
"	Stroudsburg	Stroudsburg Pass. Ry. Co.	25,600		1½	3	4-8½	L. A. Bacon	J. H. Vanderveer, Man.	
"	Wilkesbarre	Wilkesbarre & Kingston Pass. Ry. Co.	100,000		3	10	5-2	H. R. Rhoads	Wm. Hames, Supt.	
"	"	Coalville Passenger Ry. Co.	62,375		2½	3	4-8½	Wm. J. Harvey	A. J. Davis, Sec.	
"	York	York St. Ry. Co.	100,000		5½	15	4-8½	W. H. Lanius	Jno. F. Kell, Sec.	Jan., 2d Mon
R. I.	Pawtucket	Pawtucket St. Ry. Co.	200,000		8½	23	4	A. B. Chase	C. F. Luther, Gen. Man.	
"	Providence	Union R.R. Co.	2,500,000		57	307	4-8½	Jesse Metcalf	C. F. Luther, Gen. Man.	
"	"	Providence Cable Tramway Co.	300,000		8	21	4-8½	Benj. A. Jackson	A. T. Potter, Gen. Man.	
"	Woonsocket	Woonsocket St. Ry. Co.	100,000		5.6	12	4-8½	B. A. Jackson	W. R. Talbot, Sec.	
"	"	Lake View & East Cleveland St. Ry. Co.			2.68	5 tow	4-8½	Oscar J. Rathbun	Herbert Young, Supt.	
"	"	South Side St. R.R. Co.			4½	40	4-8½	A. Everett	E. Duty, Supt.	
"	"	Woodlawn Av. & West Side St. R.R. Co.			4.5	150	4-8½	A. L. Johnson	J. J. Coleman, Supt.	
S. C.	Charleston	Charleston City Ry.			13	35	4-8½	M. A. Hanna	G. G. Mulhern, Gen. Supt.	
"	"	Enterprise R.R. Co.	200,000	50,000	11	25	5	T. W. Passavlaigue	John Mohlenhoff, Supt.	April.
"	"	Middle St. Lullwar Island Ry. Co.			2½	7	4-8½	A. F. Ravenel	W. E. Hayne, Sec.	
"	Columbia	Columbia St. Ry.	50,000		4¼	6	4-8½	B. Callaghan	B. Buckley, Supt.	
"	Greenville	St. Ry. Co. of the City of Greenville.	10,000		2¼	6	5	W. R. Wister	W. D. Starling, Man.	
"	Athens	Athens Mineral Man. & Imp't. Co.			2½	..	....	T. C. Gower	A. G. Gower, Supt.	
"	Chattanooga	City St. R.R. Co.			20	32	4-8½			
"	Clarksville	Clarksville St. Ry. Co.	6,300		2	3	4-8	C. E. James	H. Bouron, Supt.	
"	Cleveland	Cleveland St. Ry. Co.			1¾	2	4-9	W. M. Daniel	J. W. Faxon, Sec.	
"	Columbia	Columbia St. Ry. Co.	50,000		2¼	4	4-8½	J. T. Craik	E. C. McDowell, Gen. Mgr.	
"	Jackson	Jackson & Suburban St. R.R. Co.	50,000		7	9	4	L. Windom	J. H. Dew, Sec. & Man.	
"	Knoxville	Elmwood St. Dummy Line.	25,000		3	4	4-8½	A. P. White	J. Lipcomb, Sec.	
"	"	West End St. Ry. Co.			2¼	3	4-8½	B. Brame	T. J. Thomas, Gen. Man.	
"	Memphis	Citizens St R. R Co.			40	75	4-8½	J. R. Godwin	R. Semmes, Supt.	Jan., 4th Thurs.
"	"	Memphis & Fort Pickering St. Ry. Co.			6	10	4-9	G. V. Rambaut	D. E. Meyer, Sec.	
"	"	Jackson Mound Park R.R. Co.	100,000		19	5	4-8½	Holmes Cummings	J. S. Norton, Sec.	
"	Nashville	Union Elec. Railway.	100,000		52	..	5	T. W. Wrenne	E. G. Connelle, Supt.	
"	"	Overland Ry. Co.	100,000		8	12	4-8½	Wm. Marrow	F. M. Morrow, Sec.	
"	Murfreesboro	Murfreesboro St. R.R. Co.	20,000		6	6	5	"	F. B. Fowler, Sec.	
Texas.	Austin	Austin City R.R. Co.			10	28	3-6	Chas. E. Judson	G. L. Hurley, Supt.	
"	Corsicana	Corsicana St. Ry. Co.	50,000		32½	3	4-8½	B. G. McKie	W. J. McKie, Sec.	
"	"	* Dallas Con. Traction Ry. Co.	1,000,000	1,500,000	26¼	29	4-8½	Royal A. Ferris	L. S. Garrison, Gen. Man.	Jan., 2d Tues.
"	Dublin	Dublin St. R.R. Co.	25,000		5	3	4	H. A. Smith	C. W. Travis, Sec.	
"	El Paso	El Paso & Paso Del Norte St. Ry. & Bridge Co.			6¼	14	4-8½	J. F. Crosby	F. P. Blutt, Gen Man.	
"	Fort Worth	Lampasas St. Ry. Co.			3	4	4-8½	R. E. Maddox	W. H. Little, Sec.	
"	Gainesville	Gainesville St. Ry. Co.	40,000		4½	6	3-6	G. L. Hurley	Chas. T. Smith, Supt.	
"	Galveston	* Gulf City St. Ry. & Real Estate Co.	100,000		64	16	4-8½	S. H. Burnell	P. S. Wren, Sec.	
"	"	* Galveston Cy. R. R. Co.	318,674	300,000	19	25	4-8½	Wm. H. Sinclair	D. Atwood, Gen. Mgr.	Jan., 3d Wed.
"	Houston	Bayou City St. R.R. Co. (oper. by Houston City Ry. Co.)			17	36	4-8½	E. A. Allen		
"	"	* Houston City St. Ry. Co.	800,000		20	92	4-8½	E. A. Allen	F. Munder, Supt.	
"	Lampasas Springs	Lampasas Springs St. R.R. Co.			3	6	4-8½	W. H. Little, Treas.	W. H. Little, Sec.	
"	Laredo	International Bridge & Tramway Co.			55	10	..	P. Ormelas		
"	Longview	Longview & Junction St. Ry.	4,500		1	2	3-6	W. S. Mayfield	R. B. Levey, Sec.	
"	Paris	Paris Ry. Co.	50,000		4¼	12	4-8½	D. H Scott	R. F. Grimes, Supt.	
"	San Antonio	* San Antonio St. Ry. Co.	200,000		5	..	....	W. H. Weiss	J. W. Greer, Supt.	
"	Sherman	Sherman City R.R. Co.			4	11	5	C. W. Batsell	J. M Batsell, Sec.	
"	Tyler	Tyler St. Ry. Co.	20,000		8	16	4-8½	W. C. Scott	J. P. Douglass, Sec.	
"	Victoria	Victoria St. Ry. & Improvement Co.	25,000		2¼	1	3	L. D. Heaton	J. E. Carpenter, Sec.	
"	Waco	Waco St. Ry. Co.			13	26	4-8½	H. E. Scott	J. L. Griffith, Supt.	
"	Waxahachie	Waxahachie St. Ry. Co.	24,000		18	3	....	T. A. Ferris	O. Goodwin, Sec.	
"	Weatherford	Weatherford City & Suburban R.R. Co.	100,000	20,000	3¾	6	4-8½	G. P. Levy	G. B. Willbanks, Supt.	August 18, 1891.
Utah.	Ogden City	‖ Ogden City St. Ry. Co.			10	14	4-8½	H. M. Beardsley	C. H. Nicholet, Sec.	
"	Provo City	† Provo City Ry. Co.	100,000		9	2	4-8½	L. Holbrook	B. Bachman, Jr., Gen. Mgr.	July, 3d Mon.
Vt.	Berkley	The Berkley St. Ry. Co.	10,000		1½	1	4-8½	T. H. Symon	W. Tillotson, Supt.	Dec. 1.
"	Charlotteville	Charlotteville & University St. Ry. Co.	10,000		1½	1	4-8½	R. P. Valentine	H. D. Porter, Supt.	July.
Va.	Norfolk	Norfolk City R.R. Co.	100,000		5¼	29	5-2	W. H. Taylor	James J. Ferris, Supt.	Feb., 1st Tues.
"	"	The Suburban & City Ry. & Improvement Co.	50,000		3	15	5-2	Jas. W. McCarrick	E. W. Savage, Supt.	
"	Portsmouth	Portsmouth St. Ry. Co.			15.2	9	4-8½	R. M. Stewart Worthy	O Emerson, Gen Mgr.	
"	Richmond	* Richmond & Manchester Ry. Co.			5	5	4-8	A. H. Rutherford	J. C. Robertson, Supt.	
"	"	* Richmond Ry. & Elec. Co.			5	..	4-8½	Dr. Munn	Chas. Selden, Gen Man.	
"	"	Manchester Ry. & Improvement Co.			32½	10	4-8½	C. W. Turner	W. W. Winston, Sec.	
"	Roanoke	* Roanoke St. Ry. Co.	300,000		8	..	4-8½	John N. Beckley	C. K. Minary, Gen. Man.	
"	Hunton	City St. Car Co.	50,000		5	2	4-8½	Samuel B. Adams	R. D. Apperson, Gen. Mgr.	
"	Burlington	Winooski & Burlington St. Ry. Co.	40,000		7	11	4-8½	Elias Lyman	K. B. Walker, Supt.	
"	Rutland	Rutland Street Railway.	50,000	28,000	8	10	4-8½	J. W. Cranston	M. McKeogh, Gen. Mgr.	July, 2d Wed.
Wash.	Seattle	James St. Ry. Co.			4	4	3-6	C. F. Witter	J. D. Loman, Sec.	
"	"	South Seattle Cable Ry. Co.			4		4-8½	A. P. Mitten	M. McMichen, Sec.	
"	"	West Seattle Cable Ry. Co.			2	2	S. Track.	Thomas Ewing		
"	Spokane Falls	Spokane Falls & Montrose Steam-Motor R.R.			1	2	1	F. H. Cook	F. H. Cook, Treas.	
"	Spokane	*‖ Spokane St. Ry. & Cable Co.	500,000	350,000	19	8	4-8½	H. Bolster	W. S. Norman, Sec.	Sept. 28, 1891.
"	Tacoma	Tacoma Ave. St. R.R. Co.			2	6	....			
"	Vancouver	Columbia Land & Improvement Co.	160,000		2½	1	3-6	Gen. Jno. Gibbon	L. M. Hidden, Supt.	Jan. and July, 1st Mon.
"	Walla Walla	Walla Walla St. Ry. & Investment Co.	100,000		4	6	3-6	W. P. Winans	J. M. Hill, Supt.	
W. Va.	Charleston	Charleston St. Ry. Co.	50,000		2½	6	4-8½	J. D. Campbell, Treas.	Geo. Davis, Gen. Man.	
"	Parkersburg	Park City St. R.R. Co.	13,000	18,000	4½	1	4-8½	D. Gould	J. R. Fox	January.
"	"	The Huntington Belt Line.			1½	6	4-8½	C. L. Hafner	F. L. Doolittle, Sec.	
"	Wheeling	* Citizens' Ry. Co.	100,000		2	..	5-2½	J. A. Miller	Michael Loftus, Supt.	
Wis.	Ashland	Ashland St. Ry. Co.	50,000		2½	6	4-8½	Edwin Ellis	G. W. Marshall, Supt.	July 13.
"	Baraboo	Baraboo, Devil's Lake & Kilbourn City Elec. Ry. Co.			..	..	....	F. S. Brewster	G. A. Korlick, Sec.	
"	Fon du Lac	Fon du Lac St. Ry. Co.	100,000		4½	8	4-8½	H. Burkholder	H. S. Clark, Sec.	
"	Janeville	Janesville St. Ry. Co.			4½	5	4-8½	S G. Clark	L. D. Richardson, Supt.	
"	La Crosse	La Crosse City Ry. Co.	200,000		7	19	4-8	B. E. Edwards	H. E. West, Sec.	
"	Madison	Madison City Ry. Co.			5¼	17	4	C. B. Holmes	G. H. Shaw, Supt.	
"	Milwaukee	Marinette St. Ry. Co.	5,000		4	6	4-8½	H. C. Higgins	T. Higgins, Sec.	
"	"	Cream City R.R. Co.			26	100	4-8½	Winfield Smith	Wm. Damkoehler, Sec.	
"	"	Milwaukee City Ry. Co.			36	108	4-8½	W. G. Oakman	R. B. Dobson, Sec.	
"	Oshkosh	Oshkosh St. R.R. Co.			8¾	13	4-8½	Chas. Barber	C. E. Montgomery, Supt.	
"	Racine	Belle City St. Ry. Co.	100,000		8	12	4	G. B. Hathaway	J. E. Dodge, Sec.	
"	Sheboygan	Sheboygan St. Ry. Co.	50,000		5	6	4-8½	J. M. Laemann	F. J. Leamann, Sec.	
Wyo.	Cheyenne	Cheyenne St. R.R. Co.			5	5	3-6	F. W. Warren	J. C. Baird, Sec.	

LIST OF CABLE RAILWAYS IN THE UNITED STATES.

(ALPHABETICALLY ARRANGED ACCORDING TO CITIES.)

EXPLANATORY NOTE.

*A number of the companies recorded below also use horses and electrical cars over a portion of their roads, which is determined in the following list by reference to the signs placed immediately before the corporate name, the * signifying that the company also uses horses, the † that electricity and the ‖ that dummy locomotives are also used. For further particulars see also lists horse, electric and dummy roads.*

The miles given represent cable mileage only.

City.	State.		Company.	Stock.	Bonds.	Miles.	Cars.	Trailers.	President.	Gen. Mgr., Supt. or Sec.	Date of Annual Meeting.
Baltimore	Md.	*	Baltimore Traction Co	.....	1,500,000	10	....	....	T. Hambleton	W. A. House, Gen. Mgr.	
Birmingham	Ala.	*‖	Birmingham Ry. & Elec. Co	3,000,000	.....	..	..	....	T. T. Hillman	Jas. A. Stratton, Sec. and T.	
Brooklyn	N. Y.		Brooklyn Heights Ry. Co	200,000	.....	2500 ft.	10	....	D. F. Lewis	A. Rodgers, Supt.	
Butte	Mont.	‖	Butte City St. R. R. Co.	500,000	500,000	6	19	....	W. Bennett	J. F. Woolston, Jr., Supt.	
Chicago	Ill.	*	Chicago City Ry. Co	6,000,000	4,000,000	35	....	....	Geo. H. Wheeler.	F. R. Greene, Sec.	
"	"	*	No. Chicago St. Ry. Co	.....	.....	....	15	....	Chas. D. Yerkes	F. L. Threedy, Gen. Mgr.	
"	"	*	West Chicago St. R.R. Co	10,000,000	4,100,000	18	150	1000	" "	John B. Parsons, Gen. Mgr.	
Cincinnati	Ohio.	*†	Cincinnati St. Ry. Co	5,775,000	400,000	8	36	72	John Kilgour	John Harris, Supt.	
"	"	*†	Mt. Adams & Eden Pk. Inc. R.R. Co	1,400,000	600,000	8	....	....	" "	A. C. Starr, Pur. Agt.	
"	"		Mt. Auburn Cable Ry. Co	300,000	300,000	8	22	23	Henry Martin.	J. D. Davies, Supt.	Sept., 3d Mon.
Cleveland	"	*	Cleveland City Cable Ry. Co	4,000,000	.....	19	47	....	Frank De H. Robison	M. S. Robison, Jr., Supt.	July, 3d Tues.
Dallas	Tex.		Dallas Cable Ry. Co	600,000	.....	6	12	12	J. M. Harry	Chas. W. Guild, Sec.	
Denver	Col.	†‖	Denver Tramway Co	1,000,000	.....	18	102	....	Rodney Curtis	C. K. Durbin, 2d, Supt.	
"	"		Denver Cable Ry. Co	500,000	.....	6	12	....	.....	.....	
"	"	*	Denver City Cable Ry. Co	3,000,000	.....	24	52	....	Geo. H. Holt.	G. E. Randolph, Gen. Mgr.	
Grand Rapids	Mich.	†*	Consolidated Street Railway Co. of Grand Rapids.	200,000	.....	9	24	....	A. J. Bowne	W. S. Crosby, Sec.	
Hoboken	N. J.	*‖	No. Hudson Co. Ry	.....	.....	25	....	....	John H. Boun	Nicholas Goetz, Supt.	
Kansas City	Kan.	‖	Inter-State Cons. Rapid Ry. Co	.....	.....	15		5	T. M. Edgerton, Receiver.	W. Stone, Supt	
"	Mo.		Kansas City Cable Ry. Co	1,575,000	.....	20.5		119	W. J. Smith	W. H. Lucas, Sec.	May.
"	"		†Grand Ave. Ry Co	1,200,000	1,200,000	8.5	8	....	W. H. Holmes	C. F. Holmes, Gen. Mgr.	
"	"	*†	Metropolitan St. Ry. Co.	3,000,000	.....	24	75	....	C. F. Morse	R. J. McCarthy, Gen. Mgr.	
"	"		People's Cable Ry. Co	750,000	.....	6.5	....	....	H. P. Churchill, Receiver.	F. Philips, Supt.	
"	"		Union Ry. Co	300,000	.....	4.5	10	10	H. M. Broadwell	E. A. Morrison, Supt.	
Los Angeles	Cal.	*	Pacific Ry. Co	2,500,000	2,500,000	20.56	100	50	C. B. Holmes	J. J. Akin, Supt.	
" "	"		Temple St. Cable Ry. Co	400,000	100,000	3	8	5	P. Beaudry	F. W. Wood, Gen. Man.	
New York	N. Y.	*	Third Ave. R.R. Co	.....	5,000,000	28	....	....	Lewis Lyon	J. H. Robinson, Supt.	Nov., 1st Wed. after 2d Mon
Oakland	Cal.		Oakland Cable Ry. Co	.....	.....	....	....	....	.....	Geo. G. Loring, Supt.	
"	"	*	Consolidated Piedmont Cable Co.	2,000,000	1,000,000	21	25	....	Mont Howe	H P. Garthwaite	
Omaha	Neb.	*†	Omaha St. Ry. Co.	.....	.....	9.5	....	....	Frank Murphy	W. A. Smith, Gen. Mgr.	
Pawtucket	R. I.	†	Pawtucket Valley Electric Street Railway Co	.....	.....	....	....	....	.....	.....	
Philadelphia	Pa.		Philadelphia Traction Co	5,000,000	.....	23	....	....	W. H. Kemble	D. W. Dickson, Sec.	
Pittsburg	"		Central Traction Co	1,500,000	.....	5	....	....	Geo. J. Whitney	W. C. Smith, Supt.	
"		*†	Citizens Traction Co	300,000	.....	12.5	66	....	John G. Holmes	J. E. Rugg, Supt	
"		*	Mount Oliver Incline Railway Co.	100,000	44,500	1.9	2	....	D. Z. Brickell	M. S. Holden, Supt.	May, 1st Tues.
Portland	Ore.		Portland Cable Ry Co	500,000	.....	5	....	....	C. H. Woodard	G. W. Lynch, Gen. Mgr.	
Providence	R. I.	*	Providence Cable Tramway Co	300,000	.....	3	14	....	P. A. Jackson	A. T. Potter, Gen. Mgr.	May, 2d Wed.
San Diego	Cal.		San Diego Cable Ry. Co	500,000	225,000	5¼	14	....	D. D. Dare	J. E. O'Brian, Sec.	
"	"		San Diego, Old Town & Pacific Beach R. R. Co.	500,000	67,500	5¼	14	....	D. D. Dare	G. B. Hensley, Supt.	
San Francisco	"		California St. Cable R. R. Co.	.....	.....	..	....	....	.....	.....	
"	"	‖	Ferries and Cliff House Ry	2,500,000	650,000	15	....	....	W. J. Adams.	H. H. Lynch, Supt.	
"	"	‖	Geary St. Pk. and Ocean Ry	1,000,000	250,000	5	....	....	C. F. Crocker	R. Stevenson, Pur. Agt	
"	"	*	Market St. Cable Ry. Co	.....	3,000,000	25	....	....	Leland Stanford	" " "	
"	"	*	Omnibus Cable Co.	2,000,000	2,000,000	23	143	....	Gustav Sutro	C. L. Anderson, Supt.	
"	"		Powell St. Railway Co.	.....	.....	..	..	....	.....	.....	
"	"	†*	Presidio & Ferries R.R. Co	1,000,000	.....	4	....	....	W. Clift	John B. Leighton, Sec.	
"	"	*	Sutter St. Ry Co	2,000,000	800,000	13	50	....	R. F. Morrow	J. Reynolds, Supt.	
Seattle	Wash.		Front St. Cable Ry. Co.	300,000	.....	5½	8	8	A. B. Stewart	E. Shephard, Gen. Mgr.	
"	"		Madison St. Cable Ry. Co	750,000	.....	4	16	....	H. G. Struve	" " "	
"	"		No. Seattle Cable Ry. Co. (Operated by Front St. Cable Ry.)	.....	.....	....	....	....	.....	.....	
"	"		Seattle City Ry. Co	600,000	.....	5	12	12	F. J. Grant	F. M. Haas, Gen. Mgr.	
Sioux City	Ia.		Sioux City Cable Ry Co	.....	.....	4	25	....	J. P. Pierce	W. H. Mack, Gen. Mgr.	
Spokane Falls	Wash.		Spokane Cable Ry. Co	200,000	.....	3	7	....	J. D. Sherwood	C. H. Moore, Sec	
"	"	*†	Spokane St. Ry. and Cable Co	500,000	350,000	3	20	....	H. Bolster	W. S. Norman, Gen. Mgr	
St. Louis	Mo.	*	Citizens Ry Co.	1,500,000	1,500,000	13	55	....	D. G. Hamilton	Robt. McCullock, Gen. Mgr.	
"	"	†	Missouri Ry. Co	2,400,000	500,000	11	....	....	P. C. Maffit	Jas. F. Davidson, Supt.	
"	"		People's R.R. Co	1,000,000	1,000,000	10	40	40	Chas. Green	J. Mahoney, Gen. Mgr	
"	"		St. Louis Ry. Co	2,500,000	1,500,000	14.5	80	200	D. G. Hamilton	Robt. McCullock, Gen. Mgr.	
"	"	†‖	St. Louis Suburban Ry. Co	2,000,000	.....	6.5	26	47	C. H. Turner	A. de Figuersedo, Supt.	
St. Paul	Minn.	†	St. Paul City Ry. Co.	5,000,000	.....	15	170	....	Thos. Lowry	A. L. Scott, Supt	
Tacoma	Wash.	†	Tacoma Ry. and Motor Co	500,000	.....	1.75	5	....	Paul Schultze	J. H. Cummings, Gen. Mgr.	
Washington	D. C.	*	Washington & Georgetown R.R. Co	500,000	.....	6	24	....	A. Henry Hurt	C. C. Sailer, Supt.	

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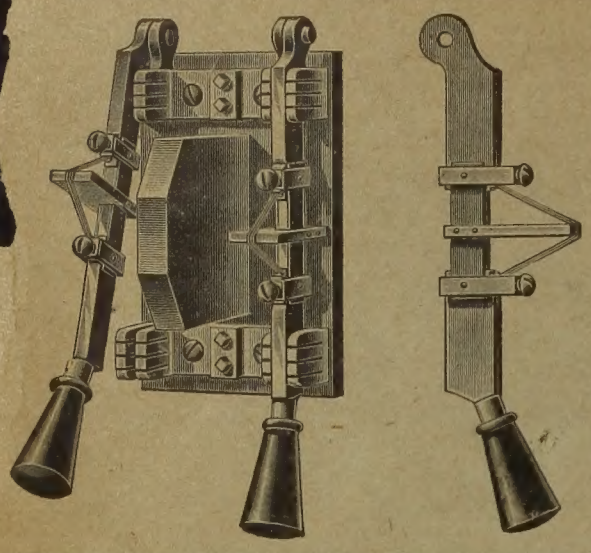
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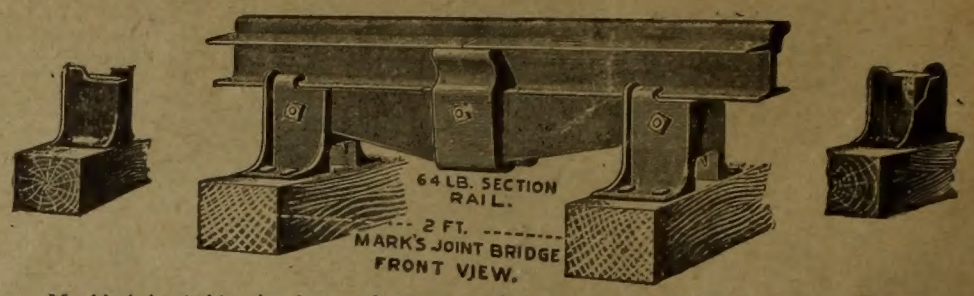
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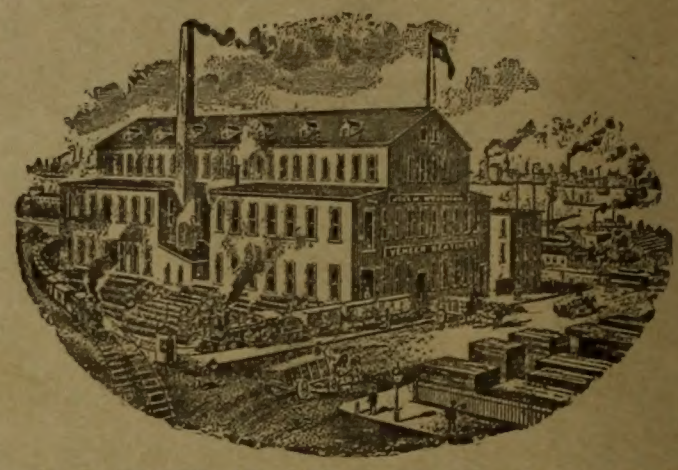
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